The BILLING method map MDE in this example may describe the pricing algorithm that should be used in this BILLING method (e.g., bill $0.001 per byte of content released). Block 1988 ("Map meter value to billing amount") functions in the same manner as block 1950 of the EVENT method; it maps the meter value to a billing value. Process step 1988 may also interrogate the secure database (as limited by the privacy filter) to determine if other objects or information (e.g., user information) are present as part of the BILLING method algorithm.

BILLING method 1980 may then write a BILLING audit trail if required to a BILLING method Audit Trail UDE (block 1990, 1992), and may prepare to return the billing amount to the calling CONTROL method (or other control process). Before that, however, BILLING method 1980 may test whether a billing amount was determined (decision block 1994). If no billing amount was determined, then the BILLING method may be failed (block 1996). This may occur if the user is not authorized to access the specific areas of the pricing table that the BILLING method MDE describes (e.g., you may purchase not more than $100.00 of information from this content object).

Access

Figure 54 is a flowchart of an example of program control steps performed by an ACCESS method 2000. As described above, an ACCESS method may be used to access content embedded in an object 300 so it can be written to, read from, or otherwise manipulated or processed. In many cases, the ACCESS method may be relatively trivial since the object may, for example, be stored in a local storage that is easily accessible. However, in the general case, an ACCESS method 2000 must go through a more complicated procedure in order to obtain the object. For example, some objects (or parts of objects) may only be available at remote sites or may be provided in the form of a real-time download or feed (e.g., in the case of broadcast transmissions). Even if the object is stored locally to the VDE node, it may be stored as a secure or protected object so that it is not directly accessible to a calling process. ACCESS method 2000 establishes the connections, routings, and security requisites needed to access the object. These steps may be performed transparently to the calling process so that the calling process only needs to issue an access request and the particular ACCESS method corresponding to the object or class of objects handles all of the details and logistics involved in actually accessing the object.

ACCESS method 2000 may first prime an ACCESS audit trail (if required) by writing to an ACCESS Audit Trail UDE (blocks 2002, 2004). ACCESS method 2000 may then read and load an ACCESS method DTD in order to determine the format of an ACCESS MDE (blocks 2006, 2008). The ACCESS method MDE specifies the source and routing information for the particular object to be accessed in the preferred embodiment. Using the ACCESS method DTD, ACCESS method 2000 may load the correction parameters (e.g., by telephone number, account ID, password and/or a request script in the remote resource dependent language).

ACCESS method 2000 reads the ACCESS method MDE from the secure database, reads it in accordance with the ACCESS method DTD, and loads encrypted content source and routing information based on the MDE (blocks 2010, 2012). This source and routing information specifies the location of the encrypted content. ACCESS method 2000 then determines whether a connection to the content is available (decision block 2014). This "connection" could be, for example, an on-line connection to a remote site, a real-time information feed, or a path to a secure/protected resource, for example. If the connection to the content is not currently available ("No" exit of decision block 2014), then ACCESS method 2000 takes steps to open the connection (block 2016). If the connection fails (e.g.,

because the user is not authorized to access a protected secure resource), then the ACCESS method 2000 returns with a failure indication (termination point 2018). If the open connection succeeds, on the other hand, then ACCESS method 2000 obtains the encrypted content (block 2020). ACCESS method 2000 then writes an ACCESS audit trail if required to the secure database ACCESS method Audit Trail UDE (blocks 2022, 2024), and then terminates (terminate point 2026).

Decrypt and Encrypt

Figure 55a is a flowchart of an example of process control steps performed by a representative example of a DECRYPT method 2030 provided by the preferred embodiment. DECRYPT method 2030 in the preferred embodiment obtains or derives a decryption key from an appropriate PERC 808, and uses it to decrypt a block of encrypted content. DECRYPT method 2030 is passed a block of encrypted content or a pointer to where the encrypted block is stored. DECRYPT 2030 selects a key number from a key block (block 2032). For security purposes, a content object may be encrypted with more than one key. For example, a movie may have the first 10 minutes encrypted using a first key, the second 10 minutes encrypted with a second key, and so on. These keys are stored in a PERC 808 in a structure called a "key block." The selection process involves determining the correct key to use from the key block in order to decrypt the content. The

process for this selection is similar to the process used by EVENT methods to map events into atomic element numbers. DECRYPT method 2030 may then access an appropriate PERC 808 from the secure database 610 and loads a key (or "seed") from a PERC (blocks 2034, 2036). This key information may be the actual decryption key to be used to decrypt the content, or it may be information from which the decryption key may be at least in part derived or calculated. If necessary, DECRYPT method 2030 computes the decryption key based on the information read from PERC 808 at block 2034 (block 2038). DECRYPT method 2030 then uses the obtained and/or calculated decryption key to actually decrypt the block of encrypted information (block 2040). DECRYPT method 2030 outputs the decrypted block (or the pointer indicating where it may be found), and terminates (termination point 2042).

Figure 55b is a flowchart of an example of process control steps performed by a representative example of an ENCRYPT method 2050. ENCRYPT method 2050 is passed as an input, a block of information to encrypt (or a pointer indicating where it may be found). ENCRYPT method 2050 then may determine an encryption key to use from a key block (block 2052). The encryption key selection makes a determination if a key for a specific block of content to be written already exists in a key block stored in PERC 808. If the key already exists in the key block,

then the appropriate key number is selected. If no such key exists in the key block, a new key is calculated using an algorithm appropriate to the encryption algorithm. This key is then stored in the key block of PERC 808 so that DECRYPT method 2030 may access the key in order to decrypt the content stored in the content object. ENCRYPT method 2050 then accesses the appropriate PERC to obtain, derive and/or compute an encryption key to be used to encrypt the information block (blocks 2054, 2056, 2058, which are similar to Figure 55a blocks 2034, 2036, 2038). ENCRYPT method 2050 then actually encrypts the information block using the obtained and/or derived encryption key (block 2060) and outputs the encrypted information block or a pointer where it can be found before terminating (termination point 2062).

Content

Figure 56 is a flowchart of an example of process control steps performed by a representative of a CONTENT method 2070 provided by the preferred embodiment. CONTENT method 2070 in the preferred embodiment builds a "synopsis" of protected content using a secure process. For example, CONTENT method 2070 may be used to derive unsecure ("public") information from secure content. Such derived public information might include, for example, an abstract, an index, a table of contents, a directory of files, a schedule when content may be available, or excerpts such as for example, a movie "trailer."

CONTENT method 2070 begins by determining whether the derived content to be provided must be derived from secure contents, or whether it is already available in the object in the form of static values (decision block 2070). Some objects may, for example, contain prestored abstracts, indexes, tables of contents, etc., provided expressly for the purpose of being extracted by the CONTENT method 2070. If the object contains such static values ("static" exit to decision block 2072), then CONTENT method 2070 may simply read this static value content information from the object (block 2074), optionally decrypt, and release this content description (block 2076). If, on the other hand, CONTENT method 2070 must derive the synopsis/content description from the secure object ("derived" exit to decision block 2072), then the CONTENT method may then securely read information from the container according to a synopsis algorithm to produce the synopsis (block 2078).

Extract and Embed

Figure 57a is a flowchart of an example of process control steps performed by a representative example of an EXTRACT method 2080 provided by the preferred embodiment. EXTRACT method 2080 is used to copy or remove content from an object and place it into a new object. In the preferred embodiment, the EXTRACT method 2080 does not involve any release of content, but rather simply takes content from one container and places it

into another container, both of which may be secure. Extraction of content differs from release in that the content is never exposed outside a secure container. Extraction and Embedding are complementary functions; extract takes content from a container and creates a new container containing the extracted content and any specified control information associated with that content. Embedding takes content that is already in a container and stores it (or the complete object) in another container directly and/or by reference, integrating the control information associated with existing content with those of the new content.

EXTRACT method 2080 begins by priming an Audit UDE (blocks 2082, 2084). EXTRACT method then calls a BUDGET method to make sure that the user has enough budget for (and is authorized to) extract content from the original object (block 2086). If the user's budget does not permit the extraction ("no" exit to decision block 2088), then EXTRACT method 2080 may write a failure audit record (block 2090), and terminate (termination point 2092). If the user's budget permits the extraction ("yes" exit to decision block 2088), then the EXTRACT method 2080 creates a copy of the extracted object with specified rules and control information (block 2094). In the preferred embodiment, this step involves calling a method that actually controls the copy. This step may or may not involve decryption

and encryption, depending on the particular the PERC 808 associated with the original object, for example. EXTRACT method 2080 then checks whether any control changes are permitted by the rights authorizing the extract to begin with (decision block 2096). In some cases, the extract rights require an exact copy of the PERC 808 associated with the original object (or a PERC included for this purpose) to be placed in the new (destination) container ("no" exit to decision block 2096). If no control changes are permitted, then extract method 2080 may simply write audit information to the Audit UDE (blocks 2098, 2100) before terminating (terminate point 2102). If, on the other hand, the extract rights permit the user to make control changes ("yes" to decision block 2096), then EXTRACT method 2080 may call a method or load module that solicits new or changed control information (e.g., from the user, the distributor who created/granted extract rights, or from some other source) from the user (blocks 2104, 2106). EXTRACT method 2080 may then call a method or load module to create a new PERC that reflects these user-specified control information (block 2104). This new PERC is then placed in the new (destination) object, the auditing steps are performed, and the process terminates.

Figure 57b is an example of process control steps performed by a representative example of an EMBED method 2110 provided by the preferred embodiment. EMBED method

2110 is similar to EXTRACT method 2080 shown in Figure 57a. However, the EMBED method 2110 performs a slightly different function—it writes an object (or reference) into a destination container. Blocks 2112-2122 shown in Figure 57b are similar to blocks 2082-2092 shown in Figure 57a. At block 2124, EMBED method 2110 writes the source object into the destination container, and may at the same time extract or change the control information of the destination container. One alternative is to simply leave the control information of the destination container alone, and include the full set of control information associated with the object being embedded in addition to the original container control information. As an optimization, however, the preferred embodiment provides a technique whereby the control information associated with the object being embedded are "abstracted" and incorporated into the control information of the destination container. Block 2124 may call a method to abstract or change this control information. EMBED method 2110 then performs steps 2126-2130 which are similar to steps 2096, 2104, 2106 shown in Figure 57a to allow the user, if authorized, to change and/or specify control information associated with the embedded object and/or destination container. EMBED method 2110 then writes audit information into an Audit UDE (blocks 2132, 2134), before terminating (at termination point 2136).

Obscure

Figure 58a is a flowchart of an example of process control steps performed by a representative example of an OBSCURE method 2140 provided by the preferred embodiment. OBSCURE method 2140 is typically used to release secure content in devalued form. For example, OBSCURE method 2140 may release a high resolution image in a lower resolution so that a viewer can appreciate the image but not enjoy its full value. As another example, the OBSCURE method 2140 may place an obscuring legend (e.g., "COPY," "PROOF," etc.) across an image to devalue it. OBSCURE method 2140 may "obscure" text, images, audio information, or any other type of content.

OBSCURE method 2140 first calls an EVENT method to determine if the content is appropriate and in the range to be obscured (block 2142). If the content is not appropriate for obscuring, the OBSCURE method terminates (decision block 2144 "no" exit, terminate point 2146). Assuming that the content is to be obscured ("yes" exit to decision block 2144), then OBSCURE method 2140 determines whether it has previously been called to obscure this content (decision block 2148). Assuming the OBSCURE 2140 has not previously called for this object/content ("yes" exit to decision block 2148), the OBSCURE method 2140 reads an appropriate OBSCURE method MDE from the secure database and loads an obscure formula and/or pattern

from the MDE (blocks 2150, 2152). The OBSCURE method 2140 may then apply the appropriate obscure transform based on the patters and/or formulas loaded by block 2150 (block 2154). The OBSCURE method then may terminate (terminate block 2156).

Fingerprint

Figure 58b is a flowchart of an example of process control steps performed by a representative example of a FINGERPRINT method 2160 provided by the preferred embodiment. FINGERPRINT method 2160 in the preferred embodiment operates to "mark" released content with a "fingerprint" identification of who released the content and/or check for such marks. This allows one to later determine who released unsecured content by examining the content. FINGERPRINT method 2160 may, for example, insert a user ID within a datastream representing audio, video, or binary format information. FINGERPRINT method 2160 is quite similar to OBSCURE method 2140 shown in Figure 58a except that the transform applied by FINGERPRINT method block 2174 "fingerprints" the released content rather than obscuring it.

Figure 58c shows an example of a "fingerprinting" procedure 2160 that inserts into released content "fingerprints" 2161 that identify the object and/or property and/or the user that

requested the released content and/or the date and time of the release and/or other identification criteria of the released content.

Such fingerprints 2161 can be "buried" -- that is inserted in a manner that hides the fingerprints from typical users, sophisticated "hackers," and/or from all users, depending on the file format, the sophistication and/or variety of the insertion algorithms, and on the availability of original, non-fingerprinted content (for comparison for reverse engineering of algorithm(s)). Inserted or embedded fingerprints 2161, in a preferred embodiment, may be at least in part encrypted to make them more secure. Such encrypted fingerprints 2161 may be embedded within released content provided in "clear" (plaintext) form.

Fingerprints 2161 can be used for a variety of purposes including, for example, the often related purposes of proving misuse of released materials and proving the source of released content. Software piracy is a particularly good example where fingerprinting can be very useful. Fingerprinting can also help to enforce content providers' rights for most types of electronically delivered information including movies, audio recordings, multimedia, information databases, and traditional "literary" materials. Fingerprinting is a desirable alternative or addition to copy protection.

Most piracy of software applications, for example, occurs not with the making of an illicit copy by an individual for use on another of the individual's own computers, but rather in giving a copy to another party. This often starts a chain (or more accurately a pyramid) of illegal copies, as copies are handed from individual to individual. The fear of identification resulting from the embedding of a fingerprint 2161 will likely dissuade most individuals from participating, as many currently do, in widespread, "casual" piracy. In some cases, content may be checked for the presence of a fingerprint by a fingerprint method to help enforce content providers' rights.

Different fingerprints 2161 can have different levels of security (e.g., one fingerprint 2161(1) could be readable/identifiable by commercial concerns, while another fingerprint 2161(2) could be readable only by a more trusted agency. The methods for generating the more secure fingerprint 2161 might employ more complex encryption techniques (e.g., digital signatures) and/or obscuring of location methodologies. Two or more fingerprints 2161 can be embedded in different locations and/or using different techniques to help protect fingerprinted information against hackers. The more secure fingerprints might only be employed periodically rather than each time content release occurs, if the technique used to provide a more secure fingerprint involves an undesired amount of

additional overhead. This may nevertheless be effective since a principal objective of fingerprinting is deterrence—that is the fear on the part of the creator of an illicit copy that the copying will be found out.

For example, one might embed a copy of a fingerprint 2161 which might be readily identified by an authorized party--for example a distributor, service personal, client administrator, or clearinghouse using a VDE electronic appliance 600. One might embed one or more additional copies or variants of a fingerprint 2161 (e.g., fingerprints carrying information describing some or all relevant identifying information) and this additional one or more fingerprints 2161 might be maintained in a more secure manner.

Fingerprinting can also protect privacy concerns. For example, the algorithm and/or mechanisms needed to identify the fingerprint 2161 might be available only through a particularly trusted agent.

Fingerprinting 2161 can take many forms. For example, in an image, the color of every N pixels (spread across an image, or spread across a subset of the image) might be subtly shifted in a visually unnoticeable manner (at least according to the normal, unaided observer). These shifts could be interpreted by analysis

of the image (with or without access to the original image), with each occurrence or lack of occurrence of a shift in color (or greyscale) being one or more binary "on or off" bits for digital information storage. The N pixels might be either consistent, or alternatively, pseudo-random in order (but interpretable, at least in part, by a object creator, object provider, client administrator, and/or VDE administrator).

Other modifications of an image (or moving image, audio, etc.) which provide a similar benefit (that is, storing information in a form that is not normally noticeable as a result of a certain modification of the source information) may be appropriate, depending on the application. For example, certain subtle modifications in the frequency of stored audio information can be modified so as to be normally unnoticeable to the listener while still being readable with the proper tools. Certain properties of the storage of information might be modified to provide such slight but interpretable variations in polarity of certain information which is optically stored to achieve similar results. Other variations employing other electronic, magnetic, and/or optical characteristic may be employed.

Content stored in files that employ graphical formats, such as Microsoft Windows word processing files, provide significant opportunities for "burying" a fingerprint 2161. Content that

includes images and/or audio provides the opportunity to embed fingerprints 2161 that may be difficult for unauthorized individuals to identify since, in the absence of an "unfingerprinted" original for purposes of comparison, minor subtle variations at one or more time instances in audio frequencies, or in one or more video images, or the like, will be in themselves undiscernible given the normally unknown nature of the original and the large amounts of data employed in both image and sound data (and which is not particularly sensitive to minor variations). With formatted text documents, particularly those created with graphical word processors (such as Microsoft Windows or Apple MacIntosh word processors and their DOS and Unix equivalents), fingerprints 2161 can normally be inserted unobtrusively into portions of the document data representation that are not normally visible to the end user (such as in a header or other non-displayed data field).

Yet another form of fingerprinting, which may be particularly suitable for certain textual documents, would employ and control the formation of characters for a given font. Individual characters may have a slightly different visual formation which connotes certain "fingerprint" information. This alteration of a given character's form would be generally undiscernible, in part because so many slight variations exist in versions of the same font available from different suppliers, and

in part because of the smallness of the variation. For example, in a preferred embodiment, a program such as Adobe Type Align could be used which, in its off-the-shelf versions, supports the ability of a user to modify font characters in a variety of ways. The mathematical definition of the font character is modified according to the user's instructions to produce a specific set of modifications to be applied to a character or font. Information content could be used in an analogous manner (as an alternative to user selections) to modify certain or all characters too subtly for user recognition under normal circumstances but which nevertheless provide appropriate encoding for the fingerprint 2161. Various subtly different versions of a given character might be used within a single document so as to increase the ability to carry transaction related font fingerprinted information.

Some other examples of applications for fingerprinting might include:

1. In software programs, selecting certain interchangeable code fragments in such a way as to produce more or less identical operation, but on analysis, differences that detail fingerprint information.
2. With databases, selecting to format certain fields, such as dates, to appear in different ways.

3. In games, adjusting backgrounds, or changing order of certain events, including noticeable or very subtle changes in timing and/or ordering of appearance of game elements, or slight changes in the look of elements of the game.

Fingerprinting method 2160 is typically performed (if at all) at the point at which content is released from a content object 300. However, it could also be performed upon distribution of an object to "mark" the content while still in encrypted form. For example, a network-based object repository could embed fingerprints 2161 into the content of an object before transmitting the object to the requester, the fingerprint information could identify a content requester/end user. This could help detect "spoof" electronic appliances 600 used to release content without authorization.

Destroy

Figure 59 is a flowchart of an example of process control steps performed by a representative performed by a DESTROY method 2180 provided by the preferred embodiment. DESTROY method 2180 removes the ability of a user to use an object by destroying the URT the user requires to access the object. In the preferred embodiment, a DESTROY method 2180 may first write audit information to an Audit UDE (blocks 2182, 2184).

DESTROY method 2180 may than call a WRITE and/or ACCESS method to write information which will corrupt (and thus destroy) the header and/or other important parts of the object (block 2186). DESTROY method 2180 may then mark one or more of the control structures (e.g., the URT) as damaged by writing appropriate information to the control structure (blocks 2188, 2190). DESTROY method 2180, finally, may write additional audit information to Audit UDE (blocks 2192, 2194) before terminating (terminate point 2196).

Panic

Figure 60 is a flowchart of an example of process control steps performed by a representative example of a PANIC method 2200 provided by the preferred embodiment. PANIC method 2200 may be called when a security violation is detected. PANIC method 2200 may prevent the user from further accessing the object currently being accessed by, for example, destroying the channel being used to access the object and marking one or more of the control structures (e.g., the URT) associated with the user and object as damaged (blocks 2206, and 2208-2210, respectively). Because the control structure is damaged, the VDE node will need to contact an administrator to obtain a valid control structure(s) before the user may access the same object again. When the VDE node contacts the administrator, the administrator may request information sufficient to satisfy itself

that no security violation occurred, or if a security violation did occur, take appropriate steps to ensure that the security violation is not repeated.

Meter

Figure 61 is a flowchart of an example of process control steps performed by a representative example of a METER method provided by the preferred embodiment. Although METER methods were described above in connection with Figures 49, 50 and 51, the METER method 2220 shown in Figure 61 is possibly a somewhat more representative example. In the preferred embodiment, METER method 2220 first primes an Audit Trail by accessing a METER Audit Trail UDE (blocks 2222, 2224). METER method 2220 may then read the DTD for the Meter UDE from the secure database (blocks 2226, 2228). METER method 2220 may then read the Meter UDE from the secure database (blocks 2230, 2232). METER method 2220 next may test the obtained Meter UDE to determine whether it has expired (decision block 2234). In the preferred embodiment, each Meter UDE may be marked with an expiration date. If the current date/time is later than the expiration date of the Meter UDE ("yes" exit to decision block 2234), then the METER method 2220 may record a failure in the Audit Record and terminate with a failure condition (block 2236, 2238).

Assuming the Meter UDE is not yet expired, the meter method 2220 may update it using the atomic element and event count passed to the METER method from, for example, an EVENT method (blocks 2239, 2240). The METER method 2220 may then save the Meter Use Audit Record in the Meter Audit Trail UDE (blocks 2242, 2244), before terminating (at terminate point 2246).

Additional Security Features Provided by the Preferred Embodiment

VDE 100 provided by the preferred embodiment has sufficient security to help ensure that it cannot be compromised short of a successful "brute force attack," and so that the time and cost to succeed in such a "brute force attack" substantially exceeds any value to be derived. In addition, the security provided by VDE 100 compartmentalizes the internal workings of VDE so that a successful "brute force attack" would compromise only a strictly bounded subset of protected information, not the entire system.

The following are among security aspects and features provided by the preferred embodiment:

- security of PPE 650 and the processes it performs
- security of secure database 610

- security of encryption/decryption performed by PPE 650
- key management; security of encryption/decryption keys and shared secrets
- security of authentication/external communications
- security of secure database backup
- secure transportability of VDE internal information between electronic appliances 600
- security of permissions to access VDE secure information
- security of VDE objects 300
- integrity of VDE security.

Some of these security aspects and considerations are discussed above. The following provides an expanded discussion of preferred embodiment security features not fully addressed elsewhere.

Management of Keys and Shared Secrets

VDE 100 uses keys and shared secrets to provide security. The following key usage features are provided by the preferred embodiment:

- different cryptosystem/key types
- secure key length
- key generation

- key "convolution" and key "aging."

Each of these types are discussed below.

A. Public-Key and Symmetric Key Cryptosystems

The process of disguising or transforming information to hide its substance is called encryption. Encryption produces "ciphertext." Reversing the encryption process to recover the substance from the ciphertext is called "decryption." A cryptographic algorithm is the mathematical function used for encryption and decryption.

Most modern cryptographic algorithms use a "key." The "key" specifies one of a family of transformations to be provided. Keys allow a standard, published and tested cryptographic algorithm to be used while ensuring that specific transformations performed using the algorithm are kept secret. The secrecy of the particular transformations thus depends on the secrecy of the key, not on the secrecy of the algorithm.

There are two general forms of key-based algorithms, either or both of which may be used by the preferred embodiment PPE 650:

symmetric; and

public-key ("PK").

Symmetric algorithms are algorithms where the encryption key can be calculated from the decryption key and vice versa. In many such systems, the encryption and decryption keys are the same. The algorithms, also called "secret-key", "single key" or "shared secret" algorithms, require a sender and receiver to agree on a key before ciphertext produced by a sender can be decrypted by a receiver. This key must be kept secret. The security of a symmetric algorithm rests in the key: divulging the key means that anybody could encrypt and decrypt information in such a cryptosystem. See Schneier, Applied Cryptography at Page 3. Some examples of symmetric key algorithms that the preferred embodiment may use include DES, Skipjack/Clipper, IDEA, RC2, and RC4.

In public-key cryptosystems, the key used for encryption is different from the key used for decryption. Furthermore, it is computationally infeasible to derive one key from the other. The algorithms used in these cryptosystems are called "public key" because one of the two keys can be made public without endangering the security of the other key. They are also sometimes called "asymmetric" cryptosystems because they use different keys for encryption and decryption. Examples of public-key algorithms include RSA, El Gamal and LUC.

The preferred embodiment PPE 650 may operate based on only symmetric key cryptosystems, based on public-key cryptosystems, or based on both symmetric key cryptosystems and public-key cryptosystems. VDE 100 does not require any specific encryption algorithms; the architecture provided by the preferred embodiment may support numerous algorithms including PK and/or secret key (non PK) algorithms. In some cases, the choice of encryption/decryption algorithm will be dependent on a number of business decisions such as cost, market demands, compatibility with other commercially available systems, export laws, etc.

Although the preferred embodiment is not dependent on any particular type of cryptosystem or encryption/decryption algorithm(s), the preferred example uses PK cryptosystems for secure communications between PPEs 650, and uses secret key cryptosystems for "bulk" encryption/decryption of VDE objects 300. Using secret key cryptosystems (e.g., DES implementations using multiple keys and multiple passes, Skipjack, RC2, or RC4) for "bulk" encryption/decryption provides efficiencies in encrypting and decrypting large quantities of information, and also permits PPEs 650 without PK-capability to deal with VDE objects 300 in a variety of applications. Using PK cryptosystems for communications may provide advantages such as eliminating reliance on secret shared external communication keys to

establish communications, allowing for a challenge/response that doesn't rely on shared internal secrets to authenticate PPEs 650, and allowing for a publicly available "certification" process without reliance on shared secret keys.

Some content providers may wish to restrict use of their content to PK implementations. This desire can be supported by making the availability of PK capabilities, and the specific nature or type of PK capabilities, in PPEs 650 a factor in the registration of VDE objects 300, for example, by including a requirement in a REGISTER method for such objects in the form of a load module that examines a PPE 650 for specific or general PK capabilities before allowing registration to continue.

Although VDE 100 does not require any specific algorithm, it is highly desirable that all PPEs 650 are capable of using the same algorithm for bulk encryption/decryption. If the bulk encryption/decryption algorithm used for encrypting VDE objects 300 is not standardized, then it is possible that not all VDE electronic appliances 600 will be capable of handling all VDE objects 300. Performance differences will exist between different PPEs 650 and associated electronic appliances 600 if standardized bulk encryption/decryption algorithms are not implemented in whole or in part by hardware-based encrypt/decrypt engine 522, and instead are implemented in

software. In order to support algorithms that are not implemented in whole or in part by encrypt/decrypt engine 522, a component assembly that implements such an algorithm must be available to a PPE 650.

B. Key Length

Increased key length may increase security. A "brute-force" attack of a cryptosystem involves trying every possible key. The longer the key, the more possible keys there are to try. At some key length, available computation resources will require an impractically large amount of time for a "brute force" attacker to try every possible key.

VDE 100 provided by the preferred embodiment accommodates and can use many different key lengths. The length of keys used by VDE 100 in the preferred embodiment is determined by the algorithm(s) used for encryption/decryption, the level of security desired, and throughput requirements. Longer keys generally require additional processing power to ensure fast encryption/decryption response times. Therefore, there is a tradeoff between (a) security, and (b) processing time and/or resources. Since a hardware-based PPE encrypt/decrypt engine 522 may provide faster processing than software-based encryption/decryption, the hardware-based approach may, in general, allow use of longer keys.

The preferred embodiment may use a 1024 bit modulus (key) RSA cryptosystem implementation for PK encryption/decryption, and may use 56-bit DES for "bulk" encryption/decryption. Since the 56-bit key provided by standard DES may not be long enough to provide sufficient security for at least the most sensitive VDE information, multiple DES encryptions using multiple passes and multiple DES keys may be used to provide additional security. DES can be made significantly more secure if operated in a manner that uses multiple passes with different keys. For example, three passes with 2 or 3 separate keys is much more secure because it effectively increases the length of the key. RC2 and RC4 (alternatives to DES) can be exported for up to 40-bit key sizes, but the key size probably needs to be much greater to provide even DES level security. The 80-bit key length provided by NSA's Skipjack may be adequate for most VDE security needs.

The capability of downloading code and other information dynamically into PPE 650 allows key length to be adjusted and changed dynamically even after a significant number of VDE electronic appliances 600 are in use. The ability of a VDE administrator to communicate with each PPE 650 efficiently makes such after-the-fact dynamic changes both possible and cost-effective. New or modified cryptosystems can be downloaded into existing PPEs 650 to replace or add to the cryptosystem

repertoire available within the PPE, allowing older PPEs to maintain compatibility with newer PPEs and/or newly released VDE objects 300 and other VDE-protected information. For example, software encryption/decryption algorithms may be downloaded into PPE 650 at any time to supplement the hardware-based functionality of encrypt/decrypt engine 522 by providing different key length capabilities. To provide increased flexibility, PPE encrypt/decrypt engine 522 may be configured to anticipate multiple passes and/or variable and/or longer key lengths. In addition, it may be desirable to provide PPEs 650 with the capability to internally generate longer PK keys.

C. Key Generation

Key generation techniques provided by the preferred embodiment permit PPE 650 to generate keys and other information that are "known" only to it.

The security of encrypted information rests in the security of the key used to encrypt it. If a cryptographically weak process is used to generate keys, the entire security is weak. Good keys are random bit strings so that every possible key in the key space is equally likely. Therefore, keys should in general be derived from a reliably random source, for example, by a cryptographically secure pseudo-random number generator seeded from such a source. Examples of such key generators are

described in Schneier, Applied Cryptography (John Wiley and Sons, 1994), chapter 15. If keys are generated outside a given PPE 650 (e.g., by another PPE 650), they must be verified to ensure they come from a trusted source before they can be used. "Certification" may be used to verify keys.

The preferred embodiment PPE 650 provides for the automatic generation of keys. For example, the preferred embodiment PPE 650 may generate its own public/private key pair for use in protecting PK-based external communications and for other reasons. A PPE 650 may also generate its own symmetric keys for various purposes during and after initialization. Because a PPE 650 provides a secure environment, most key generation in the preferred embodiment may occur within the PPE (with the possible exception of initial PPE keys used at manufacturing or installation time to allow a PPE to authenticate initial download messages to it).

Good key generation relies on randomness. The preferred embodiment PPE 650 may, as mentioned above in connection with Figure 9, includes a hardware-based random number generator 542 with the characteristics required to generate reliable random numbers. These random numbers may be used to "seed" a cryptographically strong pseudo-random number generator (e.g., DES operated in Output Feedback Mode) for

generation of additional key values derived from the random seed. In the preferred embodiment, random number generator 542 may consist of a "noise diode" or other physically-based source of random values (e.g., radioactive decay).

If no random number generator 542 is available in the PPE 650, the SPE 503 may employ a cryptographic algorithm (e.g., DES in Output Feedback Mode) to generate a sequence of pseudo-random values derived from a secret value protected within the SPE. Although these numbers are pseudo-random rather than truly random, they are cryptographically derived from a value unknown outside the SPE 503 and therefore may be satisfactory in some applications.

In an embodiment incorporating an HPE 655 without an SPE 503, the random value generator 565 software may derive reliably random numbers from unpredictable external physical events (e.g., high-resolution timing of disk I/O completions or of user keystrokes at an attached keyboard 612).

Conventional techniques for generating PK and non-PK keys based upon such "seeds" may be used. Thus, if performance and manufacturing costs permit, PPE 650 in the preferred embodiment will generate its own public/private key pair based on such random or pseudo-random "seed" values. This key pair

may then be used for external communications between the PPE 650 that generated the key pair and other PPEs that wish to communicate with it. For example, the generating PPE 650 may reveal the public key of the key pair to other PPEs. This allows other PPEs 650 using the public key to encrypt messages that may be decrypted only by the generating PPE (the generating PPE is the only PPE that "knows" the corresponding "private key"). Similarly, the generating PPE 650 may encrypt messages using its private key that, when decrypted successfully by other PPEs with the generating PPE's public key, permit the other PPEs to authenticate that the generating PPE sent the message.

Before one PPE 650 uses a public key generated by another PPE, a public key certification process should be used to provide authenticity certificates for the public key. A public-key certificate is someone's public key "signed" by a trustworthy entity such as an authentic PPE 650 or a VDE administrator. Certificates are used to thwart attempts to convince a PPE 650 that it is communicating with an authentic PPE when it is not (e.g., it is actually communicating with a person attempting to break the security of PPE 650). One or more VDE administrators in the preferred embodiment may constitute a certifying authority. By "signing" both the public key generated by a PPE 650 and information about the PPE and/or the corresponding VDE electronic appliance 600 (e.g., site ID, user ID, expiration

date, name, address, etc.), the VDE administrator certifying authority can certify that information about the PPE and/or the VDE electronic appliance is correct and that the public key belongs to that particular VDE mode.

Certificates play an important role in the trustedness of digital signatures, and also are important in the public-key authentication communications protocol (to be discussed below). In the preferred embodiment, these certificates may include information about the trustedness/level of security of a particular VDE electronic appliance 600 (e.g., whether or not it has a hardware-based SPE 503 or is instead a less trusted software emulation type HPE 655) that can be used to avoid transmitting certain highly secure information to less trusted/secure VDE installations.

Certificates can also play an important role in decommissioning rogue users and/or sites. By including a site and/or user ID in a certificate, a PPE can evaluate this information as an aspect of authentication. For example, if a VDE administrator or clearinghouse encounters a certificate bearing an ID (or other information) that meets certain criteria (e.g., is present on a list of decommissioned and/or otherwise suspicious users and/or sites), they may choose to take actions based on those criteria such as refusing to communicate,

communicating disabling information, notifying the user of the condition, etc. Certificates also typically include an expiration date to ensure that certificates must be replaced periodically, for example, to ensure that sites and/or users must stay in contact with a VDE administrator and/or to allow certification keys to be changed periodically. More than one certificate based on different keys may be issued for sites and/or users so that if a given certification key is compromised, one or more "backup" certificates may be used. If a certification key is compromised, A VDE administrator may refuse to authenticate based on certificates generated with such a key, and send a signal after authenticating with a "backup" certificate that invalidates all use of the compromised key and all certificates associated with it in further interactions with VDE participants. A new one or more "backup" certificates and keys may be created and sent to the authenticated site/user after such a compromise.

If multiple certificates are available, some of the certificates may be reserved as backups. Alternatively or in addition, one certificate from a group of certificates may be selected (e.g., by using RNG 542) in a given authentication, thereby reducing the likelihood that a certificate associated with a compromised certification key will be used. Still alternatively, more than one certificate may be used in a given authentication.

To guard against the possibility of compromise of the certification algorithm (e.g., by an unpredictable advance in the mathematical foundations on which the algorithm is based), distinct algorithms may used for different certificates that are based on different mathematical foundations.

Another technique that may be employed to decrease the probability of compromise is to keep secret (in protected storage in the PPE 650) the "public" values on which the certificates are based, thereby denying an attacker access to values that may aid in the attack. Although these values are nominally "public," they need be known only to those components which actually validate certificates (i.e., the PPE 650).

In the preferred embodiment, PPE 650 may generate its own certificate, or the certificate may be obtained externally, such as from a certifying authority VDE administrator. Irrespective of where the digital certificate is generated, the certificate is eventually registered by the VDE administrator certifying authority so that other VDE electronic appliances 600 may have access to (and trust) the public key. For example, PPE 650 may communicate its public key and other information to a certifying authority which may then encrypt the public key and other information using the certifying authority's private key. Other installations 600 may trust the "certificate" because it can

be authenticated by using the certifying authority's public key to decrypt it. As another example, the certifying authority may encrypt the public key it receives from the generating PPE 650 and use it to encrypt the certifying authority's private key. The certifying authority may then send this encrypted information back to the generating PPE 650. The generating PPE 650 may then use the certifying authority's private key to internally create a digital certificate, after which it may destroy its copy of the certifying authority's private key. The generating PPE 650 may then send out its digital certificate to be stored in a certification repository at the VDE administrator (or elsewhere) if desired. The certificate process can also be implemented with an external key pair generator and certificate generator, but might be somewhat less secure depending on the nature of the secure facility. In such a case, a manufacturing key should be used in PPE 650 to limit exposure to the other keys involved.

A PPE 650 may need more than one certificate. For example, a certificate may be needed to assure other users that a PPE is authentic, and to identify the PPE. Further certificates may be needed for individual users of a PPE 650. These certificates may incorporate both user and site information or may only include user information. Generally, a certifying authority will require a valid site certificate to be presented prior to creating a certificate for a given user. Users may each require

their own public key/private key pair in order to obtain certificates. VDE administrators, clearinghouses, and other participants may normally require authentication of both the site (PPE 650) and of the user in a communication or other interaction. The processes described above for key generation and certification for PPEs 650 may also be used to form site/user certificates or user certificates.

Certificates as described above may also be used to certify the origin of load modules 1100 and/or the authenticity of administrative operations. The security and assurance techniques described above may be employed to decrease the probability of compromise for any such certificate (including certificates other than the certificate for a VDE electronic appliance 600's identity).

D. Key Aging and Convolution

PPE 650 also has the ability in the preferred embodiment to generate secret keys and other information that is shared between multiple PPEs 650. In the preferred embodiment, such secret keys and other information may be shared between multiple VDE electronic appliances 600 without requiring the shared secret information to ever be communicated explicitly between the electronic appliances. More specifically, PPE 650 uses a technique called "key convolution" to derive keys based on

a deterministic process in response to seed information shared between multiple VDE electronic appliances 600. Since the multiple electronic appliances 600 "know" what the "seed" information is and also "know" the deterministic process used to generate keys based on this information, each of the electronic appliances may independently generate the "true key." This permits multiple VDE electronic appliances 600 to share a common secret key without potentially compromising its security by communicating it over an insecure channel.

No encryption key should be used for an indefinite period. The longer a key is used, the greater the chance that it may be compromised and the greater the potential loss if the key is compromised but still in use to protect new information. The longer a key is used, the more information it may protect and therefore the greater the potential rewards for someone to spend the effort necessary to break it. Further, if a key is used for a long time, there may be more ciphertext available to an attacker attempting to break the key using a ciphertext-based attack. See Schneier at 150-151. Key convolution in the preferred embodiment provides a way to efficiently change keys stored in secure database 610 on a routine periodic or other basis while simplifying key management issues surrounding the change of keys. In addition, key convolution may be used to provide "time

aged keys" (discussed below) to provide "expiration dates" for key usage and/or validity.

Figure 62 shows an example implementation of key convolution in the preferred embodiment. Key convolution may be performed using a combination of a site ID 2821 and the high-order bits of the RTC 528 to yield a site-unique value "V" that is time-dependent on a large scale (e.g., hours or days). This value "V" may be used as the key for an encryption process 2871 that transforms a convolution seed value 2861 into a "current convolution key" 2862. The seed value 2861 may be a universe-wide or group-wide shared secret value, and may be stored in secure key storage (e.g., protected memory within PPE 650). The seed value 2861 is installed during the manufacturing process and may be updated occasionally by a VDE administrator. There may be a plurality of seed values 2861 corresponding to different sets of objects 300.

The current convolution key 2862 represents an encoding of the site ID 2821 and current time. This transformed value 2862 may be used as a key for another encryption process 2872 to transform the stored key 810 in the object's PERC 808 into the true private body key 2863 for the object's contents.

The "convolution function" performed by blocks 2861, 2871 may, for example, be a one-way function that can be performed independently at both the content creator's site and at the content user's site. If the content user does not use precisely the same convolution function and precisely the same input values (e.g., time and/or site and/or other information) as used by the content creator, then the result of the convolution function performed by the content user will be different from the content creator's result. If the result is used as a symmetrical key for encryption by the content creator, the content user will not be able to decrypt unless the content user's result is the same as the result of the content creator.

The time component for input to the key convolution function may be derived from RTC 528 (care being taken to ensure that slight differences in RTC synchronization between VDE electronic appliances will not cause different electronic appliances to use different time components). Different portions of the RTC 528 output may be used to provide keys with different valid durations, or some tolerance can be built into the process to try several different key values. For example, a "time granularity" parameter can be adjusted to provide time tolerance in terms of days, weeks, or any other time period. As one example, if the "time granularity" is set to 2 days, and the tolerance is ±2 days, then three real-time input values can be

tried as input to the convolution algorithm. Each of the resulting key values may be tried to determine which of the possible keys is actually used. In this example, the keys will have only a 4 day life span.

Figure 63 shows how an appropriate convoluted key may be picked in order to compensate for skew between the user's RTC 528 and the producer's RTC 528. A sequence of convolution keys 2862 (a-e) may be generated by using different input values 2881(a-e), each derived from the site ID 2821 and the RTC 528 value plus or minus a differential (e.g., -2 days, -1 days, no delta, +1 days, +2 days). The convolution steps 2871(a-e) are used to generate the sequence of keys 2862(a-e).

Meanwhile, the creator site may use the convolution step 2871(z) based on his RTC 528 value (adjusted to correspond to the intended validity time for the key) to generate a convoluted key 2862(z), which may then be used to generate the content key 2863 in the object's PERC 808. To decrypt the object's content, the user site may use each of its sequence of convolution keys 2862 (a-e) to attempt to generate the master content key 810. When this is attempted, as long as the RTC 538 of the creator site is within acceptable tolerance of the RTC 528 at the user site, one of keys 2862(a-e) will match key 2862(z) and the decryption

will be successful. In this example, matching is determined by validity of decrypted output, not by direct comparison of keys.

Key convolution as described above need not use both site ID and time as a value. Some keys may be generated based on current real time, other keys might be generated on site ID, and still other keys might be generated based on both current real-time and site ID.

Key convolution can be used to provide "time-aged" keys. Such "time-aged" keys provide an automatic mechanism for allowing keys to expire and be replaced by "new" keys. They provide a way to give a user time-limited rights to make time-limited use of an object, or portions of an object, without requiring user re-registration but retaining significant control in the hands of the content provider or administrator. If secure database 610 is sufficiently secure, similar capabilities can be accomplished by checking an expiration date/time associated with a key, but this requires using more storage space for each key or group of keys.

In the preferred embodiment, PERCs 808 can include an expiration date and/or time after which access to the VDE-protected information they correspond to is no longer authorized. Alternatively or in addition, after a duration of time related to

some aspect of the use of the electronic appliance 600 or one or more VDE objects 300, a PERC 808 can force a user to send audit history information to a clearinghouse, distributor, client administrator, or object creator in order to regain or retain the right to use the object(s). The PERC 808 can enforce such time-based restrictions by checking/enforcing parameters that limit key usage and/or availability past time of authorized use. "Time aged" keys may be used to enforce or enhance this type of time-related control of access to VDE protected information.

"Time aged" keys can be used to encrypt and decrypt a set of information for a limited period of time, thus requiring re-registration or the receipt of new permissions or the passing of audit information, without which new keys are not provided for user use. Time aged keys can also be used to improve system security since one or more keys would be automatically replaced based on the time ageing criteria—and thus, cracking secure database 610 and locating one or more keys may have no real value. Still another advantage of using time aged keys is that they can be generated dynamically—thereby obviating the need to store decryption keys in secondary and/or secure memory.

A "time aged key" in the preferred embodiment is not a "true key" that can be used for encryption/decryption, but rather is a piece of information that a PPE 650, in conjunction with

other information, can use to generate a "true key." This other information can be time-based, based on the particular "ID" of the PPE 650, or both. Because the "true key" is never exposed but is always generated within a secure PPE 650 environment, and because secure PPEs are required to generate the "true key," VDE 100 can use "time aged" keys to significantly enhance security and flexibility of the system.

The process of "aging" a key in the preferred embodiment involves generating a time-aged "true key" that is a function of: (a) a "true key," and (b) some other information (e.g., real time parameters, site ID parameters, etc.) This information is combined/transformed (e.g., using the "key convolution" techniques discussed above) to recover or provide a "true key." Since the "true key" can be recovered, this avoids having to store the "true key" within PERC 808, and allow different "true keys" to correspond to the same information within PERC 808. Because the "true key" is not stored in the PERC 808, access to the PERC does not provide access to the information protected by the "true key." Thus, "time aged" keys allows content creators/providers to impose a limitation (e.g., site based and/or time based) on information access that is, in a sense, "external of" or auxiliary to the permissioning provided by one or more PERCs 808. For example, a "time aged" key may enforce an additional time limitation on access to certain protected information, this

additional time limitation being independent of any information or permissioning contained within the PERC 808 and being instead based on one or more time and/or site ID values.

As one example, time-aged decryption keys may be used to allow the purchaser of a "trial subscription" of an electronically published newspaper to access each edition of the paper for a period of one week, after which the decryption keys will no longer work. In this example, the user would need to purchase one or more new PERCs 808, or receive an update to an existing one or more permissions records, to access editions other than the ones from that week. Access to those other editions which might be handled with a totally different pricing structure (e.g., a "regular" subscription rate as opposed to a free or minimal "trial" subscription rate).

In the preferred embodiment, time-aged-based "true keys" can be generated using a one-way or invertible "key convolution" function. Input parameters to the convolution function may include the supplied time-aged keys; user and/or site specific values; a specified portion (e.g., a certain number of high order bits) of the time value from an RTC 528 (if present) or a value derived from such time value in a predefined manner; and a block or record identifier that may be used to ensure that each time aged key is unique. The output of the "key convolution" function

may be a "true key" that is used for decryption purposes until discarded. Running the function with a time-aged key and inappropriate time values typically yields a useless key that will not decrypt.

Generation of a new time aged key can be triggered based on some value of elapsed, absolute or relative time (e.g., based on a real time value from a clock such as RTC 528). At that time, the convolution would produce the wrong key and decryption could not occur until the time-aged key is updated. The criteria used to determine when a new "time aged key" is to be created may itself be changed based on time or some other input variable to provide yet another level of security. Thus, the convolution function and/or the event invoking it may change, shift or employ a varying quantity as a parameter.

One example of the use of time-aged keys is as follows:

1) A creator makes a "true" key, and encrypts content with it.

2) A creator performs a "reverse convolution" to yield a "time aged key" using, as input parameters to the "reverse convolution":

    a) the "true" key,

b) a time parameter (e.g., valid high-order time bits of RTC 528), and

c) optional other information (e.g., site ID and/or user ID).

3) The creator distributes the "time-aged key" to content users (the creator may also need to distribute the convolution algorithm and/or parameters if she is not using a convolution algorithm already available to the content users' PPE 650).

4) The content user's PPE 650 combines:

a) "time-aged" key

b) high-order time bits

c) required other information (same as 2c).

It performs a convolution function (i.e., the inverse of "reverse convolution" algorithm in step (2) above) to obtain the "true" key. If the supplied time and/or other information is "wrong," the convolution function will not yield the "true" key, and therefore content cannot be decrypted.

Any of the key blocks associated with VDE objects 300 or other items can be either a regular key block or a time-aged key block, as specified by the object creator during the object

configuration process, or where appropriate, a distributor or client administrator.

"Time aged" keys can also be used as part of protocols to provide secure communications between PPEs 650. For example, instead of providing "true" keys to PPE 650 for communications, VDE 100 may provide only "partial" communication keys to the PPE. These "partial" keys may be provided to PPE 650 during initialization, for example. A predetermined algorithm may produce "true keys" for use to encrypt/decrypt information for secure communications. The predetermined algorithm can "age" these keys the same way in all PPEs 650, or PPEs 650 can be required to contact a VDE administrator at some predetermined time so a new set of partial communications keys can be downloaded to the PPEs. If the PPE 650 does not generate or otherwise obtain "new" partial keys, then it will be disabled from communicating with other PPEs (a further, "fail safe" key may be provided to ensure that the PPE can communicate with a VDE administrator for reinitialization purposes). Two sets of partial keys can be maintained within a PPE 650 to allow a fixed amount of overlap time across all VDE appliances 600. The older of the two sets of partial keys can be updated periodically.

The following additional types of keys (to be discussed below) can also be "aged" in the preferred embodiment:

individual message keys (i.e., keys used for a particular message),

administrative, stationary and travelling object shared keys,

secure database keys, and

private body and content keys.

Initial Installation Key Management

Figure 64 shows the flow of universe-wide, or "master," keys during creating of a PPE 650. In the preferred embodiment, the PPE 650 contains a secure non-volatile key storage 2802 (e.g. SPU 500 non-volatile RAM 534 B or protected storage maintained by HPE 655) that is initialized with keys generated by the manufacturer and by the PPE itself.

The manufacturer possesses (i.e., knows, and protects from disclosure or modification) one or more public key 2811/private key 2812 key pairs used for signing and validating site identification certificates 2821. For each site, the manufacturer generates a site ID 2821 and list of site characteristics 2822. In addition, the manufacturer possesses the public keys 2813, 2814 for validating load modules and initialization code downloads. To enhance security, there may be a plurality of such certification keys, and each PPE 650 may be initialized using only a subset of such keys of each type.

As part of the initialization process, the PPE 650 may generate internally or the manufacturer may generate and supply, one or more pairs of site-specific public keys 2815 and private keys 2816. These are used by the PPE 650 to prove its identity. Similarly, site-specific database key(s) 2817 for the site are generated, and if needed (i.e., if a Random Number Generator 542 is not available), a random initialization seed 2818 is generated.

The initialization may begin by generating site ID 2821 and characteristics 2822 and the site public key 2815/private key 2816 pair(s). These values are combined and may be used to generate one or more site identity certificates 2823. The site identity certificates 2823 may be generated by the public key generation process 2804, and may be stored both in the PPE's protected key storage 2802 and in the manufacturer's VDE site certificate database 2803.

The certification process 2804 may be performed either by the manufacturer or internally to the PPE 650. If performed by the PPE 650, the PPE will temporarily receive the identity certification private key(s) 2812, generate the certificate 2823, store the certificate in local key storage 2802 and transmit it to the manufacturer, after which the PPE 650 must erase its copy of the identity certification private key(s) 2812.

Subsequently, initialization may require generation, by the PPE 650 or by the manufacturer, of site-specific database key(s) 2817 and of site-specific seed value(s) 2818, which are stored in the key storage 2802. In addition, the download certification key(s) 2814 and the load module certification key(s) 2813 may be supplied by the manufacturer and stored in the key storage 2802. These may be used by the PPE 650 to validate all further communications with external entities.

At this point, the PPE 650 may be further initialized with executable code and data by downloading information certified by the load module key(s) 2813 and download key(s) 2814. In the preferred embodiment, these keys may be used to digitally sign data to be loaded into the PPE 650, guaranteeing its validity, and additional key(s) encrypted using the site-specific public key(s) 2815 may be used to encrypt such data and protect it from disclosure.

Installation and Update Key Management

Figure 65 illustrates an example of further key installation either by the manufacturer or by a subsequent update by a VDE administrator. The manufacturer or administrator may supply initial or new values for private header key(s) 2831, external communication key(s) 2832, administrative object keys 2833, or other shared key(s) 2834. These keys may be universe-wide in

the same sense as the global certification keys 2811, 2813, and 2814, or they may be restricted to use within a defined group of VDE instances.

To perform this installation, the installer retrieves the destination site's identity certificate(s) 2823, and from that extracts the site public key(s) 2815. These key(s) may be used in an encryption process 2841 to protect the keys being installed. The key(s) being installed are then transmitted inside the destination site's PPE 650. Inside the PPE 650, the decryption process 2842 may use the site private key(s) 2816 to decrypt the transmission. The PPE 650 then stores the installed or updated keys in its key storage 2802.

Object-Specific Key Use

Figures 66 and 67 illustrate the use of keys in protecting data and control information associated with VDE objects 300.

Figure 66 shows use of a stationary content object 850 whose control information is derived from an administrative object 870. The objects may be received by the PPE 650 (e.g., by retrieval from an object repository 728 over a network or retrieved from local storage). The administrative object decryption process 2843 may use the private header key(s) 2815 to decrypt the administrative object 870, thus retrieving the

PERC 808 governing access to the content object 850. The private body key(s) 810 may then be extracted from the PERC 808 and used by the content decryption process 2845 to make the content available outside the PPE 650. In addition, the database key(s) 2817 may be used by the encryption process 2844 to prepare the PERC for storage outside the PPE 650 in the secure database 610. In subsequent access to the content object 850, the PERC 808 may be retrieved from the secure database 610, decrypted with database key(s) 2817, and used directly, rather than being extracted from administrative object 870.

Figure 67 shows the similar process involving a traveling object 860. The principal distinction between Figures 66 and 67 is that the PERC 808 is stored directly within the traveling object 860, and therefore may be used immediately after the decryption process 2843 to provide a private header key(s) 2831. This private header key 2831is used to process content within the traveling object 860.

Secret-Key Variations

Figures 64 through 67 illustrate the preferred public-key embodiment, but may also be used to help understand the secret-key versions. In secret-key embodiments, the certification process and the public key encryptions/decryptions are replaced with private-key encryptions, and the public key/private-key

pairs are replaced with individual secret keys that are shared between the PPE 650 instance and the other parties (e.g., the load module supplier(s), the PPE manufacturer). In addition, the certificate generation process 2804 is not performed in secret-key embodiments, and no site identity certificates 2823 or VDE certificate database 2803 exist.

Key Types

The detailed descriptions of key types below further explain secret-key embodiments; this summary is not intended as a complete description.The preferred embodiment PPE 650 can use different types of keys and/or different "shared secrets" for different purposes. Some key types apply to a Public-Key/Secret Key implementation, other keys apply to a Secret Key only

implementation, and still other key types apply to both. The following table lists examples of various key and "shared secret" information used in the preferred embodiment, and where this information is used and stored:

Key/Secret Information Type	Used in PK or Non-PK	Example Storage Location(s)
Master Key(s) (may include some of the specific keys mentioned below)	Both	PPE Manufacturing facility VDE administrator
Manufacturing Key	Both (PK optional)	PPE (PK case) Manufacturing facility
Certification key pair	PK	PPE Certification repository
Public/private key pair	PK	PPE Certification repository (Public Key only)
Initial secret key	Non-PK	PPE
PPE manufacturing ID	Non-PK	PPE
Site ID, shared code, shared keys and shared secrets	Both	PPE
Download authorization key	Both	PPE VDE administrator
External communication keys and other info	Both	PPE Secure Database
Administrative object keys	Both	Permission record
Stationary object keys	Both	Permission record
Traveling object shared keys	Both	Permission record
Secure database keys	Both	PPE
Private body keys	Both	Secure database Some objects
Content keys	Both	Secure database Some objects
Authorization shared secrets	Both	Permission record
Secure Database Back up keys	Both	PPE Secure database

Master Keys

A "master" key is a key used to encrypt other keys. An initial or "master" key may be provided within PPE 650 for communicating other keys in a secure way. During initialization of PPE 650, code and shared keys are downloaded to the PPE. Since the code contains secure convolution algorithms and/or coefficients, it is comparable to a "master key." The shared keys may also be considered "master keys."

If public-key cryptography is used as the basis for external communication with PPE 650, then a master key is required during the PPE Public-key pair certification process. This master key may be, for example, a private key used by the manufacturer or VDE administrator to establish the digital certificate (encrypted public key and other information of the PPE), or it may, as another example, be a private key used by a VDE administrator to encrypt the entries in a certification repository. Once certification has occurred, external communications between PPEs 650 may be established using the certificates of communicating PPEs.

If shared secret keys are used as the basis for external communications, then an initial secret key is required to establish external communications for PPE 650 initialization. This initial secret key is a "master key" in the sense that it is

used to encrypt other keys. A set of shared partial external communications keys (see discussion above) may be downloaded during the PPE initialization process, and these keys are used to establish subsequent external PPE communications.

Manufacturing Key

A manufacturing key is used at the time of PPE manufacture to prevent knowledge by the manufacturing staff of PPE-specific key information that is downloaded into a PPE at initialization time. For example, a PPE 650 that operates as part of the manufacturing facility may generate information for download into the PPE being initialized. This information must be encrypted during communication between the PPEs 650 to keep it confidential, or otherwise the manufacturing staff could read the information. A manufacturing key is used to protect the information. The manufacturing key may be used to protect various other keys downloaded into the PPE such as, for example, a certification private key, a PPE public/private key pair, and/or other keys such as shared secret keys specific to the PPE. Since the manufacturing key is used to encrypt other keys, it is a "master key."

A manufacturing key may be public-key based, or it may be based on a shared secret. Once the information is downloaded, the now-initialized PPE 650 can discard (or simply not use) the

manufacturing key. A manufacturing key may be hardwired into PPE 650 at manufacturing time, or sent to the PPE as its first key and discarded after it is no longer needed. As indicated in the table above and in the preceding discussion, a manufacturing key is not required if PK capabilities are included in the PPE.

Certification Key Pair

A certification key pair may be used as part of a "certification" process for PPEs 650 and VDE electronic appliances 600. This certification process in the preferred embodiment may be used to permit a VDE electronic appliance to present one or more "certificates" authenticating that it (or its key) can be trusted. As described above, this "certification" process may be used by one PPE 650 to "certify" that it is an authentic VDE PPE, it has a certain level of security and capability set (e.g., it is hardware based rather than merely software based), etc. Briefly, the "certification" process may involve using a certificate private key of a certification key pair to encrypt a message including another VDE node's public-key. The private key of a certification key pair is preferably used to generate a PPE certificate. It is used to encrypt a public-key of the PPE. A PPE certificate can either be stored in the PPE, or it may be stored in a certification repository.

Depending on the authentication technique chosen, the public key and the private key of a certification key pair may need to be protected. In the preferred embodiment, the certification public key(s) is distributed amongst PPEs such that they may make use of them in decrypting certificates as an aspect of authentication. Since, in the preferred embodiment, this public key is used inside a PPE 650, there is no need for this public key to be available in plaintext, and in any event it is important that such key be maintained and transmitted with integrity (e.g., during initialization and/or update by a VDE administrator). If the certification public key is kept confidential (i.e., only available in plaintext inside the PPE 650), it may make cracking security much more difficult. The private key of a certification key pair should be kept confidential and only be stored by a certifying authority (i.e., should not be distributed).

In order to allow, in the preferred embodiment, the ability to differentiate installations with different levels/degrees of trustedness/security, different certification key pairs may be used (e.g., different certification keys may be used to certify SPEs 503 then are used to certify HPEs 655).

PPE Public/Private Key Pair

In the preferred embodiment, each PPE 650 may have its own unique "device" (and/or user) public/private key pair.

Preferably, the private key of this key pair is generated within the PPE and is never exposed in any form outside of the PPE. Thus, in one embodiment, the PPE 650 may be provided with an internal capability for generating key pairs internally. If the PPE generates its own public-key crypto-system key pairs internally, a manufacturing key discussed above may not be needed. If desired, however, for cost reasons a key pair may be exposed only at the time a PPE 650 is manufactured, and may be protected at that time using a manufacturing key. Allowing PPE 650 to generate its public key pair internally allows the key pair to be concealed, but may in some applications be outweighed by the cost of putting a public-key key pair generator into PPE 650.

Initial Secret Key

The initial secret key is used as a master key by a secret key only based PPE 650 to protect information downloaded into the PPE during initialization. It is generated by the PPE 650, and is sent from the PPE to a secure manufacturing database encrypted using a manufacturing key. The secure database sends back a unique PPE manufacturing ID encrypted using the initial secret key in response.

The initial secret key is likely to be a much longer key than keys used for "standard" encryption due to its special role in PPE initialization. Since the resulting decryption overhead occurs

only during the initialization process, multiple passes through the decryption hardware with selected portions of this key are tolerable.

PPE Manufacturing ID

The PPE manufacturing ID is not a "key," but does fall within the classic definition of a "shared secret." It preferably uniquely identifies a PPE 650 and may be used by the secure database 610 to determine the PPE's initial secret key during the PPE initialization process.

Site ID, Shared Code, Shared Keys and Shared Secrets

The VDE site ID along with shared code, keys and secrets are preferably either downloaded into PPE 650 during the PPE initialization process, or are generated internally by a PPE as part of that process. In the preferred embodiment, most or all of this information is downloaded.

The PPE site ID uniquely identifies the PPE 650. The site ID is preferably unique so as to uniquely identify the PPE 650 and distinguish that PPE from all other PPEs. The site ID in the preferred embodiment provides a unique address that may be used for various purposes, such as for example to provide "address privacy" functions. In some cases, the site ID may be the public key of the PPE 650. In other cases, the PPE site ID

may be assigned during the manufacturing and/or initialization process. In the case of a PPE 650 that is not public-key-capable, it would not be desirable to use the device secret key as the unique site ID because this would expose too many bits of the key—and therefore a different information string should be used as the site ID.

Shared code comprises those code fragments that provide at least a portion of the control program for the PPE 650. In the preferred embodiment, a basic code fragment is installed during PPE manufacturing that permits the PPE to bootstrap and begin the initialization process. This fragment can be replaced during the initialization process, or during subsequent download processing, with updated control logic.

Shared keys may be downloaded into PPE 650 during the initialization process. These keys may be used, for example, to decrypt the private headers of many object structures.

When PPE 650 is operating in a secret key only mode, the initialization and download processes may import shared secrets into the PPE 650. These shared secrets may be used during communications processes to permit PPEs 650 to authenticate the identity of other PPEs and/or users.

Download Authorization Key

The download authorization key is received by PPE 650 during the initialization download process. It is used to authorize further PPE 650 code updates, key updates, and may also be used to protect PPE secure database 610 backup to allow recovery by a VDE administrator (for example) if the PPE fails. It may be used along with the site ID, time and convolution algorithm to derive a site ID specific key. The download authorization key may also be used to encrypt the key block used to encrypt secure database 610 backups. It may also be used to form a site specific key that is used to enable future downloads to the PPE 650. This download authorization key is not shared among all PPEs 650 in the preferred embodiment; it is specific to functions performed by authorized VDE administrators.

External Communications Keys and Related Secret and Public Information

There are several cases where keys are required when PPEs 650 communicate. The process of establishing secure communications may also require the use of related public and secret information about the communicating electronic appliances 600. The external communication keys and other information are used to support and authenticate secure communications. These keys comprise a public-key pair in the

preferred embodiment although shared secret keys may be used alternatively or in addition.

Administrative Object Keys

In the preferred embodiment, an administrative object shared key may be used to decrypt the private header of an administrative object 870. In the case of administrative objects, a permissions record 808 may be present in the private header. In some cases, the permissions record 808 may be distributed as (or within) an administrative object that performs the function of providing a right to process the content of other administrative objects. The permissions record 808 preferably contains the keys for the private body, and the keys for the content that can be accessed would be budgets referenced in that permissions record 808. The administrative object shared keys may incorporate time as a component, and may be replaced when expired.

Stationary Object Keys

A stationary object shared key may be used to decrypt a private header of stationary objects 850. As explained above, in some cases a permissions record 808 may be present in the private header of stationary objects. If present, the permissions record 808 may contain the keys for the private body but will not contain the keys for the content. These shared keys may

incorporate time as a component, and may be replaced when expired.

Traveling Object Shared Keys

A traveling object shared key may be used to decrypt the private header of traveling objects 860. In the preferred embodiment, traveling objects contain permissions record 808 in their private headers. The permissions record 808 preferably contains the keys for the private body and the keys for the content that can be accessed as permitted by the permissions record 808. These shared keys may incorporate time as a component, and may be replaced when expired.

Secure Database Keys

PPE 650 preferably generates these secure database keys and never exposes them outside of the PPE. They are site-specific in the preferred embodiment, and may be "aged" as described above. As described above, each time an updated record is written to secure database 610, a new key may be used and kept in a key list within the PPE. Periodically (and when the internal list has no more room), the PPE 650 may generate a new key to encrypt new or old records. A group of keys may be used instead of a single key, depending on the size of the secure database 610.

Private Body Keys

Private body keys are unique to an object 300, and are not dependent on key information shared between PPEs 650. They are preferably generated by the PPE 650 at the time the private body is encrypted, and may incorporate real-time as a component to "age" them. They are received in permissions records 808, and their usage may be controlled by budgets.

Content Keys

Content Keys are unique to an object 300, and are not dependent on key information shared between PPEs 650. They are preferably generated by the PPE 650 at the time the content is encrypted. They may incorporate time as a component to "age" them. They are received in permissions records 808, and their usage may be controlled by budgets.

Authorization Shared Secrets

Access to and use of information within a PPE 650 or within a secure database 610 may be controlled using authorization "shared secrets" rather than keys. Authorization shared secrets may be stored within the records they authorize (permissions records 808, budget records, etc.). The authorization shared secret may be formulated when the corresponding record is created. Authorization shared secrets can be generated by an authorizing PPE 650, and may be

replaced when record updates occur. Authorization shared secrets have some characteristics associated with "capabilities" used in capabilities based operating systems. Access tags (described below) are an important set of authorization shared secrets in the preferred embodiment.

Backup Keys

As described above, the secure database 610 backup consists of reading all secure database records and current audit "roll ups" stored in both PPE 650 and externally. Then, the backup process decrypts and re-encrypts this information using a new set of generated keys. These keys, the time of the backup, and other appropriate information to identify the backup, may be encrypted multiple times and stored with the previously encrypted secure database files and roll up data within the backup files. These files may then all be encrypted using a "backup key" that is generated and stored within PPE 650. This backup key 500 may be used by the PPE to recover a backup if necessary. The backup keys may also be securely encrypted (e.g., using a download authentication key and/or a VDE administrator public key) and stored within the backup itself to permit a VDE administrator to recover the backup in case of PPE 650 failure.

Cryptographic Sealing

Sealing is used to protect the integrity of information when it may be subjected to modifications outside the control of the PPE 650, either accidentally or as an attack on the VDE security. Two specific applications may be the computation of check values for database records and the protection of data blocks that are swapped out of an SPE 500.

There are two types of sealing: keyless sealing, also known as cryptographic hashing, and keyed sealing. Both employ a cryptographically strong hash function, such as MD5 or SHA. Such a function takes an input of arbitrary size and yields a fixed-size hash, or "digest." The digest has the property that it is infeasible to compute two inputs that yield the same digest, and infeasible to compute one input that yields a specific digest value, where "infeasible" is with reference to a work factor based on the size of the digest value in bits. If, for example, a 256-bit hash function is to be called strong, it must require approximately on average 10^38 (2^128) trials before a duplicated or specified digest value is likely to be produced.

Keyless seals may be employed as check values in database records (e.g., in PERC 808) and similar applications. A keyless seal may be computed based on the content of the body of the record, and the seal stored with the rest of the record. The

combination of seal and record may be encrypted to protect it in storage. If someone modifies the encrypted record without knowing the encryption key (either in the part representing the data or the part representing the seal), the decrypted content will be different, and the decrypted check value will not match the digest computed from the record's data. Even though the hash algorithm is known, it is not feasible to modify both the record's data and its seal to correspond because both are encrypted.

Keyed seals may be employed as protection for data stored outside a protected environment without encryption, or as a validity proof between two protected environments. A keyed seal is computed similarly to a keyless seal, except that a secret initial value is logically prefixed to the data being sealed. The digest value thus depends both on the secret and the data, and it is infeasible to compute a new seal to correspond to modified data even though the data itself is visible to an attacker. A keyed seal may protect data in storage with a single secret value, or may protect data in transit between two environments that share a single secret value.

The choice of keys or keyless seals depends on the nature of the data being protected and whether it is additionally protected by encryption.

Tagging

Tagging is particularly useful for supporting the secure storage of important component assembly and related information on secondary storage memory 652. Integrated use of information "tagging" and encryption strategies allows use of inexpensive mass storage devices to securely store information that, in part enables, limits and/or records the configuration, management and operation of a VDE node and the use of VDE protected content.

When encrypted or otherwise secured information is delivered into a user's secure VDE processing area (e.g., PPE 650), a portion of this information can be used as a "tag" that is first decrypted or otherwise unsecured and then compared to an expected value to confirm that the information represents expected information. The tag thus can be used as a portion of a process confirming the identity and correctness of received, VDE protected, information.

Three classes of tags that may be included in the control structures of the preferred embodiment:

- access tags
- validation tags
- correlation tags.

These tags have distinct purposes.

An access tag may be used as a "shared secret" between VDE protected elements and entities authorized to read and/or modify the tagged element(s). The access tag may be broken into separate fields to control different activities independently. If an access tag is used by an element such as a method core 1000', administrative events that affect such an element must include the access tag (or portion of the access tag) for the affected element(s) and assert that tag when an event is submitted for processing. If access tags are maintained securely (e.g., created inside a PPE 650 when the elements are created, and only released from PPE 650 in encrypted structures), and only distributed to authorized parties, modification of structures can be controlled more securely. Of course, control structures (e.g., PERCs 808) may further limit or qualify modifications or other actions expressed in administrative events.

Correlation tags are used when one element references another element. For example, a creator might be required by a budget owner to obtain permission and establish a business relationship prior to referencing their budget within the creator's PERCs. After such relationship was formed, the budget owner might transmit one or more correlation tags to the creator as one aspect of allowing the creator to produce PERCs that reference the budget owner's budget.

Validation tags may be used to help detect record substitution attempts on the part of a tamperer.

In some respects, these three classes of tags overlap in function. For example, a correlation tag mismatch may prevent some classes of modification attempts that would normally be prevented by an access tag mismatch before an access tag check is performed. The preferred embodiment may use this overlap in some cases to reduce overhead by, for example, using access tags in a role similar to validation tags as described above.

In general, tagging procedures involve changing, within SPE 503, encryption key(s), securing techniques(s), and/or providing specific, stored tag(s). These procedures can be employed with secure database 610 information stored on said inexpensive mass storage 652 and used within a hardware SPU 500 for authenticating, decrypting, or otherwise analyzing, using and making available VDE protected content and management database information. Normally, changing validation tags involves storing within a VDE node hardware (e.g., the PPE 650) one or more elements of information corresponding to the tagging changes. Storage of information outside of the hardware SPE's physically secure, trusted environment is a highly cost savings means of secure storage, and the security of important stored management database information is enhanced by this tagging of

information. Performing this tagging "change" frequently (for example, every time a given record is decrypted) prevents the substitution of "incorrect" information for "correct" information, since said substitution will not carry information which will match the tagging information stored within the hardware SPE during subsequent retrieval of the information.

Another benefit of information tagging is the use of tags to help enforce and/or verify information and/or control mechanisms in force between two or more parties. If information is tagged by one party, and then passed to another party or parties, a tag can be used as an expected value associated with communications and/or transactions between the two parties regarding the tagged information. For example, if a tag is associated with a data element that is passed by Party A to Party B, Party B may require Party A to prove knowledge of the correct value of at least a portion of a tag before information related to, and/or part of, said data element is released by Party B to Party A, or vice versa. In another example, a tag may be used by Party A to verify that information sent by Party B is actually associated with, and/or part of, a tagged data element, or vice versa.

Establishing A Secure, Authenticated, Communication Channel

From time to time, two parties (e.g., PPEs A and B), will need to establish a communication channel that is known by both

parties to be secure from eavesdropping, secure from tampering, and to be in use solely by the two parties whose identifies are correctly known to each other.

The following describes an example process for establishing such a channel and identifies how the requirements for security and authentication may be established and validated by the parties. The process is described in the abstract, in terms of the claims and belief each party must establish, and is not to be taken as a specification of any particular protocol. In particular, the individual sub-steps of each step are not required to be implemented using distinct operations; in practice, the establishment and validation of related proofs is often combined into a single operation.

The sub-steps need not be performed in the order detailed below, except to the extent that the validity of a claim cannot be proven before the claim is made by the other party. The steps may involve additional communications between the two parties than are implied by the enumerated sub-steps, as the "transmission" of information may itself be broken into sub-steps. Also, it is not necessary to protect the claims or the proofs from disclosure or modification during transmission. Knowledge of the claims (including the specific communication proposals and acknowledgements thereof) is not considered protected

information. Any modification of the proofs will cause the proofs to become invalid and will cause the process to fail.

Standard public-key or secret-key cryptographic techniques can be used to implement this process (e.g., X.509, Authenticated Diffie-Hellman, Kerberos). The preferred embodiment uses the three-way X.509 public key protocol steps.

The following may be the first two steps in the example process:

A. (*precursor step*): Establish means of creating validatable claims by A

B. (*precursor step*): Establish means of creating validatable claims by B

These two steps ensure that each party has a means of making claims that can be validated by the other party, for instance, by using a public key signature scheme in which both parties maintain a private key and make available a public key that itself is authenticated by the digital signature of a certification authority.

The next steps may be:

A (proposal step):

1. Determine B's identity

2. Acquire means of validating claims made by B
3. Create a unique identity for this specific proposed communication
4. Create a communication proposal identifying the parties and the specific communication
5. Create validatable proof of A's identity and the origin of the communication proposal
6. Deliver communication proposal and associated proof to B.

These steps establish the identity of the correspondent party B and proposes a communication. Because establishment of the communication will require validation of claims made by B, a means must be provided for A to validate such claims. Because the establishment of the communication must be unique to a specific requirement by A for communication, this communication proposal and all associated traffic must be unambiguously distinguishable from all other such traffic. Because B must validate the proposal as a legitimate proposal from A, a proof must be provided that the proposal is valid.

The next steps may be as follows:

B (acknowledgement step):

1. Extract A's identity from the communication proposal
2. Acquire means of validating claims made by A
3. Validate A's claim of identity and communication proposal origin
4. Determine the unique identification of the communication proposal
5. Determine that the communication proposal does not duplicate an earlier proposal
6. Create an acknowledgement identifying the specific communication proposal
7. Create validatable proof of B's identity and the origin of the acknowledgement
8. Deliver the acknowledgement and associated proof to A.

These steps establish that party B has received A's communication proposal and is prepared to act on it. Because B must validate the proposal, B must first determine its origin and validate its authenticity. B must ensure that its response is associated with a specific proposal, and that the proposal is not a replay. If B accepts the proposal, it must prove both B's own identity and that B has received a specific proposal.

The next steps may be:

A (establishment step):

1. Validate B's claim acknowledgement of A's specific proposal
2. Extract the identity of the specific communication proposal from the acknowledgement
3. Determine that the acknowledgement is associated with an outstanding communication proposal
4. Create unique session key to be used for the proposed communication
5. Create proof of session key's creation by A
6. Create proof of session key's association with the specific communication proposal
7. Create proof of receipt of B's acknowledgement
8. Protect the session key from disclosure in transmission
9. Protect the session key from modification in transmission
10. Deliver protected session key and all proofs to B.

These steps allows A to specify a session key to be associated with all further traffic related to A's specific communication proposal. A must create the key, prove that A created it, and prove that it is associated with the specific proposed communication. In addition, A must prove that the

session key is generated in response to B's acknowledgement of the proposal. The session key must be protected from disclosure of modification to ensure that an attacker cannot substitute a different value.

Transportability of VDE Installations Between PPEs 650

In a preferred embodiment, VDE objects 300 and other secure information may if appropriate, be transported from one PPE 650 to another securely using the various keys outlined above. VDE 100 uses redistribution of VDE administrative information to exchange ownership of VDE object 300, and to allow the portability of objects between electronic appliances 600.

The permissions record 808 of VDE objects 300 contains rights information that may be used to determine whether an object can be redistributed in whole, in part, or at all. If a VDE object 300 can be redistributed, then electronic appliance 600 normally must have a "budget" and/or other permissioning that allows it to redistribute the object. For example, an electronic appliance 600 authorized to redistribute an object may create an administrative object containing a budget or rights less than or equal to the budget or rights that it owns. Some administrative objects may be sent to other PPEs 650. A PPE 650 that receives one of the administrative objects may have the ability to use at least a portion of the budgets, or rights, to related objects.

Transfer of ownership of a VDE object 300 is a special case in which all of the permissions and/or budgets for a VDE object are redistributed to a different PPE 650. Some VDE objects may require that all object-related information be delivered (e.g., it's possible to "sell" all rights to the object). However, some VDE objects 300 may prohibit such a transfer. In the case of ownership transfer, the original providers for a VDE object 300 may need to be contacted by the new owner, informed of the transfer, and validated using an authorization shared secret that accompanies reauthorization, before transfer of ownership can be completed.

When an electronic appliance 600 receives a component assembly, an encrypted part of the assembly may contain a value that is known only to the party or PPE 650 that supplied the assembly. This value may be saved with information that must eventually returned to the assembly supplier (e.g., audit, billing and related information). When a component supplier requests that information be reported, the value may be provided by the supplier so that the local electronic appliance 600 can check it against the originally supplied value to ensure that the request is legitimate. When a new component is received, the value may be checked against an old component to determine whether the new component is legitimate (e.g., the new value for use in the next report process may be included with the new component).

Integrity of VDE Security

There are many ways in which a PPE 650 might be compromised. The goal of the security provided by VDE 100 is to reduce the possibility that the system will be compromised, and minimize the adverse effects if it is compromised.

The basic cryptographic algorithm that are used to implement VDE 100 are assumed to be safe (cryptographically strong). These include the secret-key encryption of content, public-key signatures for integrity verification, public-key encryption for privacy between PPEs 650 or between a PPE and a VDE administrator, etc. Direct attack on these algorithms is assumed to be beyond the capabilities of an attacker. For domestic versions of VDE 100 some of this is probably a safe assumption since the basic building blocks for control information have sufficiently long keys and are sufficiently proven.

The following risks of threat or attacks may be significant:

- Unauthorized creation or modification of component assemblies (e.g., budgets)
- Unauthorized bulk disclosure of content
- Compromise of one or more keys
- Software emulation of a hardware PPE
- Substitution of older records in place of newer records

- Introduction of "rogue" (i.e., unauthentic) load modules
- Replay attacks
- Defeating "fingerprinting"
- Unauthorized disclosure of individual content items
- Redistribution of individual content items.

A significant potential security breach would occur if one or more encryption keys are compromised. As discussed above, however, the encryption keys used by VDE 100 are sufficiently varied and compartmentalized so that compromising one key would have only limited value to an attacker in most cases. For example, if a certification private key is exposed, an attacker could pass the challenge/response protocol as discussed above but would then confront the next level of security that would entail cracking either the initialization challenge/response or the external communication keys. If the initialization challenge/response security is also defeated, the initialization code and various initialization keys would also be exposed. However, it would still be necessary to understand the code and data to find the shared VDE keys and to duplicate the key-generation ("convolution") algorithms. In addition, correct real time clock values must be maintained by the spoof. If the attacker is able to accomplish all of this successfully, then all secure communications to the bogus PPE would be compromised.

An object would be compromised if communications related to the permissions record 808 of that object are sent to the bogus PPE.

Knowledge of the PPE download authorization key and the algorithms that are used to derive the key that encrypts the keys for backup of secured database 610 would compromise the entire secured database at a specific electronic appliance 600. However, in order to use this information to compromise content of VDE objects 300, an understanding of appropriate VDE internals would also be required. In a preferred embodiment, the private body keys and content keys stored in a secured database 610 are "aged" by including a time component. Time is convoluted with the stored values to derive the "true keys" needed to decrypt content. If this process is also compromised, then object content or methods would be revealed. Since a backup of secured database 610 is not ever restored to a PPE 650 in the preferred embodiment without the intervention of an authorized VDE administrator, a "bogus" PPE would have to be used to make use of this information.

External communication shared keys are used in the preferred embodiment in conjunction with a key convolution algorithm based on site ID and time. If compromised, all of the steps necessary to allow communications with PPEs 650 must also be known to take advantage of this knowledge. In addition,

at least one of the administrative object shared keys must be compromised to gain access to a decrypted permissions record 808.

Compromising an administrative object shared key has no value unless the "cracker" also has knowledge of external communication keys. All administrative objects are encrypted by unique keys exchanged using the shared external communications keys, site ID and time. Knowledge of PPE 650 internal details would be necessary to further decrypt the content of administrative objects.

The private header of a stationary object (or any other stationary object that uses the same shared key) if compromised, may provide the attacker with access to content until the shared key "ages" enough to no longer decrypt the private header. Neither the private body nor the content of the object is exposed unless a permissions record 808 for that object is also compromised. The private headers of these objects may remain compromised until the key "ages" enough to no longer decrypt the private header.

Secure database encryption keys in the preferred embodiment are frequently changing and are also site specific. The consequences of compromising a secured database 610 file or

a record depends on the information that has been compromised. For example, permissions record 808 contain keys for the public body and content of a VDE object 300. If a permissions record 808 is compromised, the aspects of that object protected by the keys provided by the permissions record are also compromised—if the algorithm that generates the "true keys" is also known. If a private body key becomes known, the private body of the object is compromised until the key "ages" and expires. If the "aging" process for that key is also compromised, the breach is permanent. Since the private body may contain methods that are shared by a number of different objects, these methods may also become compromised. When the breach is detected, all administrative objects that provide budgets and permissions record should update the compromised methods. Methods stored in secure database 610 are only replaced by more recent versions, so the compromised version becomes unusable after the update is completed.

If a content key becomes compromised, the portion of the content encrypted with the key is also compromised until the key "ages" and expires. If the "aging" process for that key also becomes compromised, then the breach becomes permanent. If multiple levels of encryption are used, or portions of the content are encrypted with different keys, learning a single key would be insufficient to release some or all of the content.

If an authorization shared secret (e.g., an access tag) becomes known, the record containing the secret may be modified by an authorized means if the "cracker" knows how to properly use the secret. Generally speaking, the external communications keys, the administrative object keys and the management file keys must also be "cracked" before a shared secret is useful. Of course, any detailed knowledge of the protocols would also be required to make use of this information.

In the preferred embodiment, PPE 650 may detect whether or not it has become compromised. For example, by comparing information stored in an SPE 503 (e.g., summary service information) with information stored in secure database 610 and/or transmitted to a VDE participant (e.g., a VDE clearinghouse), discrepancies may become evident. If PPE 650 (or a VDE administrator watching its activities or communicating with it) detects that it has been compromised, it may be updated with an initialization to use new code, keys and new encryption/decryption algorithms. This would limit exposure to VDE objects 300 that existed at the time the encryption scheme was broken. It is possible to require the PPE 650 to cease functioning after a certain period of time unless new code and key downloads occur. It is also possible to have VDE administrators force updates to occur. It is also likely that the

desire to acquire a new VDE object 300 will provide an incentive for users to update their PPEs 650 at regular time intervals.

Finally, the end-to-end nature of VDE applications, in which content 108 flows in one direction, generating reports and bills 118 in the other, makes it possible to perform "back-end" consistency checks. Such checks, performed in clearinghouses 116, can detect patterns of use that may or do indicate fraud (e.g., excessive acquisition of protected content without any corresponding payment, usage records without corresponding billing records). The fine grain of usage reporting and the ready availability of usage records and reports in electronic form enables sophisticated fraud detection mechanisms to be built so that fraud-related costs can be kept to an acceptable level.

PPE Initialization

Each PPE 650 needs to be initialized before it can be used. Initialization may occur at the manufacturer site, after the PPE 650 has been placed out in the field, or both. The manufacturing process for PPE 650 typically involves embedding within the PPE sufficient software that will allow the device to be more completely initialized at a later time. This manufacturing process may include, for example, testing the bootstrap loader and challenge-response software permanently stored within PPE 650, and loading the PPE's unique ID. These steps provide a

basic VDE-capable PPE 650 that may be further initialized (e.g., after it has been installed within an electronic appliance 600 and placed in the field). In some cases, the manufacturing and further initialization processes may be combined to produce "VDE ready" PPEs 650. This description elaborates on the summary presented above with respect to Figures 64 and 65.

Figure 68 shows an example of steps that may be performed in accordance with one preferred embodiment to initialize a PPE 650. Some of the steps shown in this flowchart may be performed at the manufacturing site, and some may be performed remotely through contact between a VDE administrator and the PPE 650. Alternatively, all of the steps shown in the diagram may be performed at the manufacturing site, or all of the steps shown may be performed through remote communications between the PPE 500 and a VDE administrator.

If the initialization process 1370 is being performed at the manufacturer, PPE 650 may first be attached to a testbed. The manufacturing testbed may first reset the PPE 650 (e.g., with a power on clear) (Block 1372). If this reset is being performed at the manufacturer, then the PPE 650 preferably executes a special testbed bootstrap code that completely tests the PPE operation from a software standpoint and fails if something is wrong with the PPE. A secure communications exchange may

then be established between the manufacturing testbed and the PPE 650 using an initial challenge-response interaction (Block 1374) that is preferably provided as part of the testbed bootstrap process. Once this secure communications has been established, the PPE 650 may report the results of the bootstrap tests it has performed to the manufacturing testbed. Assuming the PPE 650 has tested successfully, the manufacturing testbed may download new code into the PPE 650 to update its internal bootstrap code (Block 1376) so that it does not go through the testbed bootstrap process upon subsequent resets (Block 1376). The manufacturing testbed may then load new firmware into the PPE internal non-volatile memory in order to provide additional standard and/or customized capabilities (Block 1378). For example, the manufacturing testbed may preload PPE 650 with the load modules appropriate for the particular manufacturing lot. This step permits the PPE 500 to be customized at the factory for specific applications.

The manufacturing testbed may next load a unique device ID into PPE 650 (Block 1380). PPE 650 now carries a unique ID that can be used for further interactions.

Blocks 1372-1380R typically are, in the preferred embodiment, performed at the manufacturing site. Blocks 1374

and 1382-1388 may be performed either at the manufacturing site, after the PPE 650 has been deployed, or both.

To further initialize PPE 650, once a secure communications has been established between the PPE and the manufacturing testbed or a VDE administrator (Block 1374), any required keys, tags or certificates are loaded into PPE 650 (Block 1382). For example, the manufacturing test bed may load its information into PPE 650 so the PPE may be initialized at a later time. Some of these values may be generated internally within PPE 650. The manufacturing testbed or VDE administrator may then initialize the PPE real time clock 528 to the current real time value (Block 1384). This provides a time and date reference for the PPE 650. The manufacturing testbed or the VDE administrator may next initialize the summary values maintained internally to the PPE 500 (Block 1386). If the PPE 650 is already installed as part of an electronic appliance 600, the PPE may at this point initialize its secure database 610 (Block 1388).

Figure 69 shows an example of program control steps performed by PPE 650 as part of a firmware download process (See Figure 68, Block 1378). The PPE download process is used to load externally provided firmware and/or data elements into the PPE. Firmware loads may take two forms: permanent loads

for software that remains resident in the PPE 650; and transient loads for software that is being loaded for execution. A related process for storing into the secure database 610 is performed for elements that have been sent to a VDE electronic appliance 600.

PPE 650 automatically performs several checks to ensure that firmware being downloaded into the PPE has not been tampered with, replaced, or substituted before it was loaded. The download routine 1390 shown in the figure illustrates an example of such checks. Once the PPE 650 has received a new firmware item (Block 1392), it may check the item to ensure that it decrypts properly using the predetermined download or administrative object key (depending on the source of the element) (decision Block 1394). If the firmware decrypts properly ("yes" exits to decision Block 1394), the firmware as check valve may be calculated and compared against the check valve stored under the encryption wrapper of the firmware (decision Block 1396). If the two check summed values compare favorably ("yes" exit to decision Block 1396), then the PPE 650 may compare the public and private header identification tags associated with the firmware to ensure that the proper firmware was provided and had not been substituted (step not shown in the figure). Assuming this test also passes, the PPE 500 may calculate the digital signatures of the firmware (assuming digital signatures are supported by the PPE 650 and the firmware is "signed") and

may check the calculated signature to ensure that it compares favorably to the digital signatures under the firmware encryption wrapper (Blocks 1398, 1400). If any of these tests fail, then the download will be aborted ("fail" termination 1401).

Assuming all of the tests described above pass, then PPE 650 determines whether the firmware is to be stored within the PPE (e.g., an internal non-volatile memory), or whether it is to be stored in the secure database 610 (decision Block 1402). If the firmware is to be stored within the PPE ("yes" exit to decision Block 1402), then the PPE 500 may simply store the information internally (Block 1404). If the firmware is to be stored within the secure database 610 ("no" exit to decision Block 1402), then the firmware may be tagged with a unique PPE-specific tag designed to prevent record substitution (Block 1406), and the firmware may then be encrypted using the appropriate secure database key and released to the secure database 610 (Block 1408).

Networking SPUs 500 and/or VDE Electronic Appliances 600

In the context of many computers interconnected by a local or wide area network, it would be possible for one or a few of them to be VDE electronic appliances 600. For example, a VDE-capable server might include one or more SPUs 500. This centralized VDE server could provide all VDE services required within the network or it can share VDE service with VDE server

nodes; that is, it can perform a few, some, or most VDE service activities. For example, a user's non-VDE computer could issue a request over the network for VDE-protected content. In response to the request, the VDE server could comply by accessing the appropriate VDE object 300, releasing the requested content and delivering the content over the network 672 to the requesting user. Such an arrangement would allow VDE capabilities to be easily integrated into existing networks without requiring modification or replacement of the various computers and other devices connected to the networks.

For example, a VDE server having one or more protected processing environments 650 could communicate over a network with workstations that do not have a protected processing environment. The VDE server could perform all secure VDE processing, and release resulting content and other information to the workstations on the network. This arrangement would require no hardware or software modification to the workstations.

However, some applications may require greater security, flexibility and/or performance that may be obtained by providing multiple VDE electronic appliances 600 connected to the same network 672. Because commonly-used local area networks constitute an insecure channel that may be subject to tampering

and/or eavesdropping, it is desirable in most secure applications to protect the information communicated across the network. It would be possible to use conventional network security techniques to protect VDE-released content or other VDE information communicated across a network 672 between a VDE electronic appliance 600 and a non-VDE electronic appliance. However, advantages are obtained by providing multiple networked VDE electronic appliances 600 within the same system.

As discussed above in connection with Figure 8, multiple VDE electronic appliances 600 may communicate with one another over a network 672 or other communications path. Such networking of VDE electronic appliances 600 can provide advantages. Advantages include, for example, the possibility of centralizing VDE resources, storing and/or archiving metering information on a server VDE and delivering information and services efficiently across the network 672 to multiple electronic appliances 600.

For example, in a local area network topology, a "VDE server" electronic appliance 600 could store VDE-protected information and make it available to one or more additional electronic appliances 600 or computers that may communicate with the server over network 672. As one example, an object

repository 728 storing VDE objects could be maintained at the centralized server, and each of many networked electronic appliance 600 users could access the centralized object repository over the network 672 as needed. When a user needs to access a particular VDE object 300, her electronic appliance 600 could issue a request over network 672 to obtain a copy of the object. The "VDE server" could deliver all or a portion of the requested object 300 in response to the request. Providing such a centralized object repository 728 would have the advantage of minimizing mass storage requirements local to each electronic appliance 600 connected to the network 672, eliminate redundant copies of the same information, ease information management burdens, provide additional physical and/or other security for particularly important VDE processes and/or information occurring at the server, where providing such security at VDE nodes may be commercially impractical for certain business models, etc.

It may also be desirable to centralize secure database 610 in a local area network topology. For example, in the context of a local area network, a secure database 610 server could be provided at a centralized location. Each of several electronic appliances 600 connected to a local area network 672 could issue requests for secure database 610 records over the network, and receive those records via the network. The records could be

provided over the network in encrypted form. "Keys" needed to decrypt the records could be shared by transmitting them across the network in secure communication exchanges. Centralizing secure database 610 in a network 672 has potential advantages of minimizing or eliminating secondary storage and/or other memory requirements for each of the networked electronic appliances 600, avoiding redundant information storage, allowing centralized backup services to be provided, easing information management burdens, etc.

One way to inexpensively and conveniently deploy multiple instances of VDE electronic appliances 600 across a network would be to provide network workstations with software defining an HPE 655. This arrangement requires no hardware modification of the workstations; an HPE 655 can be defined using software only. An SPE(s) 503 and/or HPE(s) 655 could also be provided within a VDE server. This arrangement has the advantage of allowing distributed VDE network processing without requiring workstations to be customized or modified (except for loading a new program(s) into them). VDE functions requiring high levels of security may be restricted to an SPU-based VDE server. "Secure" HPE-based workstations could perform VDE functions requiring less security, and could also coordinate their activities with the VDE server.

Thus, it may be advantageous to provide multiple VDE electronic appliances 600 within the same network. It may also be advantageous to provide multiple VDE electronic appliances 600 within the same workstation or other electronic appliance 600. For example, an electronic appliance 600 may include multiple electronic appliances 600 each of which have a SPU 500 and are capable of performing VDE functions.

For example, one or more VDE electronic appliances 600 can be used as input/output device(s) of a computer system. This may eliminate the need to decrypt information in one device and then move it in unencrypted form across some bus or other unsecured channel to another device such as a peripheral. If the peripheral device itself is a VDE electronic appliance 600 having a SPU 500, VDE-protected information may be securely sent to the peripheral across the insecure channel for processing (e.g., decryption) at the peripheral device. Giving the peripheral device the capability of handling VDE-protected information directly also increases flexibility. For example, the VDE electronic appliance 600 peripheral device may control VDE object 300 usage. It may, for example, meter the usage or other parameters associated with the information it processes, and it may gather audit trials and other information specific to the processing it performs in order to provide greater information gathering about VDE object usage. Providing multiple

cooperating VDE electronic appliances 600 may also increase performance by eliminating the need to move encrypted information to a VDE electronic appliance 600 and then move it again in unencrypted form to a non-VDE device. The VDE-protected information can be moved directly to its destination device which, if VDE-capable, may directly process it without requiring involvement by some other VDE electronic appliance 600.

Figure 70 shows an example of an arrangement 2630 comprising multiple VDE electronic appliances 600(1), 600(2), 600(3), . . . , 600(N). VDE electronic appliances 600(1) . . . 600(N) may communicate with one another over a communications path 2631 (e.g., the system bus of a work station, a telephone or other wire, a cable, a backplane, a network 672, or any other communications mechanism). Each of the electronic appliances 600 shown in the figure may have the same general architecture shown in Figure 8, i.e., they may each include a CPU (or microcontroller) 654, SPU 500, RAM 656, ROM 658, and system bus 653. Each of the electronic appliances 600 shown in the figure may have an interface/controller 2632 (which may be considered to be a particular kind of I/O controller 660 and/or communications controller 666 shown in Figure 8). This interface/controller 2632 provides an interface between the electronic appliance system bus 653 and an appropriate electrical

connector 2634. Electrical connectors 2634 of each of the respective electronic appliances 600(1), . . . 600(N) provide a connection to a common network 672 or other communication paths.

Although each of electronic appliances 600 shown in the figure may have a generally similar architecture, they may perform different specialized tasks. For example, electronic appliance 600(1) might comprise a central processing section of a workstation responsible for managing the overall operation of the workstation and providing computation resources. Electronic appliance 600(2) might be a mass storage device 620 for the same workstation, and could provide a storage mechanism 2636 that might, for example, read information from and write information to a secondary storage device 652. Electronic appliance 600(3) might be a display device 614 responsible for performing display tasks, and could provide a displaying mechanism 2638 such as a graphics controller and associated video or other display. Electronic appliance 600(N) might be a printer 622 that performs printing related tasks and could include, for example, a print mechanism 2640.

Each of electronic appliances 600(1), . . . 600(N) could comprise a different module of the same workstation device all contained within a common housing, or the different electronic

appliances could be located within different system components. For example, electronic appliance 600(2) could be disposed within a disk controller unit, electronic appliance 600(3) could be disposed within a display device 614 housing, and the electronic appliance 600(N) could be disposed within the housing of a printer 622. Referring back to Figure 7, scanner 626, modem 618, telecommunication means 624, keyboard 612 and/or voice recognition box 613 could each comprise a VDE electronic appliance 600 having its own SPU 500. Additional examples include RF or otherwise wireless interface controller, a serial interface controller, LAN controllers, MPEG (video) controllers, etc.

Because electronic appliances 600(1) . . . 600(N) are each VDE-capable, they each have the ability to perform encryption and/or decryption of VDE-protected information. This means that information communicated across network 672 or other communications path 2631 connecting the electronic appliances can be VDE-protected (e.g., it may be packaged in the form of VDE administrative and/or content objects and encrypted as discussed above). One of the consequences of this arrangement is that an eavesdropper who taps into communications path 2631 will not be able obtain information except in VDE-protected form. For example, information generated by electronic appliance 600 (1) to be printed could be packaged in a VDE content object 300

and transmitted over path 2631 to electronic appliance 600 (N) for printing. An attacker would gain little benefit from intercepting this information since it is transmitted in protected form; she would have to compromise electronic appliance 600(1) or 600(N) (or the SPU 500(1), 500(N)) in order to access this information in unprotected form.

Another advantage provided by the arrangement shown in the diagram is that each of electronic appliances 600(1), . . . 600(N) may perform their own metering, control and/or other VDE-related functions. For example, electronic appliance 600(N) may meter and/or perform any other VDE control functions related to the information to be printed, electronic appliance 600(3) may meter and/or perform any other VDE control functions related to the information to be displayed, electronic appliance 600(2) may meter and/or perform any other VDE control functions related to the information to be stored and/or retrieved from mass storage 620, and electronic appliance 600(1) may meter and/or perform any other VDE control functions related to the information it processes.

In one specific arrangement, each of electronic appliances 600(1), . . . 600(N) would receive a command that indicates that the information received by or sent to the electronic appliance is to use its SPU 500 to process the information to follow. For

example, electronic appliance 600(N) might receive a command that indicates that information it is about to receive for printing is in VDE-protected form (or the information that is sent to it may itself indicate this). Upon receiving this command or other information, electronic appliance 600(N) may decrypt the received information using SPU 500, and might also meter the information the SPU provides to the print mechanism 2644 for printing. An additional command might be sent to electronic appliance 600(N) to disable the decryption process or 600(N)'s VDE secure subsystem may determine that the information should not be decrypted and/or printed. Additional commands, for example, may exist to load encryption/decryption keys, load "limits," establish "fingerprinting" requirements, and read metered usage. These additional commands may be sent in encrypted or unencrypted form as appropriate.

Suppose, for example, that electronic appliance 600(1) produces information it wishes to have printed by a VDE-capable printer 622. SPU 500(1) could establish a secure communications across path 2631 with SPU 500(N) to provide a command instructing SPU 500(N) to decrypt the next block of data and store it as a decryption key and a limit. SPU 500(1) might then send a further command to SPU 500(N) to use the decryption key and associated limit to process any following encrypted print stream (or this command could be sent by CPU 654(1) to

microcontroller 654(N)). Electronic appliance 600(1) could then begin sending encrypted information on path 672 for decryption and printing by printer 622. Upon receipt of each new block of information by printer 622, SPU 500(N) might first check to ensure that the limit is greater than zero. SPU 500(N) could then increment a usage meter value it maintains, and decrement the limit value. If the limit value is non-zero, SPU 500(N) could decrypt the information it has received and provide it to print mechanism 2640 for printing. If the limit is zero, then SPU 500(N) would not send the received information to the print mechanism 2640, nor would it decrypt it. Upon receipt of a command to stop, printer 622 could revert to a "non-secure" mode in which it would print everything received by it across path 2631 without permitting VDE processing.

The SPU 500(N) associated with printer 622 need not necessarily be disposed within the housing of the printer, but could instead be placed within an I/O controller 660 for example (see Figure 8). This would allow at least some of the advantages similar to the ones discussed above to be provided without requiring a special VDE-capable printer 622. Alternatively, a SPU 500(N) could be provided both within printer 622 and within I/O controller 660 communicating with the printer to provide advantages in terms of coordinating I/O control and relieving processing burdens from the SPU 500 associated with the central

processing electronic appliance 600(1). When multiple VDE instances occur within an electronic appliance, one or more VDE secure subsystems may be "central" subsystems, that is "secondary" VDE instances may pass encrypted usage related information to one or more central secure subsystems so as to allow said central subsystem to directly control storage of said usage related information. Certain control information may also be centrally stored by a central subsystem and all or a portion of such information may be securely provided to the secondary secure subsystem upon its secure VDE request.

Portable Electronic Appliance

Electronic appliance 600 provided by the present invention may be portable. Figure 71 shows one example of a portable electronic appliance 2600. Portable appliance 2600 may include a portable housing 2602 that may be about the size of a credit card in one example. Housing 2602 may connect to the outside world through, for example, an electrical connector 2604 having one or more electrical contact pins (not shown). Connector 2604 may electrically connect an external bus interface 2606 internal to housing 2602 to a mating connector 2604a of a host system 2608. External bus interface 2606 may, for example, comprise a PCMCIA (or other standard) bus interface to allow portable appliance 2600 to interface with and communicate over a bus 2607 of host system 2608. Host 2608 may, for example, be almost

any device imaginable, such as a computer, a pay telephone, another VDE electronic appliance 600, a television, an arcade video game, or a washing machine, to name a few examples.

Housing 2602 may be tamper resistant. (See discussion above relating to tamper resistance of SPU barrier 502.)

Portable appliance 2600 in the preferred embodiment includes one or more SPUs 500 that may be disposed within housing 2602. SPU 500 may be connected to external bus interface 2606 by a bus 2610 internal to housing 2602. SPU 500 communicates with host 2608 (through external bus interface 2606) over this internal bus 2610.

SPU 500 may be powered by a battery 2612 or other portable power supply that is preferably disposed within housing 2602. Battery 2612 may be, for example, a miniature battery of the type found in watches or credit card sized calculators. Battery 2612 may be supplemented (or replaced) by solar cells, rechargeable batteries, capacitive storage cells, etc.

A random access memory (RAM) 2614 is preferably provided within housing 2602. RAM 2614 may be connected to SPU 500 and not directly connected to bus 2610, so that the contents of RAM 2614 may be accessed only by the SPU and not

by host 2608 (except through and as permitted by the SPU). Looking at Figure 9 for a moment, RAM 2614 may be part of RAM 534 within the SPU 500, although it need not necessarily be contained within the same integrated circuit or other package that houses the rest of the SPU.

Portable appliance 2600 RAM 534 may contain, for example, information which can be used to uniquely identify each instance of the portable appliance. This information may be employed (e.g. as at least a portion of key or password information) in authentication, verification, decryption, and/or encryption processes.

Portable appliance 2600 may, in one embodiment, comprise means to perform substantially all of the functions of a VDE electronic appliance 600. Thus, for example, portable appliance 2600 may include the means for storing and using permissions, methods, keys, programs, and/or other information, and can be capable of operating as a "stand alone" VDE node.

In a further embodiment, portable appliance 2600 may perform preferred embodiment VDE functions once it has been coupled to an additional external electronic appliance 600. Certain information, such as database management permission(s), method(s), key(s), and/or other important

information (such as at least a portion of other VDE programs: administrative, user-interface, analysis, etc.) may be stored (for example as records) at an external VDE electronic appliance 600 that may share information with portable appliance 2600.

One possible "stand alone" configuration for tamper-resistant, portable appliance 2600 arrangements includes a tamper-resistant package (housing 2602) containing one or more processors (500, 2616) and/or other computing devices and/or other control logic, along with random-access-memory 2614. Processors 500, 2616 may execute permissions and methods wholly (or at least in part) within the portable appliance 2600. The portable appliance 2600 may have the ability to encrypt information before the information is communicated outside of the housing 2602 and/or decrypt received information when said received information is received from outside of the housing. This version would also possess the ability to store at least a portion of permission, method, and/or key information securely within said tamper resistant portable housing 2602 on non-volatile memory.

Another version of portable appliance 2600 may obtain permissions and/or methods and/or keys from a local VDE electronic appliance 600 external to the portable appliance 2600 to control, limit, or otherwise manage a user's use of a VDE

protected object. Such a portable appliance 600 may be contained within, received by, installed in, or directly connected to, another electronic appliance 2600.

One example of a "minimal" configuration of portable appliance 2600 would include only SPU 500 and battery 2612 within housing 2602 (the external bus interface 2606 and the RAM 2614 would in this case each be incorporated into the SPU block shown in the Figure). In other, enhanced examples of portable appliance 2600, any or all of the following optional components may also be included within housing 2602:

one or more CPUs 2616 (with associated support components such as RAM-ROM 2617, I/O controllers (not shown), etc.);

one or more display devices 2618;

one or more keypads or other user input buttons/control information 2620;

one or more removable/replaceable memory device(s) 2622; and

one or more printing device(s) 2624.

In such more enhanced versions, the display 2618, keypad 2620, memory device 2622 and printer 2624 may be connected to bus 2610, or they might be connected to CPU 2616 through an I/O port/controller portion (not shown) of the CPU. Display 2618 may

be used to display information from SPU 500, CPU 2616 and/or host 2608. Keypad 2620 may be used to input information to SPU 500, CPU 2616 and/or host 2608. Printer 2624 may be used to print information from any/all of these sources. Removable/replaceable memory 2622 may comprise a memory cartridge or memory medium such as a bulk storage device, for providing additional long-term or short-term storage. Memory 2622 may be easily removable from housing 2602 if desired.

In one example embodiment, portable appliance 2600 may have the form factor of a "smart card" (although a "smart card" form factor may provide certain advantages, housing 2602 may have the same or different form factor as "conventional" smart cards). Alternatively, such a portable electronic appliance 2600 may, for example, be packaged in a PCMCIA card configuration (or the like) which is currently becoming quite popular on personal computers and is predicted to become common for desk-top computing devices and Personal Digital Assistants. One advantageous form factor for the portable electronic appliance housing 2602 may be, for example, a Type 1, 2, or 3 PCMCIA card (or other derivations) having credit card or somewhat larger dimensions. Such a form factor is conveniently portable, and may be insertable into a wide array of computers and consumer appliances, as well as receptacles at commercial establishments such as retail establishments and banks, and at public

communications points, such as telephone or other telecommunication "booths."

Housing 2602 may be insertable into and removable from a port, slot or other receptacle provided by host 2608 so as to be physically (or otherwise operatively) connected to a computer or other electronic appliance. The portable appliance connector 2604 may be configured to allow easy removability so that appliance 2600 may be moved to another computer or other electronic appliance at a different location for a physical connection or other operative connection with that other device.

Portable electronic appliance 2600 may provide a valuable and relatively simple means for a user to move permissions and methods between their (compatible) various electronic appliances 600, such as between a notebook computer, a desktop computer and an office computer. It could also be used, for example, to allow a consumer to visit a next door neighbor and allow that neighbor to watch a movie that the consumer had acquired a license to view, or perhaps to listen to an audio record on a large capacity optical disk that the consumer had licensed for unlimited plays.

Portable electronic appliance 2600 may also serve as a "smart card" for financial and other transactions for users to

employ in a variety of other applications such as, for example, commercial applications. The portable electronic appliance 2600 may, for example, carry permission and/or method information used to authorize (and possibly record) commercial processes and services.

An advantage of using the preferred embodiment VDE portable appliance 2600 for financial transactions such as those typically performed by banks and credit card companies is that VDE allows financial clearinghouses (such as VISA, MasterCard, or American Express) to experience significant reductions in operating costs. The clearinghouse reduction in costs result from the fact that the local metering and budget management that occurs at the user site through the use of a VDE electronic appliance 600 such as portable appliance 2600 frees the clearinghouse from being involved in every transaction. In contrast to current requirements, clearinghouses will be able to perform their functions by periodically updating their records (such as once a month). Audit and/or budget "roll-ups" may occur during a connection initiated to communicate such audit and/or budget information and/or through a connection that can occur at periodic or relatively periodic intervals and/or during a credit updating, purchasing, or other portable appliance 2600 transaction.

Clearinghouse VDE digital distribution transactions would require only occasional authorization and/or audit or other administrative "roll-ups" to the central service, rather than far more costly connections during each session. Since there would be no requirement for the maintenance of a credit card purchase "paper trail" (the authorization and then forwarding of the credit card slip), there could be substantial cost reductions for clearinghouses (and, potentially, lower costs to users) due to reduction in communication costs, facilities to handle concurrent processing of information, and paper handling aspects of transaction processing costs. This use of a portable appliance 2600 would allow credit enforcement to exploit distributed processing employing the computing capability in each VDE electronic appliance 600. These credit cost and processing advantages may also apply to the use of non-smart card and non-portable VDE electronic appliance 600s.

Since VDE 100 may be configured as a highly secure commercial environment, and since the authentication processes supported by VDE employ digital signature processes which provide a legal validation that should be equivalent to paper documentation and handwritten signatures, the need for portable appliance 2600 to maintain paper trails, even for more costly transactions, is eliminated. Since auditable billing and control mechanisms are built into VDE 100 and automated, they may

replace traditional electronic interfaces to VISA, Master Card, AMEX, and bank debit accounts for digitally distributed other products and services, and may save substantial operating costs for such clearinghouses.

Portable appliance 2600 may, if desired, maintain for a consumer a portable electronic history. The portable history can be, for example, moved to an electronic "dock" or other receptacle, in or operatively connected to, a computer or other consumer host appliance 2608. Host appliance 2608 could be, for example, an electronic organizer that has control logic at least in part in the form of a microcomputer and that stores information in an organized manner, e.g., according to tax and/or other transaction categories (such as type of use or activity). By use of this arrangement, the consumer no longer has to maintain receipts or otherwise manually track transactions but nevertheless can maintain an electronic, highly secure audit trail of transactions and transaction descriptions. The transaction descriptions may, for example, securely include the user's digital signature, and optionally, the service or goods provider's digital signature.

When a portable appliance 2600 is "docked" to a host 2608 such as a personal computer or other electronic appliance (such as an electronic organizer), the portable appliance 2600 could communicate interim audit information to the host. In one

embodiment, this information could be read, directly or indirectly, into a computer or electronic organizer money and/or tax management program (for example, Quicken or Microsoft Money and/or Turbo Tax and/or Andrew Tobias' Managing Your Money). This automation of receipt management would be an enormous boon to consumers, since the management and maintenance of receipts is difficult and time-consuming, receipts are often lost or forgotten, and the detail from credit card billings is often wholly inadequate for billing and reimbursement purposes since credit card billings normally don't provide sufficient data on the purchased items or significant transaction parameters.

In one embodiment, the portable appliance 2600 could support secure (in this instance encrypted and/or authenticated) two-way communications with a retail terminal which may contain a VDE electronic appliance 600 or communicate with a retailer's or third party provider's VDE electronic appliance 600. During such a secure two-way communication between, for example, each participant's secure VDE subsystem, portable appliance 2600 VDE secure subsystem may provide authentication and appropriate credit or debit card information to the retail terminal VDE secure subsystem. During the same or different communication session, the terminal could similarly, securely communicate back to the portable appliance 2600 VDE

secure subsystem details as to the retail transaction (for example, what was purchased and price, the retail establishment's digital signature, the retail terminal's identifier, tax related information, etc.).

For example, a host 2608 receptacle for receiving and/or attaching to portable appliance 2600 could be incorporated into or operatively connected to, a retail or other commercial establishment terminal. The host terminal 2608 could be operated by either a commercial establishment employee or by the portable appliance 2600 holder. It could be used to, for example, input specific keyboard and/or voice input specific information such as who was taken to dinner, why something was purchased, or the category that the information should be attached to. Information could then be automatically "parsed" and routed into securely maintained (for example, encrypted) appropriate database management records within portable appliance 2600. Said "parsing" and routing would be securely controlled by VDE secure subsystem processes and could, for example, be based on category information entered in by the user and/or based on class of establishment and/or type (category) of expenditure information (or other use). Categorization can be provided by the retail establishment, for example, by securely communicating electronic category information as a portion, for example, of electronic receipt information or alternatively by

printing a hard copy receipt using printer 2624. This process of categorization may take place in the portable appliance 2600 or, alternatively, it could be performed by the retail establishment and periodically "rolled-up" and communicated to the portable appliance 2600 holder.

Retail, clearinghouse, or other commercial organizations may maintain and use by securely communicating to appliance 2600 one or more of generic classifications of transaction types (for example, as specified by government taxation rules) that can be used to automate the parsing of information into records and/or for database information "roll-ups" for; and/or in portable appliance 2600 or one or more associated VDE nodes. In such instances, host 2608 may comprise an auxiliary terminal, for example, or it could comprise or be incorporated directly within a commercial establishments cash registers or other retail transactions devices. The auxiliary terminal could be menu and/or icon driven, and allow very easy user selection of categorization. It could also provide templates, based on transaction type, that could guide the user through specifying useful or required transaction specific information (for example, purpose for a business dinner and/or who attended the dinner). For example, a user might select a business icon, then select from travel, sales, meals, administration, or purchasing icons for example, and then might enter in very specific information

and/or a key word, or other code that might cause the downloading of a transaction's detail into the portable appliance 2600. This information might also be stored by the commercial establishment, and might also be communicated to the appropriate government and/or business organizations for validation of the reported transactions (the high level of security of auditing and communications and authentication and validation of VDE should be sufficiently trusted so as not to require the maintenance of a parallel audit history, but parallel maintenance may be supported, and maintained at least for a limited period of time so as to provide backup information in the event of loss or "failure" of portable appliance 2600 and/or one or more appliance 2600 associated VDE installations employed by appliance 2600 for historical and/or status information record maintenance). For example, of a retail terminal maintained necessary transaction information concerning a transaction involving appliance 2600, it could communicate such information to a clearinghouse for archiving (and/or other action) or it could periodically, for example, at the end of a business day, securely communicate such information, for example, in the form of a VDE content container object, to a clearinghouse or clearinghouse agent. Such transaction history (and any required VDE related status information such as available credit) can be maintained and if necessary, employed to reconstruct the information in a portable appliance 2600 so as to allow a replacement appliance to

be provided to an appliance 2600 user or properly reset internal information in data wherein such replacement and/or resetting provides all necessary transaction and status information.

In a retail establishment, the auxiliary terminal host 2608 might take the form of a portable device presented to the user, for example at the end of a meal. The user might place his portable appliance 2600 into a smart card receptacle such as a PCMCIA slot, and then enter whatever additional information that might appropriately describe the transaction as well as satisfying whatever electronic appliance 600 identification procedure(s) required. The transaction, given the availability of sufficient credit, would be approved, and transaction related information would then be communicated back from the auxiliary terminal directly into the portable appliance 2600. This would be a highly convenient mode of credit usage and record management.

The portable device auxiliary terminal might be "on-line," that is electronically communicating back to a commercial establishment and/or third party information collection point through the use of cellular, satellite, radio frequency, or other communications means. The auxiliary terminal might, after a check by a commercial party in response to receipt of certain identification information at the collection point, communicate back to the auxiliary terminal whether or not to accept the

portable appliance 2600 based on other information, such as a bad credit record or a stolen portable appliance 2600. Such a portable auxiliary terminal would also be very useful at other commercial establishments, for example at gasoline stations, rental car return areas, street and stadium vendors, bars, and other commercial establishments where efficiency would be optimized by allowing clerks and other personnel to consummate transactions at points other than traditional cash register locations.

As mentioned above, portable appliance 2600 may communicate from time to time with other electronic appliances 600 such as, for example, a VDE administrator. Communication during a portable appliance 2600 usage session may result from internally stored parameters dictating that the connection should take place during that current session (or next or other session) of use of the portable appliance. The portable appliance 600 can carry information concerning a real-time date or window of time or duration of time that will, when appropriate, require the communication to take place (e.g., perhaps before the transaction or other process which has been contemplated by the user for that session or during it or immediately following it). Such a communication can be accomplished quickly, and could be a secure, VDE two-way communication during which information is communicated to a central information handler. Certain other

information may be communicated to the portable appliance 2600 and/or the computer or other electronic appliance to which the portable appliance 2600 has been connected. Such communicated other information can enable or prevent a contemplated process from proceeding, and/or make the portable appliance 2600, at least in part, unusable or useable. Information communicated to the portable appliance 2600 could include one or more modifications to permissions and methods, such as a resetting or increasing of one or more budgets, adding or withdrawing certain permissions, etc.

The permissions and/or methods (i.e., budgets) carried by the portable appliance 2600 may have been assigned to it in conjunction with an "encumbering" of another, stationary or other portable VDE electronic appliance 600. In one example, a portable appliance 2600 holder or other VDE electronic appliance 600 and/or VDE electronic appliance 600 user could act as "guarantor" of the financial aspects of a transaction performed by another party. The portable appliance 2600 of the holder would record an "encumbrance," which may be, during a secure communication with a clearinghouse, be recorded and maintained by the clearinghouse and/or some other financial services party until all or a portion of debt responsibilities of the other party were paid or otherwise satisfied. Alternatively or in addition, the encumbrance may also be maintained within the

portable appliance 2600, representing the contingent obligation of the guarantor. The encumbrance may be, by some formula, included in a determination of the credit available to the guarantor. The credit transfer, acceptance, and/or record management, and related processes, may be securely maintained by the security features provided by aspects of the present invention. Portable appliance 600 may be the sole location for said permissions and/or methods for one or more VDE objects 300, or it may carry budgets for said objects that are independent of budgets for said objects that are found on another, non-portable VDE electronic appliance 600. This may allow budgets, for example, to be portable, without requiring "encumbering" and budget reconciliation.

Portable VDE electronic appliance 2600 may carry (as may other VDE electronic appliance 600s described) information describing credit history details, summary of authorizations, and usage history information (e.g., audit of some degree of transaction history or related summary information such as the use of a certain type/class of information) that allows re-use of certain VDE protected information at no cost or at a reduced cost. Such usage or cost of usage may be contingent, at least in part, on previous use of one or more objects or class of objects or amount of use, etc., of VDE protected information.

Portable appliance 2600 may also carry certain information which may be used, at least in part, for identification purposes. This information may be employed in a certain order (e.g. a pattern such as, for example, based on a pseudo-random algorithm) to verify the identity of the carrier of the portable appliance 2600. Such information may include, for example, one's own or a wife's and/or other relatives maiden names, social security number or numbers of one's own and/or others, birth dates, birth hospital(s), and other identifying information. It may also or alternatively provide or include one or more passwords or other information used to identify or otherwise verify/authenticate an individual's identity, such as voice print and retinal scan information. For example, a portable appliance 2600 can be used as a smart card that carries various permissions and/or method information for authorizations and budgets. This information can be stored securely within portable appliance 2600 in a secure database 610 arrangement. When a user attempts to purchase or license an electronic product or otherwise use the "smart card" to authorize a process, portable appliance 2600 may query the user for identification information or may initiate an identification process employing scanned or otherwise entered information (such as user fingerprint, retinal or voice analysis or other techniques that may, for example, employ mapping and/or matching of provided characteristics to information securely stored within the portable appliance 2600).

The portable appliance 2600 may employ different queries at different times (and/or may present a plurality of queries or requests for scanning or otherwise entering identifying information) so as to prevent an individual who has come into possession of appropriate information for one or more of the "tests" of identity from being able to successfully employ the portable appliance 2600.

A portable appliance 600 could also have the ability to transfer electronic currency or credit to another portable appliance 2600 or to another individual's account, for example, using secure VDE communication of relevant content between secure VDE subsystems. Such transfer may be accomplished, for example, by telecommunication to, or presentation at, a bank which can transfer credit and/or currency to the other account. The transfer could also occur by using two cards at the same portable appliance 2600 docking station. For example, a credit transaction workstation could include dual PCMCIA slots and appropriate credit and/or currency transfer application software which allows securely debiting one portable appliance 2600 and "crediting" another portable appliance (i.e., debiting from one appliance can occur upon issuing a corresponding credit and/or currency to the other appliance). One portable appliance 600, for example, could provide an authenticated credit to another user. Employing two "smart card" portable appliance 600 would enable

the user of the providing of "credit" "smart card" to go through a transaction process in which said user provides proper identification (for example, a password) and identifies a "public key" identifying another "smart card" portable appliance 2600. The other portable appliance 2600 could use acceptance processes, and provide proper identification for a digital signature (and the credit and/or currency sender may also digitally sign a transaction certificate so the sending act may not be repudiated and this certificate may accompany the credit and/or currency as VDE container content. The transactions may involve, for example, user interface interaction that stipulates interest and/or other terms of the transfer. It may employ templates for common transaction types where the provider of the credit is queried as to certain parameters describing the agreement between the parties. The receiving portable appliance 2600 may iteratively or as a whole be queried as to the acceptance of the terms. VDE negotiation techniques described elsewhere in this application may be employed in a smart card transfer of electronic credit and/or currency to another VDE smart card or other VDE installation.

Such VDE electronic appliance 600/portable appliance 2600 credit transfer features would significantly reduce the overhead cost of managing certain electronic credit and/or currency activities by significantly automating these processes

through extending the computerization of credit control and credit availability that was begun with credit cards and extended with debit cards. The automation of credit extension and/or currency transfer and the associated distributed processing advantages described, including the absence of any requirement for centralized processing and telecommunications during each transaction, truly make credit and/or currency, for many consumers and other electronic currency and/or credit users, an efficient, trusted, and portable commodity.

The portable appliance 2600 or other VDE electronic appliance 600, can, in one embodiment, also automate many tax collection functions. A VDE electronic appliance 600 may, with great security, record financial transactions, identify the nature of the transaction, and identify the required sales or related government transaction taxes, debit the taxes from the users available credit, and securely communicate this information to one or more government agencies directly at some interval (for example monthly), and/or securely transfer this information to, for example, a financial clearinghouse, which would then transfer one or more secure, encrypted (or unsecure, calculated by clearinghouse, or otherwise computed) information audit packets (e.g., VDE content containers and employing secure VDE communication techniques) to the one or more appropriate, participating government agencies. The overall integrity and

security of VDE 100 could ensure, in a coherent and centralized manner, that electronic reporting of tax related information (derived from one or more electronic commerce activities) would be valid and comprehensive. It could also act as a validating source of information on the transfer of sales tax collection (e.g., if, for example, said funds are transferred directly to the government by a commercial operation and/or transferred in a manner such that reported tax related information cannot be tampered with by other parties in a VDE pathway of tax information handling). A government agency could select transactions randomly, or some subset or all of the reported transactions for a given commercial operation can be selected. This could be used to ensure that the commercial operation is actually paying to the government all appropriate collected funds required for taxes, and can also ensure that end-users are charged appropriate taxes for their transactions (including receipt of interest from bank accounts, investments, gifts, etc.

Portable appliance 2600 financial and tax processes could involve template mechanisms described elsewhere herein. While such an electronic credit and/or currency management capability would be particularly interesting if managed at least in part, through the use of a portable appliance 2600, credit and/or currency transfer and similar features would also be applicable

for non-portable VDE electronic appliance 600's connected to or installed within a computer or other electronic device.

User Notification Exception Interface ("Pop Up") 686

As described above, the User Modification Exception Interface 686 may be a set of user interface programs for handling common VDE functions. These applications may be forms of VDE templates and are designed based upon certain assumptions regarding important options, specifically, appropriate to a certain VDE user model and important messages that must be reported given certain events A primary function of the "pop-up" user interface 686 is to provide a simple, consistent user interface to, for example, report metering events and exceptions (e.g., any condition for which automatic processing is either impossible or arguably undesirable) to the user, to enable the user to configure certain aspects of the operation of her electronic appliance 600 and, when appropriate, to allow the user to interactively control whether to proceed with certain transaction processes. If an object contains an exception handling method, that method will control how the "pop-up" user interface 686 handles specific classes of exceptions.

The "pop-user" interface 686 normally enables handling of tasks not dedicated to specific objects 300, such as for example:

- Logging onto an electronic appliance 600 and/or entering into a VDE related activity or class of activities,

- Configuring an electronic appliance 600 for a registered user, and/or generally for the installation, with regard to user preferences, and automatic handling of certain types of exceptions,

- Where appropriate, user selecting of meters for use with specific properties, and

- Providing an interface for communications with other electronic appliances 600, including requesting and/or for purchasing or leasing content from distributors, requesting clearinghouse credit and/or budgets from a clearinghouse, sending and/or receiving information to and/or from other electronic appliances, and so on.

Figure 72A shows an example of a common "logon" VDE electronic appliance 600 function that may use user interface 686. "Log-on" can be done by entering a user name, account name, and/or password. As shown in the provided example, a configuration option provided by the "pop-up" user interface 686 dialog can be "Login at Setup", which, if selected, will initiate a VDE Login procedure automatically every time the user's

electronic appliance 600 is turned on or reset. Similarly, the "pop-up" user interface 686 could provide an interface option called "Login at Type" which, if selected, will initiate a procedure automatically every time, for example, a certain type of object or specific content type application is opened such as a file in a certain directory, a computer application or file with a certain identifying extension, or the like.

Figure 72B shows an example of a "pop-up" user interface 686 dialog that is activated when an action by the user has been "trapped," in this case to warn the user about the amount of expense that will be incurred by the user's action, as well as to alert the user about the object 300 which has been requested and what that particular object will cost to use. In this example, the interface dialog provides a button allowing the user to request further detailed information about the object, including full text descriptions, a list of associated files, and perhaps a history of past usage of the object including any residual rights to use the object or associated discounts.

The "Cancel" button 2660 in Figure 72B cancels the user's trapped request. "Cancel" is the default in this example for this dialog and can be activated, for example, by the return and enter keys on the user's keyboard 612, by a "mouse click" on that button, by voice command, or other command mechanisms. The

"Approve button" 2662, which must be explicitly selected by a mouse click or other command procedure, allows the user to approve the expense and proceed. The "More options" control 2664 expands the dialog to another level of detail which provides further options, an example of which is shown in Figure 72C.

Figure 72C shows a secondary dialog that is presented to the user by the "pop-up" user interface 686 when the "More options" button 2664 in Figure 72B is selected by the user. As shown, this dialog includes numerous buttons for obtaining further information and performing various tasks.

In this particular example, the user is permitted to set "limits" such as, for example, the session dollar limit amount (field 2666), a total transaction dollar limit amount (field 2668), a time limit (in minutes) (field 2670), and a "unit limit" (in number of units such as paragraphs, pages, etc.) (field 2672). Once the user has made her selections, she may "click on" the OKAY button (2674) to confirm the limit selections and cause them to take effect.

Thus, pop-up user interface dialogues can be provided to specify user preferences, such as setting limits on budgets and/or other aspects of object content usage during any one session or over a certain duration of time or until a certain point in time.

Dialogs can also be provided for selecting object related usage options such as selecting meters and budgets to be used with one or more objects. Selection of options may be applied to types (that is classes) of objects by associating the instruction with one or more identifying parameters related to the desired one or more types. User specified configuration information can set default values to be used in various situations, and can be used to limit the number or type of occasions on which the user's use of an object is interrupted by a "pop-up" interface 686 dialog. For example, the user might specify that a user request for VDE protected content should be automatically processed without interruption (resulting from an exceptions action) if the requested processing of information will not cost more than $25.00 and if the total charge for the entire current session (and/or day and/or week, etc.) is not greater than $200.00 and if the total outstanding and unpaid charge for use hasn't exceeded $2500.00.

Pop-up user interface dialogs may also be used to notify the user about significant conditions and events. For example, interface 686 may be used to:

- remind the user to send audit information to a clearinghouse,

- inform a user that a budget value is low and needs replenishing,

- remind the user to back up secure database 610, and

- inform the user about expirations of PERCs or other dates/times events.

Other important "pop-up" user interface 686 functions include dialogs which enable flexible browsing through libraries of properties or objects available for licensing or purchase, either from locally stored VDE protected objects and/or from one or more various, remotely located content providers. Such function may be provided either while the user's computer is connected to a remote distributor's or clearinghouse's electronic appliance 600, or by activating an electronic connection to a remote source after a choice (such as a property, a resource location, or a class of objects or resources is selected). A browsing interface can allow this electronic connection to be made automatically upon a user selection of an item, or the connection itself can be explicitly activated by the user. See Figure 72D for an example of such a "browsing" dialog.

Smart Objects

VDE 100 extends its control capabilities and features to "intelligent agents." Generally, an "intelligent agent" can act as

an emissary to allow a process that dispatches it to achieve a result the originating process specifies. Intelligent agents that are capable of acting in the absence of their dispatch process are particularly useful to allow the dispatching process to access, through its agent, the resources of a remote electronic appliance. In such a scenario, the dispatch process may create an agent (e.g., a computer program and/or control information associated with a computer program) specifying a particular desired task(s), and dispatch the agent to the remote system. Upon reaching the remote system, the "agent" may perform its assigned task(s) using the remote system's resources. This allows the dispatch process to, in effect, extend its capabilities to remote systems where it is not present.

Using an "agent" in this manner increases flexibility. The dispatching process can specify, through its agent, a particular desired task(s) that may not exist or be available on the remote system. Using such an agent also provides added trustedness; the dispatch process may only need to "trust" its agent, not the entire remote system. Agents have additional advantages.

Software agents require a high level of control and accountability to be effective, safe and useful. Agents in the form of computer viruses have had devastating effects worldwide. Therefore, a system that allows an agent to access it should be

able to control it or otherwise prevent the agent from damaging important resources. In addition, systems allowing themselves to be accessed by an agent should sufficiently trust the agent and/or provide mechanisms capable of holding the true dispatcher of the agent responsible for the agent's activities. Similarly, the dispatching process should be able to adequately limit and/or control the authority of the agents it dispatches or else it might become responsible for unforeseen activities by the agent (e.g., the agent might run up a huge bill in the course of following imprecise instructions it was given by the process that dispatched it).

These significant problems in using software agents have not be adequately addressed in the past. The open, flexible control structures provided by VDE 100 addresses these problems by providing the desired control and accountability for software agents (e.g., agent objects). For example, VDE 100 positively controls content access and usage, provides guarantee of payment for content used, and enforces budget limits for accessed content. These control capabilities are well suited to controlling the activities of a dispatched agent by both the process that dispatches the agent and the resource accessed by the dispatched agent.

One aspect of the preferred embodiment provided by the present invention provides a "smart object" containing an agent. Generally, a "smart object" may be a VDE object 300 that contains some type(s) of software programs ("agents") for use with VDE control information at a VDE electronic appliance 600. A basic "smart object" may comprise a VDE object 300 that, for example, contains (physically and/or virtually):

a software agent, and

at least one rule and/or control associated with the software agent that governs the agent's operation.

Although this basic structure is sufficient to define a "smart object," Figure 73 shows a combination of containers and control information that provides one example of a particularly advantageous smart object structure for securely managing and controlling the operation of software agents.

As shown in Figure 73, a smart object 3000 may be constructed of a container 300, within which is embedded one or more further containers (300z, 300y, etc.). Container 300 may further contain rules and control information for accessing and using these embedded containers 300z, 300y, etc. Container 300z embedded in container 300 is what makes the object 3000 a "smart object." It contains an "agent" that is managed and controlled by VDE 100.

The rules and control information 806f associated with container 300z govern the circumstances under which the agent may be released and executed at a remote VDE site, including any limitations on execution based on the cost of execution for example. This rule and control information may be specified entirely in container 300z, and/or may be delivered as part of container 300, as part of another container (either within container 300 or a separately deliverable container), and/or may be already present at the remote VDE site.

The second container 300y is optional, and contains content that describes the locations at which the agent stored in container 300z may be executed. Container 300y may also contain rules and control information 806e that describe the manner in which the contents of container 300y may be used or altered. This rule and control information 806e and/or further rules 300y(1) also contained within container 300y may describe searching and routing mechanisms that may be used to direct the smart object 3000 to a desired remote information resource. Container 300y may contain and/or reference rules and control information 300y(1) that specify the manner in which searching and routing information use and any changes may be paid for.

Container 300x is an optional content container that is initially "empty" when the smart object 3000 is dispatched to a

remote site. It contains rules and control information 300x(1) for storing the content that is retrieved by the execution of the agent contained in container 300z. Container 300x may also contain limits on the value of content that is stored in the retrieval container so as to limit the amount of content that is retrieved.

Other containers in the container 300 may include administrative objects that contain audit and billing trails that describe the actions of the agent in container 300z and any charges incurred for executing an agent at a remote VDE node. The exact structure of smart object 3000 is dependent upon the type of agent that is being controlled, the resources it will need for execution, and the types of information being retrieved.

The smart object 3000 in the example shown in Figure 73 may be used to control and manage the operation of an agent in VDE 100. The following detailed explanation of an example smart object transaction shown in Figure 74 may provide a helpful, but non-limiting illustration. In this particular example, assume a user is going to create a smart object 3000 that performs a library search using the "Very Fast and Efficient" software agent to search for books written about some subject of interest (e.g., "fire flies"). The search engine is designed to return a list of books to the user. The search engine in this example may spend no more than $10.00 to find the appropriate books,

may spend no more than $3.00 in library access or communications charges to get to the library, and may retrieve no more than $15.00 in information. All information relating to the search or use is to be returned to the user and the user will permit no information pertaining to the user or the agent to be released to a third party.

In this example, a dispatching VDE electronic appliance 3010 constructs a smart object 3000 like the one shown in Figure 73. The rule set in 806a is specified as a control set that contains the following elements:

1. a smart_agent_execution event that specifies the smart agent is stored in embedded container 300z and has rules controlling its execution specified in that container;

2. a smart_agent_use event that specifies the smart agent will operate using information and parameters stored in container 300;

3. a routing_use event that specifies the information routing information is stored in container 300y and has rules controlling this information stored in that container;

4. an information_write event that specifies information written will be stored in container 300y, 300x, or 300w depending on its type (routing, retrieved, or administrative), and that these containers have independent rules that control how information is written into them.

The rule set in control set 806b contains rules that specify the rights desired by this smart object 3000. Specifically, this control set specifies that the software agent desires:

1. A right to use the "agent execution" service on the remote VDE site. Specific billing and charge information for this right is carried in container 300z.

2. A right to use the "software description list" service on the remote VDE site. Specific billing and charge information for this for this right is carried in container 300y.

3. A right to use an "information locator service" on a remote VDE site.

4. A right to have information returned to the user without charge (charges to be incurred on release of information and payment will be by a VISA budget)

5. A right to have all audit information returned such that it is readable only by the sender.

The rule set in control set 806c specifies that container 300w specifies the handling of all events related to its use. The rule set in control set 806d specifies that container 300x specifies the handling of all events related to its use. The rule set in control set 806e specifies that container 300y specifies the handling of all events related to its use. The rule set in control set 806f specifies that container 300z specifies the handling of all events related to its use.

Container 300z is specified as containing the "Very Fast and Efficient" agent content, which is associated with the following rules set:

1. A use event that specifies a meter and VISA budget that limits the execution to $10.00 charged against the owner's VISA card. Audits of usage are required and will be stored in object 300w under control information specified in that object.

After container 300z and its set are specified, they are constructed and embedded in the smart object container 300.

Container 300y is specified as a content object with two types of content. Content type A is routing information and is read/write in nature. Content type A is associated with a rules set that specifies:

1. A use event that specifies no operation for the release of the content. This has the effect of not charging for the use of the content.

2. A write event that specifies a meter and a VISA budget that limits the value of writing to $3.00. The billing method used by the write is left unspecified and will be specified by the control method that uses this rule.

3. Audits of usage are required and will be stored in object 300w under control information specified in that object.

Content type B is information that is used by the software agent to specify parameters for the agent. This content is

specified as the string "fire fly" or "fire flies". Content type B is associated with the following rule set:

1. A use event that specifies that the use may only be by the software agent or a routing agent. The software agent has read only permission, the routing agent has read/write access to the information. There are no charges associated with using the information, but two meters; one by read and one by write are kept to track use of the information by various steps in the process.

2. Audits of usage are required and will be stored in object 300w under control information specified in that object.

After container 300y and its control sets are specified, they are constructed and embedded in the smart object container 300.

Container 300x is specified as a content object that is empty of content. It contains a control set that contains the following rules:

1. A write_without_billing event that specifies a meter and a general budget that limits the value of writing to $15.00.

2. Audits of usage are required and will be stored in object 300w under control information specified in that object.

3. An empty use control set that may be filled in by the owner of the information using predefined methods (method options).

After container 300x and its control sets are specified, they are constructed and embedded in the smart object container 300.

Container 300w is specified as an empty administrative object with a control set that contains the following rules:

1. A use event that specifies that the information contained in the administrative object may only be released to the creator of smart object container 300.
2. No other rules may be attached to the administrative content in container 300w.

After container 300w and its control sets are specified, they are constructed and embedded in the smart object container 300.

At this point, the smart object has been constructed and is ready to be dispatched to a remote VDE site. The smart object is sent to a remote VDE site (e.g., using electronic mail or another transport mechanism) that contains an information locator service 3012 via path 3014. The smart object is registered at the remote site 3012 for the "item locator service." The control set in container related to "item locator service" is selected and the rules contained within it activated at the remote site 3012. The remote site 3012 then reads the contents of container 300y under the control of rule set 806f and 300y(l), and permits writes of a list of location information into container 300y pursuant to these rules. The item locator service writes a list of three items into the smart object, and then "deregisters" the smart object (now containing the location information) and sends it to a site 3016 specified in the list written to the smart object via path 3018. In this example, the user may have specified electronic mail for transport and a list of remote sites that may have the desired information is stored as a forwarding list.

The smart object 3000, upon arriving at the second remote site 3016, is registered with that second site. The site 3016 provides agent execution and software description list services

compatible with VDE as a service to smart objects. It publishes these services and specifies that it requires $10.00 to start the agent and $20/piece for all information returned. The registration process compares the published service information against the rules stored within the object and determines that an acceptable overlap does not exist. Audit information for all these activities is written to the administrative object 300w. The registration process then fails (the object is not registered), and the smart object is forwarded by site 3016 to the next VDE site 3020 in the list via path 3022.

The smart object 3000, upon arriving at the third remote site 3020, is registered with that site. The site 3020 provides agent execution and software description list services compatible with VDE as a service to smart objects. It publishes these services and specifies that it requires $1.00 to start the agent and $0.50/piece for all information returned. The registration process compares the published service information against the rules stored within the object and determines that an acceptable overlap exists. The registration process creates a URT that specifies the agreed upon control information. This URT is used in conjunction with the other control information to execute the software agent under VDE control.

The agent software starts and reads its parameters out of container 300y. It then starts searching the database and obtains 253 "hits" in the database. The list of hits is written to container 300x along with a completed control set that specifies the granularity of each item and that each item costs $0.50. Upon completion of the search, the budget for use of the service is incremented by $1.00 to reflect the use charge for the service. Audit information for all these activities is written to the administrative object 300w.

The remote site 3020 returns the now "full" smart object 3000 back to the original sender (the user) at their VDE node 3010 via path 3024. Upon arrival, the smart object 3000 is registered and the database records are available. The control information specified in container 300x is now a mix of the original control information and the control information specified by the service regarding remote release of their information. The user then extracts 20 records from the smart object 3000 and has $10.00 charged to her VISA budget at the time of extraction.

In the above smart agent VDE examples, a certain organization of smart object 3000 and its constituent containers is described. Other organizations of VDE and smart object related control information and parameter data may be created

and may be used for the same purposes as those ascribed to object 3000 in the above example.

Negotiation and Electronic Contracts

An electronic contract is an electronic form of an agreement including rights, restrictions, and obligations of the parties to the agreement. In many cases, electronic agreements may surround the use of digitally provided content; for example, a license to view a digitally distributed movie. It is not required, however, that an electronic agreement be conditioned on the presence or use of electronic content by one or more parties to the agreement. In its simplest form, an electronic agreement contains a right and a control that governs how that right is used.

Electronic agreements, like traditional agreements, may be negotiated between their parties (terms and conditions submitted by one or more parties may simply be accepted (cohesion contract) by one or more other parties and/or such other parties may have the right to select certain of such terms and conditions (while others may be required)). Negotiation is defined in the dictionary as "the act of bringing together by mutual agreement." The preferred embodiment provides electronic negotiation processes by which one or more rights and associated controls can be established through electronic automated negotiation of terms.

Negotiations normally require a precise specification of rights and controls associated with those rights. PERC and URT structures provide a mechanism that may be used to provide precise electronic representations of rights and the controls associated with those rights. VDE thus provides a "vocabulary" and mechanism by which users and creators may specify their desires. Automated processes may interpret these desires and negotiate to reach a common middle ground based on these desires. The results of said negotiation may be concisely described in a structure that may be used to control and enforce the results of the electronic agreement. VDE further enables this process by providing a secure execution space in which the negotiation process(es) are assured of integrity and confidentiality in their operation. The negotiation process(es) may also be executed in such a manner that inhibits external tampering with the negotiation.

A final desirable feature of agreements in general (and electronic representations of agreements in particular) is that they be accurately recorded in a non-repudiatable form. In traditional terms, this involves creating a paper document (a contract) that describes the rights, restrictions, and obligations of all parties involved. This document is read and then signed by all parties as being an accurate representation of the agreement. Electronic agreements, by their nature, may not be initially

rendered in paper. VDE enables such agreements to be accurately electronically described and then electronically signed to prevent repudiation. In addition, the preferred embodiment provides a mechanism by which human-readable descriptions of terms of the electronic contract can be provided.

VDE provides a concise mechanism for specifying control sets that are VDE site interpretable. Machine interpretable mechanisms are often not human readable. VDE often operates the negotiation process on behalf of at least one human user. It is thus desirable that the negotiation be expressible in "human readable form." VDE data structures for objects, methods, and load modules all have provisions to specify one or more DTDs within their structures. These DTDs may be stored as part of the item or they may be stored independently. The DTD describes one or more data elements (MDE, UDE, or other related data elements) that may contain a natural language description of the function of that item. These natural language descriptions provide a language independent, human readable description for each item. Collections of items (for example, a BUDGET method) can be associated with natural language text that describes its function and forms a term of an electronically specified and enforceable contract. Collections of terms (a control set) define a contract associated with a specific right. VDE thus permits the

electronic specification, negotiation, and enforcement of electronic contracts that humans can understand and adhere to.

VDE 100 enables the negotiation and enforcement of electronic contracts in several ways:

- it enables a concise specification of rights and control information that permit a common vocabulary and procedure for negotiation,

- it provides a secure processing environment within which to negotiate,

- it provides a distributed environment within which rights and control specifications may be securely distributed,

- it provides a secure processing environment in which negotiated contracts may be electronically rendered and signed by the processes that negotiate them, and

- it provides a mechanism that securely enforces a negotiated electronic contract.

Types of Negotiations

A simple form of a negotiation is a demand by one party to form an "adhesion" contract. There are few, if any, options that may be chosen by the other party in the negotiation. The recipient of the demand has a simple option; she may accept or reject the terms and conditions (control information) in the demand. If she accepts the conditions, she is granted rights subject to the specified control information. If she rejects the conditions, she is not granted the rights. PERC and URT structures may support negotiation by demand; a PERC or control set from a PERC may be presented as a demand, and the recipient may accept or reject the demand (selecting any permitted method options if they are presented).

A common example of this type of negotiation today is the purchase of software under the terms of a "shrink-wrap license." Many widely publicized electronic distribution schemes use this type of negotiation. CompuServe is an example of an on-line service that operates in the same manner. The choice is simple: either pay the specified charge or don't use the service or software. VDE supports this type of negotiation with its capability to provide PERCs and URTs that describe rights and control information, and by permitting a content owner to provide a REGISTER method that allows a user to select from a set of predefined method options. In this scenario, the REGISTER

method may contain a component that is a simplified negotiation process.

A more complex form of a negotiation is analogous to "haggling." In this scenario, most of the terms and conditions are fixed, but one or more terms (e.g., price or payment terms) are not. For these terms, there are options, limits, and elements that may be negotiated over. A VDE electronic negotiation between two parties may be used to resolve the desired, permitted, and optional terms. The result of the electronic negotiation may be a finalized set of rules and control information that specify a completed electronic contract. A simple example is the scenario for purchasing software described above adding the ability of the purchaser to select a method of payment (VISA, Mastercard, or American Express). A more complex example is a scenario for purchasing information in which the price paid depends on the amount of information about the user that is returned along with a usage audit trail. In this second example, the right to use the content may be associated with two control sets. One control set may describe a fixed ("higher") price for using the content. Another control set may describe a fixed ("lower") price for using the content with additional control information and field specifications requiring collection and return the user's personal information. In both of these cases, the optional and permitted fields and control sets in a PERC may describe the options that

may be selected as part of the negotiation. To perform the negotiation, one party may propose a control set containing specific fields, control information, and limits as specified by a PERC; the other party may pick and accept from the control sets proposed, reject them, or propose alternate control sets that might be used. The negotiation process may use the permitted, required, and optional designations in the PERC to determine an acceptable range of parameters for the final rule set. Once an agreement is reached, the negotiation process may create a new PERC and/or URT that describes the result of the negotiation. The resulting PERCs and/or URTs may be "signed" (e.g., using digital signatures) by all of the negotiation processes involved in the negotiation to prevent repudiation of the agreement at a later date.

Additional examples of negotiated elements are: electronic cash, purchase orders, purchase certificates (gift certificates, coupons), bidding and specifications, budget "rollbacks" and reconciliation, currency exchange rates, stock purchasing, and billing rates.

A set of PERCs that might be used to support the second example described above is presented in Figures 75A (PERC sent by the content owner), 75B (PERC created by user to represent their selections and rights), and 75C (PERC for controlling the

negotiation process). These PERCs might be used in conjunction with any of the negotiation process(es) and protocols described later in this section.

Figure 75A shows an example of a PERC 3100 that might be created by a content provider to describe their rights options. In this example, the PERC contains information regarding a single USE right. Two alternate control sets 3102a, 3102b are presented for this right in the example. Control set 3102a permits the use of the content without passing back information about the user, and another control set 3102b permits the use of the content and collects "response card" type information from the user. Both control sets 3102a, 3102b may use a common set of methods for most of the control information. This common control information is represented by a CSR 3104 and CS0 3106.

Control set 3102a in this PERC 3100 describes a mechanism by which the user may obtain the content without providing any information about its user to the content provider. This control set 3102a specifies a well-known vending control method and set of required methods and method options. Specifically, in this example, control set 3102a defines a BUDGET method 3108 (e.g., one of VISA, Mastercard, or American Express) and it defines a BILLING method 3110 that specifies a charge (e.g., a one-time charge of $100.00).

Control set 3102b in this PERC 3100 describes another mechanism by which the user may obtain the content. In this example, the control set 3102b specifies a different vending control method and a set of required methods and method options. This second control set 3102b specifies a BUDGET method 3112 (e.g., one of VISA, Mastercard, or American Express), a BILLING method 3116 that specifies a charge (e.g., a lesser one-time charge such as $25.00) and an AUDIT method 3114 that specifies a set of desired and required fields. The required and desired field specification 3116 may take the form of a DTD specification, in which, for example, the field names are listed.

The content creator may "prefer" one of the two control sets (e.g., control set 2) over the other one. If so, the "preferred" control set may be "offered" first in the negotiation process, and withdrawn in favor of the "non-preferred" control set if the other party to the negotiation "rejects" the "preferred" control set.

In this example, these two control sets 3102a, 3102b may share a common BUDGET method specification. The BUDGET method specification may be included in the CSR 3104 or CS0 3106 control sets if desired. Selecting control set 3102a (use with no information passback) causes a unique component assembly to be assembled as specified by the PERC 3100. Specifically, in this

example it selects the "Vending" CONTROL method 3118, the BILLING method 3110 for a $100 fixed charge, and the rest of the control information specified by CSR 3104 and CS0 3106. It also requires the user to specify her choice of acceptable BUDGET method (e.g., from the list including VISA, Mastercard, and American Express). Selecting control set 3102b assembles a different component assembly using the "Vending with 'response card'" CONTROL method 3120, the BILLING method 3116 (e.g., for a $25 fixed charge), an AUDIT method 3114 that requires the fields listed in the Required Fields DTD 3116. The process may also select as many of the fields listed in the Desired Fields DTD 3116 as are made available to it. The rest of the control information is specified by CSR 3104 and CS0 3106. The selection of control set 3102b also forces the user to specify their choice of acceptable BUDGET methods (e.g., from the list including VISA, Mastercard, and American Express).

Figure 75B shows an example of a control set 3125 that might be used by a user to specify her desires and requirements in a negotiation process. This control set has a USE rights section 3127 that contains an aggregated CSR budget specification 3129 and two optional control sets 3131a, 3131b for use of the content. Control set 3131a requires the use of a specific CONTROL method 3133 and AUDIT method 3135. The specified AUDIT method 3135 is parameterized with a list of

fields 3137 that may be released in the audit trail. Control set 3131a also specifies a BILLING method 3139 that can cost no more than a certain amount (e.g., $30.00). Control set 3131b in this example describes a specific CONTROL method 3141 and may reference a BILLING method 3143 that can cost no more than a certain amount (e.g., $150.00) if this option is selected.

Figure 75E shows a more high-level view of an electronic contract 3200 formed as a "result" of a negotiation process as described above. Electronic contract 3200 may include multiple clauses 3202 and multiple digital signatures 3204. Each clause 3202 may comprise a PERC/URT such as item 3160 described above and shown in Figure 75D. Each "clause" 3202 of electronic contract 3200 thus corresponds to a component assembly 690 that may be assembled and executed by a VDE electronic appliance 600. Just as in normal contracts, there may be as many contract clauses 3202 within electronic contract 3200 as is necessary to embody the "agreement" between the "parties." Each of clauses 3202 may have been electronically negotiated and may thus embody a part of the "agreement" (e.g., a "compromise") between the parties. Electronic contract 3200 is "self-executing" in the sense that it may be literally executed by a machine, i.e., a VDE electronic appliance 600 that assembles component assemblies 690 as specified by various electronic clauses 3202. Electronic contract 3200 may be automatically

"enforced" using the same VDE mechanisms discussed above that are used in conjunction with any component assembly 690. For example, assuming that a clause 3202(2) corresponds to a payment or BILLING condition or term, its corresponding component assembly 690 when assembled by a user's VDE electronic appliance 600 may automatically determine whether conditions are right for payment and, when they are, automatically access an appropriate payment mechanism (e.g., a virtual "credit card" object for the user) to arrange that payment to be made. As another example, assuming that electronic contract clause N 3202(N) corresponds to a user's obligation to provide auditing information to a particular VDE participant, electronic contract 3200 will cause VDE electronic appliance 600 to assemble a corresponding component assembly 690 that may, for example, access the appropriate audit trails within secure database 610 and provide them in an administrative object to the correct participant. Figure 75F shows that clause 3202(N) may, for example, specify a component assembly 690 that arranges for multiple steps in a transaction 3206 to occur. Some of these steps (e.g., step 3208(4), 3208(5)) may be conditional on a test (e.g., 3208(3)) such as, for example, whether content usage has exceeded a certain amount, whether a certain time period has expired, whether a certain calendar date has been reached, etc.

Digital signatures 3204 shown in the Figure 75E electronic contract 3200 may comprise, for example, conventional digital signatures using public key techniques as described above. Some electronic contracts 3200 may not bear any digital signatures 3204. However, it may be desirable to require the electronic appliance 600 of the user who is a party to the electronic contract 3200 to digitally "sign" the electronic contract so that the user cannot later repudiate the contract, for evidentiary purposes, etc. Multiple parties to the same contract may each digitally "sign" the same electronic contract 3200 similarly to the way multiple parties to a contract memorialized in a written instrument use an ink pen to sign the instrument.

Although each of the clauses 3202 of electronic contract 3200 may ultimately correspond to a collection of data and code that may be executed by a PPE 650, there may in some instances be a need for rendering a human readable version of the electronic contract. This need can be accommodated by, as mentioned above, providing text within one or more DTDs associated with the component assembly or assemblies 690 used to "self-execute" the contract. Such text might, for example, describe from a functional point of view what the corresponding electronic contract clause 3202 means or involves, and/or might describe in legally enforceable terms what the legal obligation under the contract is or represents. "Templates" (described

elsewhere herein) might be used to supply such text from a text library. An expert system and/or artificial intelligence capability might be used to impose syntax rules that bind different textual elements together into a coherent, humanly readable contract document. Such text could, if necessary, be reviewed and modified by a "human" attorney in order customize it for the particular agreement between the parties and/or to add further legal obligations augmenting the "self-executing" electronic obligations embodied within and enforced by the associated component assemblies 690 executing on a VDE electronic appliance 600. Such text could be displayed automatically or on demand upon execution of the electronic contract, or it could be used to generate a printed humanly-readable version of the contract at any time. Such a document version of the electronic contract 3200 would not need to be signed in ink by the parties to the agreement (unless desired) in view of the fact that the digital signatures 3204 would provide a sufficiently secure and trusted evidentiary basis for proving the parties' mutual assent to all the terms and conditions within the contract.

In the preferred embodiment, the negotiation process executes within a PPE 650 under the direction of a further PERC that specifies the process. Figure 75C shows an example of a PERC 3150 that specifies a negotiation process. The PERC 3150 contains a single right 3152 for negotiation, with two permitted control sets 3154a, 3154b described for that right. The first

control set 3154a may be used for a "trusted negotiation"; it references the desired negotiation CONTROL method ("Negotiate") 3156 and references (in fields 3157a, 3157b) two UDEs that this CONTROL method will use. These UDEs may be, for example, the PERCs 3100, 3125 shown in Figures 75A and 75B. The second control set 3154b may be used by "multiple negotiation" processes to manage the negotiation, and may provide two negotiation methods: "Negotiate1," and "Negotiate2". Both negotiation processes may be described as required methods ("Negotiate1" and "Negotiate2") 3156, 3158 that take respective PERCs 3100, 3125 as their inputs. The CONTROL method 3158 for this control set in this example may specify the name of a service that the two negotiation processes will use to communicate with each other, and may also manage the creation of the URT resulting from the negotiation.

When executed, the negotiation process(es) specified by the PERC 3150 shown in Figure 75C may be provided with the PERCs 3100, 3125 as input that will be used as the basis for negotiation. In this example, the choice of negotiation process type (trusted or multiple) may be made by the executing VDE node. The PERC 3150 shown in Figure 75C might be, for example, created by a REGISTER method in response to a register request from a user. The process specified by this PERC

3150 may then be used by a REGISTER method to initiate negotiation of the terms of an electronic contract.

During this example negotiation process, the PERCs 3100, 3125 shown in Figures 75A and 75B act as input data structures that are compared by a component assembly created based on PERC 3150 shown in Figure 35C. The component assembly specified by the control sets may be assembled and compared, starting with required "terms," and progressing to preferred/desired "terms" and then moving on to permitted "terms," as the negotiation continues. Method option selections are made using the desired method and method options specified in the PERCs 3100, 3125. In this example, a control set for the PERC 3100 shown in Figure 75A may be compared against the PERC 3125 shown in Figure 75B. If there is a "match," the negotiation is successfully concluded and "results" are generated.

In this embodiment, the results of such negotiation will generally be written as a URT and "signed" by the negotiation process(es) to indicate that an agreement has been reached. These electronic signatures provide the means to show that a (virtual) "meeting of minds" was reached (one of the traditional legal preconditions for a contract to exist). An example of the URT 3160 that would have been created by the above example is shown in Figure 75D.

This URT 3160 (which may itself be a PERC 808) includes a control set 3162 that reflects the "terms" that were "agreed upon" in the negotiation. In this example, the "agreed upon" terms must "match" terms required by input PERCs 3100, 3125 in the sense that they must be "as favorable as" the terms required by those PERCs. The negotiation result shown includes, for example, a "negotiated" control set 3162 that in some sense corresponds to the control set 3102a of the Figure 75A PERC 3100 and to the control set 3131a of the Figure 75B control set 3125. Resulting "negotiated" control set 3162 thus includes a required BUDGET method 3164 that corresponds to the control set 3125 desired BUDGET method 3142 but which is "within" the range of control sets allowed by control set 3100 required BUDGET method 3112. Similarly, resulting negotiated control set 3162 includes a required AUDIT method 3166 that complies with the requirements of both PERC 3100 required AUDIT method 3114 and PERC 3125 required AUDIT method 3135. Similarly, resulting negotiated control set 3162 includes a required BILLING method 3170 that "matches" or complies with each of PERC 3100 required BILLING method 3116 and PERC 3125 required BILLING method 3170.

Another class of negotiation is one under which no rules are fixed and only the desired goals are specified. The negotiation processes for this type of negotiation may be very

complex. It may utilize artificial intelligence, fuzzy logic, and/or related algorithms to reach their goals. VDE supports these types of processes by providing a mechanism for concisely specifying rights, control information, fields and goals (in the form of desired rights, control information, and fields). Goals for these types of processes might be specified as one more control sets that contain specific elements that are tagged as optional, permitted, or desired.

Types of Negotiations

Negotiations in the preferred embodiment may be structured in any of the following ways:

1. shared knowledge
2. trusted negotiator
3. "zero-based" knowledge

"Shared knowledge" negotiations are based on all parties knowing all of the rules and constraints associated with the negotiation. Demand negotiations are a simple case of shared knowledge negotiations; the demander presents a list of demands that must be accepted or rejected together. The list of demands comprises a complete set of knowledge required to accept or reject each item on the list. VDE enables this class of negotiation to occur electronically by providing a mechanism by which demands may be encoded, securely passed, and securely processed between

and with secure VDE subsystems using VDE secure processing, and communication capabilities. Other types of shared knowledge negotiations employed by VDE involve the exchange of information between two or more negotiating parties; the negotiation process(es) can independently determine desired final outcome(s) based on their independent priorities. The processes can then negotiate over any differences. Shared knowledge negotiations may require a single negotiation process (as in a demand type negotiation) or may involve two or more cooperative processes. Figures 76A and 76B illustrate scenarios in which one and two negotiation processes are used in a shared knowledge negotiation.

Figure 76A shows a single negotiation process 3172 that takes any number of PERCs 808 (e.g., supplied by different parties) as inputs to the negotiation. The negotiation process 3172 executes at a VDE node under supervision of "Negotiation Process Rules and Control information" that may be supplied by a further PERC (e.g., PERC 3150 shown in Figure 75C). The process 3172 generates one or more PERCs/URTs 3160 as results of the negotiation.

Figure 76B shows multiple negotiation processes 3172A-3172N each of which takes as input a PERC 808 from a party and a further PERC 3150 that controls the negotiation process,

and each of which generates a negotiated "result" PERC/URT 3160 as output. Processes 3172A-3172N may execute at the same or different VDE nodes and may communicate using a "negotiation protocol."

Single and multiple negotiation processes may be used for specific VDE sites. The negotiation processes are named, and can be accessed using well known method names. PERCs and URTs may be transported in administrative or smart objects to remote VDE sites for processing at that site, as may the control PERCs and REGISTER method that controls the negotiation.

Multiple negotiation processes require the ability to communicate between these processes 3172; including secure communication between secure processes that are present at physically separate VDE sites (secure subsystems). VDE generalizes the inter-process communication into a securely provided service that can be used if the configuration requires it. The inter-process communication uses a negotiation protocol to exchange information about rule sets between processes 3172. An example of a negotiation protocol includes the following negotiation "primitives":

WANT	Want a set of terms and conditions
ACCEPT	Accept a set of terms and conditions
REJECT	Reject a set of terms and conditions

OFFER	Offer a set of terms and conditions in exchange for other terms and conditions
HAVE	Assert a set of terms and conditions are possible or desirable
QUIT	Assert the end of the negotiation without reaching an agreement
AGREEMENT	Conclude the negotiation and pass the rule set for signature

The WANT primitive takes rights and control set (or parts of control sets) information, and asserts to the other process(es) 3172 that the specified terms are desired or required. Demand negotiations are a simple case of a WANT primitive being used to assert the demand. This example of a protocol may introduce a refined form of the WANT primitive, REQUIRE. In this example, REQUIRE allows a party to set terms that she decides are necessary for a contract to be formed, WANT may allow the party to set terms that are desirable but not essential. This permits a distinction between "must have" and "would like to have."

In this example, WANT primitives must always be answered by an ACCEPT, REJECT, or OFFER primitive. The ACCEPT primitive permits a negotiation process 3172 to accept a set of terms and conditions. The REJECT primitive permits a process 3172 to reject an offered set of terms and conditions.

Rejecting a set of required terms and conditions may terminate the negotiation. OFFER permits a counter-offer to be made.

The HAVE, QUIT, and AGREEMENT primitives permit the negotiation protocols to pass information about rule sets. Shared knowledge negotiations may, for example, start with all negotiation processes 3172A-3172N asserting HAVE (my PERC) to the other processes. HAVE is also used when an impasse is reached and one process 3172 needs to let the other process 3172 know about permitted options. QUIT signals an unsuccessful end of the negotiation without reaching an agreement, while AGREEMENT signals a successful end of an agreement and passes the resulting "negotiated" PERC/URT 3160 to the other process(es) 3172 for signature.

In "trusted negotiator" negotiations, all parties provide their demands and preferences to a "trusted" negotiator and agree to be bound by her decision. This is similar to binding arbitration in today's society. VDE enables this mode of negotiation by providing an environment in which a "trusted" negotiation service may be created. VDE provides not only the mechanism by which demands, desires, and limits may be concisely specified (e.g., in PERCs), but in which the PERCs may be securely transferred to a "trusted" negotiation service along with a rule set that specifies how the negotiation will be

conducted, and by providing a secure execution environment so that the negotiation process may not be tampered with. Trusted negotiator services can be used at VDE sites where the integrity of the site is well known. Remote trusted negotiation services can be used by VDE sites that do not possess sufficient computing resources to execute one or more negotiation process(es); they can establish a communication link to a VDE site that provides this service and permits the service to handle the negotiation on their behalf.

"Zero-based" knowledge negotiations share some characteristics of the zero-based knowledge protocols used for authentication. It is well understood in the art how to construct a protocol that can determine if a remote site is the holder of a specific item without exchanging or exposing the item. This type of protocol can be constructed between two negotiation processes operating on at least one VDE site using a control set as their knowledge base. The negotiation processes may exchange information about their control sets, and may make demands and counter proposals regarding using their individual rule sets. For example, negotiation process A may communicate with negotiation process B to negotiate rights to read a book. Negotiation process A specifies that it will pay not more than $10.00 for rights to read the book, and prefers to pay between $5.00 and $6.00 for this right. Process A's rule set also specifies

that for the $5.00 option, it will permit the release of the reader's name and address. Process B's rule set specifies that it wants $50.00 for rights to read the book, and will provide the book for $5.50 if the user agrees to release information about himself. The negotiation might go something like this:

Process A	<--- > Process B
Want (right to read, unrestricted)	---->
	<---- Have(right to read, unrestricted, $50)
Offer (right to read, tender user info)	---->
	< ---- Have(right to read, tender user info, $5.50)
Accept(right to read, tender user info, $5.50)	----- >

In the above example, process A first specifies that it desires the right to read the book without restrictions or other information release. This starting position is specified as a rights option in the PERC that process A is using as a rule. Process B checks its rules and determines that an unrestricted right to read is indeed permitted for a price of $50. It replies to process A that these terms are available. Process A receives this reply and checks it against the control set in the PERC it uses as a rule base. The $50 is outside the $10 limit specified for this control set, so Process A cannot accept the offer. It makes a counter offer

(as described in another optional rights option) of an unrestricted right to read coupled with the release of the reader's name and address. The name and address fields are described in a DTD referenced by Process A's PERC. Process B checks its rules PERC and determines that an unrestricted right to read combined with the release of personal information is a permitted option. It compares the fields that would be released as described in the DTD provided by Process A against the desired fields in a DTD in its own PERC, and determines an acceptable match has occurred. It then sends an offer for unrestricted rights with the release of specific information for the cost of $5.50 to Process A. Process A compares the right, restrictions, and fields against its rule set and determines that $5.50 is within the range of $5-$6 described as acceptable in its rule set. It accepts the offer as made. The offer is sealed by both parties "signing" a new PERC that describes the results of the final negotiation (unrestricted rights, with release of user information, for $5.50). The new PERC may be used by the owner of Process A to read the content (the book) subject to the described terms and conditions.

Further Chain of Handling Model

As described in connection with Figure 2, there are four (4) "participant" instances of VDE 100 in one example of a VDE chain of handling and control used, for example, for content distribution. The first of these participant instances, the content

creator 102, is manipulated by the publisher, author, rights owner or distributor of a literary property to prepare the information for distribution to the consumer. The second participant instance, VDE rights distributor 106, may distribute rights and may also administer and analyze customers' use of VDE authored information. The third participant instance, content user 112, is operated by users (included end-users and distributors) when they use information. The fourth participant instance, financial clearinghouse 116 enables the VDE related clearinghouse activities. A further participant, a VDE administrator, may provide support to keep VDE 100 operating properly. With appropriate authorizations and Rights Operating System components installed, any VDE electronic appliance 600 can play any or all of these participant roles.

Literary property is one example of raw material for VDE 100. To transfer this raw material into finished goods, the publisher, author, or rights owner uses tools to transform digital information (such as electronic books, databases, computer software and movies) into protected digital packages called "objects." Only those consumers (or others along the chain of possession such as a redistributor) who receive permission from a distributor 106 can open these packages. VDE packaged content can be constrained by "rules and control information" provided by content creator 102 and/or content distributor 106—or by other

VDE participants in the content's distribution pathway, i.e., normally by participants "closer" to the creation of the VDE secured package than the participant being constrained.

Once the content is packaged in an "object," the digital distribution process may begin. Since the information packages themselves are protected, they may be freely distributed on CD-ROM disks, through computer networks, or broadcast through cable or by airwaves. Informal "out of channel" exchange of protected packages among end-users does not pose a risk to the content property rights. This is because only authorized individuals may use such packages. In fact, such "out of channel" distribution may be encouraged by some content providers as a marginal cost method of market penetration. Consumers with usage authorizations (e.g., a VISA clearinghouse budget allowing a certain dollar amount of usage) may, for example, be free to license classes of out of channel VDE protected packages provided to them, for example, by a neighbor.

To open a VDE package and make use of its content, an end-user must have permission. Distributors 106 can grant these permissions, and can very flexibly (if permitted by senior control information) limit or otherwise specify the ways in which package contents may be used. Distributors 106 and financial clearinghouses 116 also typically have financial responsibilities

(they may be the same organization in some circumstances if desired). They ensure that any payments required from end-users fulfill their own and any other participant's requirements. This is achieved by auditing usage.

Distributors 106 using VDE 100 may include software publishers, database publishers, cable, television, and radio broadcasters, and other distributors of information in electronic form. VDE 100 supports all forms of electronic distribution, including distribution by broadcast or telecommunications, or by the physical transfer of electronic storage media. It also supports the delivery of content in homogeneous form, seamlessly integrating information from multiple distribution types with separate delivery of permissions, control mechanisms and content.

Distributors 106 and financial clearinghouses 116 may themselves be audited based on secure records of their administrative activities and a chain of reliable, "trusted" processes ensures the integrity of the overall digital distribution process. This allows content owners, for example, to verify that they are receiving appropriate compensation based on actual content usage or other agreed-upon bases.

Since the end-user 112 is the ultimate consumer of content in this example, VDE 100 is designed to provide protected

content in a seamless and transparent way—so long as the end-user stays within the limits of the permissions she has received. The activities of end-user 112 can be metered so that an audit can be conducted by distributors 106. The auditing process may be filtered and/or generalized to satisfy user privacy concerns. For example, metered, recorded VDE content and/or appliance usage information may be filtered prior to reporting it to distributor 106 to prevent more information than necessary from being revealed about content user 112 and/or her usage.

VDE 100 gives content providers the ability to recreate important aspects of their traditional distribution strategies in electronic form and to innovatively structure new distribution mechanisms appropriate to their individual needs and circumstances. VDE 100 supports relevant participants in the chain of distribution, and also enables their desired pricing strategies, access and redistribution permissions, usage rules, and related administrative and analysis procedures. The reusable functional primitives of VDE 100 can be flexibly combined by content providers to reflect their respective distribution objectives. As a result, content providers can feed their information into established distribution channels and also create their own personalized distribution channels.

A summary of the roles of the various participants of virtual distribution environment 100 is set forth in the table below:

Role	Description
"Traditional" Participants	
Content creator	Packager and initial distributor of digital information
Content owner	Owner of the digital information.
Distributors	Provide rights distribution services for budgets and/or content.
Auditor	Provides services for processing and reducing usage based audit trails.
Clearinghouse	Provides intermediate store and forward services for content and audit information. Also, typically provides a platform for other services, including third party financial providers and auditors.
Network provider	Provides communication services between sites and other participants.
Financial providers	Provider of third party sources of electronic funds to end-users and distributors. Examples of this class of users are VISA, American Express, or a government.
End Users	Consumers of information.
Other Participants	
Redistributor	Redistributes rights to use content based on chain of handling restrictions from content providers and/or other distributors.
VDE Administrator	Provider of trusted services for support of VDE nodes.

Role	Description
Independent Audit Processor	Provider of services for processing and summarizing audit trail data. Provides anonymity to end-users while maintaining the comprehensive audit capabilities required by the content providers.
Agents	Provides distributed presence for end-users and other VDE participants.

Of these various VDE participants, the "redistributor," "VDE Administrator," "independent audit processor" and "agents" are, in certain respects "new" participants that may have no counterpart in many "traditional" business models. The other VDE participants (i.e., content provider, content owner, distributors, auditor, clearinghouse, network provider and financial providers) have "traditional" business model counterparts in the sense that traditional distribution models often included non-electronic participants performing some of the same business roles they serve in the virtual distribution environment 100.

VDE distributors 106 may also include "end-users" who provide electronic information to other end-users. For example, Figure 77 shows a further example of a virtual distribution environment 100 chain of handling and control provided by the present invention. As compared to Figure 2, Figure 77 includes a new "client administrator" participant 700. In addition, Figure

77 shows several different content users 112(1), 112(2), . . . , 112(n) that may all be subject to the "jurisdiction" of the client administrator 700. Client administrator 700 may be, for example, a further rights distributor within a corporation or other organization that distributes rights to employees or other organization participant units (such as divisions, departments, networks, and or groups, etc.) subject to organization-specific "rules and control information." The client administrator 700 may fashion rules and control information for distribution, subject to "rules and control" specified by creator 102 and/or distributor 106.

As mentioned above, VDE administrator 116b is a trusted VDE node that supports VDE 100 and keeps it operating properly. In this example, VDE administrator 116b may provide, among others, any of all of the following:

- VDE appliance initialization services
- VDE appliance reinitialization/update services
- Key management services
- "Hot lists" of "rogue" VDE sites
- Certification authority services
- Public key registration
- Client participant unit content budgets and other authorizations

All participants of VDE 100 have the innate ability to participate in any role. For example, users may gather together existing protected packages, add (create new content) packages of their own, and create new products. They may choose to serve as their own distributor, or delegate this responsibility to others. These capabilities are particularly important in the object oriented paradigm which is entering the marketplace today. The production of compound objects, object linking and embedding, and other multi-source processes will create a need for these capabilities of VDE 100. The distribution process provided by VDE 100 is symmetrical; any end-user may redistribute information received to other end-users, provided they possess permission from and follow the rules established by the distribution chain VDE control information governing redistribution. End-users also may, within the same rules and permissions restriction, encapsulate content owned by others within newly published works and distribute these works independently. Royalty payments for the new works may be accessed by the publisher, distributors, or end-users, and may be tracked and electronically collected at any stage of the chain.

Independent financial providers can play an important role in VDE 100. The VDE financial provider role is similar to the role played by organizations such as VISA in traditional distribution scenarios. In any distribution model, authorizing

payments for use of products or services and auditing usage for consistency and irregularities, is critical. In VDE 100, these are the roles filled by independent financial providers. The independent financial providers may also provide audit services to content providers. Thus, budgets or limits on use, and audits, or records of use, may be processed by (and may also be put in place by) clearinghouses 116, and the clearinghouses may then collect usage payments from users 112. Any VDE user 112 may assign the right to process information or perform services on their behalf to the extend allowed by senior control information. The arrangement by which one VDE participant acts on behalf of another is called a "proxy." Audit, distribution, and other important rights may be "proxied" if permitted by the content provider. One special type of "proxy" is the VDE administrator 116b. A VDE administrator is an organization (which may be acting also as a financial clearinghouse 116) that has permission to manage (for example, "intervene" to reset) some portion or all of VDE secure subsystem control information for VDE electronic appliances. This administration right may extend only to admitting new appliances to a VDE infrastructure and to recovering "crashed" or otherwise inoperable appliances, and providing periodic VDE updates.

More On Object Creation, Distribution Methods, Budgets, and Audits

VDE node electronic appliances 600 in the preferred embodiment can have the ability to perform object creation, distribution, audit collection and usage control functions provided by the present invention. Incorporating this range of capabilities within each of many electronic appliances 600 provided by the preferred embodiment is important to a general goal of creating a single (or prominent) standard for electronic transactions metering, control, and billing, that, in its sum of installations, constitutes a secure, trusted, virtual transaction/distribution management environment. If, generally speaking, certain key functions were generally or frequently missing, at least in general purpose VDE node electronic appliances 600, then a variety of different products and different standards would come forth to satisfy the wide range of applications for electronic transaction/distribution management; a single consistent set of tools and a single "rational," trusted security and commercial distribution environment will not have been put in place to answer the pressing needs of the evolving "electronic highway." Certain forms of certain electronic appliances 600 containing VDE nodes which incorporate embedded dedicated VDE microcontrollers such as certain forms of video cassette players, cable television converters and the like may not necessarily have or need full VDE capabilities. However, the preferred

embodiment provides a number of distributed, disparately located electronic appliances 600 each of which desirably include authoring, distribution, extraction, audit, and audit reduction capabilities, along with object authoring capabilities.

The VDE object authoring capabilities provided by the preferred embodiment provides an author, for example, with a variety of menus for incorporating methods in a VDE object 300, including:

- menus for metering and/or billing methods which define how usage of the content portion of a VDE object is to be controlled,
- menus related to extraction methods for limiting and/or enabling users of a VDE object from extracting information from that object, and may include placing such information in a newly created and/or pre-existing VDE content container,,
- menus for specifying audit methods—that is, whether or not certain audit information is to be generated and communicated in some secure fashion back to an object provider, object creator, administrator, and/or clearinghouse, and

- menus for distribution methods for controlling how an object is distributed, including for example, controlling distribution rights of different participant's "down" a VDE chain of content container handling.

The authoring capabilities may also include procedures for distributing administrative budgets, object distribution control keys, and audit control keys to distributors and other VDE participants who are authorized to perform distribution and/or auditing functions on behalf of the author, distributors, and/or themselves. The authoring capabilities may also include procedures for selecting and distributing distribution methods, audit methods and audit reduction methods, including for example, securely writing and/or otherwise controlling budgets for object redistribution by distributors to subsequent VDE chain of content handling participants.

The content of an object 300 created by an author may be generated with the assistance of a VDE aware application program or a non-VDE aware application program. The content of the object created by an author in conjunction with such programs may include text, formatted text, pictures, moving pictures, sounds, computer software, multimedia, electronic games, electronic training materials, various types of files, and so on, without limitation. The authoring process may encapsulate

content generated by the author in an object, encrypt the content with one or more keys, and append one or more methods to define parameters of allowed use and/or required auditing of use and/or payment for use of the object by users (and/or by authorized users only). The authoring process may also include some or all aspects of distributing the object.

In general, in the preferred embodiment, an author can:

A. Specify what content is to be included in an object.

B. Specify content oriented methods including:

Information--typically abstract, promotional, identifying, scheduling, and/or other information related to the content and/or author

Content--e.g. list of files and/or other information resources containing content, time variables, etc.

C. Specify control information (typically a collection of methods related to one another by one or more permissions records, including any method defining variables) and any initial authorized user list including, for example:

Control information over Access & Extraction

Control information over Distribution

Control information over Audit Processing

A VDE node electronic appliance 600 may, for example, distribute an object on behalf of an object provider if a VDE node receives from an object provider administrative budget information for distributing the object and associated distribution key information.

A VDE node electronic appliance 600 may receive and process audit records on behalf of an object provider if that VDE node receives any necessary administrative budget, audit method, and audit key information (used, for example, to decrypt audit trails), from the object provider. An auditing-capable VDE electronic appliance 600 may control execution of audit reduction methods. "Audit reduction" in the preferred embodiment is the process of extracting information from audit records and/or processes that an object provider (e.g., any object provider along a chain of handling of the object) has specified to be reported to an object's distributors, object creators, client administrators, and/or any other user of audit information. This may include, for example, advertisers who may be required to pay for a user's usage of object content. In one embodiment, for example, a clearinghouse can have the ability to "append" budget, audit method, and/or audit key information to an object or class or other grouping of objects located at a user site or located at an

object provider site to ensure that desired audit processes will take place in a "trusted" fashion. A participant in a chain of handling of a VDE content container and/or content container control information object may act as a "proxy" for another party in a chain of handling of usage auditing information related to usage of object content (for example a clearinghouse, an advertiser, or a party interested in market survey and/or specific customer usage information). This may be done by specifying, for that other party, budget, audit method, and/or key information that may be necessary to ensure audit information is gathered and/or provided to, in a proper manner, said additional party. For example, employing specification information provided by said other party.

Object Creation and Initial Control Structures

The VDE preferred embodiment object creation and control structure design processes support fundamental configurability of control information. This enables VDE 100 to support a full range of possible content types, distribution pathways, usage control information, auditing requirements, and users and user groups. VDE object creation in the preferred embodiment employs VDE templates whose atomic elements represent at least in part modular control processes. Employing VDE creation software (in the preferred embodiment a GUI programming process) and VDE templates, users may create VDE objects 300

by, for example, partitioning the objects, placing "meta data" (e.g., author's name, creation date, etc.) into them, and assigning rights associated with them and/or object content to, for example, a publisher and/or content creator. When an object creator runs through this process, she normally will go through a content specification procedure which will request required data. The content specification process, when satisfied, may proceed by, for example, inserting data into a template and encapsulating the content. In addition, in the preferred embodiment, an object may also automatically register its presence with the local VDE node electronic appliance 600 secure subsystem, and at least one permissions record 808 may be produced as a result of the interaction of template instructions and atomic methods, as well as one or more pieces of control structure which can include one or more methods, budgets, and/or etc. A registration process may require a budget to be created for the object. If an object creation process specifies an initial distribution, an administrative object may also be created for distribution. The administrative object may contain one or more permission records 808, other control structures, methods, and/or load modules.

Permissions records 808 may specify various control relationships between objects and users. For example, VDE 100 supports both single access (e.g., one-to-one relationship between a user and a right user) and group access (any number of people

may be authorized as a group). A single permissions record 808 can define both single and group access. VDE 100 may provide "sharing," a process that allows multiple users to share a single control budget as a budget. Additional control structure concepts include distribution, redistribution, and audit, the latter supporting meter and budget information reduction and/or transfer. All of these processes are normally securely controlled by one or more VDE secure subsystems.

Templates and Classes

VDE templates, classes, and flexible control structures support frameworks for organizations and individuals that create, modify, market, distribute, redistribute, consume, and otherwise use movies, audio recordings and live performances, magazines, telephony based retail sales, catalogs, computer software, information databases, multimedia, commercial communications, advertisements, market surveys, infomercials, games, CAD/CAM services for numerically controlled machines, and the like. As the context surrounding these classes changes or evolves, the templates provided by the preferred embodiment of the present invention can be modified to meet these changes for broad use, or more focused activities.

VDE 100 authoring may provide three inputs into a create process: Templates, user input and object content. Templates

act as a set of control instructions and/or data for object control software which are capable of creating (and/or modifying) VDE objects in a process that interacts with user instructions and provided content to create a VDE object. Templates are usually specifically associated with object creation and/or control structures. Classes represent user groups which can include "natural" groups within an organization, such as department members, specific security clearance levels, etc., or ad hoc lists of individual's and/or VDE nodes.

For example, templates may be represented as text files defining specific structures and/or component assemblies. Templates, with their structures and/or component assemblies may serve as VDE object authoring or object control applications. A creation template may consist of a number of sub-templates, which, at the lowest level, represent an "atomic level" of description of object specification. Templates may present one or more models that describe various aspects of a content object and how the object should be created including employing secure atomic methods that are used to create, alter, and/or destroy permissions records 808 and/or associated budgets, etc.

Templates, classes (including user groups employing an object under group access), and flexible control structures including object "independent" permissions records (permissions

that can be associated with a plurality of objects) and structures that support budgeting and auditing as separate VDE processes, help focus the flexible and configurable capabilities inherent within authoring provided by the present invention in the context of specific industries and/or businesses and/or applications. VDE rationalizes and encompasses distribution scenarios currently employed in a wide array of powerful industries (in part through the use of application or industry specific templates). Therefore, it is important to provide a framework of operation and/or structure to allow existing industries and/or applications and/or businesses to manipulate familiar concepts related to content types, distribution approaches, pricing mechanisms, user interactions with content and/or related administrative activities, budgets, and the like.

The VDE templates, classes, and control structures are inherently flexible and configurable to reflect the breadth of information distribution and secure storage requirements, to allow for efficient adaptation into new industries as they evolve, and to reflect the evolution and/or change of an existing industry and/or business, as well as to support one or more groups of users who may be associated with certain permissions and/or budgets and object types. The flexibility of VDE templates, classes, and basic control structures is enhanced through the use of VDE aggregate and control methods which have a compound,

conditional process impact on object control. Taken together, and employed at times with VDE administrative objects and VDE security arrangements and processes, the present invention truly achieves a content control and auditing architecture that can be configured to most any commercial distribution embodiment. Thus, the present invention fully supports the requirements and biases of content providers without forcing them to fit a predefined application model. It allows them to define the rights, control information, and flow of their content (and the return of audit information) through distribution channels.

Modifying Object Content (Adding, Hiding, Modifying, Removing, and/or Extending)

Adding new content to objects is an important aspect of authoring provided by the present invention. Providers may wish to allow one-or more users to add, hide, modify, remove and/or extend content that they provide. In this way, other users may add value to, alter for a new purpose, maintain, and/or otherwise change, existing content. The ability to add content to an empty and/or newly created object is important as well.

When a provider provides content and accompanying control information, she may elect to add control information that enables and/or limits the addition, modification, hiding and/or deletion of said content. This control information may concern:

- the nature and/or location of content that may be added, hidden, modified, and/or deleted;
- portions of content that may be modified, hidden, deleted and/or added to;
- required secure control information over subsequent VDE container content usage in a chain of control and/or locally to added, hidden, and/or modified content;
- requirements that provider-specified notices and/or portions of content accompany added, hidden, deleted and/or modified content and/or the fact that said adding, hiding, modification and/or deletion occurred;
- secure management of limitations and/or requirements concerning content that may be removed, hidden and/or deleted from content, including the amount and/or degree of addition, hiding, modification and/or deletion of content;
- providing notice to a provider or providers that modification, hiding, addition and/or deletion has occurred and/or the nature of said occurrence; and
- other control information concerned with modification, addition, hiding, and/or deleting provider content.

A provider may use this control information to establish an opportunity for other users to add value to and/or maintain existing content in a controlled way. For example, a provider of software development tools may allow other users to add commentary and/or similar and/or complementary tools to their provided objects. A provider of movies may allow commentary and/or promotional materials to be added to their materials. A provider of CAD/CAM specifications to machine tool owners may allow other users to modify objects containing instructions associated with a specification to improve and/or translate said instructions for use with their equipment. A database owner may allow other users to add and/or remove records from a provided database object to allow flexibility and/or maintenance of the database.

Another benefit of introducing control information is the opportunity for a provider to allow other users to alter content for a new purpose. A provider may allow other users to provide content in a new setting.

To attach this control information to content, a provider may be provided with, or if allowed, design and implement, a method or methods for an object that govern addition, hiding, modification and/or deletion of content. Design and implementation of such one or more methods may be performed

using VDE software tools in combination with a PPE 650. The provider may then attach the method(s) to an object and/or provide them separately. A permissions record 808 may include requirements associated with this control information in combination with other control information, or a separate permissions record 808 may be used.

An important aspect of adding or modifying content is the choice of encryption/decryption keys and/or other relevant aspects of securing new or altered content. The provider may specify in their method(s) associated with these processes a technique or techniques to be used for creating and/or selecting the encryption/decryption keys and/or other relevant aspect of securing new and/or altered content. For example, the provider may include a collection of keys, a technique for generating new keys, a reference to a load module that will generate keys, a protocol for securing content, and/or other similar information.

Another important implication is the management of new keys, if any are created and/or used. A provider may require that such keys and reference to which keys were used must be transmitted to the provider, or she may allow the keys and/or securing strategy to remain outside a provider's knowledge and/or control. A provider may also choose an intermediate

course in which some keys must be transmitted and others may remain outside her knowledge and/or control.

An additional aspect related to the management of keys is the management of permissions associated with an object resulting from the addition, hiding, modification and/or deletion of content. A provider may or may not allow a VDE chain of control information user to take some or all of the VDE rules and control information associated with granting permissions to access and/or manipulate VDE managed content and/or rules and control information associated with said resulting object. For example, a provider may allow a first user to control access to new content in an object, thereby requiring any other user of that portion of content to receive permission from the first user. This may or may not, at the provider's discretion, obviate the need for a user to obtain permission from the provider to access the object at all.

Keys associated with addition, modification, hiding and/or deletion may be stored in an independent permissions record or records 808. Said permissions record(s) 808 may be delivered to a provider or providers and potentially merged with an existing permissions record or records, or may remain solely under the control of the new content provider. The creation and content of an initial permissions record 808 and any control information

over the permissions record(s) are controlled by the method(s) associated with activities by a provider. Subsequent modification and/or use of said permission record(s) may involve a provider's method(s), user action, or both. A user's ability to modify and/or use permissions record(s) 808 is dependent on, at least in part, the senior control information associated with the permissions record(s) of a provider.

Distribution Control information

To enable a broad and flexible commercial transaction environment, providers should have the ability to establish firm control information over a distribution process without unduly limiting the possibilities of subsequent parties in a chain of control. The distribution control information provided by the present invention allow flexible positive control. No provider is required to include any particular control, or use any particular strategy, except as required by senior control information. Rather, the present invention allows a provider to select from generic control components (which may be provided as a subset of components appropriate to a provider's specific market, for example, as included in and/or directly compatible with, a VDE application) to establish a structure appropriate for a given chain of handling/control. A provider may also establish control information on their control information that enable and limit modifications to their control information by other users.

The administrative systems provided by the present invention generate administrative "events." These "events" correspond to activities initiated by either the system or a user that correspond to potentially protected processes within VDE. These processes include activities such as copying a permissions record, copying a budget, reading an audit trail record, copying a method, updating a budget, updating a permissions record, updating a method, backing up management files, restoring management files, and the like. Reading, writing, modifying, updating, processing, and/or deleting information from any portion of any VDE record may be administrative events. An administrative event may represent a process that performs one or more of the aforementioned activities on one or more portions of one or more records.

When a VDE electronic appliance 600 encounters an administrative event, that event is typically processed in conjunction with a VDE PPE 650. As in the case of events generally related to access and/or use of content, in most cases administrative events are specified by content providers (including, for example, content creators, distributors, and/or client administrators) as an aspect of a control specified for an object, group and/or class of objects.

For example, if a user initiates a request to distribute permission to use a certain object from a desktop computer to a notebook computer, one of the administrative events generated may be to create a copy of a permissions record that corresponds to the object. When this administrative event is detected by ROS 602, an EVENT method for this type of event may be present. If an EVENT method is present, there may also be a meter, a billing, and a budget associated with the EVENT method. Metering, billing, and budgeting can allow a provider to enable and limit the copying of a permissions record 808.

For example, during the course of processing a control program, a meter, a billing, and a budget and/or audit records may be generated and/or updated. Said audit records may record information concerning circumstances surrounding an administrative event and processing of said event. For example, an audit record may contain a reference to a user and/or system activity that initiated an event, the success or failure of processing said event, the date and/or time, and/or other relevant information.

Referring to the above example of a user with both a desktop and notebook computer, the provider of a permissions record may require an audit record each time a meter for copying said permissions record is processed. The audit record provides a

flexible and configurable control and/or recording environment option for a provider.

In some circumstances, it may be desirable for a provider to limit which aspects of a control component may be modified, updated, and/or deleted. "Atomic element definitions" may be used to limit the applicability of events (and therefore the remainder of a control process, if one exists) to certain "atomic elements" of a control component. For example, if a permissions record 808 is decomposed into "atomic elements" on the fields described in Figure 26, an event processing chain may be limited, for example, to a certain number of modifications of expiration date/time information by specifying only this field in an atomic element definition. In another example, a permissions record 808 may be decomposed into atomic elements based on control sets. In this example, an event chain may be limited to events that act upon certain control sets.

In some circumstances, it may be desirable for a provider to control how administrative processes are performed. The provider may choose to include in distribution records stored in secure database 610 information for use in conjunction with a component assembly 690 that controls and specifies, for example, how processing for a given event in relation to a given method and/or record should be performed. For example, if a provider

wishes to allow a user to make copies of a permissions record 808, she may want to alter the permissions record internally. For example, in the earlier example of a user with a desktop and a notebook computer, a provider may allow a user to make copies of information necessary to enable the notebook computer based on information present in the desktop computer, but not allow any further copies of said information to be made by the notebook VDE node. In this example, the distribution control structure described earlier would continue to exist on the desktop computer, but the copies of the enabling information passed to the notebook computer would lack the required distribution control structure to perform distribution from the notebook computer. Similarly, a distribution control structure may be provided by a content provider to a content provider who is a distributor in which a control structure would enable a certain number of copies to be made of a VDE content container object along with associated copies of permissions records, but the permissions records would be altered (as per specification of the content provider, for example) so as not to allow end-users who received distributor created copies from making further copies for distribution to other VDE nodes.

Although the preceding example focuses on one particular event (copying) under one possible case, similar processes may be used for reading, writing, modifying, updating, processing,

and/or deleting information from records and/or methods under any control relationship contemplated by the present invention. Other examples include: copying a budget, copying a meter, updating a budget, updating a meter, condensing an audit trail, and the like.

Creating Custom Methods

In the preferred embodiment of the present invention, methods may be created "at will," or aliased to another method. These two modes contribute to the superior configurability, flexibility, and positive control of the VDE distribution process. Generally, creating a method involves specifying the required attributes or parameters for the data portion of the method, and then "typing" the method. The typing process typically involves choosing one or more load modules to process any data portions of a method. In addition to the method itself, the process of method creation may also result in a method option subrecord for inclusion in, or modification of, a permissions record, and a notation in the distribution records. In addition to any "standard" load module(s) required for exercise of the method, additional load modules, and data for use with those load modules, may be specified if allowed. These event processing structures control the distribution of the method.

For example, consider the case of a security budget. One form of a typical budget might limit the user to 10Mb of decrypted data per month. The user wishes to move their rights to use the relevant VDE content container object to their notebook. The budget creator might have limited the notebook to the same amount, half the original amount, a prorated amount based on the number of moves budgeted for an object, etc. A distribute method (or internal event processing structure) associated with the budget allows the creator of the budget to make a determination as to the methodology and parameters involved. Of course, different distribution methods may be required for the case of redistribution, or formal distribution of the method. The aggregate of these choices is stored in a permissions record for the method.

An example of the process steps used for the move of a budget record might look something like this:

1) Check the move budget (e.g., to determine the number of moves allowed)

2) Copy static fields to new record (e.g., as an encumbrance)

3) Decrement the Decr counter in the old record (the original budget)

4) Increment the Encumbrance counter in the old record

5) Write a distribution record

6) Write a Distribution Event Id to the new record

7) Increment the move meter

8) Decrement the move budget

9) Increment the Decr counter in the new record

Creating a Budget

In the preferred embodiment, to create a budget, a user manipulates a Graphical User Interface budget distribution application (e.g., a VDE template application). The user fills out any required fields for type(s) of budget, expiration cycle(s), auditor(s), etc. A budget may be specified in dollars, deutsche marks, yen, and/or in any other monetary or content measurement schema and/or organization. The preferred embodiment output of the application, normally has three basic elements. A notation in the distribution portion of secure database 610 for each budget record created, the actual budget records, and a method option record for inclusion in a permissions record. Under some circumstances, a budget process may not result in the creation of a method option since an existing method option may be being used. Normally, all of this output is protected by storage in secure database 610 and/or in one or more administrative objects.

There are two basic modes of operation for a budget distribution application in the preferred embodiment. In the first case, the operator has an unlimited ability to specify budgets. The budgets resulting from this type of activity may be freely used to control any aspect of a distribution process for which an operator has rights, including for use with "security" budgets such as quantities limiting some aspect of usage. For example, if the operator is a "regular person," he may use these budgets to control his own utilization of objects based on a personal accounting model or schedule. If the operator is an authorized user at VISA, the resulting budgets may have broad implications for an entire distribution system. A core idea is that this mode is controlled strictly by an operator.

The second mode of operation is used to create "alias" budgets. These budgets are coupled to a preexisting budget in an operator's system. When an operator fills a budget, an encumbrance is created on the aliased budget. When these types of budgets are created, the output includes two method option subrecords coupled together: the method option subrecord for the aliased budget, and a method option subrecord for the newly created budget. In most cases, the alias budget can be used in place of the original budget if the budget creator is authorized to modify the method options within the appropriate required method record of a permissions record.

For example, assume that a user (client administrator) at a company has the company's VISA budget on her electronic appliance 600. She wants to distribute budget to a network of company users with a variety of preexisting budgets and requirements. She also wants to limit use of the company's VISA budget to certain objects. To do this, she aliases a company budget to the VISA budget. She then modifies (if so authorized) the permissions record for all objects that the company will allow their users to manipulate so that they recognize the company budget in addition to, or instead of, the VISA budget. She then distributes the new permissions records and budgets to her users. The audit data from these users is then reduced against the encumbrance on the company's VISA budget to produce a periodic billing.

In another example, a consumer wants to control his family's electronic appliance use of his VISA card, and prevent his children from playing too many video games, while allowing unlimited use of encyclopedias. In this case, he could create two budgets. The first budget can be aliased to his VISA card, and might only be used with encyclopedia objects (referenced to individual encyclopedia objects and/or to one or more classes of encyclopedia objects) that reference the aliased budget in their explicitly modified permissions record. The second budget could be, for example, a time budget that he redistributes to the family

for use with video game objects (video game class). In this instance, the second budget is a "self-replenishing" security/control budget, that allows, for example, two hours of use per day. The first budget operates in the same manner as the earlier example. The second budget is added as a new required method to permissions records for video games. Since the time budget is required to access the video games, an effective control path is introduced for requiring the second budget -- only permissions records modified to accept the family budget can be used by the children for video games and they are limited to two hours per day.

Sharing and Distributing Rights and Budgets

Move

The VDE "move" concept provided by the preferred embodiment covers the case of "friendly sharing" of rights and budgets. A typical case of "move" is a user who owns several machines and wishes to use the same objects on more than one of them. For example, a user owns a desktop and a notebook computer. They have a subscription to an electronic newspaper that they wish to read on either machine, i.e., the user wishes to move rights from one machine to the other.

An important concept within "move" is the idea of independent operation. Any electronic appliance 600 to which

rights have been moved may contact distributors or clearinghouses independently. For example, the user mentioned above may want to take their notebook on the road for an extended period of time, and contact clearinghouses and distributors without a local connection to their desktop.

To support independent operation, the user should be able to define an account with a distributor or clearinghouse that is independent of the electronic appliance 600 she is using to connect. The transactions must be independently traceable and reconcilable among and between machines for both the end user and the clearinghouse or distributor. The basic operations of moving rights, budgets, and bitmap or compound meters between machines is also supported.

Redistribution

Redistribution forms a UDE middle ground between the "friendly sharing" of "move," and formal distribution. Redistribution can be thought of as "anonymous distribution" in the sense that no special interaction is required between a creator, clearinghouse, or distributor and a redistributor. Of course, a creator or distributor does have the ability to limit or prevent redistribution.

Unlike the "move" concept, redistribution does not imply independent operation. The redistributor serves as one point of contact for users receiving redistributed rights and/or budgets, etc. These users have no knowledge of, or access to, the clearinghouse (or and/or distributor) accounts of the redistributor. The redistributor serves as an auditor for the rights and/or budgets, etc. that they redistribute, unless specifically overridden by restrictions from distributors and/or clearinghouses. Since redistributees (recipients of redistributed rights and/or budgets, etc.) would place a relatively unquantifiable workload on clearinghouses, and furthermore, since a redistributor would be placing himself at an auditable risk (responsible for all redistributed rights and/or budgets, etc.), the audit of rights, budgets, etc. of redistributees by redistributors is assumed as the default case in the preferred embodiment.

Distribution

Distribution involves three types of entity. Creators usually are the source of distribution. They typically set the control structure "context" and can control the rights which are passed into a distribution network. Distributors are users who form a link between object (content) end users and object (content) creators. They can provide a two-way conduit for rights and audit data. Clearinghouses may provide independent

financial services, such as credit and/or billing services, and can serve as distributors and/or creators. Through a permissions and budgeting process, these parties collectively can establish fine control over the type and extent of rights usage and/or auditing activities.

Encumbrance

An "encumbrance" is a special type of VDE budget. When that a budget distribution of any type occurs, an "encumbrance" may be generated. An encumbrance is indistinguishable from an original budget for right exercise (e.g., content usage payment) purposes, but is uniquely identified within distribution records as to the amount of the encumbrance, and all necessary information to complete a shipping record to track the whereabouts of an encumbrance. For right exercise purposes, an encumbrance is identical to an original budget; but for tracking purposes, it is uniquely identifiable.

In the preferred embodiment of the present invention, a Distribution Event ID will be used by user VDE nodes and by clearinghouse services to track and reconcile encumbrances, even in the case of asynchronous audits. That is, the "new" encumbrance budget is unique from a tracking point of view, but indistinguishable from a usage point of view.

Unresolved encumbrances are a good intermediate control for a VDE distribution process. A suitable "grace period" can be introduced during which encumbrances must be resolved. If this period elapses, an actual billing or payment may occur. However, even after the interval has expired and the billing and/or payment made, an encumbrance may still be outstanding and support later reconciliation. In this case, an auditor may allow a user to gain a credit, or a user may connect to a VDE node containing an encumbered budget, and resolve an amount as an internal credit. In some cases, missing audit trails may concern a distributor sufficiently to revoke redistribution privileges if encumbrances are not resolved within a "grace period," or if there are repeated grace period violations or if unresolved encumbrances are excessively large.

Encumbrances can be used across a wide variety of distribution modes. Encumbrances, when used in concert with aliasing of budgets, opens important additional distribution possibilities. In the case of aliasing a budget, the user places himself in the control path for an object -- an aliased budget may only be used in conjunction with permissions records that have been modified to recognize it. An encumbrance has no such restrictions.

For example, a user may want to restrict his children's use of his electronic, VDE node VISA budget. In this case, the user can generate an encumbrance on his VISA budget for the children's family alias budget, and another for his wife that is a transparent encumbrance of the original VISA budget. BigCo may use a similar mechanism to distribute VISA budget to department heads, and aliased BigCo budget to users directly.

Account Numbers and User IDs

In the preferred embodiment, to control access to clearinghouses, users are assigned account numbers at clearinghouses. Account numbers provide a unique "instance" value for a secure database record from the point of view of an outsider. From the point of view of an electronic appliance 600 site, the user, group, or group/user ids provide the unique instance of a record. For example, from the point of view of VISA, your Gold Card belongs to account number #123456789. From the point of view of the electronic appliance site (for example, a server at a corporation), the Gold card might belong to user id 1023. In organizations which have plural users and/or user groups using a VDE node, such users and/or user groups will likely be assigned unique user IDs. differing budgets and/or other user rights may be assigned to different users and/or user groups and/or other VDE control information may be applied on a differing manner to electronic content and/or appliance usage by

users assigned with different such IDs. Of course, both a clearinghouse and a local site will likely have both pieces of information, but "used data" versus the "comment data" may differ based on perspective.

In the preferred embodiment case of "move," an account number stored with rights stays the same. In the preferred embodiment of other forms of distribution, a new account number is required for a distributee. This may be generated automatically by the system, or correspond to a methodology developed by a distributor or redistributor. Distributors maintain account numbers (and associated access secrets) in their local name services for each distributee. Conversely, distributees' name services may store account numbers based on user id for each distributor. This record usually is moved with other records in the case of move, or is generated during other forms of distribution.

Organizations (including families) may automatically assign unique user IDs when creating control information (e.g., a budget) for a new user or user group.

Requirements Record

In order to establish the requirements, and potentially options, for exercising a right associated with a VDE content

container object before one or more required permissions records are received for that object, a requirements record may exist in the private header of such an object. This record will help the user establish what they have, and what they need from a distributor prior to forming a connection. If the requirements or possibilities for exercising a particular right have changed since such an object was published, a modified requirements record may be included in a container with an object (if available and allowed), or a new requirements record may be requested from a distributor before registration is initiated. Distributors may maintain "catalogs" online, and/or delivered to users, of collections of requirements records and/or descriptive information corresponding to objects for which they may have ability to obtain and/or grant rights to other users.

Passing an Audit

In the preferred embodiment of VDE there may be at least two types of auditing. In the case of budget distribution, billing records that reflect consumption of a budget generally need to be collected and processed. In the case of permissions distribution, usage data associated with an object are also frequently required.

In order to effect control over an object, a creator may establish the basic control information associated with an object.

This is done in the formulation of permissions, the distribution of various security, administrative and/or financial budgets, and the level of redistribution that is allowed, etc. Distributors (and redistributors) may further control this process within the rights, budgets, etc. (senior control information) they have received.

For example, an object creator may specify that additional required methods may be added freely to their permissions records, establish no budget for this activity, and allow unlimited redistribution of this right. As an alternative example, a creator may allow moving of usage rights by a distributor to half a dozen subdistributors, each of whom can distribute 10,000 copies, but with no redistribution rights being allowed to be allocated to subdistributors' (redistributors') customers. As another example, a creator may authorize the moving of usage rights to only 10 VDE nodes, and to only one level of distribution (no redistribution). Content providers and other contributors of control information have the ability through the use of permissions records and/or component assemblies to control rights other users are authorized to delegate in the permissions records they send to those users, so long as such right to control one, some, or all such rights of other users is either permitted or restricted (depending on the control information distribution model). It is possible and often desirable, using VDE, to construct a mixed model in which a distributor is restricted from

controlling certain rights of subsequent users and is allowed to control other rights. VDE control of rights distribution in some VDE models will in part or whole, at least for certain one or more "levels" of a distribution chain, be controlled by electronic content control information providers who are either not also providers of the related content or provide only a portion of the content controlled by said content control information. for example, in certain models, a clearinghouse might also serve as a rights distribution agent who provides one or more rights to certain value chain participants, which one or more rights may be "attached" to one or more rights to use the clearinghouse's credit (if said clearinghouse is, at least in part, a financial clearinghouse (such a control information provider may alternatively, or in addition, restrict other users' rights.

A content creator or other content control information provider may budget a user (such as a distributor) to create an unlimited number of permissions records for a content object, but revoke this right and/or other important usage rights through an expiration/termination process if the user does not report his usage (provide an audit report) at some expected one or more points in time and/or after a certain interval of time (and/or if the user fails to pay for his usage or violates other aspects of the agreement between the user and the content provider). This termination (or suspension or other specified consequence) can be

enforced, for example, by the expiration of time-aged encryption keys which were employed to encrypt one or more aspects of control information. This same termination (or other specified consequence such as budget reduction, price increase, message displays on screen to users, messages to administrators, etc.) can also be the consequence of the failure by a user or the users VDE installation to complete a monitored process, such as paying for usage in electronic currency, failure to perform backups of important stored information (e.g., content and/or appliance usage information, control information, etc.), failure to use a repeated failure to use the proper passwords or other identifiers, etc.).

Generally, the collection of audit information that is collected for reporting to a certain auditor can be enforced by expiration and/or other termination processes. For example, the user's VDE node may be instructed (a) from an external source to no longer perform certain tasks, (b) carries within its control structure information informing it to no longer perform certain tasks, or (c) is elsewise no longer able to perform certain tasks. The certain tasks might comprise one or more enabling operations due to a user's (or installation's) failure to either report said audit information to said auditor and/or receive back a secure confirmation of receipt and/or acceptance of said audit information. If an auditor fails to receive audit information from

a user (or some other event fails to occur or occur properly), one or more time-aged keys which are used, for example, as a security component of an embodiment of the present invention, may have their aging suddenly accelerated (completed) so that one or more processes related to said time-aged keys can no longer be performed.

Authorization Access Tags and Modification Access Tags

In order to enable a user VDE installation to pass audit information to a VDE auditing party such as a Clearinghouse, VDE allows a VDE auditing party to securely, electronically communicate with the user VDE installation and to query said installation for certain or all information stored within said installation's secure sub-system, depending on said auditing party's rights (said party shall normally be unable to access securely stored information that said party is not expressly authorized to access, that is one content provider will normally not be authorized to access content usage information related to content provided by a different content provider). The auditing party asserts a secure secret (e.g., a secure tag) that represents the set of rights of the auditor to access certain information maintained by said subsystem. If said subsystem validates said tag, the auditing party may then receive auditing information that it is allowed to request and receive.

Great flexibility exists in the enforcement of audit trail requirements. For example, a creator (or other content provider or control information provider or auditor in an object's or audit report's chain of handling) may allow changes by an auditor for event trails, but not allow anyone but themselves to read those trails, and limit the redistribution of this right to, for example, six levels. Alternatively, a creator or other controlling party may give a distributor the right to process, for example, 100,000 audit records (and/or, for example, the right to process 12 audit records from a given user) before reporting their usage. If a creator or other controlling party desires, he may allow (and/or require) separate (and containing different, a subset of, overlapping, or the same information) audit "packets" containing audit information, certain of said audit information to be processed by a distributor and certain other of said audit information to be passed back to the creator and/or other auditors (each receiving the same, overlapping, a subset of, or different audit information). Similarly, as long as allowed by, for example, an object creator, a distributor (or other content and/or control information provider) may require audit information to be passed back to it, for example, after every 50,000 audit records are processed (or any other unit of quantity and/or after a certain time interval and/or at a certain predetermined date) by a redistributor. In the preferred embodiment, audit rules, like other control structures, may be stipulated at any stage of a

distribution chain of handling as long as the right to stipulate said rules has not been restricted by a more "senior" object and/or control information distributing (such as an auditing) participant.

Audit information that is destined for different auditors may be encrypted by different one or more encryption keys which have been securely provided by each auditor's VDE node and communicated for inclusion in a user's permissions record(s) as a required step, for example, during object registration. This can provide additional security to further ensure (beyond the use of passwords and/or other identification information and other VDE security features) that an auditor may only access audit information to which he is authorized. In one embodiment, encrypted (and/or unencrypted) "packets" of audit information (for example, in the form of administrative objects) may be bound for different auditors including a clearinghouse and/or content providers and/or other audit information users (including, for example, market analysts and/or list purveyors). The information may pass successively through a single chain of handling, for example, user to clearinghouse to redistributor to distributor to publisher/object creator, as specified by VDE audit control structures and parameters. Alternatively, encrypted (or, normally less preferably, unencrypted) audit packets may be required to be dispersed directly from a user to a plurality of

auditors, some one or more who may have the responsibility to "pass along" audit packets to other auditors. In another embodiment, audit information may be passed, for example, to a clearinghouse, which may then redistribute all and/or appropriate subsets of said information (and/or some processed result) to one or more other parties, said redistribution employing VDE secure objects created by said clearinghouse.

An important function of an auditor (receiver of audit information) is to pass administrative events back to a user VDE node in acknowledgement that audit information has been received and/or "recognized." In the preferred embodiment, the receipt and/or acceptance of audit information may be followed by two processes. The first event will cause the audit data at a VDE node which prepared an audit report to be deleted, or compressed into, or added to, one or more summary values. The second event, or set of events, will "inform" the relevant security (for example, termination and/or other consequence) control information (for example, budgets) at said VDE node of the audit receipt, modify expiration dates, provide key updates, and/or etc. In most cases, these events will be sent immediately to a site after an audit trail is received. In some cases, this transmission may be delayed to, for example, first allow processing of the audit trail and/or payment by a user to an auditor or other party.

In the preferred embodiment, the administrative events for content objects and independently distributed methods/component assemblies are similar, but not necessarily identical. For example, key updates for a budget may control encryption of a billing trail, rather than decryption of object content. The billing trail for a budget is in all respects a method event trail. In one embodiment, this trail must include sufficient references into distribution records for encumbrances to allow reconciliation by a clearinghouse. This may occur, for example, if a grace period elapses and the creator of a budget allows unresolved encumbrances to ultimately yield automatic credits if an expired encumbrance is "returned" to the creator.

Delivery of audit reports through a path of handling may be in part insured by an inverse (return of information) audit method. Many VDE methods have at least two pieces: a portion that manages the process of producing audit information at a user's VDE node; and a portion that subsequently acts on audit data. In an example of the handling of audit information bound for a plurality of auditors, a single container object is received at a clearinghouse (or other auditor). This container may contain (a) certain encrypted audit information that is for the use of the clearinghouse itself, and (b) certain other encrypted audit information bound for other one or more auditor parties. The two sets of information may have the same, overlapping and in part

different, or entirely different, information content. Alternatively, the clearinghouse VDE node may be able to work with some or all of the provided audit information. The audit information may be, in part, or whole, in some summary and/or analyzed form further processed at the clearinghouse and/or may be combined with other information to form a, at least in part, derived set of information and inserted into one or more at least in part secure VDE objects to be communicated to said one or more (further) auditor parties. When an audit information container is securely processed at said clearinghouse VDE node by said inverse (return) audit method, the clearinghouse VDE node can create one or more VDE administrative objects for securely carrying audit information to other auditors while separately processing the secure audit information that is specified for use by said clearinghouse. Secure audit processes and credit information distribution between VDE participants normally takes place within the secure VDE "black box," that is processes are securely processed within secure VDE PPE650 and audit information is securely communicated between the VDE secure subsystems of vDE participants employing VDE secure communication techniques (e.g., public key encryption, and authentication).

This type of inverse audit method may specify the handling of returned audit information, including, for example, the local

processing of audit information and/or the secure passing along of audit information to one or more auditor parties. If audit information is not passed to one or more other auditor parties as may be required and according to criteria that may have been set by said one or more other auditor parties and/or content providers and/or control information providers during a permissions record specification and/or modification process, the failure to, for example, receive notification of successful transfer of required audit information by an auditor party, e.g., a content provider, can result in the disablement of at least some capability of the passing through party's VDE node (for example, disablement of the ability to further perform certain one or more VDE managed business functions that are related to object(s) associated with said audit or party). In this preferred embodiment example, when an object is received by an auditor, it is automatically registered and permissions record(s) contents are entered into the secure management database of the auditor's VDE node.

One or more permissions records that manage the creation and use of an audit report object (and may manage other aspects of object use as well) may be received by a user's system during an audit information reporting exchange (or other electronic interaction between a user and an auditor or auditor agent). Each received permissions record may govern the creation of the

next audit report object. After the reporting of audit information, a new permissions record may be required at a user's VDE node to refresh the capability of managing audit report creation and audit information transfer for the next audit reporting cycle. In our above example, enabling an auditor to supply one or more permissions records to a user for the purpose of audit reporting may require that an auditor (such as a clearinghouse) has received certain, specified permissions records itself from "upstream" auditors (such as, for example, content and/or other content control information providers). Information provided by these upstream permissions records may be integrated into the one or more permissions records at an auditor VDE (e.g., clearinghouse) installation that manage the permissions record creation cycle for producing administrative objects containing permissions records that are bound for users during the audit information reporting exchange. If an upstream auditor fails to receive, and/or is unable to process, required audit information, this upstream auditor may fail to provide to the clearinghouse (in this example) the required permissions record information which enables a distributor to support the next permission record creation/auditing cycle for a given one or more objects (or class of objects). As a result, the clearinghouse's VDE node may be unable to produce the next cycle's permissions records for users, and/or perform some other important process. This VDE audit reporting control process may be entirely electronic process

management involving event driven VDE activities at both the intended audit information receiver and sender and employing both their secure PPE650 and secure VDE communication techniques.

In the preferred embodiment, each time a user registers a new object with her own VDE node, and/or alternatively, with a remote clearinghouse and/or distributor VDE node, one or more permissions records are provided to, at least in part, govern the use of said object. The permissions records may be provided dynamically during a secure UDE registration process (employing the VDE installation secure subsystem), and/or may be provided following an initial registration and received at some subsequent time, e.g. through one or more separate secure VDE communications, including, for example, the receipt of a physical arrangement containing or otherwise carrying said information. At least one process related to the providing of the one or more permissions records to a user can trigger a metering event which results in audit information being created reflecting the user's VDE node's, clearinghouse's, and/or distributor's permissions records provision process. This metering process may not only record that one or more permissions records have been created. It may also record the VDE node name, user name, associated object identification information, time, date, and/or other identification information. Some or all of this information can

become part of audit information securely reported by a clearinghouse or distributor, for example, to an auditing content creator and/or other content provider. This information can be reconciled by secure VDE applications software at a receiving auditor's site against a user's audit information passed through by said clearinghouse or distributor to said auditor. For each metered one or more permissions records (or set of records) that were created for a certain user (and/or VDE node) to manage use of certain one or more VDE object(s) and/or to manage the creation of VDE object audit reports, it may be desirable that an auditor receive corresponding audit information incorporated into an, at least in part, encrypted audit report. This combination of metering of the creation of permissions records; secure, encrypted audit information reporting processes; secure VDE subsystem reconciliation of metering information reflecting the creation of registration and/or audit reporting permissions with received audit report detail; and one or more secure VDE installation expiration and/or other termination and/or other consequence processes; taken together significantly enhances the integrity of the VDE secure audit reporting process as a trusted, efficient, commercial environment.

Secure Document Management Example

VDE 100 may be used to implement a secure document management environment. The following are some examples of how this can be accomplished.

In one example, suppose a law firm wants to use VDE 100 to manage documents. In this example, a law firm that is part of a litigation team might use VDE in the following ways:

1. to securely control access to, and/or other usage of, confidential client records,
2. to securely control access, distribution, and/or other rights to documents and memoranda created at the law firm,
3. to securely control access and other use of research materials associated with the case,
4. to securely control access and other use, including distribution of records, documents, and notes associated with the case,
5. to securely control how other firms in the litigation team may use, including change, briefs that have been distributed for comment and review,
6. to help manage client billing.

The law firm may also use VDE to electronically file briefs with the court (presuming the court is also VDE capable) including providing secure audit verification of the ID (e.g., digital signature) of filers and other information pertinent to said filing procedure.

In this example, the law firm receives in VDE content containers documents from their client's VDE installation secure subsystem(s). Alternatively, or in addition, the law firm may receive either physical documents which may be scanned into electronic form, and/or they receive electronic documents which have not yet been placed in VDE containers. The electronic form of a document is stored as a VDE container (object) associated with the specific client and/or case. The VDE container mechanism supports a hierarchical ordering scheme for organizing files and other information within a container; this mechanism may be used to organize the electronic copies of the documents within a container, A VDE container is associated with specific access control information and rights that are described in one or more permissions control information sets (PERCs) associated with that container. In this example, only those members of the law firm who possess a VDE instance, an appropriate PERC, and the VDE object that contains the desired document, may use the document. Alternatively or in addition, a law firm member may use a VDE instance which has been

installed on the law firm's network server. In this case, the member must be identified by an appropriate PERC and have access to the document containing VDE object (in order to use the server VDE installation). Basic access control to electronic documents is enabled using the secure subsystem of one or more user VDE installations.

VDE may be used to provide basic usage control in several ways. First, it permits the "embedding" of multiple containers within a single object. Embedded objects permit the "nesting" of control structures within a container. VDE also extends usage control information to an arbitrary granular level (as opposed to a file based level provided by traditional operating systems) and provides flexible control information over any action associated with the information which can be described as a VDE controlled process. For example, simple control information may be associated with viewing the one or more portions of documents and additional control information may be associated with editing, printing and copying the same and/or different one or more portions of these same documents.

In this example, a "client" container contains all documents that have been provided by the client (documents received in other containers can be securely extracted and embedded into the VDE client container using VDE extraction and embedding

capabilities). Each document in this example is stored as an object within the parent, client VDE container. The "client" container also has several other objects embedded within it; one for each attorney to store their client notes, one (or more) for research results and related information, and at least one for copies of letters, work papers, and briefs that have been created by the law firm. The client container may also contain other information about the client, including electronic records of billing, time, accounting, and payments. Embedding VDE objects within a parent VDE content container provides a convenient way to securely categorize and/or store different information that shares similar control information. All client provided documents may, for example, be subject to the same control structures related to use and non-disclosure. Attorney notes may be subject to control information, for example, their use may be limited to the attorney who created the notes and those attorneys to whom such creating attorney expressly grants access rights. Embedded containers also provide a convenient mechanism to control collections of dissimilar information. For example, the research object(s) may be stored in the form of (or were derived from) VDE "smart objects" that contain the results of research performed by that object. Research results related to one aspect of the case retrieved from a VDE enabled LEXIS site might be encapsulated as one smart object; the results of another session related to another (or the same) aspect of the case may be encapsulated as a

different object. Smart objects are used in this example to help show that completely disparate and separately delivered control information may be incorporated into a client container as desired and/or required to enforce the rights of providers (such as content owners).

Control structures may be employed to manage any variety of desired granularities and/or logical document content groupings; a document, page, paragraph, topically related materials, etc. In this example, the following assumptions are made: client provided documents are controlled at the page level, attorney notes are controlled at the document level on an attorney by attorney basis, court filings and briefs are controlled at a document level, research information is controlled at whatever level the content provider specifies at the time the research was performed, and certain highly confidential information located in various of the above content may be identified as subject to display and adding comments only, and only by the lead partner attorneys, with only the creator and/or embedder of a given piece of content having the right to be otherwise used (printed, extracted, distributed, etc).

In general, container content in this example is controlled with respect to distribution of rights. This control information are associated at a document level for all internally generated

documents, at a page level for client level documents, and at the level specified by the content provider for research documents.

VDE control information can be structured in either complex or simple structures, depending on the participant's desires. In some cases, a VDE creator will apply a series of control structure definitions that they prefer to use (and that are supported by the VDE application managing the specification of rules and control information, either directly, or through the use of certified application compatible VDE component assemblies.

In this example, the law firm sets up a standard VDE client content container for a new client at the time they accept the case. A law firm VDE administrator would establish a VDE group for the new client and add the VDE IDs of the attorneys at the firm that are authorized to work on the case, as well as provide, if appropriate, one or more user template applications. These templates provide, for example, one or more user interfaces and associated control structures for selection by users of additional and/or alternative control functions (if allowed by senior control information), entry of control parameter data, and/or performing user specific administrative tasks. The administrator uses a creation tool along with a predefined creation template to create the container. This creation template specifies the document usage (including distribution control

information) for documents as described above. Each electronic document from the client (including letters, memoranda, E-mail, spreadsheet, etc.) are then added to the container as separate embedded objects. Each new object is created using a creation template that satisfies that the default control structures specified with the container as required for each new object of a given type.

As each attorney works on the case, they may enter notes into an object stored within the client's VDE container. These notes may be taken using a VDE aware word processor already in use at the law firm. In this example, a VDE redirector handles the secure mapping of the word processor file requests into the VDE container and its objects through the use of VDE control processes operating with one or more VDE PPEs. Attorney note objects are created using the default creation template for the document type with assistance from the attorney if the type cannot be automatically determined from the content. This permits VDE to automatically detect and protect the notes at the predetermined level, e.g. document, page, paragraph.

Research can be automatically managed using VDE. Smart objects can be, used to securely search out, pay for if necessary, and retrieve information from VDE enabled information resources on the information highway.

Examples of such resources might include LEXIS, Westlaw, and other related legal databases. Once the information is retrieved, it may be securely embedded in the VDE content client container. If the smart object still contains unreleased information, the entire smart object may be embedded in the client's VDE container. This places the unreleased information under double VDE control requirements: those associated with releasing the information from smart object (such as payment and/or auditing requirements) and those associated with access to, or other usage of, client information of the specified type.

Briefs and other filings may be controlled in a manner similar to that for attorney notes. The filings may be edited using the standard word processors in the law firm; with usage control structures controlling who may review, change, and/or add to the document (or, in a more sophisticated example, a certain portion of said document). VDE may also support electronic filing of briefs by providing a trusted source for time/date stamping and validation of filed documents.

When the client and attorney want to exchange confidential information over electronic mail or other means, VDE can play an important role in ensuring that information exchanged under privilege, properly controlled, and not

inappropriately released and/or otherwise used. The materials (content) stored in a VDE content container object will normally be encrypted. Thus wrapped, a VDE object may be distributed to the recipient without fear of unauthorized access and/or other use. The one or more authorized users who have received an object are the only parties who may open that object and view and/or manipulate and/or otherwise modify its contents and VDE secure auditing ensures a record of all such user content activities. VDE also permits the revocation of rights to use client/attorney privileged information if such action becomes necessary, for example, after an administrator review of user usage audit information.

Large Organization Example

In a somewhat more general example, suppose an organization (e.g., a corporation or government department) with thousands of employees and numerous offices disposed throughout a large geographic area wishes to exercise control over distribution of information which belongs to said organization (or association). This information may take the form of formal documents, electronic mail messages, text files, multimedia files, etc,, which collectively are referred to as "documents."

Such documents may be handled by people (referred to as "users") and/or by computers operating on behalf of users. The documents may exist both in electronic form for storage and transmission and in paper form for manual handling.

These documents may originate wholly within the organization, or may be created, in whole or in part, from information received from outside the organization. Authorized persons within the organization may choose to release documents, in whole or in part, to entities outside the organization. Some such entities may also employ VDE 100 for document control, whereas others may not.

Document Control Policies

The organization as a whole may have a well-defined policy for access control to, and/or other usage control of documents. This policy may be based on a "lattice model" of information flow, in which documents are characterized as having one or more hierarchical "classification" security attributes 9903 and zero or more non-hierarchical "compartment" security attributes, all of which together comprise a sensitivity security attribute.

The classification attributes may designate the overall level of sensitivity of the document as an element of an ordered set. For example, the set "unclassified," "confidential," "secret,"

"top secret" might be appropriate in a government setting, and the set "public," "internal," "confidential," "registered confidential" might be appropriate in a corporate setting.

The compartment attributes may designate the document's association with one or more specific activities within the organization, such as departmental subdivisions (e.g., "research," "development," "marketing") or specific projects within the organization.

Each person using an electronic appliance 600 would be assigned, by an authorized user, a set of permitted sensitivity attributes to designate those documents, or one or more portions of certain document types, which could be processed in certain one or more ways, by the person's electronic appliance. A document's sensitivity attribute would have to belong to the user's set of permitted sensitivity values to be accessible.

In addition, the organization may desire to permit users to exercise control over specific documents for which the user has some defined responsibility. As an example, a user (the "originating user") may wish to place an "originator controlled" ("ORCON") restriction on a certain document, such that the document may be transmitted and used only by those specific other users whom he designates (and only in certain, expressly

authorized ways). Such a restriction may be flexible if the "distribution list" could be modified after the creation of the document, specifically in the event of someone requesting permission from the originating user to transmit the document outside the original list of authorized recipients. The originating user may wish to permit distribution only to specific users, defined groups of users, defined geographic areas, users authorized to act in specific organizational roles, or a combination of any or all such attributes.

In this example, the organization may also desire to permit users to define a weaker distribution restriction such that access to a document is limited as above, but certain or all information within the document may be extracted and redistributed without further restriction by the recipients.

The organization and/or originating users may wish to know to what uses or geographic locations a document has been distributed. The organization may wish to know where documents with certain protection attributes have been distributed, for example, based on geographic information stored in site configuration records and/or name services records.

A user may wish to request a "return receipt" for a distributed document, or may wish to receive some indication of

how a document has been handled by its recipients (e.g., whether it has been viewed, printed, edited and/or stored), for example, by specifying one or more audit requirements (or methods known to have audit requirements) in a PERC associated with such document(s).

User Environment

In an organization (or associateion) such as that described above, users may utilize a variety of electronic appliances 600 for processing and managing documents. This may include personal computers, both networked and otherwise, powerful single-user workstations, and servers or mainframe computers. To provide support for the control information described in this example, each electronic appliance that participates in use and management of VDE-protected documents may be enhanced with a VDE secure subsystem supporting an SPE 503 and/or HPE 655.

In some organizations, where the threats to secure operation are relatively low, an HPE 655 may suffice. In other organizations (e.g., government defense), it may be necessary to employ an SPE 503 in all situations where VDE-protected documents are processed. The choice of enhancement environment and technology may be different in different of the organization. Even if different types of PPE 650 are used within

an organization to serve different requirements, they may be compatible and may operate on the same types (or subsets of types) of documents.

Users may employ application programs that are customized to operate in cooperation with the VDE for handling of VDE-protected documents. Examples of this may include VDE-aware document viewers, VDE aware electronic mail systems, and similar applications. Those programs may communicate with the PPE 650 component of a user's electronic appliance 600 to make VDE-protected documents available for use while limiting the extent to which their contents may be copied, stored, viewed, modified, and/or transmitted and/or otherwise further distributed outside the specific electronic appliance.

Users may wish to employ commercial, off-the-shelf ("COTS") operating systems and application programs to process the VDE-protected documents. One approach to permit the use of COTS application programs and operating systems would be to allow such use only for documents without restrictions on redistribution. The standard VDE operating system redirector would allow users to access VDE-protected documents in a manner equivalent to that for files. In such an approach, however, a chain of control for metering and/or auditing use may

be "broken" to some extent at the point that the protected object was made available to the COTS application. The fingerprinting (watermarking) techniques of VDE may be used to facilitate further tracking of any released information.

A variety of techniques may be used to protect printing of protected documents, such as, for example: server-based decryption engines, special fonts for "fingerprinting," etc.

Another approach to supporting COTS software would use the VDE software running on the user's electronic appliance to create one or more "virtual machine" environments in which COTS operating system and application programs may run, but from which no information may be permanently stored or otherwise transmitted except under control of VDE. Such an environment would permit VDE to manage all VDE-protected information, yet may permit unlimited use of COTS applications to process that information within the confines of a restricted environment. The entire contents of such an environment could be treated by VDE 100 as an extension to any VDE-protected documents read into the environment. Transmission of information out of the environment could be governed by the same rules as the original document(s).

"Coarse-Grain" Control Capabilities

As mentioned above, an organization may employ VDE-enforced control capabilities to manage the security, distribution, integrity, and control of entire documents. Some examples of these capabilities may include:

1) A communication channel connecting two or more electronic appliances 600 may be assigned a set of permitted sensitivity attributes. Only documents whose sensitivity attributes belong to this set would be permitted to be transmitted over the channel. This could be used to support the Device Labels requirement of the Trusted Computer System Evaluation Criteria (TCSEC).

2) A writable storage device (e.g., fixed disk, diskette, tape drive. optical disk) connected to or incorporated in an electronic appliance 600 may be assigned a set of permitted sensitivity attributes. Only documents whose sensitivity attributes belong to this set would be permitted to be stored on the device. This could be used to support the TCSEC Device Labels requirement.

3) A document may have a list of users associated with it representing the users who are permitted to "handle" the document. This list of users may represent, for example, the only users who may view the document, even if other users receive the document container, they could not manipulate the contents. This could be used to support the standard ORCON handling caveat.

4) A document may have an attribute designating its originator and requiring an explicit permission to be granted by an originator before the document's content could be viewed. This request for permission may be made at the time the document is accessed by a user, or, for example, at the time one user distributes the document to another user. If permission is not granted, the document could not be manipulated or otherwise used.

5) A document may have an attribute requiring that each use of the document be reported to the document's originator. This may be used by an originator to gauge the distribution of the document. Optionally, the report may be required to have been made successfully before any use of the document is

permitted, to ensure that the use is known to the controlling party at the time of use. Alternatively, for example, the report could be made in a deferred ("batch") fashion.

6) A document may have an attribute requiring that each use of the document be reported to a central document tracking clearinghouse. This could be used by the organization to track specific documents, to identify documents used by any particular user and/or group of users to track documents with specific attributes (e.g., sensitivity), etc. Optionally, for example, the report may be required to have been made successfully before any use of the document is permitted.

7) A VDE protected document may have an attribute requiring that each use of the document generate a "return receipt," to an originator. A person using the document may be required to answer specific questions in order to generate a return receipt, for example by indicating why the document is of interest, or by indicating some knowledge of the document's contents (after reading it). This may be used as assurance that the document had been

handled by a person, not by any automated software mechanism.

8) A VDE protected document's content may be made available to a VDE-unaware application program in such a way that it is uniquely identifiable (traceable) to a user who caused its release. Thus, if the released form of the document is further distributed, its origin could be determined. This may be done by employing VDE "fingerprinting" for content release. Similarly, a printed VDE protected document may be marked in a similar, VDE fingerprinted unique way such that the person who originally printed the document could be determined, even if copies have since been made.

9) Usage of VDE protected documents could be permitted under control of budgets that limit (based on size, time of access, etc.) access or other usage of document content. This may help prevent wholesale disclosure by limiting the number of VDE documents accessible to an individual during a fixed time period. For example, one such control might permit a user, for some particular class of documents, to view at most 100 pages/day, but only print 10

pages/day and permit printing only on weekdays between nine and five. As a further example, a user might be restricted to only a certain quantity of logically related, relatively "contiguous" and/or some other pattern (such as limiting the use of a database's records based upon the quantity of records that share a certain identifier in field) of VDE protected document usage to identify, for example, the occurrence of one or more types of excessive database usage (under normal or any reasonable circumstances). As a result, VDE content providers can restrict usage of VDE content to acceptable usage characteristics and thwart and/or identify (for example, by generating an exception report for a VDE administrator or organization supervisor) user attempts to inappropriately use, for example, such an information database resource.

These control capabilities show some examples of how VDE can be used to provide a flexible, interactive environment for tracking and managing sensitive documents. Such an environment could directly trace the flow of a document from person to person, by physical locations, by organizations, etc. It would also permit specific questions to be answered such as "what persons outside the R&D department have received any

R&D-controlled document." Because the control information is carried with each copy of a VDE protected document, and can ensure that central registries are updated and/or that originators are notified of document use, tracking can be prompt and accurate.

This contrasts with traditional means of tracking paper documents: typically, a paper-oriented system of manually collected and handled receipts is used. Documents may be individually copy-numbered and signed for, but once distributed are not actively controlled. In a traditional paper-oriented system, it is virtually impossible to determine the real locations of documents; what control can be asserted is possible only if all parties strictly follow the handling rules (which are at best inconvenient).

The situation is no better for processing documents within the context of ordinary computer and network systems. Although said systems can enforce access control information based on user identity, and can provide auditing mechanisms for tracking accesses to files, these are low-level mechanisms that do not permit tracking or controlling the flow of content. In such systems, because document content can be freely copied and manipulated, it is not possible to determine where document content has gone, or where it came from. In addition, because the

control mechanisms in ordinary computer operating systems operate at a low level of abstraction, the entities they control are not necessarily the same as those that are manipulated by users. This particularly causes audit trails to be cluttered with voluminous information describing uninteresting activities.

Fine-Grain" Control Capabilities

In addition to controlling and managing entire documents, users may employ customized VDE-aware application software to control and manage individual modifications to documents. Examples of these capabilities include the following:

1) A VDE content user may be permitted to append further information to a VDE document to indicate a proposed alternative wording. This proposed alteration would be visible to all other users (in addition to the original text) of the document but would (for example) be able to be incorporated into the actual text only by the document's owner.

2) A group of VDE users could be permitted to modify one or more parts of a document in such a way that each individual alteration would be unambiguously traceable to the specific user who performed it. The rights to modify certain portions of a document, and

the extension of differing sets of rights to different users, allows an organization or secure environment to provide differing permissions enabling different rights to users of the same content.

3) A group of users could create a VDE document incrementally, by building it from individual contributions. These contributions would be bound together within a single controlled document, but each would be individually identified, for example, through their incorporation in VDE content containers as embedded container objects.

4) VDE control and management capabilities could be used to track activities related to individual document areas, for instance recording how many times each section of a document was viewed.

Example - VDE Protected Content Repository

As the "Digital Highway" emerges, there is increased discussion concerning the distribution of content across networks and, in particular, public networks such as the Internet. Content may be made available across public networks in several ways including:

- "mailing" content to a user in response to a request or advance purchase (sending a token representing the commitment of electronic funds or credit to purchase an item);

- supporting content downloadable from an organization's own content repository, such a repository comprising, for example, a store of products (such as software programs) and/or a store of information resources, normally organized into one or more databases; and

- supporting a public repository into which other parties can deposit their products for redistribution to customers (normally by making electronic copies for distribution to a customer in response to a request).

One possible arrangement of VDE nodes involves use of one or more "repositories." A repository, for example, may serve as a location from which VDE participants may retrieve VDE content containers. In this case, VDE users may make use of a network to gain access to a "server" system that allows one or more VDE users to access an object repository containing VDE content containers.

Some VDE participants may create or provide content and/or VDE content container objects, and then store content and/or content objects at a repository so that other participants may access such content from a known and/or efficiently organized (for retrieval) location. For example, a VDE repository (portion of a VDE repository, multiple VDE repositories, and/or providers of content to such repositories) may advertise the availability of certain types of VDE protected content by sending out email to a list of network users. If the network users have secure VDE subsystems in their electronic appliances, they may then choose to access such a repository directly, or through one or more smart agents and, using an application program for example, browse (and/or electronically search) through the offerings of VDE managed content available at the repository, download desirable VDE content containers, and make use of such containers. If the repository is successful in attracting users who have an interest in such content, VDE content providers may determine that such a repository is a desirable location(s) to make their content available for easy access by users. If a repository, such as CompuServe, stores content in non-encrypted (plaintext) form, it may encrypt "outgoing" content on an "as needed" basis through placing such content in VDE content containers with desired control information, and may employ VDE secure communications techniques for content communication to VDE participants.

VDE repositories may also offer other VDE services. For example, a repository may choose to offer financial services in the form of credit from the repository that may be used to pay fees associated with use of VDE objects obtained from the repository. Alternatively or in addition, a VDE repository may perform audit information clearinghouse services on behalf of VDE creators or other participants (e.g. distributors, redistributors, client administrators, etc.) for usage information reported by VDE users. Such services may include analyzing such usage information, creating reports, collecting payments, etc.

A "full service" VDE repository may be very attractive to both providers and users of VDE managed content. Providers of VDE managed content may desire to place their content in a location that is well known to users, offers credit, and/or performs audit services for them. In this case, providers may be able to focus on creating content, rather than managing the administrative processes associated with making content available in a "retail" fashion, collecting audit information from many VDE users, sending and receiving bills and payments, etc. VDE users may find the convenience of a single location (or an integrated arrangement of repositories) appealing as they are attempting to locate content of interest. In addition, a full service VDE repository may serve as a single location for the reporting of usage information generated as a consequence of their use of

VDE managed content received from a VDE repository and/or, for example, receiving updated software (e.g. VDE-aware applications, load modules, component assemblies, non VDE-aware applications, etc.) VDE repository services may be employed in conjunction with VDE content delivery by broadcast and/or on physical media, such as CD-ROM, to constitute an integrated array of content resources that may be browsed, searched, and/or filtered, as appropriate, to fulfill the content needs of VDE users.

A public repository system may be established and maintained as a non-profit or for-profit service. An organization offering the service may charge a service fee, for example, on a per transaction basis and/or as a percentage of the payments by, and/or cost of, the content to users. A repository service may supply VDE authoring tools to content creators, publishers, distributors, and/or value adding providers such that they may apply rules and controls that define some or all of the guidelines managing use of their content and so that they may place such content into VDE content container objects.

A repository may be maintained at one location or may be distributed across a variety of electronic appliances, such as a variety of servers (e.g. video servers, etc.) which may be at different locations but nonetheless constitute a single resource. A

VDE repository arrangement may employ VDE secure communications and VDE node secure subsystems ("protected processing environments"). The content comprising a given collection or unit of information desired by a user may be spread across a variety of physical locations. For example, content representing a company's closing stock price and the activity (bids, lows, highs, etc.) for the stock might be located at a World Wide Web server in New York, and content representing an analysis of the company (such as a discussions of the company's history, personnel, products, markets, and/or competitors) might be located on a server in Dallas. The content might be stored using VDE mechanisms to secure and audit use. The content might be maintained in clear form if sufficient other forms of security are available at such one or more of sites (e.g. physical security, password, protected operating system, data encryption, or other techniques adequate for a certain content type). In the latter instances, content may be at least in part encrypted and placed in VDE containers as it streams out of a repository so as to enable secure communication and subsequent VDE usage control and usage consequence management.

A user might request information related to such a company including stock and other information. This request might, for example, be routed first through a directory or a more sophisticated database arrangement located in Boston. This

arrangement might contain pointers to, and retrieve content from, both the New York and Dallas repositories. This information content may, for example, be routed directly to the user in two containers (e.g. such as a VDE content container object from Dallas and a VDE content container object from New York). These two containers may form two VDE objects within a single VDE container (which may contain two content objects containing the respective pieces of content from Dallas and New York) when processed by the user's electronic appliance. Alternatively, such objects might be integrated together to form a single VDE container in Boston so that the information can be delivered to the user within a single container to simplify registration and control at the user's site. The information content from both locations may be stored as separate information objects or they may be joined into a single, integrated information object (certain fields and/or categories in an information form or template may be filled in by one resource and other fields and/or categories may be filled by information provided by a different resource). A distributed database may manage such a distributed repository resource environment and use VDE to secure the storing, communicating, auditing, and/or use of information through VDE's electronic enforcement of VDE controls. VDE may then be used to provide both consistent content containers and content control services.

An example of one possible repository arrangement 3300 is shown in Figure 78. In this example, a repository 3302 is connected to a network 3304 that allows authors 3306A, 3306B, 3306C, and 3306D; a publisher 3308; and one or more end users 3310 to communicate with the repository 3302 and with each other. A second network 3312 allows the publisher 3308, authors 3306E and 3306F, an editor 3314, and a librarian 3316 to communicate with each other and with a local repository 3318. The publisher 3308 is also directly connected to author 3306E. In this example, the authors 3306 and publisher 3308 connect to the repository 3302 in order to place their content into an environment in which end users 3310 will be able to gain access to a broad selection of content from a common location.

In this example, the repository has two major functional areas: a content system 3302A and a clearinghouse system 3302B. The content system 3302A is comprised of a user/author registration system 3320, a content catalog 3322, a search mechanism 3324, content storage 3326, content references 3328, and a shipping system 3330 comprised of a controls packager 3322, a container packager 3334, and a transaction system 3336. The clearinghouse system 3302B is comprised of a user/author registration system 3338; template libraries 3340; a control structure library 3342; a disbursement system 3344; an authorization system 3346 comprised of a financial system 3348

and a content system 3350; a billing system 3352 comprised of a paper system 3354, a credit card system 3356, and an electronic funds transfer (EFT) system 3358; and an audit system 3360 comprised of a receipt system 3362, a response system 3364, a transaction system 3366, and an analysis system 3368.

In this example, author 3306A creates content in electronic form that she intends to make broadly available to many end users 3310, and to protect her rights through use of VDE. Author 3306A transmits a message to the repository 3302 indicating her desire to register with the repository to distribute her content. In response to this message, the user/author registration system 3320 of the content system 3302A, and the user/author registration system 3338 of the clearinghouse system 3302B transmit requests for registration information to author 3306A using the network 3304. These requests may be made in an on-line interactive mode; or they may be transmitted in a batch to author 3306A who then completes the requested information and transmits it as a batch to the repository 3302; or some aspects may be handled on-line (such as basic identifying information) and other information may be exchanged in a batch mode.

Registration information related to the content system 3302A may, for example, include:

- a request that Author 3306A provide information concerning the types and/or categories of content proposed for storage and access using the repository,

- the form of abstract and/or other identifying information required by the repository—in addition to providing author 3306A with an opportunity to indicate whether or not author 3306A generally includes other information with content submissions (such as promotional materials, detailed information regarding the format of submitted content, any equipment requirements that should or must be met for potential users of submitted content to successfully exploit its value, etc.),

- requests for information from author 3306A concerning where the content is to be located (stored at the repository, stored at author 3306A's location, stored elsewhere, or some combination of locations),

- what general search characteristics should be associated with content submissions (e.g. whether abstracts should be automatically indexed for searches by users of the repository, the manner in which content titles, abstracts, promotional

materials, relevant dates, names of performers and/or authors, or other information related to content submissions may or should be used in lists of types of content and/or in response to searches, etc.), and/or

- how content that is stored at and/or passed through the repository should be shipped (including any container criteria, encryption requirements, transaction requirements related to content transmissions, other control criteria, etc.)

The information requested from author 3306A by the user/author registration system of the clearinghouse may, for example, consist of:

- VDE templates that author 3306A may or must make use of in order to correctly format control information such that, for example, the audit system 3360 of the clearinghouse system 3302B is properly authorized to receive and/or process usage information related to content submitted by author 3306A,

- VDE control information available from the clearinghouse 3302B that may or must be used by

author 3306A (and/or included by reference) in some or all of the VDE component assemblies created and/or used by author 3306A associated with submitted content,

- the manner in which disbursement of any funds associated with usage of content provided by, passed through, or collected by the repository clearinghouse system 3302B should be made,

- the form and/or criteria of authorizations to use submitted content and/or financial transactions associated with content,

- the acceptable forms of billing for use of content and/or information associated with content (such as analysis reports that may be used by others),

- how VDE generated audit information should be received,

- how responses to requests from users should be managed,

- how transactions associated with the receipt of audit information should be formatted and authorized,

- how and what forms of analysis should be performed on usage information, and/or

- under what circumstances (if any) usage information and/or analysis results derived from VDE controlled content usage information should be managed (including to whom they may or must be delivered, the form of delivery, any control information that may be associated with use of such information, etc.)

The repository 3302 receives the completed registration information from author 3306A and uses this information to build an account profile for author 3306A. In addition, software associated with the authoring process may be transmitted to author 3306A. This software may, for example, allow author 3306A to place content into a VDE content container with appropriate controls in such a way that many of the decisions associated with creating such containers are made automatically to reflect the use of the repository 3302 as a content system and/or a clearinghouse system (for example, the location of content, the party to contact for updates to content and/or controls associated with content, the party or parties to whom

audit information may and/or must be transmitted and the pathways for such communication, the character of audit information that is collected during usage, the forms of payment that are acceptable for use of content, the frequency of audit transmissions required, the frequency of billing, the form of abstract and/or other identifying information associated with content, the nature of at least a portion of content usage control information, etc.)

Author 3306A makes use of a VDE authoring application to specify the controls and the content that she desires to place within a VDE content container, and produces such a container in accordance with any requirements of the repository 3302. Such a VDE authoring application may be, for example, an application provided by the repository 3302 which can help ensure adherence to repository content control requirements such as the inclusion of one or more types of component assemblies or other VDE control structures and/or required parameter data, an application received from another party, and/or an application created by author 3306A in whole or in part. Author 3306A then uses the network 3304 to transmit the container and any deviations from author 3306A's account profile that may relate to such content to the repository 3302. The repository 3302 receives the submitted content, and then -- in accordance with any account profile requirements, deviations and/or desired options in

this example—makes a determination as to whether the content was produced within the boundaries of any content and/or control information requirements of the repository and therefore should be placed within content storage or referenced by a location pointer or the like. In addition to placing the submitted content into content storage or referencing such content's location, the repository 3302 may also make note of characteristics associated with such submitted content in the search mechanism 3324, content references 3328, the shipping system 3330, and/or the relevant systems of the clearinghouse system 3302B related to templates and control structures, authorizations, billing and/or payments, disbursements, and/or audits of usage information.

During an authoring process, author 3306A may make use of VDE templates. Such templates may be used as an aspect of a VDE authoring application. For example, such templates may be used in the construction of a container as described above. Alternatively or in addition, such templates may also be used when submitted content is received by the repository 3302. References to such templates may be incorporated by author 3306A as an aspect of constructing a container for submitted content (in this sense the container delivered to the repository may be in some respects "incomplete" until the repository "completes" the container through use of indicated templates). Such references may be required for use by the repository 3302

(for example, to place VDE control information in place to fulfill an aspect of the repository's business or security models such as one or more map tables corresponding to elements of content necessary for interacting with other VDE control structures to accommodate certain metering, billing, budgeting, and/or other usage and/or distribution related controls of the repository).

For example, if content submitted by author 3306A consists of a periodical publication, a template delivered to the author by the repository 3302 when the author registers at the repository may be used as an aspect of an authoring application manipulated by the author in creating a VDE content container for such a periodical. Alternatively or in addition, a template designed for use with periodical publications may be resident at the repository 3302, and such a template may be used by the repository to define, in whole or in part, control structures associated with such a container. For example, a VDE template designed to assist in formulating control structures for periodical publications might indicate (among other things) that:

- usage controls should include a meter method that records each article within a publication that a user opens,

- a certain flat rate fee should apply to opening the periodical regardless of the number of articles opened, and/or

- a record should be maintained of every advertisement that is viewed by a user.

If content is maintained in a known and/or identifiable format, such a template may be used during initial construction of a container without author 3306A's intervention to identify any map tables that may be required to support such recording and billing actions. If such a VDE template is unavailable to author 3306A, she may choose to indicate that the container submitted should be reconstructed (e.g. augmented) by the repository to include the VDE control information specified in a certain template or class of templates. If the format of the content is known and/or identifiable by the repository, the repository may be able to reconstruct (or "complete") such a container automatically.

One factor in a potentially ongoing financial relationship between the repository and author 3306A may relate to usage of submitted content by end users 3310. For example, author 3306A may negotiate an arrangement with the repository wherein the repository is authorized to keep 20% of the total revenues generated from end users 3310 in exchange for

maintaining the repository services (e.g. making content available to end users 3310, providing electronic credit, performing billing activities, collecting fees, etc.) A financial relationship may be recorded in control structures in flexible and configurable ways. For example, the financial relationship described above could be created in a VDE container and/or installation control structure devised by author 3306A to reflect author 3306A's financial requirements and the need for a 20% split in revenue with the repository wherein all billing activities related to usage of submitted content could be processed by the repository, and control structures representing reciprocal methods associated with various component assemblies required for use of author 3306A's submitted content could be used to calculate the 20% of revenues. Alternatively, the repository may independently and securely add and/or modify control structures originating from author 3306A in order to reflect an increase in price. Under some circumstances, author 3306A may not be directly involved (or have any knowledge of) the actual price that the repository charges for usage activities, and may concern herself only with the amount of revenue and character of usage analysis information that she requires for her own purposes, which she specifies in VDE control information which governs the use, and consequences of use, of VDE controlled content.

Another aspect of the relationship between authors and the repository may involve the character of transaction recording requirements associated with delivery of VDE controlled content and receipt of VDE controlled content usage audit information. For example, author 3306A may require that the repository make a record of each user that receives a copy of content from the repository. Author 3306A may further require collection of information regarding the circumstances of delivery of content to such users (e.g. time, date, etc.) In addition, the repository may elect to perform such transactions for use internally (e.g. to determine patterns of usage to optimize systems, detect fraud, etc.)

In addition to recording information regarding delivery of such VDE controlled content, author 3306A may have required or requested the repository to perform certain VDE container related processes. For example, author 3306A may want differing abstract and/or other descriptive information delivered to different classes of users. In addition, author 3306A may wish to deliver promotional materials in the same container as submitted content depending on, for example, the character of usage exhibited by a particular user (e.g. whether the user has ever received content from author 3306A, whether the user is a regular subscriber to author 3306A's materials, and/or other patterns that may be relevant to author 3306A and/or the end

user that are used to help determine the mix of promotional materials delivered to a certain VDE content end user.) In another example, author 3306A may require that VDE fingerprinting be performed on such content prior to transmission of content to an end user.

In addition to the form and/or character of content shipped to an end user, authors may also require certain encryption related processes to be performed by the repository as an aspect of delivering content. For example, author 3306A may have required that the repository encrypt each copy of shipped content using a different encryption key or keys in order to help maintain greater protection for content (e.g. in case an encryption key was "cracked" or inadvertently disclosed, the "damage" could be limited to the portion(s) of that specific copy of a certain content deliverable). In another example, encryption functions may include the need to use entirely different encryption algorithms and/or techniques in order to fulfill circumstantial requirements (e.g. to comply with export restrictions). In a further example, encryption related processes may include changing the encryption techniques and/or algorithms based on the level of trustedness and/or tamper resistance of the VDE site to which content is delivered.

In addition to transaction information gathered when content is shipped from a VDE repository to an end user, the repository may be required to keep transaction information related to the receipt of usage information, requests, and/or responses to and/or from end users 3310. For example, author 3306A may require the repository to keep a log of some or all connections made by end users 3310 related to transmissions and or reception of information related to the use of author 3306A's content (e.g. end user reporting of audit information, end user requests for additional permissions information, etc.)

Some VDE managed content provided to end users 3310 through the repository may be stored in content storage. Other information may be stored elsewhere, and be referenced through the content references. In the case where content references are used, the repository may manage the user interactions in such a manner that all repository content, whether stored in content storage or elsewhere (such as at another site), is presented for selection by end users 3310 in a uniform way, such as, for example, a consistent or the same user interface. If an end user requests delivery of content that is not stored in content storage, the VDE repository may locate the actual storage site for the content using information stored in content references (e.g. the network address where the content may be located, a URL, a filesystem reference, etc.) After the content is located, the

content may be transmitted across the network to the repository or it may be delivered directly from where it is stored to the requesting end user. In some circumstances (e.g. when container modification is required, when encryption must be changed, if financial transactions are required prior to release, etc.), further processing may be required by the repository in order to prepare such VDE managed content and/or VDE content container for transmission to an end user.

In order to provide a manageable user interface to the content available to VDE repository end users 3310 and to provide administrative information used in the determination of control information packaged in VDE content containers shipped to end users 3310, the repository in this example includes a content catalog 3322. This catalog is used to record information related to the VDE content in content storage, and/or content available through the repository reflected in content references. The content catalog 3322 may consist of titles of content, abstracts, and other identifying information. In addition, the catalog may also indicate the forms of electronic agreement and/or agreement VDE template applications (offering optional, selectable control structures and/or one or more opportunities to provide related parameter data) that are available to end users 3310 through the repository for given pieces of content in deciding, for example, options and/or requirements for: what

type(s) of information is recorded during such content's use, the charge for certain content usage activities, differences in charges based on whether or not certain usage information is recorded and/or made available to the repository and/or content provider, the redistribution rights associated with such content, the reporting frequency for audit transmissions, the forms of credit and/or currency that may be used to pay certain fees associated with use of such content, discounts related to certain volumes of usage, discounts available due to the presence of rights associated with other content from the same and/or different content providers, sales, etc. Furthermore, a VDE repository content catalog 3322 may indicate some or all of the component assemblies that are required in order to make use of content such that the end user's system and the repository can exchange messages to help ensure that any necessary VDE component assemblies or other VDE control information is identified, and if necessary and authorized, are delivered along with such content to the end user (rather than, for example, being requested later after their absence has been detected during a registration and/or use attempt).

In order to make use of the VDE repository in this example, an end user must register with the repository. In a manner similar to that indicated above in the case of an author, a VDE end user transmits a message from her VDE installation to

the repository across the network indicating that she wishes to make use of the services provided by the repository (e.g. access content stored at and/or referenced by the repository, use credit provided by the repository, etc.) In response to this message, the user/author registration systems of the content system 3302A and the clearinghouse system 3302B of the repository transmit requests for information from the end user (e.g. in an on-line and/or batch interaction). The information requested by the user/author registration system of the content system 3302A may include type(s) of content that the user wishes to access, the characteristics of the user's electronic appliance 600, etc. The information requested by the user/author registration system of the clearinghouse system 3302B may include whether the user wishes to establish a credit account with the clearinghouse system 3302B, what other forms of credit the user may wish to use for billing purposes, what other clearinghouses may be used by the end user in the course of interacting with content obtained from the repository, any general rules that the user has established regarding their preferences for release and handling of usage analysis information, etc. Once the end user has completed the registration information and transmitted it to the repository, the repository may construct an account profile for the user. In this example, such requests and responses are handled by secure VDE communications between secure VDE subsystems of both sending and receiving parties.

In order to make use of the repository, the end user may operate application software. In this example, the end user may either make use of a standard application program (e.g. a World Wide Web browser such as Mosaic), or they may make use of application software provided by the repository after completion of the registration process. If the end user chooses to make use of the application software provided by the repository, they may be able to avoid certain complexities of interaction that may occur if a standard package is used. Although standardized packages are often relatively easy to use, a customized package that incorporates VDE aware functionality may provide an easier to use interface for a user. In addition, certain characteristics of the repository may be built in to the interface to simplify use of the services (e.g. similar to the application programs provided by America Online).

The end user may connect to the repository using the network. In this example, after the user connects to the repository, an authentication process will occur. This process can either be directed by the user (e.g. through use of a login and password protocol) or may be established by the end user's electronic appliance secure subsystems interacting with a repository electronic appliance in a VDE authentication. In either event, the repository and the user must initially ensure that they are connected to the correct other party. In this

example, if secured information will flow between the parties, a VDE secured authentication must occur, and a secure session must be established. On the other hand, if the information to be exchanged has already been secured and/or is available without authentication (e.g. certain catalog information, containers that have already been encrypted and do not require special handling, etc.), the "weaker" form of login/password may be used.

Once an end user has connected to the VDE repository and authentication has occurred, the user may begin manipulating and directing their user interface software to browse through a repository content catalog 3322 (e.g. lists of publications, software, games, movies, etc.), use the search mechanism to help locate content of interest, schedule content for delivery, make inquiries of account status, availability of usage analysis information, billing information, registration and account profile information, etc. If a user is connecting to obtain content, the usage requirements for that content may be delivered to them. If the user is connecting to deliver usage information to the repository, information related to that transmission may be delivered to them. Some of these processes are described in more detail below.

In this example, when an end user requests content from the VDE repository (e.g. by selecting from a menu of available

options), the content system 3302A locates the content either in the content references and/or in content storage. The content system 3302A may then refer to information stored in the content catalog 3322, the end user's account profile, and/or the author's account profile to determine the precise nature of container format and/or control information that may be required to create a VDE content container to fulfill the end user's request. The shipping system then accesses the clearinghouse system 3302Bto gather any necessary additional control structures to include with the container, to determine any characteristics of the author's and/or end user's account profiles that may influence either the transaction(s) associated with delivering the content to the end user or with whether the transaction may be processed. If the transaction is authorized, and all elements necessary for the container are available, the controls packager forms a package of control information appropriate for this request by this end user, and the container packager takes this package of control information and the content and forms an appropriate container (including any permissions that may be codeliverable with the container, incorporating any encryption requirements, etc.) If required by the repository or the author's account profile, transactions related to delivery of content are recorded by the transaction system of the shipping system. When the container and any transactions related to delivery have been completed, the container is transmitted across the network to the end user.

An end user may make use of credit and/or currency securely stored within the end user's VDE installation secure subsystem to pay for charges related to use of VDE content received from the repository, and/or the user may maintain a secure credit and/or currency account remotely at the repository, including a "virtual" repository where payment is made for the receipt of such content by an end user. This later approach may provide greater assurance for payment to the repository and/or content providers particularly if the end user has only an HPE based secure subsystem. If an end user electronic credit and/or currency account is maintained at the repository in this example, charges are made to said account based on end user receipt of content from the repository. Further charges to such a remote end user account may be made based on end user usage of such received content and based upon content usage information communicated to the repository clearinghouse system 3302B.

In this example, if an end user does not have a relationship established with a financial provider (who has authorized the content providers whose content may be obtained through use of the repository to make use of their currency and/or credit to pay for any usage fees associated with such provider's content) and/or if an end user desires a new source of such credit, the end user may request credit from the repository clearinghouse system 3302B. If an end user is approved for credit, the repository may

extend credit in the form of credit amounts (e.g. recorded in one or more UDEs) associated with a budget method managed by the repository. Periodically, usage information associated with such a budget method is transmitted by the end user to the audit system of the repository. After such a transmission (but potentially before the connection is terminated), an amount owing is recorded for processing by the billing system, and in accordance with the repository's business practices, the amount of credit available for use by the end user may be replenished in the same or subsequent transmission. In this example, the clearinghouse of the repository supports a billing system with a paper system for resolving amounts owed through the mail, a credit card system for resolving amounts owed through charges to one or more credit cards, and an electronic funds transfer system for resolving such amounts through direct debits to a bank account. The repository may automatically make payments determined by the disbursement system for monies owed to authors through use of similar means. Additional detail regarding the audit process is provided below.

As indicated above, end users 3310 in this example will periodically contact the VDE repository to transmit content usage information (e.g. related to consumption of budget, recording of other usage activities, etc.), replenish their budgets, modify their account profile, access usage analysis information, and perform

other administrative and information exchange activities. In some cases, an end user may wish to contact the repository to obtain additional control structures. For example, if an end user has requested and obtained a VDE content container from the repository, that container is typically shipped to the end user along with control structures appropriate to the content, the author's requirements and account profile, the end user's account profile, the content catalog 3322, and/or the circumstances of the delivery (e.g. the first delivery from a particular author, a subscription, a marketing promotion, presence and/or absence of certain advertising materials, requests formulated on behalf of the user by the user's local VDE instance, etc.) Even though, in this example, the repository may have attempted to deliver all relevant control structures, some containers may include controls structures that allow for options that the end user did not anticipate exercising (and the other criteria did not automatically select for inclusion in the container) that the end user nonetheless determines that they would like to exercise. In this case, the end user may wish to contact the repository and request any additional control information (including, for example, control structures) that they will need in order to make use of the content under such option.

For example, if an end user has obtained a VDE content container with an overall control structure that includes an

option that records of the number of times that certain types of accesses are made to the container and further bases usage fees on the number of such accesses, and another option within the overall control structure allows the end user to base the fees paid for access to a particular container based on the length of time spent using the content of the container, and the end user did not originally receive controls that would support this latter form of usage, the repository may deliver such controls at a later time and when requested by the user. In another example, an author may have made changes to their control structures (e.g. to reflect a sale, a new discounting model, a modified business strategy, etc.) which a user may or must receive in order to use the content container with the changed control structures. For example, one or more control structures associated with a certain VDE content container may require a "refresh" for continued authorization to employ such structures, or the control structures may expire. This allows (if desired) a VDE content provider to periodically modify and/or add to VDE control information at an end user's site (employing the local VDE secure subsystem).

Audit information (related to usage of content received from the repository) in this example is securely received from end users 3310 by the receipt system 3362 of the clearinghouse. As indicated above, this system may process the audit information and pass some or all of the output of such a process to the billing

system and/or transmit such output to appropriate content authors. Such passing of audit information employs secure VDE pathway of reporting information handling techniques. Audit information may also be passed to the analysis system in order to produce analysis results related to end user content usage for use by the end user, the repository, third party market researchers, and/or one or more authors. Analysis results may be based on a single audit transmission, a portion of an audit transmission, a collection of audit transmissions from a single end user and/or multiple end users 3310, or some combination of audit transmissions based on the subject of analysis (e.g. usage patterns for a given content element or collection of elements, usage of certain categories of content, payment histories, demographic usage patterns, etc.) The response system 3364 is used to send information to the end user to, for example, replenish a budget, deliver usage controls, update permissions information, and to transmit certain other information and/or messages requested and/or required by an end user in the course of their interaction with the clearinghouse. During the course of an end user's connections and transmissions to and from the clearinghouse, certain transactions (e.g. time, date, and/or purpose of a connection and/or transmission) may be recorded by the transaction system of the audit system to reflect requirements of the repository and/or authors.

Certain audit information may be transmitted to authors. For example, author 3306A may require that certain information gathered from an end user be transmitted to author 3306A with no processing by the audit system. In this case, the fact of the transmission may be recorded by the audit system, but author 3306A may have elected to perform their own usage analysis rather than (or in addition to) permitting the repository to access, otherwise process and/or otherwise use this information. The repository in this example may provide author 3306A with some of the usage information related to the repository's budget method received from one or more end users 3310 and generated by the payment of fees associated with such users' usage of content provided by author 3306A . In this case, author 3306A may be able to compare certain usage information related to content with the usage information related to the repository's budget method for the content to analyze patterns of usage (e.g. to analyze usage in light of fees, detect possible fraud, generate user profile information, etc.) Any usage fees collected by the clearinghouse associated with author 3306A's content that are due to author 3306A will be determined by the disbursement system of the clearinghouse. The disbursement system may include usage information (in complete or summary form) with any payments to author 3306A resulting from such a determination. Such payments and information reporting may be an entirely automated sequence of processes occurring within

the VDE pathway from end user VDE secure subsystems, to the clearinghouse secure subsystem, to the author's secure subsystem.

In this example, end users 3310 may transmit VDE permissions and/or other control information to the repository 3302 permitting and/or denying access to usage information collected by the audit system for use by the analysis system. This, in part, may help ensure end user's privacy rights as it relates to the usage of such information. Some containers may require, as an aspect of their control structures, that an end user make usage information available for analysis purposes. Other containers may give an end user the option of either allowing the usage information to be used for analysis, or denying some or all such uses of such information. Some users may elect to allow analysis of certain information, and deny this permission for other information. End users 3310 in this example may, for example, elect to limit the granularity of information that may be used for analysis purposes (e.g. an end user may allow analysis of the number of movies viewed in a time period but disallow use of specific titles, an end user may allow release of their ZIP code for demographic analysis, but disallow use of their name and address, etc.) Authors and/or the repository 3302 may, for example, choose to charge end users 3310 smaller fees if they agree to release certain usage information for analysis purposes.

In this example, the repository 3302 may receive content produced by more than one author. For example, author B, author C, and author D may each create portions of content that will be delivered to end users 3310 in a single container. For example, author B may produce a reference work. Author C may produce a commentary on author B's reference work, and author D may produce a set of illustrations for author B's reference work and author C's commentary. Author B may collect together author C's and author D's content and add further content (e.g. the reference work described above) and include such content in a single container which is then transmitted to the repository 3302. Alternatively, each of the authors may transmit their works to the repository 3302 independently, with an indication that a template should be used to combine their respective works prior to shipping a container to an end user. Still alternatively, a container reflecting the overall content structure may be transmitted to the repository 3302 and some or all of the content may be referenced in the content references rather than delivered to the repository 3302 for storage in content storage.

When an end user makes use of container content, their content usage information may, for example, be segregated in accordance with control structures that organize usage information based at least in part on the author who created that segment. Alternatively, the authors and/or the VDE repository

3302 may negotiate one or more other techniques for securely dividing and/or sharing usage information in accordance with VDE control information. Furthermore, control structures associated with a container may implement models that differentiate any usage fees associated with portions of content based on usage of particular portions, overall usage of the container, particular patterns of usage, or other mechanism negotiated (or otherwise agreed to) by the authors. Reports of usage information, analysis results, disbursements, and other clearinghouse processes may also be generated in a manner that reflects agreements reached by repository 3302 participants (authors, end users 3310 and/or the repository 3302) with respect to such processes. These agreements may be the result of a VDE control information negotiation amongst these participants.

In this example, one type of author is a publisher 3308. The publisher 3308 in this example communicates over an "internal" network with a VDE based local repository 3302 and over the network described above with the public repository 3302. The publisher 3308 may create or otherwise provide content and/or VDE control structure templates that are delivered to the local repository 3302 for use by other participants who have access to the "internal" network. These templates may be used to describe the structure of containers, and may further describe whom in the publisher 3308's organization may take which

actions with respect to the content created within the organization related to publication for delivery to (and/or referencing by) the repository 3302. For example, the publisher 3308 may decide (and control by use of said temple) that a periodical publication will have a certain format with respect to the structure of its content and the types of information that may be included (e.g. text, graphics, multimedia presentations, advertisements, etc.), the relative location and/or order of presentation of its content, the length of certain segments, etc. Furthermore, the publisher 3308 may, for example, determine (through distribution of appropriate permissions) that the publication editor is the only party that may grant permissions to write into the container, and that the organization librarian is the only party that may index and/or abstract the content. In addition, the publisher 3308 may, for example, allow only certain one or more parties to finalize a container for delivery to the repository 3302 in usable form (e.g. by maintaining control over the type of permissions, including distribution permissions, that may be required by the repository 3302 to perform subsequent distribution activities related to repository end users 3310).

In this example, author 3306E is connected directly to the publisher 3308, such that the publisher 3308 can provide templates for that author that establish the character of containers for author 3306E's content. For example, if author

3306E creates books for distribution by the publisher 3308, the publisher 3308 may define the VDE control structure template which provides control method options for author 3306E to select from and which provides VDE control structures for securely distributing author 3306E's works. Author 3306E and the publisher 3308 may employ VDE negotiations for the template characteristics, specific control structures, and/or parameter data used by author 3306E. Author 3306E may then use the template(s) to create control structures for their content containers. The publisher 3308 may then deliver these works to the repository 3302 under a VDE extended agreement comprising electronic agreements between author 3306E and the publisher 3308 and the repository 3302 and the publisher 3308.

In this example, the publisher 3308 may also make author 3306E's work available on the local repository 3302. The editor may authorize (e.g. through distribution of appropriate permissions) author F to create certain portions of content for a publication. In this example, the editor may review and/or modify author F's work and further include it in a container with content provided by author 3306E (available on the local repository 3302). The editor may or may not have permissions from the publisher 3308 to modify author 3306E's content (depending on any negotiation(s) that may have occurred between the publisher 3308 and author 3306E, and the publisher

3308's decision to extend such rights to the editor if permissions to modify author 3306E's content are held in redistributable form by the publisher 3308). The editor may also include content from other authors by (a) using a process of granting permissions to authors to write directly into the containers and/or (b) retrieving containers from the local repository 3302 for inclusion. The local repository 3302 may also be used for other material used by the publisher 3308's organization (e.g. databases, other reference works, internal documents, draft works for review, training videos, etc.), such material may, given appropriate permissions, be employed in VDE container collections of content created by the editor.

The librarian in this example has responsibility for building and/or editing inverted indexes, keyword lists (e.g. from a restricted vocabulary), abstracts of content, revision histories, etc. The publisher 3308 may, for example, grant permissions to only the librarian for creating this type of content. The publisher 3308 may further require that this building and/or editing occur prior to release of content to the repository 3302.

Example -- Evolution and Transformation of VDE Managed Content and Control Information

The VDE content control architecture allows content control information (such as control information for governing content usage) to be shaped to conform to VDE control information requirements of multiple parties. Formulating such multiple party content control information normally involves securely deriving control information from control information securely contributed by parties who play a role in a content handling and control model (e.g. content creator(s), provider(s), user(s), clearinghouse(s), etc.). Multiple party control information may be necessary in order to combine multiple pieces of independently managed VDE content into a single VDE container object (particularly if such independently managed content pieces have differing, for example conflicting, content control information). Such secure combination of VDE managed pieces of content will frequently require VDE's ability to securely derive content control information which accommodates the control information requirements, including any combinatorial rules, of the respective VDE managed pieces of content and reflects an acceptable agreement between such plural control information sets.

The combination of VDE managed content pieces may result in a VDE managed composite of content. Combining VDE

managed content must be carried out in accordance with relevant content control information associated with said content pieces and processed through the use of one or more secure VDE sub-system PPEs 650. VDE's ability to support the embedding, or otherwise combining, of VDE managed content pieces, so as to create a combination product comprised of various pieces of VDE content, enables VDE content providers to optimize their VDE electronic content products. The combining of VDE managed content pieces may result in a VDE content container which "holds" consolidated content and/or concomitant, separate, nested VDE content containers.

VDE's support for creation of content containers holding distinct pieces of VDE content portions that were previously managed separately allows VDE content providers to develop products whose content control information reflects value propositions consistent with the objectives of the providers of content pieces, and further are consistent with the objectives of a content aggregator who may be producing a certain content combination as a product for commercial distribution. For example, a content product "launched" by a certain content provider into a commercial channel (such as a network repository) may be incorporated by different content providers and/or end-users into VDE content containers (so long as such incorporation is allowed by the launched product's content

control information). These different content providers and/or end-users may, for example, submit differing control information for regulating use of such content. They may also combine in different combinations a certain portion of launched content with content received from other parties (and/or produced by themselves) to produce different content collections, given appropriate authorizations.

VDE thus enables copies of a given piece of VDE managed content to be securely combined into differing consolidations of content, each of which reflects a product strategy of a different VDE content aggregator. VDE's content aggregation capability will result in a wider range of competitive electronic content products which offer differing overall collections of content and may employ differing content control information for content that may be common to such multiple products. Importantly, VDE securely and flexibly supports editing the content in, extracting content from, embedding content into, and otherwise shaping the content composition of, VDE content containers. Such capabilities allow VDE supported product models to evolve by progressively reflecting the requirements of "next" participants in an electronic commercial model. As a result, a given piece of VDE managed content, as it moves through pathways of handling and branching, can participate in many different content container and content control information commercial models.

VDE content, and the electronic agreements associated with said content, can be employed and progressively manipulated in commercial ways which reflect traditional business practices for non-electronic products (though VDE supports greater flexibility and efficiency compared with most of such traditional models). Limited only by the VDE control information employed by content creators, other providers, and other pathway of handling and control participants, VDE allows a "natural" and unhindered flow of, and creation of, electronic content product models. VDE provides for this flow of VDE products and services through a network of creators, providers, and users who successively and securely shape and reshape product composition through content combining, extracting, and editing within a Virtual Distribution Environment.

VDE provides means to securely combine content provided at different times, by differing sources, and/or representing differing content types. These types, timings, and/or different sources of content can be employed to form a complex array of content within a VDE content container. For example, a VDE content container may contain a plurality of different content container objects, each containing different content whose usage can be controlled, at least in part, by its own container's set of VDE content control information.

A VDE content container object may, through the use of a secure VDE sub-system, be "safely" embedded within a "parent" VDE content container. This embedding process may involve the creation of an embedded object, or, alternatively, the containing, within a VDE content container, of a previously independent and now embedded object by, at minimum, appropriately referencing said object as to its location.

An embedded content object within a parent VDE content container:

(1) may have been a previously created VDE content container which has been embedded into a parent VDE content container by securely transforming it from an independent to an embedded object through the secure processing of one or more VDE component assemblies within a VDE secure sub-system PPE 650. In this instance, an embedded object may be subject to content control information, including one or more permissions records associated with the parent container, but may not, for example, have its own content control information other than content identification information, or the embedded object may be more extensively controlled by its own content control information (e.g. permissions records).

(2) may include content which was extracted from another VDE content container (along with content control information, as may be applicable) for inclusion into a parent VDE content container in the form of an embedded VDE content container object. In this case, said extraction and embedding may use one or more VDE processes which run securely within a VDE secure sub-system PPE 650 and which may securely remove (or copy) the desired content from a source VDE content container and place such content in a new or existing container object, either of which may be or become embedded into a parent VDE content container.

(3) may include content which was first created and then placed in a VDE content container object. Said receiving container may already be embedded in a parent VDE content container and may already contain other content. The container in which such content is placed may be specified using a VDE aware application which interacts with content and a secure VDE subsystem to securely create such VDE container and place such content therein followed by securely embedding such container into the destination, parent container. Alternatively, content may be specified without the use of a VDE aware application, and then manipulated using a VDE aware

application in order to manage movement of the content into a VDE content container. Such an application may be a VDE aware word processor, desktop and/or multimedia publishing package, graphics and/or presentation package, etc. It may also be an operating system function (e.g. part of a VDE aware operating system or mini-application operating with an O/S such as a Microsoft Windows compatible object packaging application) and movement of content from "outside" VDE to within a VDE object may, for example, be based on a "drag and drop" metaphor that involves "dragging" a file to a VDE container object using a pointing device such as a mouse. Alternatively, a user may "cut" a portion of content and "paste" such a portion into a VDE container by first placing content into a "clipboard," then selecting a target content object and pasting the content into such an object. Such processes may, at the direction of VDE content control information and under the control of a VDE secure subsystem, put the content automatically at some position in the target object, such as at the end of the object or in a portion of the object that corresponds to an identifier carried by or with the content such as a field identifier, or the embedding process might pop-up a user interface that allows a user to browse a target object's contents and/or table of contents and/or other directories, indexes, etc. Such processes may further

allow a user to make certain decisions concerning VDE content control information (budgets limiting use, reporting pathway(s), usage registration requirements, etc.) to be applied to such embedded content and/or may involve selecting the specific location for embedding the content, all such processes to be performed as transparently as practical for the application.

(4) may be accessed in conjunction with one or more operating system utilities for object embedding and linking, such as utilities conforming to the Microsoft OLE standard. In this case, a VDE container may be associated with an OLE "link." Accesses (including reading content from, and writing content to) to a VDE protected container may be passed from an OLE aware application to a VDE aware OLE application that accesses protected content in conjunction with control information associated with such content.

A VDE aware application may also interact with component assemblies within a PPE to allow direct editing of the content of a VDE container, whether the content is in a parent or embedded VDE content container. This may include the use of a VDE aware word processor, for example, to directly edit (add to, delete, or otherwise modify) a VDE container's content. The

secure VDE processes underlying VDE container content editing may be largely or entirely transparent to the editor (user) and may transparently enable the editor to securely browse through (using a VDE aware application) some or all of the contents of, and securely modify one or more of the VDE content containers embedded in, a VDE content container hierarchy.

The embedding processes for all VDE embedded content containers normally involves securely identifying the appropriate content control information for the embedded content. For example, VDE content control information for a VDE installation and/or a VDE content container may securely, and transparently to an embedder (user), apply the same content control information to edited (such as modified or additional) container content as is applied to one or more portions (including all, for example) of previously "in place" content of said container and/or securely apply control information generated through a VDE control information negotiation between control sets, and/or it may apply control information previously applied to said content. Application of control information may occur regardless of whether the edited content is in a parent or embedded container. This same capability of securely applying content control information (which may be automatically and/or transparently applied), may also be employed with content that is embedded into a VDE container through extracting and embedding content,

or through the moving, or copying and embedding, of VDE container objects. Application of content control information normally occurs securely within one or more VDE secure sub-system PPEs 650. This process may employ a VDE template that enables a user, through easy to use GUI user interface tools, to specify VDE content control information for certain or all embedded content, and which may include menu driven, user selectable and/or definable options, such as picking amongst alternative control methods (e.g. between different forms of metering) which may be represented by different icons picturing (symbolizing) different control functions and apply such functions to an increment of VDE secured content, such as an embedded object listed on an object directory display.

Extracting content from a VDE content container, or editing or otherwise creating VDE content with a VDE aware application, provides content which may be placed within a new VDE content container object for embedding into said parent VDE container, or such content may be directly placed into a previously existing content container. All of these processes may be managed by processing VDE content control information within one or more VDE installation secure sub-systems.

VDE content container objects may be embedded in a parent object through control information referenced by a parent

object permissions record that resolves said embedded object's location and/or contents. In this case, little or no change to the embedded object's previously existing content control information may be required. VDE securely managed content which is relocated to a certain VDE content container may be relocated through the use of VDE sub-system secure processes which may, for example, continue to maintain relocated content as encrypted or otherwise protected (e.g. by secure tamper resistant barrier 502) during a relocation/embedding process.

Embedded content (and/or content objects) may have been contributed by different parties and may be integrated into a VDE container through a VDE content and content control information integration process securely managed through the use of one or more secure VDE subsystems. This process may, for example, involve one or more of:

(1.) securely applying instructions controlling the embedding and/or use of said submitted content, wherein said instructions were securely put in place, at least in part, by a content provider and/or user of said VDE container. For example, said user and/or provider may interact with one or more user interfaces offering a selection of content embedding and/or control options (e.g. in the form of a VDE template). Such options may include which, and/or whether, one or more controls should

be applied to one or more portions of said content and/or the entry of content control parameter data (such a time period before which said content may not be used, cost of use of content, and/or pricing discount control parameters such as software program suite sale discounting). Once required and/or optional content control information is established by a provider and/or user, it may function as content control information which may be, in part or in full, applied automatically to certain, or all, content which is embedded in a VDE content container.

(2.) secure VDE managed negotiation activities, including the use of a user interface interaction between a user at a receiving VDE installation and VDE content control information associated with the content being submitted for embedding. For example, such associated control information may propose certain content information and the content receiver may, for example, accept, select from a plurality, reject, offer alternative control information, and/or apply conditions to the use of certain content control information (for example, accept a certain one or more controls if said content is used by a certain one or more users and/or if the volume of usage of certain content exceeds a certain level).

(3.) a secure, automated, VDE electronic negotiation process involving VDE content control information of the

receiving VDE content container and/or VDE installation and content control information associated with the submitted content (such as control information in a permissions record of a contributed VDE object, certain component assemblies, parameter data in one or more UDEs and/or MDEs, etc.).

Content embedded into a VDE content container may be embedded in the form of:

(1.) content that is directly, securely integrated into previously existing content of a VDE content container (said container may be a parent or embedded content container) without the formation of a new container object. Content control information associated with said content after embedding must be consistent with any pre-embedding content control information controlling, at least in part, the establishment of control information required after embedding. Content control information for such directly integrated, embedded content may be integrated into, and/or otherwise comprise a portion of, control information (e.g. in one or more permissions records containing content control information) for said VDE container, and/or

(2.) content that is integrated into said container in one or more objects which are nested within said VDE content container object. In this instance, control information for said content may

be carried by either the content control information for the parent VDE content container, or it may, for example, be in part or in full carried by one or more permissions records contained within and/or specifically associated with one or more content containing nested VDE objects. Such nesting of VDE content containing objects within a parent VDE content container may employ a number of levels, that is a VDE content container nested in a VDE content container may itself contain one or more nested VDE content containers.

VDE content containers may have a nested structure comprising one or more nested containers (objects) that may themselves store further containers and/or one or more types of content, for example, text, images, audio, and/or any other type of electronic information (object content may be specified by content control information referencing, for example, byte offset locations on storage media). Such content may be stored, communicated, and/or used in stream (such as dynamically accumulating and/or flowing) and/or static (fixed, such as predefined, complete file) form. Such content may be derived by extracting a subset of the content of one or more VDE content containers to directly produce one or more resulting VDE content containers. VDE securely managed content (e.g. through the use of a VDE aware application or operating system having extraction capability) may be identified for extraction from each of one or more

locations within one or more VDE content containers and may then be securely embedded into a new or existing VDE content container through processes executing VDE controls in a secure subsystem PPE 650. Such extraction and embedding (VDE "exporting") involves securely protecting, including securely executing, the VDE exporting processes.

A VDE activity related to VDE exporting and embedding involves performing one or more transformations of VDE content from one secure form to one or more other secure forms. Such transformation(s) may be performed with or without moving transformed content to a new VDE content container (e.g. by component assemblies operating within a PPE that do not reveal, in unprotected form, the results or other output of such transforming processes without further VDE processes governing use of at least a portion of said content). One example of such a transformation process may involve performing mathematical transformations and producing results, such as mathematical results, while retaining, none, some, or all of the content information on which said transformation was performed. Other examples of such transformations include converting a document format (such as from a WordPerfect format to a Word for Windows format, or an SGML document to a Postscript document), changing a video format (such as a QuickTime video format to a MPEG video format), performing an artificial

intelligence process (such as analyzing text to produce a summary report), and other processing that derives VDE secured content from other VDE secured content.

Figure 79 shows an example of an arrangement of commercial VDE users. The users in this example create, distribute, redistribute, and use content in a variety of ways. This example shows how certain aspects of control information associated with content may evolve as control information passes through a chain of handling and control. These VDE users and controls are explained in more detail below.

Creator A in this example creates a VDE container and provides associated content control information that includes references (amongst other things) to several examples of possible "types" of VDE control information. In order to help illustrate this example, some of the VDE control information passed to another VDE participant is grouped into three categories in the following more detailed discussion: distribution control information, redistribution control information, and usage control information. In this example, a fourth category of embedding control information can be considered an element of all three of the preceding categories. Other groupings of control information are possible (VDE does not require organizing control information in this way). The content control information associated with this

example of a container created by creator A is indicated on Figure 80 as C_A. Figure 80 further shows the VDE participants who may receive enabling control information related to creator A's VDE content container. Some of the control information in this example is explained in more detail below.

Some of the distribution control information (in this example, control information primarily associated with creation, modification, and/or use of control information by distributors) specified by creator A includes: (a) distributors will compensate creator A for each active user of the content of the container at the rate of $10 per user per month, (b) distributors are budgeted such that they may allow no more than 100 independent users to gain access to such content (i.e. may create no more than 100 permissions records reflecting content access rights) without replenishing this budget, and (c) no distribution rights may be passed on in enabling control information (e.g. permissions records and associated component assemblies) created for distribution to other participants.

Some of the content redistribution control information (in this example, control information produced by a distributor within the scope permitted by a more senior participant in a chain of handling and control and passed to user/providers (in this example, user/distributors) and associated with controls

and/or other requirements associated with redistribution activities by such user/distributors) specified by creator A includes: (a) a requirement that control information enabling content access may be redistributed by user/distributors no more than 2 levels, and further requires that each redistribution decrease this value by one, such that a first redistributor is restricted to two levels of redistribution, and a second redistributor to whom the first redistributor delivers permissions will be restricted to one additional level of redistribution, and users receiving permissions from the second redistributor will be unable to perform further redistribution (such a restriction may be enforced, for example, by including as one aspect of a VDE control method associated with creating new permissions a requirement to invoke one or more methods that: (i) locate the current level of redistribution stored, for example, as an integer value in a UDE associated with such one or more methods, (ii) compare the level of redistribution value to a limiting value, and (iii) if such level of redistribution value is less than the limiting value, increment such level of redistribution value by one before delivering such a UDE to a user as an aspect of content control information associated with VDE managed content, or fail the process if such value is equal to such a limiting value), and (b) no other special restrictions are placed on redistributors.

Some of the usage control information (in this example, control information that a creator requires a distributor to provide in control information passed to users and/or user/distributors) specified by creator A may include, for example: (a) no moves (a form of distribution explained elsewhere in this document) of the content are permitted, and (b) distributors will be required to preserve (at a minimum) sufficient metering information within usage permissions in order to calculate the number of users who have accessed the container in a month and to prevent further usage after a rental has expired (e.g. by using a meter method designed to report access usages to creator A through a chain of handling and reporting, and/or the use of expiration dates and/or time-aged encryption keys within a permissions record or other required control information).

Some of the extracting and/or embedding control information specified by creator A in this example may include a requirement that no extracting and/or embedding of the content is or will be permitted by parties in a chain of handling and control associated with this control information, except for users who have no redistribution rights related to such VDE secured content provided by Creator A. Alternatively, or in addition, as regards different portions of said content, control information enabling certain extraction and/or embedding may be provided

along with the redistribution rights described in this example for use by user/distributors (who may include user content aggregators, that is they may provide content created by, and/or received from, different sources so as to create their own content products).

Distributor A in this example has selected a basic approach that distributor A prefers when offering enabling content control information to users and/or user/distributors that favors rental of content access rights over other approaches. In this example, some of the control information provided by creators will permit distributor A to fulfill this favored approach directly, and other control structures may disallow this favored approach (unless, for example, distributor A completes a successful VDE negotiation allowing such an approach and supporting appropriate control information). Many of the control structures received by distributor A, in this example, are derived from (and reflect the results of) a VDE negotiation process in which distributor A indicates a preference for distribution control information that authorizes the creation of usage control information reflecting rental based usage rights. Such distribution control information may allow distributor A to introduce and/or modify control structures provided by creators in such a way as to create control information for distribution to users and/or user/distributors that, in effect, "rent" access rights. Furthermore, distributor A in

this example services requests from user/distributors for redistribution rights, and therefore also favors distribution control information negotiated (or otherwise agreed to) with creators that permits distributor A to include such rights as an aspect of control information produced by distributor A.

In this example, distributor A and creator A may use VDE to negotiate (for example, VDE negotiate) for a distribution relationship. Since in this example creator A has produced a VDE content container and associated control information that indicates creator A's desire to receive compensation based on rental of usage rights, and such control information further indicates that creator A has placed acceptable restrictions in redistribution control information that distributor A may use to service requests from user/distributors, distributor A may accept creator A's distribution control information without any negotiated changes.

After receiving enabling distribution control information from creator A, distributor A may manipulate an application program to specify some or all of the particulars of usage control information for users and/or user/distributors enabled by distributor A (as allowed, or not prevented, by senior control information). Distributor A may, for example, determine that a price of $15 per month per user would meet distributor A's

business objectives with respect to payments from users for creator A's container. Distributor A must specify usage control information that fulfill the requirements of the distribution control information given to distributor A by creator A. For example, distributor A may include any required expiration dates and/or time-aged encryption keys in the specification of control information in accordance with creator A's requirements. If distributor A failed to include such information (or to meet other requirements) in their specification of control information, the control method(s) referenced in creator A's permissions record and securely invoked within a PPE 650 to actually create this control information would, in this example, fail to execute in the desired way (e.g. based on checks of proposed values in certain fields, a requirement that certain methods be included in permissions, etc.) until acceptable information were included in distributor A's control information specification.

In this example, user A may have established an account with distributor A such that user A may receive VDE managed content usage control information from distributor A. User A may receive content usage control information from distributor A to access and use creator A's content. Since the usage control information has passed through (and been added to, and/or modified by) a chain of handling including distributor A, the usage control information requested from distributor A to make

use of creator A's content will, in this example, reflect a composite of control information from creator A and distributor A. For example, creator A may have established a meter method that will generate an audit record if a user accesses creator A's VDE controlled content container if the user has not previously accessed the container within the same calendar month (e.g. by storing the date of the user's last access in a UDE associated with an open container event referenced in a method core of such a meter method and comparing such a date upon subsequent access to determine if such access has occurred within the same calendar month). Distributor A may make use of such a meter method in a control method (e.g. also created and/or provided by creator A, or created and/or provided by distributor A) associated with opening creator A's container that invokes one or more billing and/or budget methods created, modified, referenced in one or more permissions records and/or parameterized by distributor A to reflect a charge for monthly usage as described above. If distributor A has specified usage and/or redistribution control information within the boundaries permitted by creator A's senior control information, a new set of control information (shown as $D_A(C_A)$ in Figure 80) may be associated with creator A's VDE content container when control information associated with that container by distributor A are delivered to users and/or user/distributors (user A, user B, and user/distributor A in this example).

In this example, user A may receive control information related to creator A's VDE content container from distributor A. This control information may represent an extended agreement between user A and distributor A (e.g. regarding fees associated with use of content, limited redistribution rights, etc.) and distributor A and creator A (e.g. regarding the character, extent, handling, reporting, and/or other aspects of the use and/or creation of VDE controlled content usage information and/or content control information received, for example, by distributor A from creator A, or vice versa, or in other VDE content usage information handling). Such an extended agreement is enforced by processes operating within a secure subsystem of each participant's VDE installation. The portion of such an extended agreement representing control information of creator A as modified by distributor A in this example is represented by $D_A(C_A)$, including, for example, (a) control structures (e.g. one or more component assemblies, one or more permissions records, etc.), (b) the recording of usage information generated in the course of using creator A's content in conformance with requirements stated in such control information, (c) making payments (including automatic electronic credit and/or currency payments "executed" in response to such usage) as a consequence of such usage (wherein such consequences may also include electronically, securely and automatically receiving a bill delivered through use of VDE, wherein such a bill is derived from

said usage), (d) other actions by user A and/or a VDE secure subsystem at user A's VDE installation that are a consequence of such usage and/or such control information.

In addition to control information $D_A(C_A)$, user A may enforce her own control information on her usage of creator A's VDE content container (within the limits of senior content control information). This control information may include, for example, (a) transaction, session, time based, and/or other thresholds placed on usage such that if such thresholds (e.g. quantity limits, for example, self imposed limits on the amount of expenditure per activity parameter) are exceeded user A must give explicit approval before continuing, (b) privacy requirements of user A with respect to the recording and/or transmission of certain usage related details relating to user A's usage of creator A's content, (c) backup requirements that user A places on herself in order to help ensure a preservation of value remaining in creator A's content container and/or local store of electronic credit and/or currency that might otherwise be lost due to system failure or other causes. The right to perform in some or all of these examples of user A's control information, in some examples, may be negotiated with distributor A. Other such user specified control information may be enforced independent of any control information received from any content provider and may be set in relationship to a user's, or more generally, a VDE installation's,

control information for one or more classes, or for all classes, of content and/or electronic appliance usage. The entire set of VDE control information that may be in place during user A's usage of creator A's content container is referred to on Figure 80 as $U_A(D_A(C_A))$. This set may represent the control information originated by creator A, as modified by distributor A, as further modified by user A, all in accordance with control information from value chain parties providing more senior control information, and therefore constitutes, for this example, a "complete" VDE extended agreement between user A, distributor A, and creator A regarding creator A's VDE content container. User B may, for example, also receive such control information $D_A(C_A)$ from distributor A, and add her own control information in authorized ways to form the set $U_B(D_A(C_A))$.

User/distributor A may also receive VDE control information from distributor A related to creator A's VDE content container. User/distributor A may, for example, both use creator A's content as a user and act as a redistributor of control information. In this example, control information $D_A(C_A)$ both enables and limits these two activities. To the extent permitted by $D_A(C_A)$, user/distributor A may create their own control information based on $D_A(C_A)$ -- $UD_A(D_A(C_A))$ -- that controls both user/distributor A's usage (in a manner similar to that described above in connection with user A and user B), and control

information redistributed by user/distributor A (in a manner similar to that described above in connection with distributor A). For example, if user/distributor A redistributes $UD_A(D_A(C_A))$ to user/distributor B, user/distributor B may be required to report certain usage information to user/distributor A that was not required by either creator A or distributor A. Alternatively or in addition, user/distributor B may, for example, agree to pay user/distributor A a fee to use creator A's content based on the number of minutes user/distributor B uses creator A's content (rather than the monthly fee charged to user/distributor A by distributor A for user/distributor B's usage).

In this example, user/distributor A may distribute control information $UD_A(D_A(C_A))$ to user/distributor B that permits user/distributor B to further redistribute control information associated with creator A's content. User/distributor B may make a new set of control information $UD_B(UD_A(D_A(C_A)))$. If the control information $UD_A(D_A(C_A))$ permits user/distributor B to redistribute, the restrictions on redistribution from creator A in this example will prohibit the set $UD_B(UD_A(D_A(C_A)))$ from including further redistribution rights (e.g. providing redistribution rights to user B) because the chain of handling from distributor A to user/distributor A (distribution) and the continuation of that chain from user/distributor A to user/distributor B (first level of redistribution) and the further

continuation of that chain to another user represents two levels of redistribution, and, therefore, a set $UD_B(UD_A(D_A(C_A)))$ may not, in this example, include further redistribution rights.

As indicated in Figure 79, user B may employ content from both user/distributor B and distributor A (amongst others). In this example, as illustrated in Figure 80, user B may receive control information associated with creator A's content from distributor A and/or user/distributor B. In either case, user B may be able to establish their own control information on $D_A(C_A)$ and/or $UD_B(UD_A(D_A(C_A)))$, respectively (if allowed by such control information. The resulting set(s) of control information, $U_B(D_A(C_A))$ and/or $U_B(UD_B(UD_A(D_A(C_A))))$ respectively, may represent different control scenarios, each of which may have benefits for user B. As described in connection with an earlier example, user B may have received control information from user/distributor B along a chain of handling including user/distributor A that bases fees on the number of minutes that user B makes use of creator A's content (and requiring user/distributor A to pay fees of $15 per month per user to distributor A regardless of the amount of usage by user B in a calendar month). This may be more favorable under some circumstances than the fees required by a direct use of control information provided by distributor A, but may also have the disadvantage of an exhausted chain of redistribution and, for

example, further usage information reporting requirements included in $UD_B(UD_A(D_A(C_A)))$. If the two sets of control information $D_A(C_A)$ and $UD_B(UD_A(D_A(C_A)))$ permit (e.g. do not require exclusivity enforced, for example, by using a registration interval in an object registry used by a secure subsystem of user B's VDE installation to prevent deregistration and reregistration of different sets of control information related to a certain container (or registration of plural copies of the same content having different control information and/or being supplied by different content providers) within a particular interval of time as an aspect of an extended agreement for a chain of handling and control reflected in $D_A(C_A)$ and/or $UD_B(UD_A(D_A(C_A)))$), user B may have both sets of control information registered and may make use of the set that they find preferable under a given usage scenario.

In this example, creator B creates a VDE content container and associates a set of VDE control information with such container indicated in Figure 81 as C_B. Figure 81 further shows the VDE participants who may receive enabling control information related to creator B's VDE content container. In this example, control information may indicate that distributors of creator B's content: (a) must pay creator B $0.50 per kilobyte of information decrypted by users and/or user/distributors authorized by such a distributor, (b) may allow users and/or

user/distributors to embed their content container in another container while maintaining a requirement that creator B receive $0.50 per kilobyte of content decrypted, (c) have no restrictions on the number of enabling control information sets that may be generated for users and/or user/distributors, (d) must report information concerning the number of such distributed control information sets at certain time intervals (e.g. at least once per month), (e) may create control information that allows users and/or user/distributors to perform up to three moves of their control information, (f) may allow redistribution of control information by user/distributors up to three levels of redistribution, (g) may allow up to one move per user receiving redistributed control information from a user/distributor.

In this example, distributor A may request control information from creator B that enables distributor A to distribute control information to users and/or user/distributors that is associated with the VDE container described above in connection with creator B. As stated earlier, distributor A has established a business model that favors "rental" of access rights to users and user/distributors receiving such rights from distributor A. Creator B's distribution control information in this example does not force a model including "rental" of rights, but rather bases payment amounts on the quantity of content decrypted by a user or user/distributor. In this example,

distributor A may use VDE to negotiate with creator B to include a different usage information recording model allowed by creator B. This model may be based on including one or more meter methods in control structures associated with creator B's container that will record the number of bytes decrypted by end users, but not charge users a fee based on such decryptions; rather distributor A proposes, and creator B's control information agrees to allow, a "rental" model to charge users, and determines the amount of payments to creator B based on information recorded by the bytes decrypted meter methods and/or collections of payment from users.

Creator B may, for example, (a) accept such a new control model with distributor A acting as the auditor (e.g. trusting a control method associated with processing audit information received by distributor A from users of creator B's content using a VDE secure subsystem at distributor A's site, and further to securely calculate amounts owed by distributor A to creator B and, for example, making payments to creator B using a mutually acceptable budget method managing payments to creator B from credit and/or currency held by distributor A), (b) accept such a new control model based on distributor A's acceptance of a third party to perform all audit functions associated with this content, (c) may accept such a model if information associated with the one or more meter methods that

record the number of bytes decrypted by users is securely packaged by distributor B's VDE secure subsystem and is securely, employing VDE communications techniques, sent to creator B in addition to distributor A, and/or (d) other mutually acceptable conditions. Control information produced by distributor A based on modifications performed by distributor A as permitted by C_B are referred to in this example as $D_A(C_B)$.

User A may receive a set of control information $D_A(C_B)$ from distributor A. As indicated above in connection with content received from creator A via a chain of handling including distributor A, user A may apply their own control information to the control information $D_A(C_B)$, to the extent permitted by $D_A(C_B)$, to produce a set of control information $U_A(D_A(C_B))$. The set of control information $D_A(C_B)$ may include one or more meter methods that record the number of bytes of content from creator B's container decrypted by user A (in order to allow correct calculation of amounts owed by distributor A to creator B for user A's usage of creator B's content in accordance with the control information of C_B that requires payment of $0.50 per kilobyte of decrypted information), and a further meter method associated with recording usage such that distributor A may gather sufficient information to securely generate billings associated with user A's usage of creator B's content and based on a "rental" model (e.g. distributor A may, for example, have included a meter

method that records each calendar month that user A makes use of creator B's content, and relates to further control information that charges user A $10 per month for each such month during which user A makes use of such content.)

User/distributor A may receive control information C_B directly from creator B. In this case, creator B may use VDE to negotiate with user/distributor A and deliver a set of control information C_B that may be the same or differ from that described above in connection with the distribution relationship established between creator B and distributor A. For example, user/distributor A may receive control information C_B that includes a requirement that user/distributor A pay creator B for content decrypted by user/distributor A (and any participant receiving distributed and/or redistributed control information from user/distributor A) at the rate of $0.50 per kilobyte. As indicated above, user/distributor A also may receive control information associated with creator B's VDE content container from distributor A. In this example, user/distributor A may have a choice between paying a "rental" fee through a chain of handling passing through distributor A, and a fee based on the quantity of decryption through a chain of handling direct to creator B. In this case, user/distributor A may have the ability to choose to use either or both of C_B and $D_A(C_B)$. As indicated earlier in connection with a chain of handling including creator A

and distributor A, user/distributor A may apply her own control information to the extent permitted by C_B and/or $D_A(C_B)$ to form the sets of control information $UD_A(C_B)$ and $UD_A(D_A(C_B))$, respectively.

As illustrated in Figure 81, in this example, user B may receive control information associated with creator B's VDE content container from six different sources: C_B directly from creator B, $D_A(C_B)$ from distributor A, $UD_B(UD_A(D_A(C_B)))$ and/or $UD_B(UD_A(C_B))$ from user/distributor B, $D_C(C_B)$ from distributor C, and/or $D_B(D_C(C_B))$ from distributor B. This represents six chains of handling through which user B may enter into extended agreements with other participants in this example. Two of these chains pass through user/distributor B. Based on a VDE negotiation between user/distributor B and user B, an extended agreement may be reached (if permitted by control information governing both parties) that reflects the conditions under which user B may use one or both sets of control information. In this example, two chains of handling and control may "converge" at user/distributor B, and then pass to user B (and if control information permits, later diverge once again based on distribution and/or redistribution by user B).

In this example, creator C produces one or more sets of control information C_C associated with a VDE content container

created by creator C, as shown in Figure 82. Figure 82 further shows the VDE participants who may receive enabling control information related to creator C's VDE content container. The content in such a container is, in this example, organized into a set of text articles. In this example control information may include one or more component assemblies that describe the articles within such a container (e.g. one or more event methods referencing map tables and/or algorithms that describe the extent of each article). C_C may further include, for example: (a) a requirement that distributors ensure that creator C receive $1 per article accessed by users and/or user/distributors, which payment allows a user to access such an article for a period of no more than six months (e.g. using a map-type meter method that is aged once per month, time aged decryption keys, expiration dates associated with relevant permissions records, etc.), (b) control information that allows articles from creator C's container to be extracted and embedded into another container for a one time charge per extract/embed of $10, (c) prohibits extracted/embedded articles from being reextracted, (d) permits distributors to create enabling control information for up to 1000 users or user/distributors per month, (e) requires that information regarding the number of users and user/distributors enabled by a distributor be reported to creator C at least once per week, (f) permits distributors to enable users or user/distributors

to perform up to one move of enabling control information, and (g) permits up to 2 levels of redistribution by user/distributors.

In this example, distributor B may establish a distribution relationship with creator C. Distributor B in this example may have established a business model that favors the distribution of control information to users and user/distributors that bases payments to distributor B based on the number of accesses performed by such VDE participants. In this example, distributor B may create a modified set $D_B(C_C)$ of enabling control information for distribution to users and/or user/distributors. This set $D_B(C_C)$ may, for example, be based on a negotiation using VDE to establish a fee of $0.10 per access per user for users and/or user/distributors who receive control information from distributor B. For example, if one or more map-type meter methods have been included in C_C to ensure that adequate information may be gathered from users and/or user/distributors to ensure correct payments to creator C by distributor B based on C_C, such methods may be preserved in the set $D_B(C_C)$, and one or more further meter methods (and any other necessary control structures such as billing and/or budget methods) may be included to record each access such that the set $D_B(C_C)$ will also ensure that distributor B will receive payments based on each access.

The client administrator in this example may receive a set of content control information $D_B(C_C)$ that differs, for example, from control information received by user B from distributor B. For example, the client administrator may use VDE to negotiate with distributor B to establish a set of control information for content from all creators for whom distributor B may provide enabling content control information to the client administrator. For example, the client administrator may receive a set of control information $D_B(C_C)$ that reflects the results of a VDE negotiation between the client administrator and distributor B. The client administrator may include a set of modifications to $D_B(C_C)$ and form a new set $CA(D_B(C_C))$ that includes control information that may only be available to users and user/distributors within the same organization as the client administrator (e.g. coworkers, employees, consultants, etc.) In order to enforce such an arrangement, $CA(D_B(C_C))$ may, for example, include control structures that examine name services information associated with a user or user/distributor during registration, establish a new budget method administered by the client administrator and required for use of the content, etc.

A distributor may provide redistribution rights to a client administrator which allows said administrator to redistribute rights to create permissions records for certain content (redistribute rights to use said content) only within the

administrator's organization and to no other parties. Similarly, such administrator may extend such a "limited" right to redistribute to department and/or other administrator within his organization such that they may redistribute such rights to use content based on one or more restricted lists of individuals and/or classes and/or other groupings of organization personnel as defined by said administrator. This VDE capability to limit redistribution to certain one or more parties and/or classes and/or other groupings of VDE users and/or installations can be applied to content by any VDE content provider, so long as such a control is allowed by senior control information.

User D in this example may receive control information from either the client administrator and/or user/distributor C. User/distributor C may, for example, distribute control information $UD_C(CA(D_B(C_C)))$ to user D that includes a departmental budget method managed by user/distributor C to allow user/distributor C to maintain an additional level of control over the actions of user D. In this case, $UD_C(CA(D_B(C_C)))$ may include multiple levels of organizational controls (e.g. controls originating with the client administrator and further controls originating with user/distributor C) in addition to controls resulting from a commercial distribution channel. In addition or alternatively, the client administrator may refuse to distribute certain classes of control information to user D even if the client

administrator has adequate control information (e.g. control information distributed to user/distributor C that allows redistribution to users such as user D) to help ensure that control information flows through the client administrator's organization in accordance with policies, procedures, and/or other administrative processes.

In this example, user E may receive control information from the client administrator and/or distributor B. For example, user E may have an account with distributor B even though some control information may be received from the client administrator. In this case, user E may be permitted to request and receive control information from distributor B without restriction, or the client administrator may have, as a matter of organizational policy, control information in place associated with user E's electronic appliance that limits the scope of user E's interaction with distributor B. In the latter case, the client administrator may, for example, have limited user E to registering control information with the secure subsystem of user E's electronic appliance that is not available from the client administrator, is from one or more certain classes of distributors and/or creators, and/or has a cost for usage, such as a certain price point (e.g. $50 per hour of usage). Alternatively or in addition, the client administrator may, for example, limit user E to receiving control information from distributor B in which user

E receives a more favorable price (or other control information criteria) than the price (or other criteria) available in control information from the client administrator.

In this example, creator D may create a VDE content container that is designed primarily for integration with other content (e.g. through use of a VDE extracting/embedding process), for example, content provided by creator B and creator C. Figure 83 shows the VDE participants who may receive enabling control information related a VDE content container produced by creator D. Control information associated with creator D's content (C_D in Figure 83) may include, for example: (a) a requirement that distributors make payment of either $1.50 per open per user, or $25 per user for an unlimited number of opens, (b) a discount of 20% for any user that has previously paid for an unlimited number of opens for certain other content created by creator D (e.g. implemented by including one or more billing methods that analyze a secure database of a user's VDE installation to determine if any of such certain other containers are registered, and further determines the character of rights held by a user purchasing rights to this container), (c) a requirement that distributors report the number of users and user/distributors enabled by control information produced in accordance with C_D after such number exceeds 1000, (d) a requirement that distributors limit the number of moves by users

and/or user/distributors to no more than one, (e) a requirement that distributors limit user/distributors to no more than four levels of redistribution, and (f) that distributors may create enabling control information that permits other distributors to create control information as distributors, but may not pass this capability to such enabled distributors, and further requires that audit information associated with use of control information by such enabled distributors shall pass directly to creator D without processing by such enabling distributor and that creator D shall pay such an enabling distributor 10% of any payments received by creator D from such an enabled distributor.

In this example, distributor C may receive VDE content containers from creator B, creator C, and creator D, and associated sets of control information C_B, C_C, and C_D. Distributor C may use the embedding control information and other control information to produce a new container with two or more VDE objects received from creator B, creator C, and creator D. In addition or alternatively, distributor C may create enabling control information for distribution to users and/or user/distributors (or in the case of C_D, for distributors) for such received containers individually. For example, distributor C may create a container including content portions (e.g. embedded containers) from creator B, creator C, and creator D in which each such portion has control information related to its access

and use that records, and allows an auditor to gather, sufficient information for each such creator to securely and reliably receive payments from distributor C based on usage activities related to users and/or user/distributors enabled by distributor C. Furthermore, distributor C may negotiate using VDE with some or all of such creators to enable a model in which distributor C provides overall control information for the entire container based on a "uniform" fee (e.g. calculated per month, per access, from a combined model, etc.) charged to users and/or user/distributors, while preserving the models of each such creator with respect to payments due to them by distributor C based on C_B, C_C, and/or C_D, and, for example, resulting from each of their differing models for the collection of content usage information and any related (e.g. advertising) information.

In this example, distributor B may receive a VDE content container and associated content control information C_E from creator E as shown in Figure 83. If C_E permits, distributor B may extract a portion of the content in such a container. Distributor B may then, for example, embed this portion in a container received from distributor C that contains an aggregation of VDE objects created by creator B, creator C, and creator D. Depending on the particular restrictions and/or permissions in the sets of control information received from each creator and distributor C, distributor B may, for example, be able

to embed such an extracted portion into the container received from distributor C as an independent VDE object, or directly into content of "in place" objects from creator B, creator C, and/or creator D. Alternatively, or in addition, distributor B may, if permitted by C_E, choose to distribute such an extracted portion of content as an independent VDE object.

User B may, in this example, receive a VDE content container from distributor C that is comprised of VDE objects created by creator B, creator C, and creator D. In addition, user B may receive a VDE content container from distributor B that contains the same content created by creator B, creator C, and creator D in addition to one or more extracted/embedded portions of content created by creator E. User B may base decisions concerning which of such containers they choose to use (including which embedded containers she may wish to use), and under which circumstances, based on, for example, the character of such extracted/embedded portions (e.g. multimedia presentations illustrating potential areas of interest in the remainder of the content, commentary explaining and/or expositing other elements of content, related works, improved application software delivered as an element of content, etc.); the quality, utility, and/or price (or other attributes of control information) of such portions; and other considerations which distinguish the

containers and/or content control information received, in this example, from distributor B and distributor C.

User B may receive content control information from distributor B for such a VDE content container that permits user B to add and/or modify content contained therein. User B may, for example, desire an ability to annotate content in such a container using a VDE aware word processor or other application(s). If permitted by senior control information, some or all of the content may be available to user B for modification and/or additions. In this case, user B is acting as a VDE creator for added and/or modified content. User B may, for example, provide new control information for such content, or may be required (or desire to) make use of existing control information (or control information included by senior members of a chain of handling for this purpose) to manage such content (based on control information related to such a container and/or contained objects).

In this example, VDE 100 has been used to enable an environment including, for example, content distribution, redistribution, aggregation (extracting and/or embedding), reaggregation, modification, and usage. The environment in this example allows competitive models in which both control information and content may be negotiated for and have different

particulars based on the chain of handling through which control information and/or content has been passed. Furthermore, the environment in this example permits content to be added to, and/or modified by, VDE participants receiving control information that enables such activities.

Example -- Content Distribution Through a Content VDE Chain of Handling

Figure 84 reflects certain aspects of a relatively simple model 3400 of VDE content distribution involving several categories of VDE participants. In this instance, and for simplicity of reference purposes, various portions of content are represented as discrete items in the form of VDE content container objects. One or more of such content portions may also be integrated together in a single object and may (as may the contents of any VDE content container object if allowed by content control information) be extracted in whole or part by a user. In this example, publishers of historical/educational multimedia content have created VDE content containers through the use of content objects available from three content resources:

- a Video Library 3402 product available to Publishers on optical discs and containing video clip VDE objects representing various historical situations,

- an Internet Repository 3404 which stores history information text and picture resources in VDE objects which are available for downloading to Publishers and other users, and

- an Audio Library 3406, also available on optical discs, and containing various pieces of musical performances and vocal performances (for example, historical narrations) which can be used alone or to accompany other educational historical materials.

The information provided in library 3402, repository 3404, and library 3406 may be provided to different publishers 3408(a), 3408(b), ..., 3408(n). Publishers 3408 may, in turn, provide some or all of the information they obtain to end users 3410.

In this example, the Video Library 3402 control information allows publishers to extract objects from the Video Library product container and content control information enabling use of each extracted object during a calendar year if the object has a license cost of $50 or less, and is shorter than 45 minutes in duration, and 20,000 copies of each of any other extracted objects, and further requires all video objects to be VDE fingerprinted upon decryption. The Audio Library 3404 has established similar controls that match its business model. The Internet Repository 3406 VDE containerizes, including encrypts, selected object content as it streams out of the Repository in response to an online, user request to download an object. The Repository 3406 may fingerprint the identification of the receiving VDE installation into its content prior to encryption

and communication to a publisher, and may further require user identification fingerprinting of their content when decrypted by said Publisher or other content user.

The Publishers 3408 in this example have selected, under terms and conditions VDE negotiated (or otherwise agreed to) with the providing resources, various content pieces which they combine together to form their VDE object container products for their teacher customers. Publisher 3408(A) has combined video objects extracted from the Video Library 3402 (as indicated by circles), text and image objects extracted from the Internet Repository 3404 (indicated by diamonds), and one musical piece and one historical narration extracted from the Audio Library 3406 (as indicated by rectangles). Publisher 3408(B) has extracted a similar array of objects to be combined into his product, and has further added graphical elements (indicated by a hexagon) created by Publisher 3408(B) to enhance the product. Publisher 3408(C) has also created a product by combining objects from the Internet Repository 3404 and the Audio Library 3406. In this example, all publisher products are delivered, on their respective optical discs, in the form of VDE content container objects with embedded objects, to a modern high school for installation on the high school's computer network.

In this particular example, End-Users 3410 are teachers who use their VDE node's secure subsystems to access the VDE installation on their high school server that supports the publishers' products (in an alternative example, the high school may maintain only a server based VDE installation). These teachers license the VDE products from one or more of the publishers and extract desired objects from the VDE product content containers and either download the extracted VDE content in the form of VDE content containers for storage on their classroom computers and/or as appropriate and/or efficient. The teachers may store extracted content in the form of VDE content containers on server mass storage (and/or if desired and available to an end-user, and further according to acceptable pricing and/or other terms and conditions and/or senior content control information, they may store extracted information in "clear" unencrypted form on their nodes' and/or server storage means). This allows the teachers to play, and/or otherwise use, the selected portions of said publishers' products, and as shown in two instances in this example, add further teacher and/or student created content to said objects. End-user 3410(2), for example, has selected a video piece 1 received from Publisher A, who received said object from the Video Library. End-user 3410(3) has also received a video piece 3 from the same Publisher 3408(A) wherein said piece was also available to her from Publisher 3408(B), but perhaps under not as favorable terms and

conditions (such as a support consultation telephone line). In addition, end-user 3410(3) has received an audio historical narration from Publisher 3408(B) which corresponds to the content of historical reference piece 7. End-user 3410(3) has also received a corresponding historical reference piece 7 (a book) from publisher 3408(2) who received said book from the Internet Repository 3404. In this instance, perhaps publisher 3408(2) charged less for said book because end-user 3410(3) has also licensed historical reference piece 7 from him, rather than publisher 3408(1), who also carried the same book. End-user 3410(3), as a teacher, has selected the items she considers most appropriate for her classes and, through use of VDE, has been able to flexibly extract such items from resources available to her (in this instance, extracting objects from various optical products provided by publishers and available on the local high school network server).

Example -- Distribution of Content Control Information Within an Organization

Figure 85 shows two VDE content containers, Container 300(A) and Container 300(B), that have been distributed to a VDE Client Administrator 3450 in a large organization. As shown in the figure, Container 300(A) and Container 300(B), as they arrive at the corporation, carry certain control information specifying available usage rights for the organization. As can be further seen in Figure 85, the client administrator 3450 has distributed certain subsets of these rights to certain department administrators 3452 of her organization, such as Sales and Marketing Administrator 3452(1), Planning Administrator 3452(2), and Research and Development Administrator 3452(k). In each instance, the Client Administrator 3450 has decided which usage options and how much budget should be made available to each department.

Figure 85 is a simplified example and, for example, the Client Administrator 3450 could have added further VDE controls created by herself and/or modified and/or deleted in place controls (if allowed by senior content control information) and/or (if allowed by control information) she could have further divided the available monetary budget (or other budgets) among specific usage activities. In this example, departmental administrators have the same rights to determine the rights of departmental

end-users as the client administrator has in regard to departments. In addition, in this example (but not shown in Figure 85) the client administrator 3450 and/or content provider(s) may also determine certain control information which must directly control (including providing rights related to) end-user content usage and/or the consequences of said usage for all or certain classes of end-users. In the example shown in Figure 85, there are only three levels of VDE participants within the organization:

a Client Administrator 3450,

department administrators 3452, and

end-users 3454.

In other examples, VDE will support many levels of VDE administration (including overlapping groups) within an organization (e.g., division, department, project, network, group, end-users, etc). In addition, administrators in a VDE model may also themselves be VDE content users.

Within an organization, VDE installations may be at each end-user 3454 node, only on servers or other multiple user computers or other electronic appliances, or there may be a mixed environment. Determination as to the mix of VDE server and/or node usage may be based on organization and/or content provider security, performance, cost overhead, or other considerations.

In this example, communications between VDE participants in Figure 85 employs VDE secure communication techniques between VDE secure subsystems supporting PPEs and other VDE secure system components at each VDE installation within the organization.

Example -- Another Content Distribution Example

Creators of VDE protected content may interact with other VDE participants in many different ways. A VDE creator 102 may, for example, distribute content and/or content control information directly to users, distribute content and/or content control information to commercial content repositories, distribute content and/or content control information to corporate content repositories, and/or distribute content and/or content control information to other VDE participants. If a creator 102 does not interact directly with all users of her content, she may transmit distribution permissions to other VDE participants that permit such participants to further distribute content and/or content control information. She may also allow further distribution of VDE content and/or content control information by, for example, not restricting redistribution of control information, or allowing a VDE participant to act as a "conduit" for one or more permissions records that can be passed along to another party, wherein said permissions record provides for including the identification of the first receiving party and/or the second receiving party.

Figure 86 shows one possible arrangement of VDE participants. In this example, creator 102 may employ one or more application software programs and one or more VDE secure subsystems to place unencrypted content into VDE protected

form (i.e., into one or more VDE content containers). In addition, creator 102 may produce one or more distribution permissions 3502 and/or usage permissions 3500 as an aspect of control information associated with such VDE protected content. Such distribution and/or usage permissions 3500, 3502 may be the same (e.g., all distribution permissions may have substantively all the same characteristics), or they may differ based on the category and/or class of participant for whom they are produced, the circumstances under which they are requested and/or transmitted, changing content control models of either creator 102 or a recipient, etc.

In this example, creator 102 transmits (e.g., over a network, via broadcast, and/or through transfer of physical media) VDE protected content to user 112a, user 112b, and/or user 112c. In addition, creator 102 transmits, using VDE secure communications techniques, usage permissions to such users. User 112a, user 112b, and user 112c may use such VDE protected content within the restrictions of control information specified by usage permissions received from creator 102. In this case, creator 102 may, for example, manage all aspects of such users activities related to VDE protected content transmitted to them by creator 102. Alternatively, creator 102 may, for example, include references to control information that must be

available to users that is not provided by creator 102 (e.g., component assemblies managed by another party).

Commercial content repository 200g, in this example, may receive VDE protected (or otherwise securely delivered) content and distribution, permissions and/or other content usage control information from creator 102. Commercial content repository 200g may store content securely such that users may obtain such, when any required conditions are met, content from the repository 200g. The distribution permissions 3502 may, for example, permit commercial content repository 200g to create redistribution permissions and/or usage permissions 3500, 3502 using a VDE protected subsystem within certain restrictions described in content control information received from creator 102 (e.g., not to exceed a certain number of copies, requiring certain payments by commercial content repository 200g to creator 102, requiring recipients of such permissions to meet certain reporting requirements related to content usage information, etc.). Such content control information may be stored at the repository installation and be applied to unencrypted content as it is transmitted from said repository in response to a user request, wherein said content is placed into a VDE container as a step in a secure process of communicating such content to a user. Redistribution permissions may, for example, permit a recipient of such permissions to create a

certain number of usage permissions within certain restrictions (e.g., only to members of the same household, business other organization, etc.). Repository 200g may, for example, be required by control information received from creator 102 to gather and report content usage information from all VDE participants to whom the repository has distributed permissions.

In this example, power user 112d may receive VDE protected content and redistribution permissions from commercial content repository 200g using the desktop computer 3504. Power user 112d may, for example, then use application software in conjunction with a VDE secure subsystem of such desktop computer 3504 in order to produce usage permissions for the desktop computer 3504, laptop computer 3506 and/or settop appliance 3508 (assuming redistribution permissions received from commercial content repository 200g permit such activities). If permitted by senior control information (for example, from creator 102 as may be modified by the repository 200g), power user 112d may add her own restrictions to such usage permissions (e.g., restricting certain members of power user 112d's household using the settop appliance to certain times of day, amounts of usage, etc. based on their user identification information). Power user 112d may then transmit such VDE protected content and usage permissions to the laptop computer 3506 and the settop appliance 3508 using VDE secure

communications techniques. In this case, power user 112d has redistributed permissions from the desktop computer 3504 to the settop appliance 3508 and the laptop computer 3506, and periodically the settop appliance and the laptop computer may be required to report content usage information to the desktop computer, which in turn may aggregate, and/or otherwise process, and report user usage information to the repository 200g.

User 112e and/or user 112f may receive usage permissions and VDE protected content from commercial content repository 200g. These users may be able to use such content in ways authorized by such usage information. In contrast to power user 112d, these users may not have requested and/or received redistribution permissions from the repository 200g. In this case, these users may still be able to transfer some or all usage rights to another electronic appliance 600, and/or they may be permitted to move some of their rights to another electronic appliance, if such transferring and/or moving is permitted by the usage permissions received from the repository 200g. In this case, such other appliances may be able to report usage information directly to the repository 200g.

In this example, corporate content repository 702 within corporation 700 may receive VDE protected content and

distribution permissions from creator 102. The distribution permissions received by corporate repository 702 may, for example, include restrictions that limit repository 702 to distribution activities within corporation 700.

The repository 702 may, for example, employ an automated system operating in conjunction with a VDE secure subsystem to receive and/or transmit VDE protected content, and/or redistribution and/or usage permissions. In this case, an automated system may, for example, rely on criteria defined by corporate policies, departmental policies, and/or user preferences to determine the character of permissions and/or content delivered to various parties (corporation groups and/or individuals) within corporation 700. Such a system may, for example, automatically produce redistribution permissions for a departmental content repository 704 in response to corporation 700 receiving distribution permissions from creator 102, and/or produce usage permissions for user 112j and/or user 112k.

The departmental repository 704 may automatically produce usage permissions for user 112g, user 112h, and/or user 112i. Such users may access content from the corporate content repository 702, yet receive usage permissions from departmental repository 704. In this case, user 112g, user 112h, and/or user 112i may receive usage permissions from departmental

repository 704 that incorporate departmental restrictions in addition to restrictions imposed by senior control information (in this example, from creator 102, as may be modified by corporate repository 702, as may be further modified by departmental repository 704, that reflect a VDE extended agreement incorporating commercial requirements of creator 102 and corporation 700 in addition to corporate and/or departmental policies and agreements with corporate personnel of corporation 700).

Example—"Virtual Silicon Container"

As discussed above, VDE in one example provides a "virtual silicon container" ("virtual black box") in that several different instances of SPU 500 may securely communicate together to provide an overall secure hardware environment that "virtually" exists at multiple locations and multiple electronic appliances 600. Figure 87 shows one model 3600 of a virtual silicon container. This virtual container model 3600 includes a content creator 102, a content distributor 106, one or more content redistributors 106a, one or more client administrators 700, one or more client users 3602, and one or more clearinghouses 116. Each of these various VDE participants has an electronic appliance 600 including a protected processing environment 655 that may comprise, at least in part, a silicon-based semiconductor hardware element secure processing unit

500. The various SPUs 500 each encapsulate a part of the virtual distribution environment, and thus, together form the virtual silicon container 3600.

Example -- Testing/Examinations

A scheduled SAT examination for high school seniors is prepared by the Educational Testing Service. The examination is placed in a VDE container for scheduled release on November 15, 1994 at 1:00 PM Eastern Standard time. The SAT prepares one copy of the container for each school or other location which will conduct the examination. The school or other location ("test site") will be provided with a distributed examination container securely containing the VDE identification for the "administration" electronic appliance and/or test administrator at the test site (such as, a testing organization) and a budget enabling, for example, the creation of 200 test VDE content containers. Each container created at the test site may have a permissions record containing secure identification information for each electronic appliance 600, on the test site's network, that will be used by a test taker, as well as, for example, an identification for the student who will take the test. The student identification could, for example, be in the form of a secure PIN password which is entered by the student prior to taking the test (a test monitor or administrator might verify the student

identification by entering in a PIN password). Of course, identification might take the firm of automated voice recognition, handwriting recognition (signature recognition), fingerprint information, eye recognition, or similar one or more recognition forms which may be used either to confirm the identity of the test taker (and/or test monitor/administrator) and/or may be stored with the test results in a VDE container or the like or in a location pointed to by certain container information. This identification may be stored in encrypted or unencrypted form. If stored in encrypted or otherwise protected form, certain summary information, such as error correction information, may be stored with the identification information to authenticate the associated test as corresponding to the identification.

As the student takes the test using the computer terminal, the answers selected may be immediately securely stored (but may be changed by the student during the test session). Upon the completion of the test, the student's answers, along with a reference to the test, are securely stored in a VDE reporting object which is passed along to the network to the test administrator and the administration electronic appliance 600. All test objects for all students could then be placed in a VDE object 300 for communication to the Educational Testing Service, along with whatever other relevant information (which may also be secured by VDE 100), including summary information giving

average and mean scores, and other information that might be desirable to summarize and/or act as an authentication of the test objects sent. For example, certain information might be sent separately from each student summary object containing information which helps validate the object as an "authentic" test object.

Applying VDE to testing scenarios would largely eliminate cheating resulting from access to tests prior to testing (normally the tests are stolen from a teacher or test administrator). At ETS, individuals who have access to tests could be limited to only a portion of the test to eliminate the risk of the theft of a "whole" test. Employing VDE would also ensure against processing errors or other manipulation of test answers, since absolutely authentic test results can be archived for a reasonable period of time.

Overall, employing VDE 100 for electronic testing will enable the benefits of electronic testing to be provided without the substantial risks associated with electronic storing, communicating, and processing of test materials and testing results. Electronic testing will provide enormous efficiency improvements, significantly lowering the cost of conducting and processing tests by eliminating printing, shipping, handling, and human processing of tests. At the same time, electronic testing

will allow users to receive a copy (encrypted or unencrypted) of their test results when they leave the test sessions. This will help protect the tested individual against lost of, or improperly processed, test results. Electronic testing employing VDE 100 may also ensure that timing related variables of testing (for example precise starting, duration, and stopping times) can be reliably managed. And, of course, proper use of VDE 100 for the testing process can prevent improper access to test contents prior to testing and ensure that test taking is properly audited and authenticated, that is which person took which test, at which time, on which electronic appliance, at which location. Retesting due to lost, stolen, improperly timed, or other variables can be avoided or eliminated.

VDE assisted testing may, of course, be employed for many different applications including secure identification of individuals for security/authentication purposes, for employment (e.g. applying for jobs) applications, and for a full range of evaluation testing. For example, an airline pilot, or a truck, train, or bus driver might take a test immediately prior to departure or during travel, with the test evaluating alertness to test for fatigue, drug use, etc. A certain test may have a different order and/or combination of test activities each time, or each group of times, the test is taken. The test or a master test might be stored in a VDE container (the order of, and which, test

questions might be determined by a process executed securely within an PPE 650). The test responses may be encrypted as they occur and either locally stored for aggregated (or other test result) transmission or dynamically transmitted (for example, to a central test administration computer). If the test taker "flunks" the test, perhaps he or she is then prevented from operating the vehicle, either by a local PPE 650 issuing control instructions to that effect on some portion of the vehicle's electronic control system or a local PPE failing to decrypt or otherwise provide certain key information required for vehicle operation.

Example -- Appliance Rental

Through use of the present invention, electronic appliances can be "leased" or otherwise provided to customers who, rather than purchasing a given appliance for unlimited usage, may acquire the appliance (such as a VCR, television, microwave oven, etc.) and be charged according to one or more aspects of use. For example, the charge for a microwave might be for each time it is used to prepare an item and/or for the duration of time used. A telephone jack could be attached, either consistently or periodically, to an inexpensive modem operatively attached or within the microwave (the modem might alternatively be located at a location which services a plurality of items and/or functions -- such as burglar alarm, light and/or heat control). Alternatively,

such appliances may make use of a network formed by the power cables in a building to transmit and receive signals.

At a periodic interval, usage information (in summary form and/or detailed) could be automatically sent to a remote information utility that collects information on appliance usage (the utility might service a certain brand, a certain type of appliance, and/or a collection of brands and/or types). The usage information would be sent in VDE form (e.g. as a VDE object 300). The information utility might then distribute information to financial clearinghouse(s) if it did not itself perform the billing function, or the information "belonging" to each appliance manufacturer and/or lessor (retailer) might be sent to them or to their agents. In this way a new industry would be enabled of leased usage of appliances where the leases might be analogous to car leasing.

With VDE installed, appliances could also be managed by secure identification (PIN, voice or signature recognition, etc.). This might be required each time a unit is used, or on some periodic basis. Failure to use the secure identification or use it on a timely basis could disable an appliance if a PPE 650 issued one or more instructions (or failed to decrypt or otherwise provide certain information critical to appliance operation) that prevented use of a portion or all of the appliance's functions.

This feature would greatly reduce the desirability of stealing an electronic appliance. A further, allied use of VDE is the "registration" of a VDE secure subsystem in a given appliance with a VDE secure subsystem at some control location in a home or business. This control location might also be responsible for VDE remote communications and/or centralized administration (including, for example, restricting your children from viewing R rated movies either on television or videocassettes through the recognition of data indicating that a given movie, song, channel, game, etc. was R rated and allowing a parent to restrict viewing or listening). Such a control location may, for example, also gather information on consumption of water, gas, electricity, telephone usage, etc. (either through use of PPEs 650 integrated in control means for measuring and/or controlling such consumption, or through one or more signals generated by non-VDE systems and delivered to a VDE secure subsystem, for example, for processing, usage control (e.g. usage limiting), and/or billing), transmit such information to one or more utilities, pay for such consumption using VDE secured electronic currency and/or credit, etc.

In addition, one or more budgets for usage could be managed by VDE which would prevent improper, excessive use of a certain, leased appliance, that might, for example lead to failure of the appliance, such as making far more copies using a

photocopier than specified by the duty cycle. Such improper use could result in a message, for example on a display panel or television screen, or in the form of a communication from a central clearinghouse, that the user should upgrade to a more robust model.

While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the appended claims.

WE CLAIM:

1. A method for secure content delivery including:

a) encapsulating digital information within one or more digital containers;

b) encrypting at least one portion of said digital information;

c) associating at least partially secure control information for managing interaction with said encrypted digital information and/or the digital container;

d) delivering one or more of said one or more digital containers to a digital information user;

e) employing a protected processing environment for securely controlling decryption of at least a portion of said digital information.

2. A system for secure content delivery including:

encrypting means for encrypting at least one portion of digital information;

container processing means for encapsulating digital information within one or more digital containers and for associating at least partially secure control information for managing interaction with said encrypted digital information;

delivery means for delivering one or more of said one or more digital containers to a digital information user; and

at least one protected processing environment for securely controlling decryption of at least a portion of said digital information.

3. A method for secure digital information delivery characterized by the steps of: (a) encrypting at least a portion of said digital information through the use of a first at least one VDE node, (b) creating and encrypting, through the use of said first at least one VDE node, control information to control use of at least a portion of said digital information by plural, users, (c) securely providing said control information to said plural users, and (d) employing at least one VDE node different from said first at least one VDE node to process at least portions of said control information and to control use of said encrypted digital information by said users.

4. A system for secure digital information delivery characterized by:

a first at least one VDE node for encrypting at least a portion of said digital information,

means for creating and encrypting, through the use of said first at least one VDE node, control information to control use of at least a portion of said digital information by plural, users,

means for securely providing said control information to said plural users, and

at least one VDE node different from said first at least one VDE node for processing at least portions of said control information and to control use of said encrypted digital information by said users.

5. A method for secure content delivery wherein at least partially encrypted content is encapsulated within at least one digital container and the digital container is delivered to a digital information user, the method characterized by the steps of:

associating, with the encapsulated content and/or the digital container, at least partially secure control information for managing interaction with the container and/or the content; and

employing a protected processing environment for securely controlling decryption of at least a portion of the encrypted content based at least in part on the control information.

6. A system for secure content delivery wherein at least partially encrypted content is encapsulated within at least one digital container and the digital container is delivered to a digital information user, the system characterized by:

a data structure that associates, with the encapsulated content and/or the digital container, at least partially secure

control information for managing interaction with the information; and

a protected processing environment for securely controlling decryption of at least a portion of the encrypted content based at least in part on the control information.

7. A method for secure digital information delivery characterized by the steps of: (a) encrypting at least a portion of said digital information, (b) associating protected control information to at least a portion of said digital information, and c) providing at least a portion of said encrypted digital information to a first user and at least in part controlling use of at least a portion of said encrypted digital information through the use of at least a portion of said protected control information, wherein said first user further provides at least one of (a) a copy of said at least a portion of said encrypted digital information , or (b) said encrypted digital information, to a second user, and wherein said second user associates further control information with said encrypted digital information for use in controlling use of said encrypted digital information by a third user.

8. A system for secure digital information delivery characterized by:

means for encrypting at least a portion of said digital information,

means for associating protected control information to at least a portion of said digital information,

means for providing at least a portion of said encrypted digital information to a first user

means for at least in part controlling use of at least a portion of said encrypted digital information through the use of at least a portion of said protected control information,

means for allowing the first user to provide at least one of (a) a copy of said at least a portion of said encrypted digital information, or (b) said encrypted digital information, to a second user, and

means for allowing said second user to associate further control information with said encrypted digital information for use in controlling use of said encrypted digital information by a third user.

9. A method for secure digital transaction management including:

a) encrypting digital information at a first location;

b) enabling a first party to securely associate at least one control with said information for use in ensuring at least one consequence of use of said information;

c) enabling one or more additional parties to securely associate at least one further control with said

information for use in ensuring at least one consequence of use of said information;

d) distributing at least a portion of said information to a party other than the first and additional parties at a location different from the locations of the first and additional locations; and

f) decrypting at least a portion of said information at said third location, and ensuring said consequences of use of said information.

10. A system for secure digital transaction management including interconnected structures for performing the following functions:

a) encrypting digital information;

b) enabling a first party to securely associate at least one control with said information for use in ensuring at least one consequence of use of said information;

c) enabling one or more additional parties to securely associate at least one further control with said information for use in ensuring at least one additional consequence of use of said information;

d) distributing at least a portion of said information to a further party; and

e) decrypting at least a portion of said information; and

f) securely ensuring said consequences.

11. A system for secure digital transaction management wherein digital information is encrypted by a first party at a first location and distributed, characterized by:

a first protected processing environment for enabling the first party to securely associate at least a first control with said information,

a further protected processing environment for enabling the further party to securely associate at least a further control with said information, and

a still further protected processing environment for decrypting at least a portion of said information while controlling at least one consequence of use of the information based at least in part on the first and further controls.

12. A method for secure digital transaction management wherein digital information is encrypted by a first party at a first location and distributed, characterized by the following steps:

enabling the first party to securely associate at least a first control with said information,

enabling a further party to securely associate at least a further control with said information, and

transmitting the first and further controls; and

decrypting at least a portion of said information while controlling at least one consequence at least in part on the transmitted controls.

13. A method for securely automating distributed electronic processes including:

a) providing secure, interoperable, general purpose rights management processing means to multiple, parties;

b) establishing secure process management controls for automatically, at least partially remotely, and securely supporting requirements related to electronic events;

c) securely distributing process management controls to party sites;

d) securely maintaining at least a portion of said process management controls under the control of party processing means at said party sites;

e) automatically managing electronic processes at said party sites to enforce interests related to said electronic content.

14. A system for securely automating distributed electronic processes including:

interoperable rights management processing means disposed at multiple parties' sites;

control establishing means for establishing secure process management controls; for remotely, automatically, and securely supporting requirements related to electronic events; and for

securely distributing process management controls to party sites;

security means for securely maintaining at least a portion of said process management controls under the control of processing means at said party sites; and

managing means for automatically managing electronic processes at plural party sites to enforce interests related to said electronic events.

15. A method for automating distributed electronic processes using interoperable processors at multiple sites, characterized by the following steps:

securely distributing, to the processors, process management controls for automatically, and securely supporting requirements related to electronic events;

securely maintaining at least a portion of said process management controls under the control of the processors; and

automatically managing, in a distributed manner with the processors, electronic processes at the multiple sites to enforce interests related to electronic events.

16. A system for automating distributed electronic processes using interoperable processors at multiple sites, characterized by the following:

distributing means connected to the processors for securely distributing, to the processors, process management controls for remotely, automatically, and securely supporting requirements related to electronic events;

process control means for securely maintaining at least a portion of said process management controls under the control of the processors; and

management means for automatically managing, in a distributed manner with the processors, electronic processes at the multiple sites to enforce the interests related to the electronic events.

17. A method of securely enforcing a rights seniority system characterized by the steps of:

allowing a first user to create at least one control over electronic content; and

allowing a second user to contribute at least one further control over electronic content and/or alter the control in place, the second control being subject to the first control.

18. A system for securely enforcing a rights seniority system characterized by:

a first secure environment for allowing a first user to contribute at least one control over electronic content; and

a second secure environment for allowing a second user to contribute at least one further control over electronic content and/or alter the control in place, the second control being subject to the first control.

19. A method of securely enforcing a rights seniority system characterized by the step of allowing a first user to create at least one electronic control that at least in part dictates the rights a second user has to create further electronic controls over the use of and/or access to electronic content.

20. A system for securely enforcing a rights seniority system characterized by at least one means for allowing a first user to create at least one electronic control that at least in part dictates the rights a second user has to create further electronic controls over the use of and/or access to electronic content.

21. A method for employing protected processing environments including:

a) distributing interoperable protected processing environments to plural parties;

b) providing a first interoperable protected processing environment for use by a first party to enable said party to (a) encrypt digital information, and (b)

create control information for managing at least one aspect of use of said digital information;

c) encrypting said digital information in response to one or more instructions from said first party;

d) making said digital information available to a second party;

e) through the use of a second interoperable protected processing environment, satisfying requirements enforced by said control information and allowing said second party to use at least a portion of said digital information;

f) through the use of said second interoperable protected processing environment securely reporting information reflecting at least one aspect of said second party use of said digital information.

22. A system for employing protected processing environments including:

interoperable protected processing environments distributed to plural parties, including a first interoperable protected processing environment for use by a first party to enable said party to (a) encrypt digital information, and (b) create control information for managing at least one aspect of use of said digital information, and further including a second interoperable protected processing environment;

means for encrypting said digital information in response to one or more instructions from said first party, and for making said digital information available to a second party;

means for a second interoperable protected processing environment to satisfy requirements enforced by said control information and to allow said second party to use at least a portion of said digital information; and to securely report information reflecting at least one aspect of said second party's use of said digital information.

23. A method for employing protected processing environments distributed to plural parties characterized by the following steps:

using a first protected processing environment to encrypt digital information, and control information specifying requirements for managing at least one aspect of use of said digital information;

using a second protected processing environment interoperable with the first protected processing environment to enforce the requirement specified by said control information and conditionally allowing use of at least a portion of said digital information; and

using the second protected processing environment to report information reflecting at least one aspect of use of said digital information.

24. A system for employing protected processing environments distributed to plural parties characterized by:

a first protected processing environment to encrypt digital information, and for handling control information specifying requirements for managing at least one aspect of use of said digital information;

a second protected processing environment interoperable with the first protected processing environment for enforcing at least one requirement specified by said control information and conditionally allowing use of at least a portion of said digital information; and for reporting information reflecting at least one aspect of use of said digital information.

25. A secure network architecture comprising multiple cooperating interconnected nodes having protected processing environments, at least a portion of said nodes being able to intercommunicate, characterized in that VDE-protected information can be moved from a source node to a destination node and processed at least in part by the destination node.

26. In a secure network architecture comprising multiple cooperating interconnected nodes having protected processing environments, the nodes being able to intercommunicate, a method comprising the step of moving VDE-protected

information from a source node to a destination node and processed at least in part by the destination node.

27. A secure local area network topology comprising multiple cooperating interconnected nodes, characterized in that at least some of the nodes comprise network workstations with software defining protected processing environments, and at least one of the nodes comprises a secure database server that provides information in protected form for processing by the network workstation protected processing environments.

28. In a secure local area network topology comprising multiple cooperating interconnected nodes, a method characterized by the steps of:

executing, at least in part with network workstations, software defining protected processing environments, and

providing, with a secure database server, information for processing by the network workstation protected processing environments.

29. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that at least one of the plural nodes provides a protected processing environment that performs

a server function for a client comprising at least a portion of the protected processing environment of at least one other node.

30. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by providing, with at least one of the plural nodes, a protected processing environment; and performing, with the protected processing environment, a server function for a client comprising at least a portion of the protected processing environment of at least one other node.

31. A method for securely managing electronic negotiations related to electronic commerce value chain activities including:

a) employing a protected processing environment by a first party to securely specify rules and/or controls for managing an electronic commerce process;

b) securely making said specified rules and/or controls available to a second party;

c) employing a protected processing environment different from said first protected processing environment to further securely specify rules and/or controls for managing at least one commerce process related to the common commercial interests of said first party and said second party;

d) employing said protected processing environment to securely electronically negotiate at least one aggregate rules and/or controls set representing the electronic interests of both said first party and said second party;

e) employing a protected processing environment to manage said electronic commerce process consistent with at least a portion of said aggregate rules and/or controls set.

32. A system for securely managing electronic negotiations related to electronic commerce value chain activities including:

a first party's protected processing environment for securely specifying rules and/or controls for managing an electronic commerce process, and for securely making said specified rules and/or controls available to a second party;

a second party's protected processing environment different from said first party's protected processing environment to further securely specify rules and/or controls including means for managing at least one commerce process related to the common commercial interests of said first party and said second party;

at least one of the first party's and the second party's protected processing environment for securely electronically negotiating at least one aggregate rules and/or controls set

representing the electronic interests of both said first party and said second party; and

at least one of the first party's and the second party's protected processing environment including means for managing said electronic commerce process consistent with said at least a portion of said aggregate rules and/or controls set.

33. A method for securely managing electronic negotiations related to electronic commerce value chain activities through use of first and second protected processing environment characterized by:

using the first environment, securely specifying rules and/or controls for managing an electronic commerce process;

using the second environment, further securely specifying rules and/or controls for managing at least one commerce process related to the commercial interests of a first and a second party;

employing at least one of the first and second protected processing environments to securely electronically negotiate at least one aggregate rules and/or controls set representing the electronic interests of the first party and said second party; and

employing at least one of the first and second protected processing environment to manage said electronic commerce process consistent with at least a portion of said aggregate rules and controls set.

34. A system for securely managing electronic negotiations related to electronic commerce value chain activities through use of first and second protected processing environment characterized by:

the first environment including means for securely specifying rules for managing an electronic commerce process;

the second environment including means for further securely specify rules for managing at least one commerce process related to the commercial interests of first and second parties;

at least one of the first and second protected processing environments including means for securely electronically negotiating at least one aggregate rules set at least partially representing the electronic interests of said first party and said second party; and

at least one of the first and second protected processing environment including means for managing said electronic commerce process consistent with said at least a portion of said aggregate rules set.

35. A method for managing a distributed electronic commerce environment including:

a) establishing a secure, certificate authority for authenticating a user identity for an electronic

commerce participant wherein said identity includes one or more user class parameters;

b) certifying said user identity through the use of one or more certificates enabled by said certificate authority;

c) controlling the use of distributed electronic information based at least in part on class parameter information included in such certified identity.

36. A system for securely managing a distributed electronic commerce environment including:

means for establishing a user identify for an electronic commerce participant wherein said identity includes one or more user class parameters;

a certificate authority for authenticating such user identity by certifying said user identity through the use of one or more certificates enabled by said certificate authority; and

means for controlling the use of distributed electronic information based at least in part on class parameter information included in such certified identity.

37. A method for securely managing a distributed electronic commerce environment to allow interaction with an electronic commerce participant having a user identity that is certified by a certificate authority, characterized by:

establishing a user identity;

certifying the user identity and the user class parameter; and

associating, with the user identity, at least one user class parameter, wherein said certified class parameter, at least in part, is used to control use of distributed electronic information.

38. A system for managing a distributed electronic commerce environment to allow interaction with an electronic commerce participant having a certified user identity, characterized by:

means for associating at least one user class parameter with an established user identity;

means for ascertaining the authenticity of the user identity and/or the user class parameter; and

means for controlling use of distributed electronic information based at least in part on said status.

39. A system as in claim 38 wherein the class parameter represents the user's age, and the controlling means includes means for controlling the use of distributed electronic information based on the user's age.

40. A method of securely establishing user identity through use of certificates, the method characterized by:

presenting an electronic token reflecting at least one user class characteristic;

determining whether an electronic certificate authenticates the user class characteristic reflected by the token; and

using the token as a basis for granting rights.

41. A system for identifying a user through use of certificates, the system characterized by:

means presenting an electronic token reflecting at least one user class characteristic;

means for obtaining an electronic certificate;

means for determining whether the electronic certificate authenticates the user class characteristic reflected by the token; and

means for using the certified, authenticated token as a basis for granting rights.

42. A system for securely managing a distributed electronic commerce environment including:

means for identifying an electronic commerce participant by specifying at least one user category;

means for authenticating such user identity; and

means for controlling the use of distributed electronic information based at least in part on the user category.

43. A method for securely managing a distributed electronic commerce environment to allow interaction with an electronic commerce participant, characterized by:

establishing a user identity and an associated user class parameter; and

using the class parameter to, at least in part, control use of distributed electronic information.

44. A system for managing a distributed electronic commerce environment to allow interaction with an electronic commerce participant, characterized by:

means for associating at least one user class parameter with a user identity;

means for authenticating the user identity and/or the user class parameter; and

means for controlling use of distributed electronic information based at least in part on said status.

45. A system as in claim 44 wherein the class parameter represents the user's age, and the controlling means includes means for controlling the use of distributed electronic information based on the user's age.

46. A method of securely establishing user identity, the method characterized by:

presenting an electronic token reflecting at least one user class characteristic;

determining the user class characteristic reflected by the token is authentic; and

using the token as at least a partial basis for granting rights.

47. A system for securely establishing user identity characterized by:

means presenting an electronic token reflecting at least one user class characteristic;

authenticating the user class characteristic reflected by the token; and

means for using the authenticated token as a basis for granting rights.

48. A method of authenticating a user identity, the method characterized by:

receiving a certificate request and associated user identity; and

issuing an electronic certificate for use in authenticating at least one user class characteristic associated with the user identity for granting rights based on the user class characteristic.

49. A system for authenticating user identity, characterized by:

means for receiving a certificate request and associated user identity; and

means for issuing an electronic certificate for use in authenticating at least one user class characteristic associated with the user identity for granting rights based on the user class characteristic.

50. A method of securely establishing user identity, the method characterized by:

receiving a certificate request; and

issuing an electronic certificate specifying at least one user class characteristic.

51. A system for securely establishing user identity through use of certificates, characterized by:

means for receiving a certificate request and associated user identity; and

means for issuing an electronic certificate specifying at least one user class characteristic.

52. A method or system of managing rights characterized in that a cryptographically signed token is used to certify membership in a class, the token is authenticated, and the class membership represented by the token is used as a basis for granting and/or withholding rights and/or permissions.

53. A method or system of managing rights characterized in that a cryptographically signed token is used to certify membership in a class, the status of such token is ascertained, and the class membership represented by the token is used as a basis for allowing a user presenting the token to create electronic rules.

54. A method or system of managing rights characterized in that a cryptographically signed token is used to certify membership in a class, the token is validated, and the class membership represented by the token is used as a basis for allowing a user presenting the token to exercise rights under electronic rules.

55. A method for enabling a distributed electronic commerce electronic agreement system including:

a) enabling distributed, interoperable secure client protected processing environment nodes;

b) establishing at least one system wide secure communications key;

c) employing public key encryption for communications between plural client nodes;

d) supporting the delivery of electronic control information by individual clients wherein said control information at least in part specifies their respective electronic commerce agreement rights;

e) supporting at least one protected processing environment for determining the respective and/or collective rights of said clients by establishing one or more electronic agreements based at least in part on said secure delivery of electronic control information;

f) employing a secure software container data control structure for ensuring persistent maintenance of the electronic rights of the clients;

g) using secure software containers which provide for data structures that support rules and/or controls corresponding to electronic commerce model agreement enforcement.

56. A distributed electronic agreement system including:

plural distributed, interoperable secure client protected processing environment nodes for supporting delivery of electronic control information by individual clients wherein said

control information at least in part specifies said client's respective electronic commerce model agreement rights, and for employing public key encryption and authentication for communications between said plural client nodes;

means coupled to said nodes for establishing at least one system wide secure communications key; and

at least one protected processing environment for:

(a) determining the respective and/or collective rights of electronic commerce model clients by establishing one or more electronic agreements based at least in part on said secure delivery of electronic control information;

(b) employing a secure software container data control structure for ensuring persistent maintenance of the electronic rights of commerce model clients; and

(c) using secure software containers which provide for data structures that support controls corresponding to electronic commerce model agreement enforcement.

57. A method for enabling a distributed electronic commerce electronic agreement system including distributed, interoperable secure client protected processing environment nodes employing at least one system wide secure communications key, employing public key encryption and authentication for

communications between plural client nodes, and employing an certification authority for establishing client identity, the method characterized by:

supporting the , secure delivery of electronic commerce model agreement rights control information;

determining the respective and/or collective rights of electronic commerce model clients by establishing one or more electronic agreements based at least in part on said secure delivery of the electronic control information;

employing a secure software container data control structure for ensuring remote, persistent maintenance of the electronic rights of commerce model clients; and

using secure software containers which provide for data structures supporting rules and controls corresponding to electronic commerce model agreement enforcement.

58. A distributed electronic commerce electronic agreement system including:

distributed, interoperable secure client protected processing environment nodes employing at least one system wide secure communications key, employing public key encryption and authentication for communications between plural client nodes, employing an certification authority for establishing client identity, and supporting the, secure delivery of electronic commerce model agreement rights control information;

means disposed in at least one node for determining the respective and/or collective rights of electronic commerce model clients by establishing one or more electronic agreements based at least in part on said secure delivery of the electronic control information; and

means disposed in at least one node for employing a secure software container data control structure for ensuring remote, persistent maintenance of the electronic rights of commerce model clients, and for using secure software containers which provide for data structures supporting rules and controls corresponding to electronic commerce model agreement enforcement.

59. A method of securely handling electronic currency characterized by the following steps:

packaging electronic currency within a software container, and

delivering the software container as payment for goods or services.

60. A system for securely handling electronic currency characterized by:

means for packaging electronic currency within a software container, and

means for delivering the software container as payment for goods or services.

61. A method or system for managing rights within an organization characterized in that electronic containers are distributed within the organization, the electronic containers having controls associated therewith, the controls enforcing, at least in part, an organizational hierarchy relating to the use of the containers and/or the contents thereof.

62. A method of organizational rights management characterized by the steps of:

distributing an electronic container within an organization and

restricting usage, access and/or further distribution of the electronic container or the contents thereof within or outside of the organization based on electronic controls associated with the electronic container.

63. A system for organizational rights management characterized by:

means for distributing an electronic container and

means for restricting usage, access and/or further distribution of the electronic container or the contents thereof

within or outside of the organization based on electronic controls associated with the electronic container.

64. A method of organizational rights management characterized by the steps of:

distributing electronic containers within an organization, and

using the electronic containers, at least in part, to administer content usage by persons within the organization.

65. A system for organizational rights management characterized by:

means for distributing electronic containers within an organization, and

means for using the electronic containers, at least in part, to administer content usage by persons within the organization.

66. A method of organizational rights management characterized by the steps of:

distributing electronic containers within an organization, and

using the electronic containers, at least in part, to administer use of money within the organization.

67. A system for organizational rights management characterized by electronic containers distributed within an

organization for, at least in part, administering use of money within the organization.

68. A method of organizational rights management characterized by the steps of:

distributing protected processing environments within an organization, and

using the environments to, at least in part, to administer content usage by persons within the organization.

69. A system for organizational rights management characterized by protected processing environments distributed within an organization, for, at least in part, administering content usage within the organization.

70. A method of organizational rights management characterized by the steps of:

distributing protected processing environments within an organization, and

using the processing environments to, at least in part, to administer use of money by persons within the organization.

71. A system for organizational rights management characterized by plural protected processing environments

distributed within an organization for, at least in part, administering use of money within the organization.

72. A rights management appliance including:

a user input device,

a user display device,

at least one processor, and

at least one element defining a protected processing environment,

characterized in that the protected processing environment stores and uses permissions, methods, keys, programs and/or other information to electronically manage rights.

73. In a rights management appliance including:

a user input device,

a user display device,

at least one processor, and

at least one element defining a protected processing environment,

a method of operating the appliance characterized by the step of storing and using permissions, methods, keys, programs and/or other information to electronically manage rights.

74. A rights management appliance including at least one processor element at least in part defining a protected processing

environment, characterized in that the protected processing environment stores and uses permissions, methods, keys, programs and/or other information to electronically manage rights.

75. In a rights management appliance including at least one processor element at least in part defining a protected processing environment, a method comprising storing and using permissions, methods, keys, programs and/or other information to electronically manage rights.

76. A method of electronically storing information in a repository and distributing it on request, characterized in that the information is protected by associating electronic controls with the information, the electronic controls serving to enforce rights in the information.

77. A system for electronically storing information in a repository and distributing it on request, characterized by means for protecting information by associating electronic controls with the information, and further including means for using the electronic controls to enforce rights in the information.

78. A self-protecting electronic container comprising:

an electronic container structure for containing digital information, and

an electronic protection mechanism that protects or destroys the digital information in the event of tampering.

79. A method for a self-protecting electronic container comprising an electronic container structure for containing digital information, the method characterized by detecting an attempt at tampering and protecting or destroying the digital information in the said attempt.

80. A method of creating a self-protecting container system comprising:

providing at least one property,

providing at least one attribute,

providing at least one cryptographic key,

providing at least one organizational structure relating the key to the property and/or attribute, and

encapsulating the property, the attribute, the cryptographic key and the organizational structure, either explicitly or by reference, into an electronic container structure.

81. A self-protecting container system comprising:

at least one property,

at least one attribute,

at least one cryptographic key, and

at least one organizational structure relating the key to the property and/or attribute.

82. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that each node can perform self-administering processes in response to electronic components.

83. A self-administering electronic component comprising:

at least one method for performing at least a portion of a transaction,

at least one method for generating audit information, and

at least one method for securely receiving and interpreting administrative information.

84. A self-administering electronic component performing the following methods:

at least one method for performing at least a portion of a transaction,

at least one method for generating audit information, and

at least one method for securely receiving and interpreting administrative information.

85. A self-describing electronic component defining at least one parameter and/or function, characterized in that the component includes at least one secure, descriptive portion used to create a human readable interface describing the parameter and/or function.

86. A method for processing a self-describing electronic component defining at least one parameter and/or function, characterized by the step of creating, at least in part with the component, a human readable interface describing the parameter and/or function based at least in part on at least one secure, descriptive portion of the component.

87. A method of performing an electronic transaction comprising:

receiving plural components,

electronically detecting the occurrence of an event,

determining, based on the event, a subset of the plural received components to process the event, and

performing, in response to the event, at least one electronic process based on the component subset.

88. A system for performing an electronic transaction comprising:

means for receiving plural components,

means for electronically detecting the occurrence of an event,

means for determining, based on the event, a subset of the plural received components to process the event, and

means for performing, in response to the event, at least one electronic process based on the component subset.

89. A distributed transaction processing method characterized by the following steps:

receiving a first electronic component at a first location,

receiving a second electronic component at a second location,

electronically detecting occurrence of an event at the first location,

processing, in response to the event detection, a first portion of an electronic transaction at the first location based at least in part on the first electronic component,

securely transmitting at least one signal from the first location to the second location, and

processing at least a second portion of the electronic transaction at the second location based at least in part on the second electronic component.

90. A method as in claim 89 further characterized by:

sending at least one signal from the second location to the first location, and

performing at least a third portion of the electronic transaction at the first location based at least in part on receipt of the signal from the second location.

91. A distributed transaction processing system characterized by:

means at a first location for receiving a first electronic component, for electronically detecting occurrence of an event, for processing, in response to the event detection, a first portion of an electronic transaction at the first location based at least in part on the first electronic component, and for securely transmitting at least one signal from the first location to a second location; and

means at the second location for receiving a second electronic component, and for processing at least a second portion of the electronic transaction based at least in part on the second electronic component.

92. A system as in claim 91 further characterized by:

means at the second location for sending at least one signal from the second location to the first location, and

means at the first location for performing at least a third portion of the electronic transaction at the first location based at least in part on receipt of the signal from the second location.

93. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that each node can perform electronic processes in response to receipt and assembly of electronic components, and the node authenticates each of the electronic components before assembling them.

94. A distributed electronic rights management method comprising:

performing, with at least one protected processing environment, electronic processes in response to receipt and assembly of electronic components, and

authenticating, within the protected processing environment, each of the electronic components before assembling them.

95. A method as in claim 94 wherein the authenticating step includes the step of obtaining a corresponding certificate from a certifying authority.

96. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that each node can perform electronic processes in response to receipt and assembly of electronic components, and the node authenticates each of the electronic components by obtaining a corresponding certificate from a certifying authority.

97. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a certifying authority that issues certificates allowing each node to authenticate electronic components before assembling them to perform and/or control electronic rights management processes.

98. In a distributed electronic rights management system comprising plural nodes each having a protected processing environment, a method characterized by the step of issuing certificates allowing each node to authenticate electronic components before assembling them to perform and/or control electronic rights management processes.

99. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that said nodes enforce usage

and/or access controls and is capable of electronically obtaining compensation from a user and/or other processing of usage information for subsequent transfer to rights holders.

100. In a distributed electronic rights management system comprising plural nodes having a protected processing environment, a method characterized by the step of enforcing usage and/or access controls and electronically obtaining compensation from a user and/or other processing of usage information for subsequent transfer to rights holders.

101. A distributed electronic rights management system comprising plural nodes each having a protected processing environment, characterized in that each node enforces usage and/or access controls based on receipt of information from multiple other nodes.

102. A distributed electronic rights management method characterized by the step of enforcing, with a protected processing environment, usage and/or access controls based on receipt of information from multiple other nodes.

103. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that said nodes are capable of at

least temporarily extending electronic credit to an associated user for use in compensating rights holders.

104. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method of operating the environment characterized by the step of at least temporarily extending electronic credit to an associated user for use in compensating rights holders.

105. A distributed electronic rights management system comprising plural nodes each having a protected processing environment, characterized in that said nodes are capable of requesting and obtaining a user-specific electronic credit assurance from a clearinghouse before granting the user rights to access and/or use electronically protected information.

106. In a distributed electronic rights management system comprising plural nodes each having a protected processing environment, a method characterized by the step of requesting and obtaining a user-specific electronic credit assurance from a clearinghouse before granting the user rights to access and/or use electronically protected information.

107. A distributed electronic rights management system comprising plural nodes each having a protected processing environment, characterized in that each node is capable of performing and/or requesting an electronic debit or credit transaction as a condition to granting the user rights to access and/or use electronically protected information.

108. In a distributed electronic rights management system comprising plural nodes each having a protected processing environment, a method characterized by the step of performing and/or requesting an electronic debit or credit transaction as a condition to granting the user rights to access and/or use electronically protected information.

109. A distributed electronic rights management system comprising plural nodes each having a protected processing environment, characterized in that each node can maintain an audit trail of user activities for reporting to a centralized location, the centralized location analyzing the user activities based on the audit trail.

110. In a distributed electronic rights management system comprising plural nodes each having a protected processing environment, a method characterized by the steps of:

maintaining, a plural locations, audit trails of user activities for reporting to a centralized location, and

analyzing, at the centralized location, the user activities based on the audit trail.

111. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that said node can monitor user activities and trigger the occurrence of unrelated events based on the user activities and/or the electronic controls that associate the user activities with the unrelated events.

112. A system as in claim 111 wherein the unrelated event is activation of an application program.

113. A system as in claim 111 wherein the unrelated event is use of a secure container.

114. A system as in claim 111 wherein the unrelated event is use of the protected processing environment.

115. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of monitoring user activities at said nodes, and triggering the occurrence of

unrelated events based on the user activities and electronic controls that associate the user activities with the unrelated events.

116. A method as in claim 115 wherein the unrelated event is at least one of:

activation of an application program,

use of a secure container, and

use of the protected processing environment.

117. A method of compromising a distributed electronic rights management system comprising plural nodes having protected processing environments, characterized by the following steps:

exposing a certification private key to allow a person to pass a challenge/response protocol,

defeating at least one of (a) an initialization challenge/response security, and/or (b) exposing external communication keys,

creating a processing environment based at least in part on the above-mentioned steps, and

participating in distributed rights management using the processing environment.

118. A processing environment for compromising a distributed electronic rights management system comprising plural nodes having protected processing environments, characterized by the following:

means including an exposed certification private key to pass a challenge/response protocol,

means for defeating at least one of (a) an initialization challenge/response security, and/or (b) exposing external communication keys, and

means for participating in distributed rights management.

119. A method of compromising a distributed electronic rights management system comprising plural nodes having protected processing environments, characterized by the step of compromising the permissions record of an electronic container and using the compromised permissions record to access and/or use electronic information.

120. A system for compromising a distributed electronic rights management system comprising plural nodes having protected processing environments, characterized by means for using a compromised permissions record of an electronic container for accessing and/or using electronic information.

121. A method of tampering with a protected processing environment characterized by the steps of:

discovering at least one system-wide key, and

using the key to obtain access to content and/or administrative information without authorization.

122. An arrangement including means for using at least one compromised system-wide key to decrypt and compromise content and/or administrative information of a protected processing environment without authorization.

123. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that said nodes can electronically fingerprint content before releasing it in unprotected form.

124. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by performing, in at least one of the nodes, the step of electronically fingerprinting content before releasing it in unprotected form.

125. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that said nodes can embed,

within the electronic content, an electronic fingerprint containing specified information identifying a content rights holder and/or an indication of origin before including the content in an electronic container or allowing access to such content.

126. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of embedding, within electronic content, an electronic fingerprint containing specified information, including information identifying a content rights holder and/or an indication of origin before including the content in an electronic container or allowing access to such content.

127. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system includes one or more usage clearinghouses that receive usage information from one or more of the plural nodes.

128. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of receiving, with a usage clearinghouse, usage information from one or more of said plural nodes.

129. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system includes one or more financial clearinghouses that receive financial information relating to the use of or access to content from one or more of nodes.

130. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of receiving, with one or more financial clearinghouses, financial information from one or more of the plural nodes.

131. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system includes one or more analysis clearinghouses that receive information from one or more of the plural nodes and analyzes the received information.

132. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of receiving, with one or more analysis clearinghouses, information from one

or more of the plural nodes and analyzing the received information.

133. A method of processing information pertaining to the use of or access to electronic content wherein such information is received from one or more nodes having protected processing environments.

134. A method of providing credit for interaction with content to a protected processing environment node.

135. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system includes one or more clearinghouses that transmits rights and/or permissioning information to one or more of the plural nodes.

136. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of transmitting rights and/or permissioning information from a clearinghouse to one or more of the plural nodes.

137. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system includes one or more clearinghouses that periodically transmit cryptographic material to one or more of said nodes, the cryptographic material renewing and/or replacing expiring cryptographic material.

138. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the step of periodically transmitting cryptographic material from one or more clearinghouses to one more of said nodes, the cryptographic material renewing and/or replacing expiring cryptographic material.

139. A secure electronic container characterized in that the container contains electronic controls for controlling the use of and/or access to electronic content that is external to the container.

140. A method comprising:

accessing electronic controls within a secure electronic container; and

using the controls for at least in part controlling the use of and/or access to electronic content that is external to the container.

141. A secure electronic container characterized in that the container contains electronic controls for controlling, at least in part, the use of and/or access to distributed electronic content.

142. A method comprising:

accessing electronic controls within a secure electronic container; and

using the controls for controlling, at least in part, the use of and/or access to distributed electronic content.

143. A secure electronic container characterized in that the container contains electronic controls that cause electronic content to expire on a time-dependent basis.

144. A method for processing a secure electronic container including the step of causing, at least in part based on electronic controls within the container, electronic content to expire on a time-dependent basis.

145. A method of metering use of and/or access to electronic information characterized by the step of maintaining a bitmap meter data structure including data partitions that subdivide the metering information by time and/or subject matter.

146. A system for metering use of and/or access to electronic information characterized by means for maintaining a bitmap meter data structure including data partitions that subdivide the metering information by time and/or subject matter.

147. A distributed electronic rights management system comprising plural nodes having protected processing environments, characterized in that the system permits at least some of the nodes to securely describe permitted uses of electronic content and securely enforces said description.

148. In a distributed electronic rights management system comprising plural nodes having protected processing environments, a method characterized by the steps of permitting at least some of the nodes to securely describe permitted uses of electronic content, and securely enforcing said description.

149. A document management system comprising one or more electronic appliances containing one or more secure processing units and one or more secure databases operatively connected to at least one of said secure processing units, said system further including protected usage control information wherein (a) at least a portion of said control information is securely stored within one or more of said secure databases, and (b) at least a portion of said control information governs the production of usage information, at least a portion of which usage information is reported to one or more parties.

150. In a document management system comprising one or more electronic appliances containing one or more secure processing units and one or more secure databases operatively connected to at least one of said secure processing units, a method for processing protected usage control information including the steps of securely storing at least a portion of said control information within one or more of said secure databases, and (b) based at least in part on said control information, governing the production of usage information and the reporting of at least a portion of said usage information to one or more parties.

151. A document management system comprising plural electronic appliances containing protected processing

environments and one or more secure databases operatively connected to at least one of said protected processing environments, said system further including protected usage control information, wherein (a) at least a portion of said control information is securely stored within one or more of said secure databases, and (b) at least a portion of said control information governs the production of usage information and the reporting of at least a portion of said usage information to one or more parties.

152. In a document management system comprising plural electronic appliances containing protected processing environments and one or more secure databases operatively connected to at least one of said protected processing environments, a method of handling usage control information including the steps of (a) securely storing at least a portion of said control information within one or more of said secure databases, and (b) governing, based on at least a portion of said control information, the production of usage information and the reporting of at least a portion of said usage information to one or more parties.

153. An electronic contract system comprising electronic appliances containing one or more secure processing units and one or more secure databases operatively connected to at least

one of the secure processing units, said system furthering including means for enabling plural parties to enter into an electronic arrangement, at least one of said databases containing secure control information for managing at least a portion of a plural party electronic arrangement.

154. In an electronic contract system comprising plural electronic appliances containing one or more secure processing units and one or more secure databases operatively connected to at least one of the secure processing units, a method characterized by the steps of enabling plural parties to enter into to an electronic arrangement, and using secure control information contained by at least one of said databases for managing at least a portion of a plural party electronic arrangement.

155. An electronic appliance arrangement containing at least one secure processing unit and at least one secure database operatively connected to at least one of said secure processing unit(s), said arrangement including means to monitor usage of at least one aspect of appliance usage and control said usage based at least in part upon protected appliance usage control information.

156. In an electronic appliance arrangement containing at least one secure processing unit and at least one secure database operatively connected to at least one of said secure processing unit(s), a method characterized by the steps of monitoring usage of at least one aspect of appliance usage and controlling said usage based at least in part upon protected appliance usage control information.

157. An electronic appliance arrangement containing a protected processing environment and at least one secure database operatively connected to said protected processing environment, said arrangement including means to monitor usage of at least one aspect of an amount of appliance usage and control said usage based at least in part upon protected appliance usage control information processed at least in part through use of said protected processing environment.

158. In an electronic appliance arrangement containing a protected processing environment and at least one secure database operatively connected to said protected processing environment, a method characterized by the steps of monitoring usage of at least one aspect of appliance usage and controlling said usage based at least in part upon protected appliance usage control information processed at least in part through use of said protected processing environment.

159. An electronic appliance arrangement containing one or more CPUs wherein at least one of the CPUs incorporates an integrated secure processing unit, said arrangement storing protected appliance usage control information designed to be securely processed by said integrated secure processing unit.

160. In an electronic appliance arrangement containing one or more CPUs wherein at least one of the CPUs incorporates an integrated secure processing unit, a method including the step of storing and securely processing protected modular component appliance usage control information with said integrated secure processing unit.

161. An electronic appliance arrangement containing at least one first secure processing unit and one or more video controllers where at least one of the video controllers incorporates at least one second secure processing unit, said arrangement storing protected video function control information designed to be securely processed by said incorporated secure processing unit(s).

162. In an electronic appliance arrangement containing at least one first secure processing unit and one or more video controllers where at least one of the video controllers incorporates at least one second secure processing unit, the

method characterized by the step of storing protected video function control information designed to be securely processed by said incorporated secure processing unit(s).

163. An electronic appliance arrangement containing one or more video controllers where at least one of the video controllers incorporates at least one secure processing unit, said arrangement storing protected video function control information designed to be securely processed by said incorporated secure processing unit(s), wherein at least a portion of said video function control information is stored within a secure database operatively connected to at least one of said at least one secure processing units.

164. In an electronic appliance arrangement containing one or more video controllers where at least one of the video controllers incorporates at least one secure processing unit, a method including the steps of storing protected video function control information designed to be securely processed by said incorporated secure processing unit(s), within a database operatively connected to at least one of said at least one secure processing units.

165. An electronic appliance arrangement containing one or more video controllers and at least one secure processing unit,

said arrangement storing component, modular protected video function control information designed to be securely processed by said secure processing unit(s), wherein at least a portion of said video function control information is stored within a secure database operatively connected to at least one of said at least one secure processing unit(s).

166. An electronic appliance arrangement containing one or more video controllers and at least one secure processing unit, a method including the step of storing component, modular protected video function control information designed to be securely processed by said secure processing unit(s), within a secure database operatively connected to at least one of said at least one secure processing unit(s).

167. An electronic appliance arrangement containing at least one secure processing unit and one or more network communications means where at least one of the network communications means incorporates at least one further secure processing unit, said arrangement storing protected networking control information designed to be processed by said incorporated secure processing unit(s).

168. In an electronic appliance arrangement containing at least one secure processing unit and one or more network

communications means, a method characterized by the steps of incorporating, within at least one of the network communications means, at least one further secure processing unit, storing networking control information at least in part within said incorporated secure processing unit(s), and securely processing said protected networking control information with said secure processing unit(s).

169. An electronic appliance arrangement containing one or more modems where at least one of the modems incorporates at least one secure processing unit, said arrangement storing modular, component protected modem control information designed to be securely processed by said incorporated secure processing unit(s).

170. In an electronic appliance arrangement containing one or more modems where at least one of the modems incorporates at least one secure processing unit, a method characterized by the step of storing and securely processing modular, component protected modem control information with said incorporated secure processing unit(s).

171. An electronic appliance arrangement containing at least one secure processing unit and one or more modems where at least one of the modems includes at least one further secure

processing unit, said arrangement storing protected modem control information designed to be securely processed by said included secure processing unit(s).

172. In an electronic appliance arrangement containing at least one secure processing unit and one or more modems where at least one of the modems includes at least one further secure processing unit, a method including the step of storing and securely processing protected modem control information within said included secure processing unit(s).

173. An electronic appliance arrangement containing at least one secure processing unit and one or more CD-ROM devices where at least one of the CD-ROM devices incorporates at least one further secure processing unit, said arrangement storing protected CD-ROM control information designed to be securely processed by said incorporated secure processing unit(s).

174. In an electronic appliance arrangement containing at least one secure processing unit and one or more CD-ROM devices where at least one of the CD-ROM devices incorporates at least one further secure processing unit, a method characterized by the step of storing and securely processing protected CD-ROM

control information within said incorporated secure processing unit(s).

175. An electronic appliance arrangement containing one or more network communications means where at least one of the network communications means incorporates at least one secure processing unit, said arrangement storing modular, component, protected networking control information designed to be securely processed by said incorporated secure processing unit(s).

176. In an electronic appliance arrangement containing one or more network communications means where at least one of the network communications means incorporates at least one secure processing unit, a method characterized by the step of storing and securely processing protected networking control information with said incorporated secure processing unit(s).

177. A set-top controller arrangement containing a protected processing environment and a database operatively connected to said protected processing environment, said arrangement further containing control information for controlling usage of said controller based upon processing of at least a portion of said control information within said protected processing environment, wherein at least a portion of said control information is stored within said database.

178. In a set-top controller arrangement containing a protected processing environment and a database operatively connected to said protected processing environment, a method characterized by the step of: (a) using control information within the set-top controller arrangement for controlling usage of said controller based upon processing of at least a portion of said control information within said protected processing environment, and storing at least a portion of said control information within said database.

179. An electronic game arrangement containing a protected processing environment for controlling the use of electronic games, said arrangement including game usage control information, database means operatively connected to said protected processing environment for, at least in part, storing usage control information for regulating at least some aspect of use of at least a portion of at least one of said games, and traveling objects containing protected electronic game content.

180. In an electronic game arrangement containing a protected processing environment for controlling the use of electronic games, a method including the steps of:

(a) including game usage control information within a database means operatively connected to said protected processing environment; and

(b) regulating, at least in part with the stored usage control information, at least some aspect of use of at least a portion of at least one of said games.

181. A method as in claim 178 further including the step of regulating the use of traveling objects containing protected electronic game content.

182. An electronic game arrangement containing interoperable protected processing environments for controlling the use of interactive games, said arrangement including protected game usage control information, and database means operatively connected to said protected processing environments for, at least in part, storing game usage control information.

183. In an electronic game arrangement containing protected processing environments, a method comprising:

(a) storing, within a secure database means operatively connected to said protected processing environments protected game usage control information; and

(b) controlling the use of interactive games based at least in part on the storing game usage control information.

184. An electronic game arrangement containing interoperable protected processing environments for controlling

the use of games, said arrangement including component, modular, protected game usage control information, wherein at least a portion of said protected control information was provided independently by plural parties securing their respective rights in at least one electronic value chain.

185. In an electronic game arrangement containing interoperable protected processing environments for controlling the use of games, a method including the steps of:

(a) providing at least a portion of component, modular, protected game usage control information independently by plural parties; and

(b) using the control information at least in part to securing respective rights of said plural parties in at least one electronic value chain.

186. An electronic multimedia arrangement containing protected processing environments for controlling the use of multimedia, said arrangement including component, modular multimedia usage control information and database means operatively connected to said protected processing environments for, at least in part, storing multimedia usage control information.

187. In an electronic multimedia arrangement containing protected processing environments for controlling the use of multimedia, a method including the steps of storing multimedia usage control information within a database means operatively connected to said protected processing environments, and using the stored control information to control multimedia.

188. An electronic multimedia arrangement containing a protected processing environment for controlling the use of multimedia, said arrangement including multimedia usage control information, database means operatively connected to said protected processing environment for, at least in part, storing multimedia usage control information, and protected traveling objects containing distributed multimedia electronic content.

189. In an electronic multimedia arrangement containing a protected processing environment, a method characterized by the steps of storing multimedia usage control information within a database means operatively connected to said protected processing environment, and controlling, based at least in part on the stored information, protected traveling objects containing distributed multimedia electronic content.

190. An electronic multimedia arrangement containing interoperable protected processing environments for controlling the use of multimedia, said arrangement including component, modular, protected multimedia usage control information, wherein at least a portion of said protected control information was provided independently by plural parties securing their respective rights in at least one electronic value chain.

191. A system as in claim 188 further including a secure processing unit.

192. In an electronic multimedia arrangement containing protected processing environments, a method comprising providing at least a portion of component, modular, protected multimedia usage control information independently by plural parties securing their respective rights in at least one electronic value chain, and using the usage control information to control the use of multimedia.

193. A method as in claim 190 wherein the using step is performed at least in part within a secure processing unit.

194. An integrated circuit supporting multiple encryption algorithms comprising at least one microprocessor, memory, input/output means, at least one circuit for encrypting and/or

decrypting information and one or more software programs for use with at least one of the microprocessors to perform encryption and/or decryption functions.

195. In a secure integrated circuit supporting multiple encryption algorithms comprising at least one microprocessor, memory, input/output means, and providing a protected processing environment, a method characterized by executing at least a portion of one or more software programs with the microprocessor to perform encryption and/or decryption functions within the integrated circuit.

196. An integrated circuit comprising at least one microprocessor, memory, at least one real time clock, at least one random number generator, at least one circuit for encrypting and/or decrypting information and independently delivered and/or independently deliverable certified software.

197. An integrated circuit comprising at least one microprocessor, memory, input/output means, a tamper resistant barrier and at least a portion of a Rights Operating System.

198. An integrated circuit comprising at least one microprocessor, memory, input/output means, at least one real

time clock, a tamper resistant barrier and means for recording interruption of power to at least one of the real time clocks.

199. A method of distributing information characterized by the steps of compressing information, encrypting the compressed information at the first location, distributing the encrypted information to one or more second locations, using a tamper resistant integrated circuit to first decrypt and then decompress the information.

200. A system for distributing information characterized by:

means for compressing information,

means for encrypting the compressed information at the first location,

means for distributing the encrypted information to one or more second locations, and

means for using a tamper resistant integrated circuit to first decrypt and then decompress the information.

201. A method of securely managing distributed events characterized by the steps of providing secure event processing environments to one or more users, enabling a first user to specify control information for event management through the use of a first secure event processing environment, and managing

the processing of such an event through the use of a second secure event processing environment.

202. A system for securely managing distributed events characterized by:

a first secure event processing environment for enabling a first user to specify control information for event management, and

a second secure event processing environment interoperable with the first event processing environment for managing the processing of such an event.

203. A method for enabling electronic commerce chain of handling and control characterized by the step of a first and a second party independently specifying protected, modular component control information describing requirements related to the operation of an electronic commerce value chain.

204. A system for enabling electronic commerce chain of handling and control characterized by means for permitting a first and a second party to independently specify protected, modular component control information describing requirements related to the operation of an electronic commerce value chain of handling and control, and means for securely enforcing the requirements described by the control information.

205. A method for enabling electronic commerce characterized by the step of a first and a second party independently stipulating control information managing the use of digital information, wherein said first and said second party independently maintain persistent rights enforced by said control information as said digital information moves through a chain of handling and control.

206. A system for enabling electronic commerce including:

means for allowing a first party to stipulate control information managing the use of digital information,

means for allowing a second party to stipulate control information managing the use of the digital information, and

chain of handling and control means for maintaining persistent rights enforced by said control information as said digital information moves from one location and/or process to another.

207. A method for secure maintenance of electronic rights comprising a first step of plural parties in a value chain independently and securely stipulating control information regarding their electronic rights, wherein said control information is used to enforce conditions related to the use of electronic information distributed in software containers.

208. A system for secure maintenance of electronic rights comprising:

means permitting plural parties in a value chain to independently and securely stipulates control information regarding their electronic rights, and

means for using said control information to enforce conditions related to the use of electronic information distributed in software containers.

209. A method for securely controlling the use of protected electronic content including the step of supporting modular separate control information arrangements for managing at least one event related to use of said content such that a user may select between separate control information arrangements for managing such at least one event.

210. A system for securely controlling the use of protected electronic content including modular separate control information arrangements for managing at least one event related to use of said content such that a user may select between separate control information arrangements for managing such at least one event.

211. A method employing separate, modular control structures for managing the use of encrypted digital information

characterized by the step of enabling commercial value chain participants to support plural relationships between two or more of: (1) content event triggering, (2) auditing, and (3) budgeting, control variables.

212. A system for employing separate, modular control structures for managing the use of encrypted digital information characterized by means for enabling commercial value chain participants to support plural relationships between two or more of: (1) content event triggering, (2) auditing, and (3) budgeting, control variables.

213. A method of chain of handling and control enabling a party not directly participating in an electronic value chain to contribute secure control information to enforce at least one control requirement, said method characterized by a first step of a first value chain participant stipulating control information associated with digital information and a second step wherein said not directly participating party independently and securely contributes secure control information for inclusion in an aggregate control information set including said associated control information, said aggregate control information at least in part managing conditions related to the use of at least a portion of said digital information by a second value chain participant.

214. A chain of handling and control system for enabling a party not directly participating in an electronic value chain to contribute secure control information to enforce at least one control requirement, said system characterized by:

means for allowing a first value chain participant to stipulate control information associated with digital information,

means for allowing the not directly participating party to independently and securely contribute secure control information for inclusion in an aggregate control information set including said associated control information,

and means responsive to said aggregate control information for at least in part managing conditions related to the use of at least a portion of said digital information by a second value chain participant.

215. A method of electronic commerce control information management for delegating the administration of certain rights held by a value chain party to a second value chain party characterized by the step of said first party stipulating secure control information describing at least a portion of their rights related to one or more chain of handling and control electronic events wherein said first party provides further control information authorizing said second party to administer some or all of said rights as an agent for said first party.

216. A system for electronic commerce control information management for delegating the administration of certain rights held by a value chain party to a second value chain party characterized by:

means for allowing said first party to stipulate secure control information describing at least a portion of their rights related to one or more chain of handling and control electronic events; and

means for allowing said first party to provide further control information authorizing said second party to administer some or all of said rights as an agent for said first party.

217. A method of governing taxation of commercial events resulting from electronic chain of handling and control characterized by a first step of distributing secure digital information to a user and specifying secure control information controlling at least one condition for use of said digital information and a second step of a government agency securely, independently contributing secure control information for automatically governing tax payments for said commercial events.

218. A system for governing taxation of commercial events resulting from electronic chain of handling and control characterized by:

means for distributing secure digital information to a user;

means for specifying secure control information controlling at least one condition for use of said digital information; and

means for allowing a government agency to securely, independently contribute secure control information for automatically governing tax payments for said commercial events.

219. A method of governing privacy rights related to electronic events characterized by a first step of a first party protecting digital information containing information descriptive of preventing a second party from at least one unauthorized use and a second step of specifying certain control information related to use of at least a portion of said protected digital information, wherein said control information enforces at least one right of said second party related to privacy and/or permitted use(s) of personal and/or proprietary information included in said protected digital information.

220. A system for governing privacy rights related to electronic events characterized by:

means for permitting a first party to protect digital information containing information descriptive of preventing a second party from at least one unauthorized use;

means for specifying certain control information related to use of at least a portion of said protected digital information; and

means for using the control information to enforce at least one right of said second party related to privacy and/or permitted use(s) of personal and/or proprietary information included in said protected digital information.

221. A method of governing privacy rights related to electronic events characterized by a first step of a first party protecting digital information from at least one unauthorized use and stipulating certain control information for establishing conditions for use of said protected information and a second step of a user of said digital information stipulating further control information regulating the reporting of information regarding said user's use of at least a portion of said digital information.

222. A system for governing privacy rights related to electronic events characterized by:

means for allowing a first party to protect digital information from at least one unauthorized use and for stipulating certain control information for establishing conditions for use of said protected information; and

means for allowing a user of said digital information to stipulate further control information regulating the reporting of

information regarding said user's use of at least a portion of said digital information.

223. A secure method for regulating electronic conduct and commerce characterized by a step of distributing interoperable protected processing environments and circulating amongst plural recipients of said protected processing environments software containers containing digital content and related content control information prepared for use by at least a portion of said protected processing environments, wherein said method includes the further step of regulating the use at least some of said digital content based, at least in part, on the secure processing of at least a portion of said control information through the use of at least one protected processing environment.

224. A secure system for regulating electronic conduct and commerce characterized by:

distributed interoperable protected processing environments,

means for circulating, amongst said protected processing environments, software containers containing digital content and related content control information prepared for use by at least a portion of said protected processing environments, and

means within at least some of the protected processing environments for regulating the use at least some of said digital

content based, at least in part, on the secure processing of at least a portion of said control information.

225. A method of electronic commerce networking for enabling a secure electronic retail environment characterized by the step of supplying user certified control information, smart cards, secure processing units, and retailing terminal arrangements networked together using VDE communication techniques and secure software containers.

226. An electronic commerce networking system for enabling a secure electronic retail environment characterized by:

means for networking together smart cards, secure processing units, and retailing terminal arrangements; and

means for making the smart cards, secure processing units, and retailing terminal arrangements interoperable with one another and with VDE communication techniques and secure software containers.

227. A method of enabling electronic commerce appliances for securely administering user rights in commerce activities characterized by the step of providing to users at least a portion of a VDE node contained within a physical device, said device being configured to be compatible with mating connectors in host

systems for supporting secure, interoperable transaction activity between plural parties.

228. A system for securely administering user rights in commerce activities comprising a physical device including at least a portion of a portable VDE node, said device being configured to be compatible with mating connectors in host systems for supporting secure, interoperable transaction activity between plural parties.

229. A method for enabling a programmable, electronic commerce environment characterized by the step of providing to multiple parties secure commerce nodes that securely process separate, modular component billing management methods, budgeting management methods, metering management methods, and related auditing management methods and further characterized by the step of supporting triggering of metering, auditing, billing, and budgeting methods in response to electronic commerce event activities.

230. A programmable, electronic commerce environment characterized by secure commerce nodes each including:

means for securely processing separate, modular component billing management methods, budgeting management

methods, metering management methods, and related auditing management methods, and

means for supporting triggering of metering, auditing, billing, and budgeting methods in response to electronic commerce event activities.

231. An electronic commerce system including modular, standardized control components comprising electronic commerce event control instructions stipulated by commerce participants, and plural electronic appliances containing one or more secure processing units which process at least a portion of such commerce event control instructions, said system further containing one or more databases, operatively connected to at least one of the secure processing units, for at least in part securely storing at least a portion of such control instructions for use by said at least one secure processing unit.

232. In an electronic commerce system including modular, standardized control components comprising electronic commerce event control instructions stipulated by commerce participants, and plural electronic appliances containing one or more secure processing units which process at least a portion of such commerce event control instructions, a method characterized by the step of providing one or more secure databases, operatively connected to at least one of the secure processing units, and at

least in part securely storing, within the secure databases, at least a portion of such control instructions for use by said at least one secure processing unit.

233. A content distribution system comprising plural electronic appliances containing one or more interoperable secure processing units operatively connected to one or more databases for use with at least one of said secure processing units, said one or more databases containing (a) one or more decryption keys for use in decrypting distributed, encrypted digital information, and (b) encrypted audit information, said audit information reflecting at least one aspect of use of said distributed digital information

234. A content distribution method comprising:

distributing plural electronic appliances containing one or more interoperable secure processing units

operatively connecting the appliances to one or more databases,

storing within said one or more databases one or more decryption keys,

using the decryption keys for decrypting distributed, encrypted digital information, and

storing within the one or more databases encrypted audit information, said audit information reflecting at least one aspect of use of said distributed digital information.

235. An electronic currency system comprising plural, electronic appliances containing (a) protected processing environments, (b) encrypted electronic currency and related secure control information configured so as to be useable by at least one of said protected processing environments, and (c) usage reporting means for securely communicating electronic currency usage related information from a first interoperable protected processing environment to a second interoperable protected processing environment.

236. An electronic currency method comprising:

distributing plural, electronic appliances containing (a) protected processing environments, (b) encrypted electronic currency and related secure control information configured so as to be useable by at least one of said protected processing environments, and

securely communicating electronic currency usage related information from a first interoperable protected processing environment to a second interoperable protected processing environment.

237. A method for electronic financial activities characterized by the steps of:

communicating digital containers containing financial information from a first interoperable secure node to a second interoperable secure node,

communicating modular, standard control information to said second secure node to, at least in part, set the conditions for use of at least a portion of said financial information,

reporting information related to said use to said first interoperable secure node.

238. A system for electronic financial activities characterized by:

means for communicating digital containers containing financial information from a first interoperable secure node to a second interoperable secure node,

means for communicating modular, standard control information to said second secure node,

means at the second node for, at least in part, setting the conditions for use of at least a portion of said financial information, and

means for reporting information related to said use from the second secure node to said first interoperable secure node.

239. A method for electronic currency management including:

communicating encrypted electronic currency from a first, interoperable secure user node to a second interoperable user node using at least one secure container, and

providing secure control information for use with said at least one secure container, said secure control information, at least in part, maintaining conditionally anonymous currency usage information.

240. A system for electronic currency management including:

means for communicating encrypted electronic currency from a first, interoperable secure user node to a second interoperable user node using at least one secure container, and

means for providing secure control information for use with said at least one secure container, said secure control information, at least in part, maintaining conditionally anonymous currency usage information.

241. A method for electronic financial activities management characterized by the steps of:

securely communicating from a first secure node to a second secure node financial information standardized control information for controlling the use of financial information used in a financial value chain,

securely communicating from said first secure node to a third secure node said financial information standardized control information for controlling the use of financial information used in a financial value chain,

securely communicating encrypted financial information from said second secure node to said third secure node, including communicating secure control information,

processing said financial information at said third node at least in part through the use of secure control information supplied by said first and said second secure nodes, wherein said standardized control information is at least in part stored in a secure database contained within said third secure node.

242. A system for electronic financial activities management characterized by the steps of:

means coupled to a first and a second secure node for securely communicating from said first secure node to said second secure node financial information standardized control information for controlling the use of financial information used in a financial value chain,

means coupled between the first secure node and a third secure node for securely communicating from said first secure node to said third secure node said financial information standardized control information for controlling the use of financial information used in a financial value chain,

means coupled between the second and third nodes for securely communicating encrypted financial information from said second secure node to said third secure node, including communicating secure control information, and

means at the third node for processing said financial information at said third node at least in part through the use of secure control information supplied by said first and said second secure nodes, and

a secure database at the third node for at least in part storing said standardized control information.

243. A method of information management characterized by the steps of creating at least one smart object at a first location, protecting at least a portion of said smart object including protecting at least one rule and/or control assigned to said smart object, distributing said at least one smart object to at least one second location, securely processing at least a portion of the contents of said at least one smart object at said at least one second location in accordance with at least a portion of at least one said rule and/or control assigned to said smart object.

244. An information management system characterized by:

means for creating at least one smart object at a first location,

means for protecting at least a portion of said smart object including means for protecting at least one rule and/or control assigned to said smart object,

means for distributing said at least one smart object to at least one second location, and

means for securely processing at least a portion of the contents of said at least one smart object at said at least one second location in accordance with at least a portion of at least one said rule and/or control assigned to said smart object.

245. An object processing system comprising at least one secure object containing at least in part protected executable content and at least one at least in part protected rule and/or control associated with operations related to the execution of such content, and at least one secure execution environment for processing the executable content in accordance with at least a portion of at least one of said at least one associated rule and/or control.

246. An object processing method comprising:

providing at least one secure object containing at least in part protected executable content and at least one at least in part protected rule and/or control associated with operations related to the execution of such content,

processing, within at least one secure execution environment, the executable content in accordance with at least a portion of at least one of said at least one associated rule and/or control.

247. A rights distributed database environment including (a) means allowing one or more central authorities to establish control information for use of encrypted digital information, (b) interoperable database management systems at plural user sites for securely storing control information and audit information, (c) secure communication means for securely communicating control information and audit information between user sites, and (d) centralized database means for compiling and analyzing usage information from plural user sites.

248. Within a rights distributed database environment, a method characterized by the following steps:

establishing control information for use of encrypted digital information,

securely storing, within interoperable database management systems at plural user sites, control information and audit information,

securely communicating control information and audit information between user sites, and

compiling and analyzing usage information from plural user sites.

249. A method of distributed database searching characterized by the steps of creating at least one secure object containing search criteria, transmitting at least one such secure object to one or more second locations to perform database searches in accordance with at least one rule and/or control, processing at least one database search based at least in part on the search criteria within a secure object in accordance with at least a portion of at least one of the said at least one associated rule and/or control, storing database search results in the same and/or one or more new secure objects, and transmitting the secure object containing search results to the first location.

250. A method as in claim 247 further characterized by the additional step of associating at least one additional rule and/or control with the search results for establishing at least one condition related to the use of at least one portion of said search results.

251. A system for distributed database searching characterized by:

means for creating at least one secure object containing search criteria,

means for transmitting at least one such secure object to one or more second locations to perform database searches in accordance with at least one rule and/or control,

means for processing at least one database search based at least in part on the search criteria within a secure object in accordance with at least a portion of at least one of the said at least one associated rule and/or control,

means for storing database search results in the same and/or one or more new secure objects, and

means for transmitting the secure object containing search results to the first location.

252. A system as in claim 249 further characterized by means for associating at least one additional rule and/or control with the search results for establishing at least one condition related to the use of at least one portion of said search results.

253. A rights management system comprising protected information, at least two protected processing arrangements, and a rights management language that allows the expression of permitted operations and the consequences of performing such operations on at least a portion of the information processed at least in part by at least one of the protected processing arrangements.

254. A rights management method comprising:

providing protected information for processing by at least two protected processing arrangements, and

expressing, in a rights management language, permitted operations and the consequences of performing such operations on at least a portion of the information processed at least in part by at least one of the protected processing arrangements.

255. A method of protecting digital information characterized by the steps of encrypting at least a portion of the information, using a rights management language to describe the conditions related to use of the information, distributing at least a portion of such information and at least a portion of such rights language expressed conditions to one or more recipients, using an electronic appliance arrangement including at least one protected processing arrangement to securely govern at least a portion of the use of such information.

256. A system for protecting digital information characterized by:

means for encrypting at least a portion of the information,

means for using a rights management language to describe the conditions related to use of the information,

means for distributing at least a portion of such information and at least a portion of such rights language expressed conditions to one or more recipients, and

an electronic appliance arrangement including at least one protected processing arrangement for securely governing at least a portion of the use of such information.

257. A distributed digital information management system comprising software components, a rights management language for expressing processing relationships between two or more of the software components, protected processing means for at least a portion of the software components and at least a portion of the rights management expressions, means for protecting content, means for creating software objects that relate protected content to rights management expressions, and means for delivering protected content, rights management expressions, and such software objects from a providing location to a user's location.

258. A distributed digital information management method comprising:

expressing, in a rights management language, processing relationships between two or more of the software components,

processing, within at least one protected environment, at least a portion of the software components and at least a portion of the rights management expressions,

protecting content,

creating software objects that relate protected content to rights management expressions, and

delivering protected content, rights management expressions, and such software objects from a providing location to a user's location.

259. An authentication system comprising at least two electronic appliances, at least two digital certificates reflecting identity information encrypted using different certifying private keys where such certificates are stored in a first electronic appliance, communications means for transmitting and receiving signals between electronic appliances, means for determining compromised and/or expired certifying private keys operatively connected to a second electronic appliance, means for the second electronic appliance to request transmission of one of the digital certificates from the first electronic appliance based at least in part on such determination, and means operatively connected to such second electronic appliance for decrypting such certificate and determining such certificate's validity and/or the validity of identity information.

260. In a system comprising at least two electronic appliances, an authenticating method comprising:

issuing at least two digital certificates reflecting identification information, including the step of encrypting the two certificates using different certifying private keys,

storing the certificates in a first electronic appliance,

transmitting and receiving signals between electronic appliances,

determining compromised and/or expired certifying private keys operatively connected to a second electronic appliance,

requesting, with the second electronic appliance, transmission of one of the digital certificates from the first electronic appliance based at least in part on such determination,

decrypting such certificate with the second electronic appliance, and

determining such certificate's validity and/or the validity of identity information.

261. An authentication system comprising at least two electronic appliances, at least two digital certificates reflecting identify information encrypted using different certifying private keys where such certificates are stored in a first electronic appliance, communications means for transmitting and receiving signals between electronic appliances, means for a second electronic appliance to request transmission of one of the digital certificates from the first electronic appliance wherein the selection of which certificate is requested is based at least in part

on a random or pseudo-random number, means operatively connected to such second electronic appliance for decrypting such certificate and determining such certificate's validity and/or the validity of identity information.

262. In a system comprising at least two electronic appliances, an authenticating method comprising:

issuing at least two digital certificates reflecting identify information, including the step of encrypting the two digital certificates using different certifying private keys,

storing such certificates in a first electronic appliance,

transmitting and receiving signals between electronic appliances,

requesting, with a second electronic appliance, transmission of one of the digital certificates from the first electronic appliance, including the step of selecting a certificate based at least in part on a random or pseudo-random number,

decrypting such certificate with the second electronic appliance; and

determining such certificate's validity and/or the validity of identity information.

263. A method of secure electronic mail characterized by the steps of creating at least one electronic message using an interoperable protected processing environment, encrypting at

least a portion of said at least one message, securely associating one or more sets of control information with one or more messages to set at least one condition for the use of said at least one message, communicating the protected electronic messages to one or more recipients having protected processing environments, securely communicating at least one set of the same or differing control information to each recipient, enabling recipients of both control information and protected messages to use message information at least in part in accordance with the conditions specified by the control information.

264. A system for secure electronic mail including multiple protected processing environments, the system characterized by:

a first protected processing environment for creating at least one electronic message, the first environment including means for encrypting at least a portion of said at least one message, means for securely associating one or more sets of control information with one or more messages to set at least one condition for the use of said at least one message, and means for communicating the protected electronic messages to one or more recipients having interoperable protected processing environments,

means for securely communicating at least one set of the same or differing control information to each recipient, and

means for enabling recipients of both control information and protected messages to use message information at least in part in accordance with the conditions specified by the control information.

265. A method of information management characterized by the steps of protecting content from unauthorized use, securely associating enabling control information with at least a portion of such protected content wherein such enabling control information incorporates information describing how the enabling control information may be redistributed, delivering at least a portion of the protected content to a first user, delivering such enabling control information to such first user, receiving a request to redistribute such enabling control information from such first user, using the description of how enabling control information may be redistributed to create new enabling control information where such new enabling control information may be the same or different than the enabling control information received by such first user, delivering the new enabling control information and/or protected information to a second user.

266. An information management system characterized by:

means for protecting content from unauthorized use,

means for securely associating enabling control information with at least a portion of such protected content, including means for incorporating enabling control information describing how the enabling control information may be redistributed,

means for delivering at least a portion of the protected content to a first user,

means for delivering such enabling control information to such first user,

means for receiving a request to redistribute such enabling control information from such first user,

means for using the description of how enabling control information may be redistributed to create new enabling control information where such new enabling control information may be the same or different than the enabling control information received by such first user, and

means for delivering the new enabling control information and/or protected information to a second user.

267. A method of controlling redistribution of distributed digital information including the steps of encrypting digital information, distributing said encrypted digital information from a first party to a second party, establishing control information regarding the redistribution of at least a portion of said encrypted digital information from said second party to at least one third

party, regulating the redistribution of said at least a portion of said encrypted digital information through the use of a protected processing environment processing said control information.

268. A system for controlling redistribution of distributed digital information including:

means for encrypting digital information,

means for distributing said encrypted digital information from a first party to at least one second party,

means for establishing control information regarding the redistribution of at least a portion of said encrypted digital information from said second party to at least one third party, and

a protected processing environment for processing said control information and for regulating the redistribution of said at least a portion of said encrypted digital information.

269. A method of controlling a robot characterized by the steps of creating instructions for one or more robots, creating a secure container incorporating such instructions, associating control information with such secure container, incorporating at least one secure processing unit into such one or more robots, and performing at least a portion of such instructions in accordance with at least a portion of such control information.

270. A method as in claim 267 further characterized in that such control information includes information describing the conditions under which such instructions may be used and the nature of audit reports required when such instructions are performed.

271. A robot control system characterized by:

means for creating instructions for one or more robots,

means for creating a secure container incorporating such instructions,

means for associating control information with such secure container,

means for incorporating at least one secure processing unit into such one or more robots, and

means for performing at least a portion of such instructions in accordance with at least a portion of such control information.

272. A system as in claim 269 further characterized by means for creating such control information, including means for describing the conditions under which such instructions may be used and the nature of audit reports required when such instructions are performed.

273. A method of detecting fraud in electronic commerce characterized by the steps of creating at least one secure

container, associating control information with such one or more containers including control information requiring that audit information be collected and transmitted to an auditing party, delivering such one or more containers and such control information to at least one user, recording information identifying each container and each such user, receiving audit information, creating a profile of usage based at least in part on such received audit information and/or such control information, detecting cases where certain audit information differs at least in part from such profile of usage.

274. A system for detecting fraud in electronic commerce characterized by

means for creating at least one secure container,

means for associating control information with such one or more containers including control information requiring that audit information be collected and transmitted to an auditing party,

means for delivering such one or more containers and such control information to at least one user,

means for recording information identifying each container and each such user,

means for receiving audit information,

means for creating a profile of usage based at least in part on such received audit information and/or such control information, and

means for detecting cases where certain audit information differs at least in part from such profile of usage.

275. A method of detecting fraud in electronic commerce characterized by the steps of distributing at least in part protected digital information to customers, distributing one or more rights to use at least a portion of such digital information across an electronic network, allowing a customer to use at least a part of said at least in part protected digital information through the use of a protected processing environment and at least one of said one or more distributed rights, detecting unusual usage activity related to use of said digital information.

276. A system for detecting fraud in electronic commerce characterized by

means for distributing at least in part protected digital information to customers,

means for distributing one or more rights to use at least a portion of such digital information across an electronic network,

a protected processing environment for allowing a customer to use at least a part of said at least in part protected

digital information through at least one of said one or more distributed rights, and

means for detecting unusual usage activity related to use of said digital information.

277. A programmable component arrangement comprising a tamper resistant processing environment including a microprocessor, memory, a task manager, memory manager and external interface controller, means for loading arbitrary components at least in part into the memory, means for initiating one or more tasks associated with processing such components, means for certifying the validity, integrity and/or trustedness of such components, means for creating arbitrary components, means for associating arbitrary events with such created components, means for certifying the validity, integrity and/or trustedness of such created components, and means for securely delivering such created components.

278. In a programmable component arrangement comprising a tamper resistant processing environment including a microprocessor, memory, a task manager, memory manager and an external interface controller, a processing method characterized by the following steps:

creating arbitrary components,

associating arbitrary events with such created components,

loading the arbitrary components at least in part into the memory,

initiating one or more tasks associated with processing such loaded components,

certifying the validity, integrity and/or trustedness of such created components, and

securely delivering such created components.

279. A distributed, protected, programmable component arrangement comprising at least two tamper resistant processing environments including a microprocessor, memory, a task manager, memory manager and external interface controller, means for loading arbitrary components at least in part into the memory, means for initiating one or more tasks associated with processing such components, and means for certifying the validity, integrity and/or trustedness of such components, said arrangement further comprising means for creating arbitrary components, means for associating arbitrary events with such created components, means for certifying the validity, integrity and/or trustedness of such created components, means for securely delivering such created components between at least two of said at least two tamper resistant processing environments.

280. In a distributed, protected, programmable component arrangement comprising at least two tamper resistant processing

environments including a microprocessor, memory, a task manager, memory manager and external interface controller, a method comprising

creating arbitrary components,

certifying the validity, integrity and/or trustedness of such components,

loading arbitrary components at least in part into the memory,

initiating one or more tasks associated with processing such components,

associating arbitrary events with such created components, and

securely delivering such created components between at least two of said at least two tamper resistant processing environments.

281. An electronic appliance comprising at least one CPU, memory, at least one system bus, at least one protected processing environment, and at least one of a Rights Operating System or Rights Operating System layer associated with a host operating system.

282. An operating system comprising at least one task manager, at least one memory manager, at least one input/output manager, at least one protected processing environment, means

for detecting events, means for associating events with rights control functions, means for performing rights control functions at least in part within such one or more protected processing environments.

283. In an operating system comprising at least one task manager, at least one memory manager, at least one input/output manager, at least one protected processing environment, an operating method comprising:

detecting events,

associating events with rights control functions, and

performing rights control functions at least in part within such one or more protected processing environments.

284. A method of business automation characterized by the steps of creating one or more secure containers including accounting and/or other administrative information, associating control information with such one or more secure containers including a description of (a) the one or more parties to whom the container may and/or must be delivered and/or (b) the operations that one or more parties may and/or must perform with respect to such accounting and/or other administrative information, delivering one or more of such containers to one or more parties, and enabling the description and/or enforcement of at least a portion of such control information prior, during and/or

subsequent to use of such accounting and/or other administrative information by one or more parties.

285. A method as in claim 282 where such control information further includes at least one requirement that audit information be collected and delivered to one or more auditing parties, and further includes the step of delivering at least a portion of such audit information to one or more parties.

286. A method as in claim 283 where at least a portion of such audit information is automatically processed by at least one of such auditing parties, and further includes the step of transmitting further accounting, administrative and/or audit information to one or more parties that may be the same and/or differ from the one or more parties from whom audit information was received based at least in part on the receipt and/or content of such received audit information.

287. A method as in claim 282 where at least two of such parties are associated with different businesses and/or other organizations and such control information includes information that at least in part describes an accounting, administrative, reporting and/or other audit relationship between such businesses and/or other organizations.

288. A method as in claim 282, 283, 284, or 285 where some or all of such accounting and/or other administrative information is included in such control information.

289. A business automation system characterized by:

means for creating one or more secure containers including accounting and/or other administrative information,

means for associating, with such one or more secure containers, control information including a description of (a) the one or more parties to whom the container may and/or must be delivered and/or (b) the operations that one or more parties may and/or must perform with respect to such accounting and/or other administrative information,

means for delivering one or more of such containers to one or more parties, and

means for enabling the description and/or enforcement of at least a portion of such control information prior, during and/or subsequent to use of such accounting and/or other administrative information by one or more parties.

290. A system as in claim 287 where the associating means further includes means for associating at least one requirement that audit information be collected and delivered to one or more auditing parties, and the delivering means includes

means for delivering at least a portion of such audit information to one or more parties.

291. A system as in claim 288 further including means for automatically processing at least a portion of such audit information, and the system further includes means for transmitting further accounting, administrative and/or audit information to one or more parties that may be the same and/or differ from the one or more parties from whom audit information was received based at least in part on the receipt and/or content of such received audit information.

292. A system as in claim 287 where at least two of such parties are associated with different businesses and/or other organizations and the associating means includes means for generating control information including information that at least in part describes an accounting, administrative, reporting and/or other audit relationship between such businesses and/or other organizations.

293. A system as in claim 286, 287, 288, or 290 where some or all of such accounting and/or other administrative information is included in such control information.

294. A method of distributing content characterized by the steps of creating one or more first secure containers, associating control information with such first containers including information describing the conditions under which some or all of the content of such first containers may be extracted, delivering at least a portion of such first containers and such control information to one or more parties, detecting a request by one or more of such parties to extract some or all of the content of such first containers, determining if such request is permitted in whole or in part by such control information, to the extent permitted by such control information creating one or more second secure containers in accordance with such request and such control information, associating control information with such one or more second secure containers based at least in part on control information associated with such first containers.

295. A system for distributing content characterized by:

means for creating one or more first secure containers,

means for associating control information with such first containers including information describing the conditions under which some or all of the content of such first containers may be extracted,

means for delivering at least a portion of such first containers and such control information to one or more parties,

means for detecting a request by one or more of such parties to extract some or all of the content of such first containers,

means for determining if such request is permitted in whole or in part by such control information, to the extent permitted by such control information creating one or more second secure containers in accordance with such request and such control information, and

means for associating control information with such one or more second secure containers based at least in part on control information associated with such first containers.

296. A method of distributing content characterized by the steps of creating one or more first secure containers, associating control information with such first secure containers including information describing the conditions under which such first secure containers (a) may in whole or in part be embedded into and/or securely associated with one or more second secure containers and/or (b) may allow one or more secure containers to be in whole or in part embedded into and/or securely associated with such first secure containers, delivering at least a portion of such first secure containers and such control information to one or more parties, detecting a request by one or more of such parties or by additional parties to (a) in whole or in part embed into and/or securely associate with such first containers one or

more second containers and/or (b) in whole or in part embed into and/or securely associate with a secure container such first secure containers, determining if such request is permitted by control information, to the extent permitted by control information performing one or more embedding and/or secure association operations, to the extent required by control information and/or requested by one or more of such parties, modifying and/or creating new control information at least in part as a consequence of such one or more embedding and/or secure association operations.

297. A system for distributing content characterized by

means for creating one or more first secure containers,

means for associating control information with such first secure containers including information describing the conditions under which such first secure containers (a) may in whole or in part be embedded into and/or securely associated with one or more second secure containers and/or (b) may allow one or more secure containers to be in whole or in part embedded into and/or securely associated with such first secure containers,

means for delivering at least a portion of such first secure containers and such control information to one or more parties,

means for detecting a request by one or more of such parties to (a) in whole or in part embed into and/or securely associate with such first containers one or more second

containers and/or (b) in whole or in part embed into and/or securely associate with a secure container such first secure containers, and

means for determining if such request is permitted by control information, to the extent permitted by control information performing one or more embedding and/or secure association operations, to the extent required by control information and/or requested by one or more of such parties, modifying and/or creating new control information at least in part as a consequence of such one or more embedding and/or secure association operations.

298. A method of distributing information characterized by the steps of protecting information from unauthorized use, associating control information with such protected information, delivering at least a portion of such protected information to one or more parties using plural pathways, delivering at least a portion of such control information to one or more parties using the same or different plural pathways, enabling at least one of such parties to make at least some use of such protected information delivered using a first pathway in accordance with control information at least a portion of which is delivered using a second pathway.

299. A method as in claim 296 in which at least one of such pathways of delivering protected information and/or control information is described by such control information.

300. A system for distributing information characterized by:

means for protecting information from unauthorized use,

means for associating control information with such protected information,

means for delivering at least a portion of such protected information to one or more parties using plural pathways,

means for delivering at least a portion of such control information to one or more parties using the same or different plural pathways,

means for enabling at least one of such parties to make at least some use of such protected information delivered using a first pathway in accordance with control information at least a portion of which is delivered using a second pathway.

301. A system as in claim 298 wherein the delivering means includes means for delivering, over at least one of such pathways, protected information and/or control information described by such control information.

302. A method of distributing information characterized by the steps of protecting information from unauthorized use, associating control information with such protected information including information requiring the collection of audit information, enabling one or more parties to receive and/or process audit information, delivering at least a portion of such protected information and such control information to one or more parties, enabling at least some use of such protected information in accordance with at least a portion of such control information that requires the collection of audit information, delivering such audit information to one or more of such enabled auditing parties different from such delivering party or parties.

303. A method as in claim 300 in which at least one of such auditing parties is specified in such control information.

304. A system for distributing information characterized by

means for protecting information from unauthorized use,

means for associating control information with such protected information including information requiring the collection of audit information,

means for enabling one or more parties to receive and/or process audit information,

means for delivering at least a portion of such protected information and such control information to one or more parties,

means for enabling at least some use of such protected information in accordance with at least a portion of such control information that requires the collection of audit information, and

means for delivering such audit information to one or more of such enabled auditing parties different from such delivering party or parties.

305. A system as in claim 302 in which at least one of such auditing parties is specified in such control information.

306. A secure component-based operating process including:

(a) retrieving at least one component;

(b) retrieving a record that specifies a component assembly;

(c) checking said component and/or said record for validity;

(d) using said component to form said component assembly in accordance with said record; and

(e) performing a process based at least in part on said component assembly.

307. A process as in claim 304 wherein said step (c) further comprises executing said component assembly.

308. A process as in claim 304 wherein said component comprises executable code.

309. A process as in claim 304 wherein said component comprises a load module.

310. A process as in claim 304 wherein:

said record comprises:

(i) directions for assembling said component assembly; and

(ii) information that at least in part specifies a control; and

said process further comprises controlling said step (d) and/or said step (e) based at least in part on said control.

311. A process as in claim 304 wherein said component has a security wrapper, and said controlling step comprises selectively opening said security wrapper based at least in part on said control.

312. A process as in claim 304 wherein:

said permissions record includes at least one decryption key; and

said controlling step includes controlling use of said decryption key.

313. A process as in claim 304 including performing at least two of said steps (a) and (e) within a protected processing environment.

314. A process as in claim 304 including performing at least two of said steps (a) and (e) at least in part within tamper-resistant hardware.

315. A method as in claim 304 wherein said performing step (e) includes metering usage.

316. A method as in claim 304 wherein said performing step (e) includes auditing usage.

317. A method as in claim 304 wherein said performing step (e) includes budgeting usage.

318. A secure component operating system process including:

receiving a component;

receiving directions specifying use of said component to form a component assembly;

authenticating said received component and/or said directions;

forming, using said component, said component assembly based at least in part on said received directions; and

using said component assembly to perform at least one operation.

319. A method comprising performing the following steps within a secure operating system environment:

providing code;

providing directions specifying assembly of said code into an executable program;

checking said received code and/or said assembly directors for validity; and

in response to occurrence of an event, assembling said code in accordance with said received assembly directions to form an assembly for execution.

320. A method for managing at least one resource with a secure operating environment, said method comprising:

securely receiving a first control from a first entity external to said operating environment;

securely receiving a second control from a second entity external to said operating environment, said second entity being different from said first entity;

securely processing, using at least one resource, a data item associated with said first and second controls; and

securely applying said first and second controls to manage said resource for use with said data item.

321. A method for securely managing at least one operation on a data item performed at least in part by an electronic arrangement, said method comprising:

(a) securely delivering a first procedure to said electronic arrangement;

(b) securely delivering, to said electronic arrangement, a second procedure separable or separate from said first procedure;

(c) performing at least one operation on said data item, including using said first and second procedures in combination to at least in part securely manage said operation; and

(d) securely conditioning at least one aspect of use of said data item based on said delivering steps (a) and (b) having occurred.

322. A method as in claim 319 including performing said delivering step (b) at a time different from the time said delivering step (a) is performed.

323. A method as in claim 319 wherein said step (a) includes delivering said first procedure from a first source, and said step (b) includes delivering said second procedure from a second source different from said first source.

324. A method as in claim 319 further including ensuring the integrity of said first and second procedures.

325. A method as in claim 319 further including validating each of said first and second procedures.

326. A method as in claim 319 further including authenticating each of said first and second procedures.

327. A method as in claim 319 wherein said using step (c) includes executing at least one of said first and second procedures within a tamper-resistant environment.

328. A method as in claim 319 wherein said step (c) includes the step of controlling said data item with at least one of said first and second procedures.

329. A method as in claim 319 further including establishing a relationship between at least one of said first and second procedures and said data item.

330. A method as in claim 319 further including establishing correspondence between said data item and at least one of said first and second procedures.

331. A method as in claim 319 wherein said delivering step (b) comprises delivering at least one load module encrypted at least in part.

332. A method as in claim 329 wherein said delivering step (a) comprises delivering at least one further load module encrypted at least in part.

333. A method as in claim 319 wherein said delivering step (b) comprises delivering at least one content container carrying at least in part secure control information.

334. A method as in claim 319 wherein said delivering step (b) comprises delivering a control method and at least one further method.

335. A method as in claim 319 wherein said delivering step (a) includes:

encrypting at least a portion of said first procedure,

communicating said at least in part encrypted first procedure to said electronic arrangement,

decrypting at least a portion of said first procedure at least in part using said electronic arrangement, and

validating said first procedure with said electronic arrangement.

336. A method as in claim 319 wherein said delivering step (b) includes delivering at least one of said first and second procedures within an administrative object.

337. A method as in claim 319 wherein said delivering step (b) includes codelivering said second procedure in at least in part encrypted form with said data item.

338. A method as in claim 319 wherein said performing step includes metering usage.

339. A method as in claim 319 wherein said performing step includes auditing usage.

340. A method as in claim 319 wherein said performing step includes budgeting usage.

341. A method for securely managing at least one operation performed at least in part by a secure electronic appliance, comprising:

(a) selecting an item that is protected with respect to at least one operation;

(b) securely independently delivering plural separate procedures to said electronic appliance;

(c) using said plural separate procedures in combination to at least in part securely manage said operation with respect to said selected item; and

(d) conditioning successful completion of said operation on said delivering step (b) having occurred.

342. A method for processing based on deliverables comprising:

securely delivering a first piece of code defining a first part of a process;

separately, securely delivering a second piece of code defining a second part of said process;

ensuring the integrity of the first and second delivered pieces of code; and

performing said process based at least in part on said first and second delivered code pieces.

343. A method as in claim 340 wherein a first piece of code for said process at least in part controls decrypting content.

344. A method as in claim 340 wherein said ensuring step includes validating said first and second pieces of code.

345. A method as in claim 340 wherein said ensuring step includes validating said first and second pieces of code relative to one another.

346. A method as in claim 340 wherein said performing step includes metering usage.

347. A method as in claim 340 wherein said performing step includes auditing activities.

348. A method as in claim 340 wherein said performing step includes budgeting usage.

349. A method as in claim 340 wherein said performing step includes electronically processing content based on electronic controls.

350. A method of securely controlling at least one protected operation with respect to a data item comprising:

(a) supplying at least a first control from a first party;

(b) supplying at least a second control from a second party different from said first party;

(c) securely combining said first and second controls to form a set of controls;

(d) securely associating said control set with said data item; and

(e) securely controlling at least one protected operation with respect to said data item based on said control set.

351. A method as in claim 348 wherein said data item is protected.

352. A method as in claim 348 wherein at least one of said plural controls includes a control relating to metering at least one aspect of use of said protected data item.

353. A method as in claim 348 wherein at least one of said plural controls include a control relating to budgeting at least one aspect of use of said protected data item.

354. A secure method for combining data items into a composite data item comprising:

(a) securely providing a first data item having at least a first control associated therewith;

(b) securely providing a second data item having at least a second control associated therewith;

(c) forming a composite of said first and second data items;

(d) securely combining said first and second controls into a composite control set; and

(e) performing at least one operation on said composite of said first and second data items based at least in part on said composite control set.

355. A method as in claim 352 wherein said combining step includes preserving each of said first and second controls in said composite set.

356. A method as in claim 352 wherein said performing step comprises governing the operation on said composite of said first and second data items in accordance with said first control and said second control .

357. A method as in claim 352 wherein said providing step includes ensuring the integrity of said association between said first controls and said first data item is maintained during at least one of transmission, storage and processing of said first data item.

358. A method as in claim 352 wherein said providing step comprises delivering said first data item separately from said first control .

359. A method as in claim 352 wherein said providing step comprises codelivering said first data item and said first control .

360. A secure method for controlling a protected operation comprising:

(a) delivering at least a first control and a second control; and

(b) controlling at least one protected operation based at least in part on a combination of said first and second controls, including at least one of the following steps:

resolving at least one conflict between said first and second controls based on a predefined order;

providing an interaction with a user to form said combination; and

dynamically negotiating between said first and second controls.

361. A method as in claim 358 wherein said controlling step (b) includes controlling decryption of electronic content.

362. A method as in claim 358 further including:

receiving protected electronic content from a party; and

authenticating the identity of said party prior to using said received protected electronic content.

363. A secure method comprising:

selecting protected data;

extracting said protected data from an object;

identifying at least one control to manage at least one aspect of use of said extracted data;

placing said extracted data into a further object; and

associating said at least one control with said further object.

364. A method as in claim 361 further including limiting at least one aspect of use of said further object based on said at least one control.

365. A secure method of modifying a protected object comprising:

(a) providing a protected object; and

(b) embedding at least one additional element into said protected object without unprotecting said object.

366. A method as in claim 60 further including:

associating at least one control with said object; and

limiting usage of said element in accordance with said control.

367. A method as in claim 363 further including a permissions record within said object.

368. A method as in claim 364 further including at least in part encrypting said object.

369. A method for managing at least one resource with a secure operating environment, said method comprising:

securely receiving a first load module from a first entity external to said operating environment;

securely receiving a second load module from a second entity external to said operating environment, said second entity being different from said first entity;

securely processing, using at least one resource, a data item associated with said first and second load modules; and

securely applying said first and second load modules to manage said resource for use with said data item.

370. A method for negotiating electronic contracts, comprising:

receiving a first control set from a remote site;

providing a second control set;

performing, within a protected processing environment, an electronic negotiation between said first control set and said

second control set, including providing interaction between said first and second control sets; and

producing a negotiated control set resulting from said interaction between said first and second control sets.

371. A system for supporting electronic commerce including:

means for creating a first secure control set at a first location;

means for creating a second secure control set at a second location;

means for securely communicating said first secure control set from said first location to said second location; and

means at said second location for securely integrating said first and second control sets to produce at least a third control set comprising plural elements together comprising an electronic value chain extended agreement.

372. A system for supporting electronic commerce including:

means for creating a first secure control set at a first location;

means for creating a second secure control set at a second location;

means for securely communicating said first secure control set from said first location to said second location; and

negotiation means at said second location for negotiating an electronic contract through secure execution of at least a portion of said first and second secure control sets.

373. A system as in claim 370 further including means for controlling use by a user of protected information content based on at least a portion of said first and/or second control sets.

374. A system as in claim 370 further including means for charging for at least a part of said content use.

375. A secure component-based operating system including:

component retrieving means for retrieving at least one component;

record retrieving means for retrieving a record that specifies a component assembly;

checking means, operatively coupled to said component retrieving means and said record retrieving means, for checking said component and/or said record for validity;

using means, coupled to said checking means, for using said component to form said component assembly in accordance with said record; and

performing means, coupled to said using means, for performing a process based at least in part on said component assembly.

376. A secure component-based operating system including:

a database manager that retrieves, from a secure database, at least one component and at least one record that specifies a component assembly;

an authenticating manager that checks said component and/or said record for validity;

a channel manager that uses said component to form said component assembly in accordance with said record; and

an execution manager that performs a process based at least in part on said component assembly.

377. A secure component operating system including:

means for receiving a component;

means for receiving directions specifying use of said component to form a component assembly;

means, coupled to said receiving means, for authenticating said received component and/or said directions;

means, coupled to said authenticating means, for forming, using said component, said component assembly based at least in part on said received directions; and

means, coupled to said forming means, for using said component assembly to perform at least one operation.

378. A secure component operating environment including:

a storage device that stores a component and directions specifying use of said component to form a component assembly;

an authenticating manager that authenticates said component and/or said directions;

a channel manager that forms, using said component, said component assembly based at least in part on said directions; and

a channel that executes said component assembly to perform at least one operation.

379. A secure operating system environment comprising:

a storage device that stores code and directions specifying assembly of said code into an executable program;

a validating device that checks said received code and/or said assembly directors for validity; and

an event-driven channel that, in response to occurrence of an event, assembles said code in accordance with said assembly directions to form an assembly for execution.

380. A secure operating environment system for managing at least one resource comprising:

a communications arrangement that securely receives a first control from a first entity external to said operating environment, and securely receives a second control from a second entity external to said operating environment, said second entity being different from said first entity; and

a protected processing environment, coupled to said communications arrangement, that:

(a) securely processes, using at least one resource, a data item associated with said first and second controls, and

(b) securely applies said first and second controls to manage said resource for use of said data item.

381. A system for negotiating electronic contracts, comprising:

a storage arrangement that stores a first control set received from a remote site, and stores a second control set;

a protected processing environment, coupled to said storage arrangement, that:

(a) performs an electronic negotiation between said first control set and said second control set,

(b) provides interaction between said first and second control sets, and

(c) produces a negotiated control set resulting from said interaction between said first and second control sets.

382. A system as in claim 379 further including means for electronically enforcing said negotiated control set.

383. A system as in claim 379 further including means for generating an electronic contract based on said negotiated control set.

384. A method for supporting electronic commerce including:

creating a first secure control set at a first location;

creating a second secure control set;

electronically negotiating, at said location different from said first location, an electronic contract, including the step of securely executing at least a portion of said first and second control sets.

385. An electronic appliance comprising:

a processor; and

at least one memory device connected to said processor;

wherein said processor includes:

retrieving means for retrieving at least one component, and at least one record that specifies a component assembly, from said memory device,

checking means coupled to said retrieving means for checking said component and/or said record for validity, and

using means coupled to said retrieving means for using said component to form said component assembly in accordance with said record.

386. An electronic appliance comprising:

at least one processor;

at least one memory device connected to said processor; and

at least one input/output connection operatively coupled to said processor,

wherein said processor at least in part executes a rights operating system to provide a secure operating environment within said electronic appliance.

387. An electronic appliance as in claim 384 wherein said processor includes means for providing a channel, said channel assembling independently deliverable components into a component assembly and executing said component assembly.

388. An electronic appliance as in claim 384 further including a secondary storage device coupled to said processor, said secondary storage device storing a secure database, said processor including means for decrypting information obtained from said secure database and for encrypting information to be written to said secure database.

389. An electronic appliance as in claim 384 wherein said processor and said memory device are disposed in a secure, tamper-resistance encapsulation.

390. An electronic appliance as in claim 384 wherein said processor includes a hardware encryptor/decryptor.

391. An electronic appliance as in claim 384 wherein said processor includes a real time clock.

392. An electronic appliance as in claim 384 wherein said processor includes a random number generator.

393. An electronic appliance as in claim 384 wherein said memory device stores audit information.

394. A method for auditing the use of at least one resource with a secure operating environment, said method comprising:

securely receiving a first control from a first entity external to said operating environment;

securely receiving a second control from a second entity external to said operating environment, said second entity being different from said first entity;

using at least one resource;

securely sending to said first entity in accordance with said first control, first audit information concerning use of said resource; and

securely sending to said second entity in accordance with said second control, second audit information concerning use of said resource, said second audit information being at least in part different from said first audit information.

395. A method for auditing the use of at least one resource with a secure operating environment, said method comprising:

securely receiving first and second control alternatives from an entity external to said operating environment;

selecting one of said first and second control alternatives;

using at least one resource;

if said first control alternative is selected by said selecting step, securely sending to said entity in accordance with said first control alternative, first audit information concerning use of said resource; and

if said second control alternative is selected by said selecting step, securely sending to said second entity in accordance with said second control alternative, second audit information concerning use of said resource, said second audit information being at least in part different from said first audit information.

396. A method and/or system for enabling a sale of protected digital information that has been previously distributed to users, the method or system being characterized by a secure element that selectively controls access to the protected digital information based on electronic controls associated with the information.

397. A distributed, secure electronic point of sale system or method characterized by a secure processing element for selectively releasing goods and/or services in exchange for compensation.

398. In a distributed digital network, an advertising method characterized by the steps of tracking usage of digital information that has associated with it one or more controls with respect to access to and/or usage of said information; and targeting advertising messages based at least in part on said tracking.

399. A distributed electronic advertising system characterized in that the system uses a distributed network of interoperable protected processing environments to at least in part deliver advertising to users.

400. A distributed, secure, virtual black box comprised of nodes located at VDE content container creators, other content providers, client users, and recipients of secure VDE content usage information) site, the nodes of said virtual black box including a secure subsystem having at least one secure hardware element such as a semiconductor element or other hardware module for securely executing VDE control processes, said secure subsystems being distributed at nodes along a pathway of information storage, distribution, payment, usage, and/or auditing.

401. A protected processing system or method providing multiple currencies and/or payment arrangements for the secure processing and releasing of protected digital information.

402. A distributed secure method or system characterized in that a user's age is used as a criteria for electronically, securely releasing information and/or resources to the user.

403. A method of renting an electronic appliance defining a secure processing environment.

404. A virtual distribution environment providing any one or more of the following features and/or elements and/or combinations thereof:

a configurable protected, distributed event management system; and/or

a trusted, distributed transaction and storage management arrangement; and/or

plural pathways for providing information, for control information, and/or for reporting; and/or

multiple payment methods; and/or

multiple currencies; and/or

EDI; and/or

Electronic banking; and/or

electronic document management; and/or

electronic secure communication; and/or

e-mail; and/or

distributed asynchronous reporting; and/or

combination asynchronous and online management; and/or

privacy control by users; and/or

testing; and/or

using age as a class; and/or

appliance control (renting, etc.); and/or

telecommunications infrastructure; and/or

games management; and/or

extraction of content from an electronic container; and/or

embedding of content into an electronic container; and/or

multiple certificate to allow for breach of a key; and/or

virtual black box; and/or

independence of control information from content; and/or

multiple, separate, simultaneous control sets for one digital information property; and/or

updating control information for already distributed digital information; and/or

organization information management; and/or

coupled external and organization internal chain of handling and control; and/or

a content usage consequence management system (reporting, payment, etc., multiple directions); and/or

a content usage reporting system providing differing audit information and/or reduction going to multiple parties holding rights in content; and/or

an automated remote secure object creation system; and/or

infrastructure background analysis to identify improper use; and/or

seniority of control information system; and/or

secure distribution and enforcement of rules and controls separately from the content they apply to; and/or

redistribution management by controlling the rights and/or number of copies and or pieces etc. that may be redistributed; and/or

an electronic commerce taxation system; and/or

an electronic shopping system; and/or

an electronic catalog system; and/or

a system handling electronic banking, electronic shopping, and electronic content usage management; and/or

an electronic commerce multimedia system; and/or

a distributed, secure, electronic point of sale system; and/or

advertising; and/or

electronics rights management; and/or

a distributed electronic commerce system; and/or

a distributed transaction system or environment; and/or

a distributed event management system; and/or

a distributed right systems.

405. A Virtual Distribution Environment substantially as shown in Figure 1.

406. An "Information Utility" substantially as shown in Figure 1A.

407. A chain of handling and control substantially as shown in Figure 1.

408. Persistent rules and control information substantially as shown in Figure 2A.

409. A method of providing different control information substantially as shown in Figure 1.

410. Rules and/or control information substantially as shown in Figure 4.

411. An object substantially as shown in Figures 5A and 5B.

412. A Secure Processing Unit substantially as shown in Figure 6.

413. An electronic appliance substantially as shown in Figure 7.

414. An electronic appliance substantially as shown in Figure 8.

415. A Secure Processing Unit substantially as shown in Figure 9.

416. A "Rights Operating System" ("ROS") architecture substantially as shown in Figure 10.

417. Functional relationship(s) between applications and the Rights Operating System substantially as shown in Figures 11A-11C.

418. Components and component assemblies substantially as shown in Figures 11D-11J.

419. A Rights Operating System substantially as shown in FIGURE 12.

420. A method of objection creation substantially as shown in Figure 12A.

421. A "protected processing environment" software architecture substantially as shown in Figure 13.

422. A method of supporting a channel substantially as shown in Figure 15.

423. A channel header and channel detail record substantially as shown in Figure 15 A.

424. A method of creating a channel substantially as shown in Figure 15B.

425. A secure data base substantially as shown in Figure 16.

426. A logical object substantially as shown in Figure 17.

427. A stationary object substantially as shown in FIGURE 18.

428. A travelling object substantially as shown in FIGURE 19.

429. A content object substantially as shown in FIGURE 20.

430. An administrative object substantially as shown in Figure 21.

431. A method core substantially as shown in Figure 22.

432. A load module substantially as shown in FIGURE 23.

433. A User Data Element (UDE) and/or Method Data Element (MDE) substantially as shown in FIGURE 24.

434. Map meters substantially as shown in FIGURES 25A-25C.

435. A permissions record (PERC) substantially as shown in FIGURE 26.

436. A permissions record (PERC) substantially as shown in FIGURES 26A and 26B.

437. A shipping table substantially as shown in FIGURE 27.

438. A receiving table substantially as shown in FIGURE 28.

439. An administrative event log substantially as shown in FIGURE 29.

440. A method of interrelating and using an object registration table, a subject table and a user rights table substantially as shown in Figure 30.

441. A method of using a site record table and a group record table to track portions of a secure database substantially as shown in FIGURE 34.

442. A process for updating a secure database substantially as shown in FIGURE 35.

443. A process of inserting new elements into a secure database substantially as shown in FIGURE 36.

444. A process of accessing elements in a secure database substantially as shown in FIGURE 37.

445. A process of protecting a secure database element substantially as shown in FIGURE 38.

446. A process of backing up a secure database substantially as shown in FIGURE 39.

447. A process of recovering a secure database substantially as shown in FIGURE 40.

448. A process of enabling performing reciprocal methods to provide a chain of handling and control substantially as shown in FIGURES 41A-41D.

449. A "reciprocal" BUDGET method substantially as shown in FIGURES 42A-42D.

450. A reciprocol audit method substantially as shown in FIGURES 44A-44C.

451. A method for controlling release of content or other method substantially as shown in any of FIGURES 45-48.

452. An event method substantially as shown in FIGURES 53A-53B.

453. A billing method substantially as shown in FIGURE 53C.

454. An extract method substantially as shown in FIGURE 57A.

455. An embed method substantially as shown in FIGURE 57A.

456. An obscure method substantially as shown in FIGURE 58A.

457. A fingerprint method substantially as shown in FIGURE 58B.

458. A fingerprint method substantially as shown in FIGURE 58C.

459. A meter method substantially as shown in FIGURE 6.

460. A key "convolution" process substantially as shown in FIGURE 62.

461. A process of generating different keys using a key convolution process to determine a "true" key substantially as shown in FIGURE 63.

462. A process of initializing protected processing environment keys substantially as shown in FIGURES 64 and/or 65.

463. A process for decrypting information contained within stationary objects substantially as shown in FIGURE 66.

464. A process for decrypting information contained within traveling objects substantially as shown in FIGURE 67.

465. A process for initializing a protected processing environment substantially as shown in FIGURE 68.

466. A process of downloading firmware into a protected processing environment substantially as shown in FIGURE 69.

467. Multiple VDE electronic appliances connected together with a network or other communications means substantially as shown in FIGURE 70.

468.A portable VDE electronic appliance substantially as shown in FIGURE 71.

469. "Pop-up" displays that may be generated by the user notification and exception interface substantially as shown in Figures 72A-72D.

470. A smart object substantially as shown in FIGURE 73.

471. A method of processing smart objects substantially as shown in FIGURE 74.

472. Electronic negotiation substantially as shown in any of FIGURES 75A-75D.

473. An electronic agreement substantially as shown in FIGURES 75E-75F.

474. Electronic negotiation processes substantially as shown in any of FIGURES 76A-76B.

475. A chain of handling and control substantially as shown in FIGURE 77.

476. A VDE "repository" substantially as shown in FIGURE 78.

477. A process of using a chain of handling and control to evolve and transform VDE managed content and control information substantially as shown in any or all of FIGURES 79-83.

478. A chain of handling and control involving several categories of VDE participants substantially as shown in FIGURE 84.

479. A chain of distribution and handling within an organization substantially as shown in FIGURE 85.

480. A chain of handling and control substantially as shown in Figures 86 and/or 86A.

481. A virtual silicon container model substantially as shown in Figure 87.

482. A method of business automation characterized by the steps of (a) creatings one or more secure containers including encrypted accounting and/or other administrative information content, (b) associating control information with one or more of such one or more secure containers including a description of (i) the one or more parties whom may use one or more of the one or more containers, and (ii) the operations that will be performed for one or more parties with respect to such accounting and/or other administrative information, (c) electronically delivering one or more of such one or more containers such to one or more parties, and (d) enabling through the use of a protected processing environment the enforcement of at least a portion of such control information.

483. A business automation system characterized by:

means for providing at least one secure container including administrative information content having control information associated therewith, and

a protected processing environment for enforcing, at least in part, the control information.

484. A business automation system comprising (a) distributed, interoperable protected processing environment installations, (b) secure containers for distribution of digital

information, (c) control information supporting the automation of chain of handling and control functions.

485. A method of business automation characterized by the steps of providing interoperable protected processing environment nodes to plural parties, communicating first encrypted digital information from a first party to a second party, communicating second encrypted digital information including at least a portion of said first communicated digital information and/or information related to the use of said first digital information, to a third party different from said first or second parties, wherein use of said second encrypted digital information is regulated, at least in part, by an interoperable protected processing environment available to said third party.

486. A business automation system characterized by:

plural protected processing environment nodes,

means for communicating digital information between the nodes, and

wherein at least one of the nodes includes means for regulating the use of said communicated digital information.

487. A method for chain of handling and control characterized by the steps of (a) a first party placing protected digital information into a first software container and stipulating

rules and controls governing use of at least a portion of said digital information, (b) providing said software container to a second party, wherein said second party places said software container into a further software container and stipulates rules and controls for at least in part managing use of at least a portion of said digital information and/or said first software container by a third party.

488. A chain of handling and control system characterized by:

means for placing digital information into a first software container and for stipulating rules and/or controls governing use of at least a portion of said digital information, and

means for placing said software container into a further software container and for stipulating further rules and/or controls for at least in part managing use of at least a portion of said digital information and/or said first software container.

489. A system for chain of handling and control including (a) a first container containing at least in part protected digital information, (b) at least in part protected control information stipulated by a first party establishing conditions for use of at least a portion of said digital content, (c) a second container different from said first container, said second container containing said first container, (d) control information stipulated

independently by a second party for at least in part setting conditions for managing use of the contents of said second container.

490. A system for electronic advertising including: (a) means to provide digital information to users for their use, (b) means to provide advertising content to said users in combination with said digital information, (c) means to audit use of said digital information, (d) means to securely acquire usage information regarding use of advertising content, (e) means to securely report information based upon said advertising content usage information, (f) compensating at least one content provider at least in part based upon use of said advertising content.

491. A method for electronic advertising characterized by the steps of (a) placing digital information into a container, (b) associating advertising information with at least a portion of said digital information, (c) securely providing said container to a container user, (d) monitoring user viewing of advertising information, and (d) receiving payment from an advertiser, wherein said payment is related to user viewing of said advertising information.

492. A system for electronic advertising involving (a) means to containerize digital information including both content

and advertising information, (b) means to monitor viewing of at least a portion of said advertising information, (c) means to charge for user viewing of at least a portion of said advertising information, (d) means to securely communicate information based upon said viewing in a secure container, and (e) control information related to said containerized digital information for managing the communication of said information based upon said viewing.

493. A method for electronic advertising characterized by the steps of (a) containerizing digital information including both content and advertising information, (b) monitoring user viewing of at least a portion of said advertising information, (c) charging for user viewing of at least a portion of said advertising information, (d) securely communicating information based upon said viewing in a secure container, and (e) at least in part managing, through the use of control information related to said advertising information, the communication of information based upon said viewing.

494. A method of clearing transaction information characterized by the steps of (a) securely distributing digital information to a first user of an interoperable protected processing environment, (b) securely distributing further digital information to a user of an interoperable protected processing

environment different from said at first user (c) receiving information related to usage of said digital information, (d) receiving information related to usage of said further digital information, and (e) processing information received according to steps (c) and (d) to perform at least one of (I) an administrative, or (II) an analysis, function.

495. A system for clearing transaction information including (a) a first container containing at least in part protected digital information and associated control information, (b) a second secure container containing further at least in part protected digital information and associated control information, (c) means to distribute said first and second containers to users, (d) communication means for communicating information at least in part derived from user usage of said first container digital information, (e) communication means for communicating information at least in part derived from user usage of said second container digital information, (f) processing means at a clearinghouse site for receiving the information communicated through steps (d) and (e), wherein said processing means perform administrative and/or analysis processing of at least a portion of said communicated information.

496. A method for clearinghouse analysis characterized by the steps of: (a) enabling plural independent clearinghouses for

administrating and/or analyzing usage of distributed, at least in part protected, digital information, (b) providing interoperable protected processing environments to plural, independent users, and (c) enabling a user to select a clearinghouse for use with an interoperable protected processing environment

497. A system for clearinghouse analysis including (a) plural independent clearinghouses for administrating and/or analyzing usage of distributed, at least in part protected, digital information, (b) at least one interoperable protected processing environments at each of plural user locations, (c) selecting means for enabling a user to select one of said plural independent clearinghouse to perform payment and/or analysis functions related to the use of at least a portion of said at least in part protected, digital information.

498. A method of electronic advertising characterized by the steps of

creating one or more electronic advertisements, creating one or more secure containers including at least a portion of such advertisements,

associating control information with such advertisements including control information describing at least one of: (a) reporting at least some advertisement usage information to one or more content providers, advertisers and/or agents, (b)

providing one or more credits to a user based on such user's viewing and/or other usage of such advertisements, (c) reporting advertisement usage information to one or more market analysts, (d) providing a user with ordering information for and/or means for ordering one or more products and/or services, and/or (e) providing one or more credits to a content provider based on one or more users' viewing and/or other usage of such advertisements,

providing such containers and such control information to one or more users,

enabling such users to use such containers at least in part in accordance with such control information.

499. A system for electronic advertising including (a) means to provide digital information to users for their use, (b) means to provide advertising content to said users in combination with said digital information, (c) means to audit use of said digital information, (d) means to acquire usage information regarding use of advertising content, (e) means to securely report information based upon said advertising content usage information, and (f) compensating at least one content provider at least in part based upon use of such advertising content.

500. A system for chain of handling and control including (a) a first container containing at least in part protected digital information, (b) at least in part protected control information stipulated by a first party establishing condition for use of at least a portion of said digital content, (c) a second container different from said first container, said second container containing said first container, and (d) control information stipulated independently by a second party for at least in part setting conditions for managing use of the contents of said second container.

501. A method of operating a clearinghouse characterized by the steps of receiving usage information related at least in part to use of secure containers from plural parties, determining payments due to one or more parties based at least in part on such usage information, performing and/or causing to be performed transactions resulting in payments to such parties based at least in part on such determinations.

502. An electronic clearinghouse comprising:

means for receiving usage information related at least in part to use of secure containers from plural parties,

means for determining payments due to one or more parties based at least in part on such usage information,

means for performing and/or causing to be performed transactions resulting in payments to such parties based at least in part on such determinations.

503. A method of operating a clearinghouse characterized by the steps of receiving usage information related at least in part to use of secure containers from plural parties, determining reports of usage for one or more parties based at least in part on such usage information, creating and/or causing to be created reports of usage based at least in part on such determination, delivering at least one of such reports to at least one of such parties.

504. A method of operating a clearinghouse characterized by the steps of receiving permissions and/or other control information from one or more content providers including information that enables delivery of at least one right in at least one secure container to other parties, receiving requests from plural parties for one or more rights in one or more secure containers, delivering permissions and/or other control information to such parties based at least in part on such requests.

505. A method of operating a clearinghouse characterized by the steps of receiving information from one or more parties

establishing a party's identity information, creating one or more electronic representations of at least a portion of such identity information for use in enabling and/or withholding at least one right in at least one secure container, performing an operation to certify such electronic representations, delivering such electronic representations to such party.

506. A method of operating a clearinghouse characterized by the steps of receiving a request for credit from a party for use with secure containers, determining an amount of credit based at least in part on such request, creating control information related to such an amount, delivering such control information to such user, receiving usage information related to use of such credit, performing and/or causing to be performed at least one transaction associated with collecting payment from such user.

507. A method for contributing secure control information with respect to an electronic value chain wherein control information is contributed by a party not directly participating in said value chain, comprising steps of: aggregating said contributed control information with control information associated with digital information stipulated by one or more parties in an electronic value chain, said aggregate control information at least in part managing conditions related to the use of at least a portion of said digital information.

508. A method for entering the payment of taxes associated with commercial events wherein secure control information for automatically governing tax payments for said commercial events is contributed by a party comprising steps of: aggregating said secure control information with control information that has been contributed by a separate party and controlling at least one condition for use of digital information.

509. A method for general purpose reusable electronic commerce arrangement characterized by the steps of:

(a) providing component structures, modular methods that can be configured together to comprise event controlled

(b) providing integrateable protected processing environments to plural independent users;

(c) employing secure communications means for communicating digital control information between integrateable protected processing environments; and

(d) enabling database managers operably connected to said processing environments for storing at least a portion of said provided component modular methods.

510. A system for general purpose, reusable electronic commerce including:

(a) component modular methods configured together to comprise event control structures;

(b) at least one interoperable processing environment at each of plural independent user locations;

(c) secure communications means for communicating digital control information between interoperable protected processing environments; and

(d) secured database managers operably connected to said protected processing environments for storing at least a portion of said component modular methods.

511. A general purpose electronic commerce credit system including:

(a) a secure interoperable protected processing environment;

(b) general purpose credit control information for providing credit for user usage of at least in part protected digital information; and

(c) at least in part protected digital information related control information for providing necessary information for employing credit through the use, at least in part, of said general purpose credit control information.

512. A method for enabling a general purpose electronic commerce credit system including:

(a) providing secure interoperable protected processing environments;

(b) supplying general purpose credit control information for providing credit for user usage of at least in part protected digital information; and

(c) providing, at least in part, protected digital information related control information for providing necessary information for employing credit through the use, at least in part, of said general purpose credit control information.

513. A document management system comprising one or more electronic appliances containing one or more SPUs and one or more secure databases operatively connected to at least one of the SPUs.

514. An electronic contract system comprising one or more electronic appliances containing one or more SPUs and one or more secure databases operatively connected to at least one of the SPUs.

515. An electronic appliance containing at least one SPU and at least one secure database operatively connected to at least one of the SPU(s).

516. An electronic appliance containing one or more CPUs where at least one of the CPUs is integrated with at least one SPU.

517. An electronic appliance containing one or more video controllers where at least one of the video controllers is integrated with at least one SPU.

518. An electronic appliance containing one or more network communications means where at least one of the network communications means is integrated with at least one SPU.

519. An electronic appliance containing one or more modems where at least one of the modems is integrated with at least one SPU.

520. An electronic appliance containing one or more CD-ROM devices where at least one of the CD-ROM devices is integrated with at least one SPU.

521. An electronic appliance containing one or more set-top controllers where at least one of the set-top controllers is integrated with at least one SPU.

522. An electronic appliance containing one or more game systems where at least one of the game systems is integrated with at least one SPU.

523. An integrated circuit supporting multiple encryption algorithms comprising at least one microprocessor, memory, input/output means, at least one circuit for encrypting and/or decrypting information and one or more software programs for use with at least one of the microprocessors to perform encryption and/or decryption functions.

524. An integrated circuit comprising at least one microprocessor, memory, at least one real time clock, at least one random number generator, at least one circuit for encrypting and/or decrypting information and independently delivered and/or independently deliverable certified software.

525. An integrated circuit comprising at least one microprocessor, memory, input/output means, a tamper resistant barrier and at least a portion of a Rights Operating System.

526. An integrated circuit comprising at least one microprocessor, memory, input/output means, at least one real time clock, a tamper resistant barrier and means for recording interruption of power to at least one of the real time clocks.

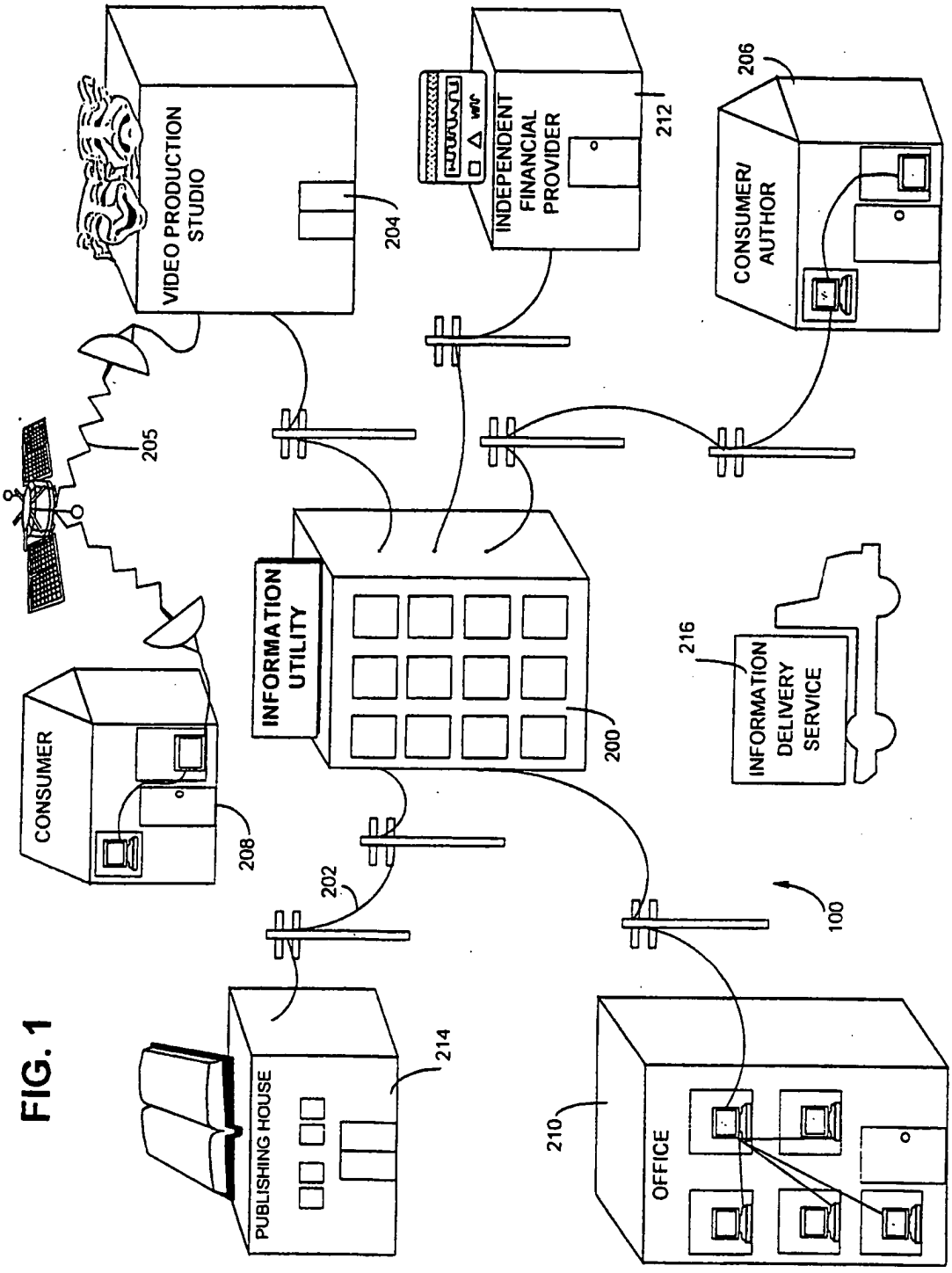

VIDEO PRODUCTION STUDIO
204
INDEPENDENT FINANCIAL PROVIDER
212
206
CONSUMER/ AUTHOR
205
INFORMATION UTILITY
200
216
INFORMATION DELIVERY SERVICE
CONSUMER
208
202
100
PUBLISHING HOUSE
214
210
OFFICE

FIG. 1

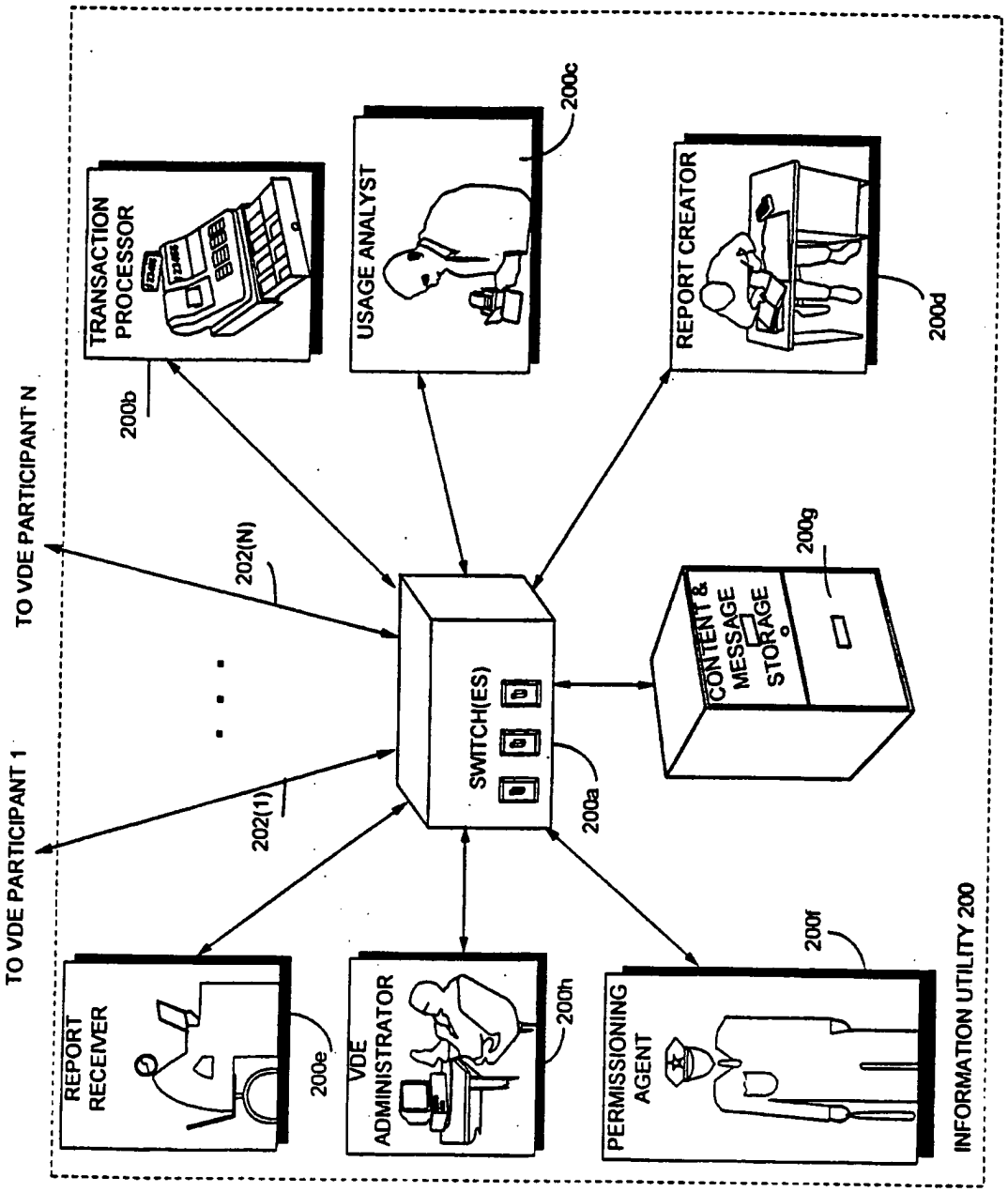


FIG. 1A

FIG. 2

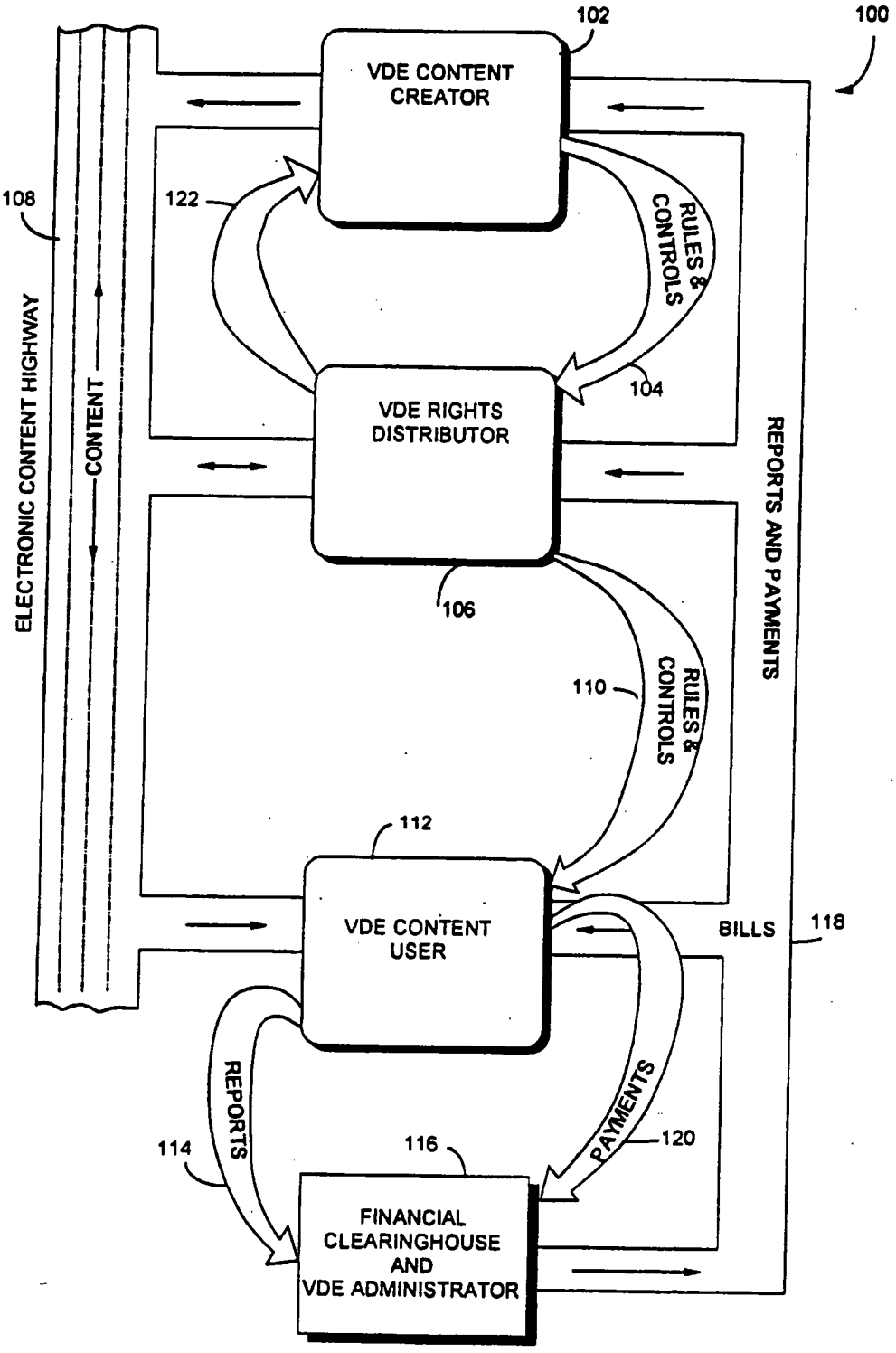


FIG. 2A

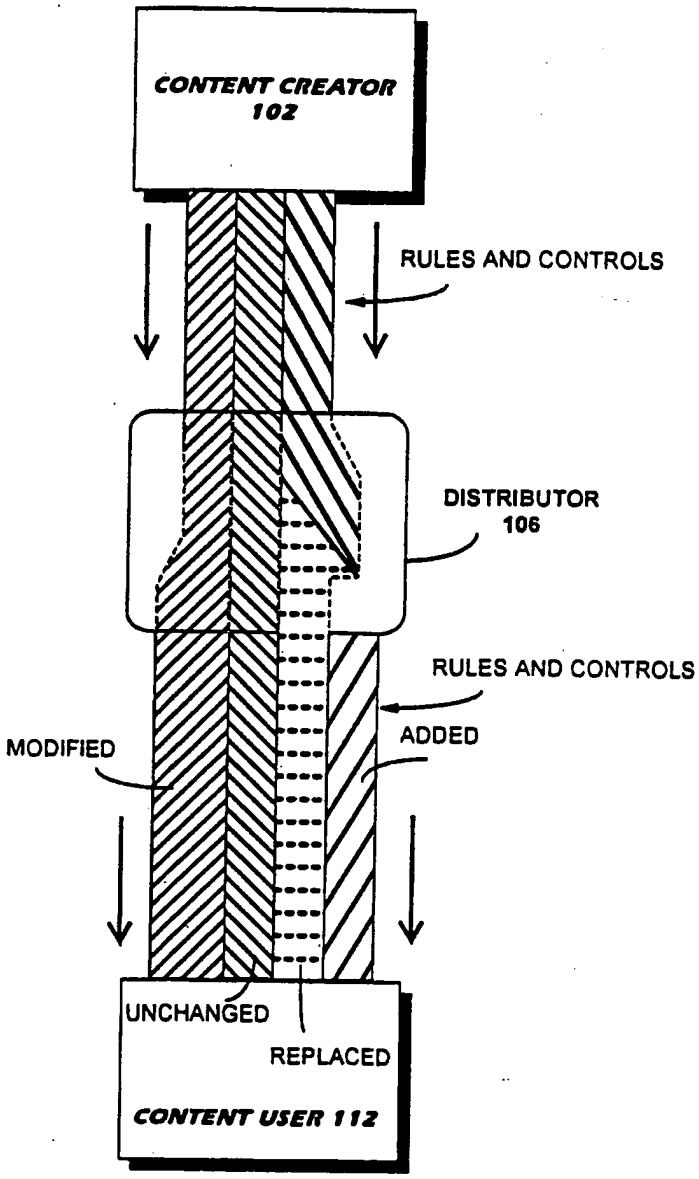
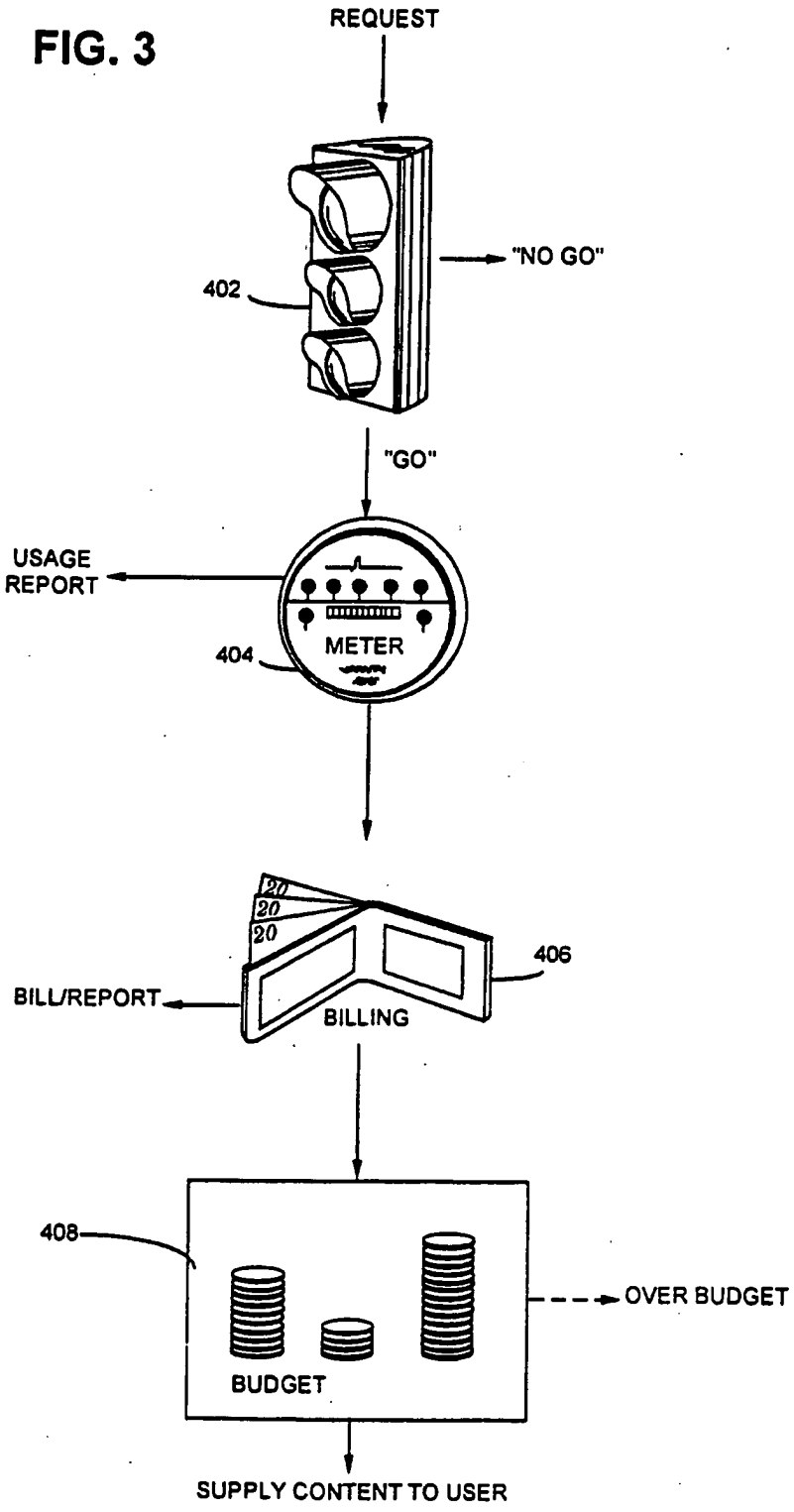


FIG. 3



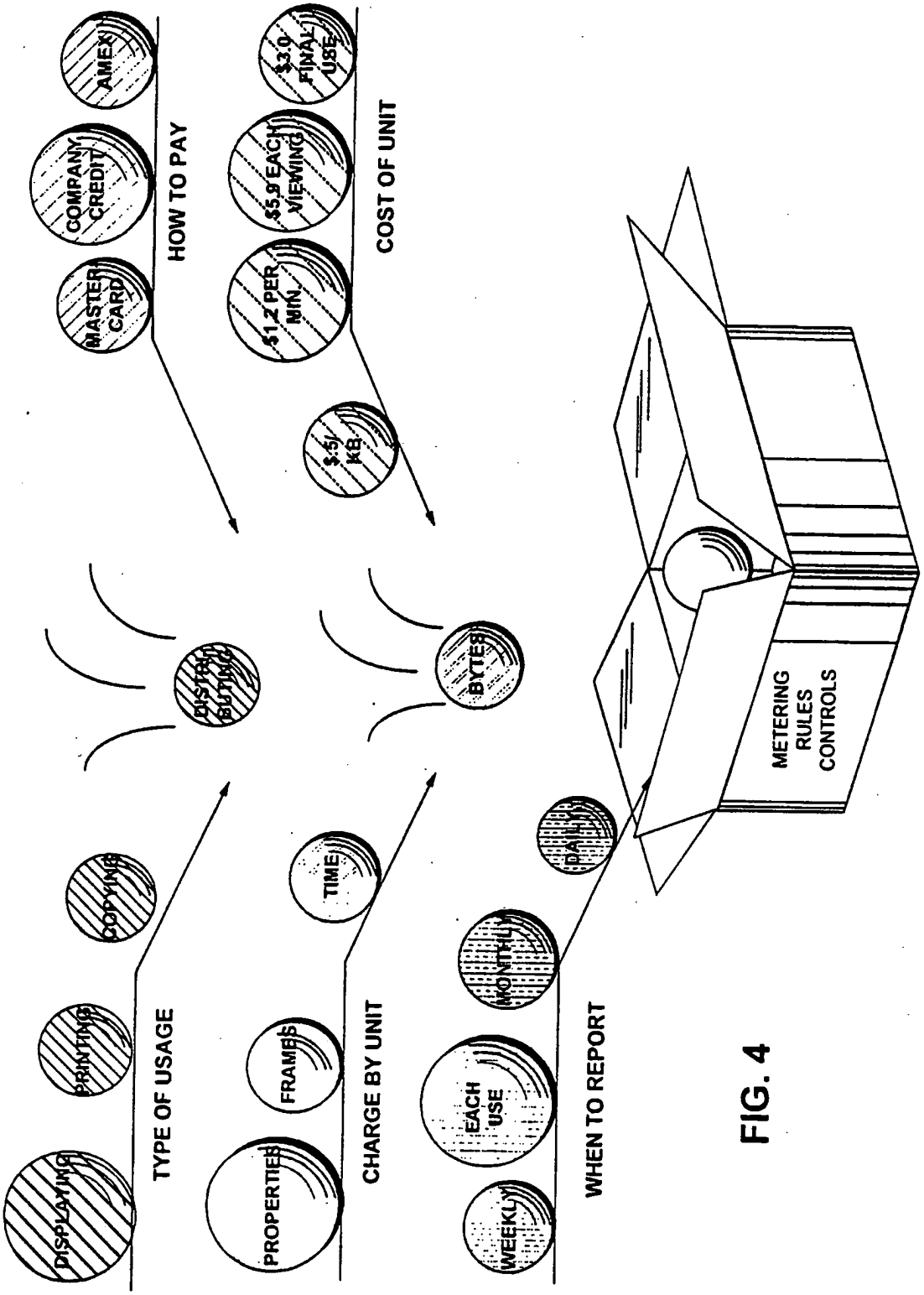
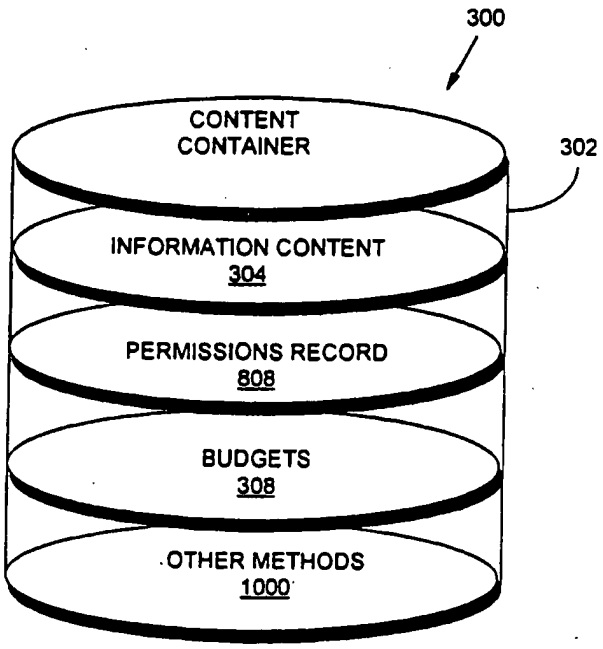

HOW TO PAY
AMEX
COMPANY CREDIT
MASTER CARD
COST OF UNIT
$3.0 FINAL USE
$5.9 EACH VIEWING
$1.2 PER MIN.
$.5/ KB
TYPE OF USAGE
DISPLAYING
PRINTING
COPYING
CUSTOM BUTTONS
CHARGE BY UNIT
PROPERTIES
FRAMES
TIME
BYTES
WHEN TO REPORT
WEEKLY
EACH USE
MONTHLY
DAILY
METERING RULES CONTROLS

FIG. 4

FIG. 5A



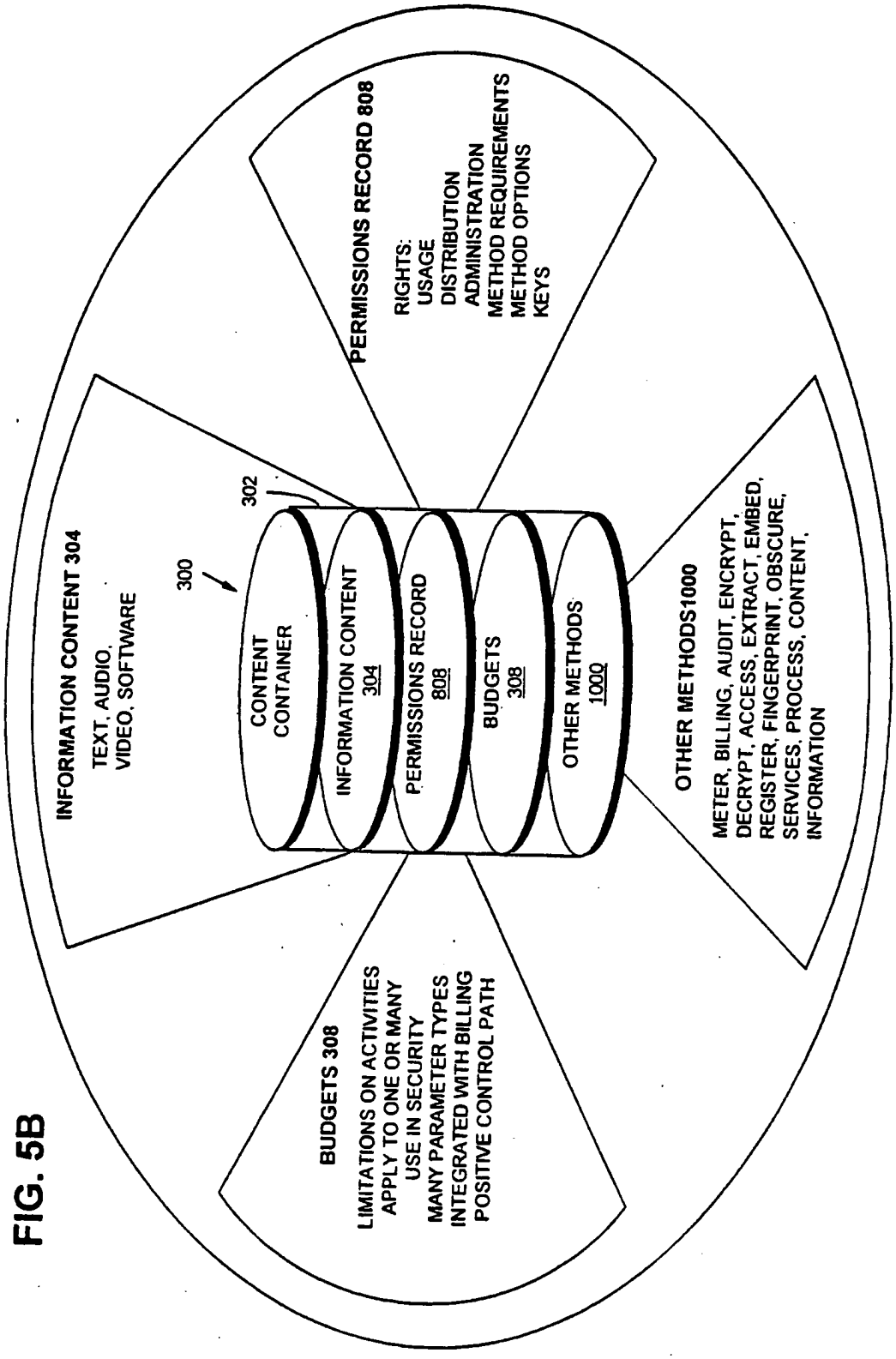
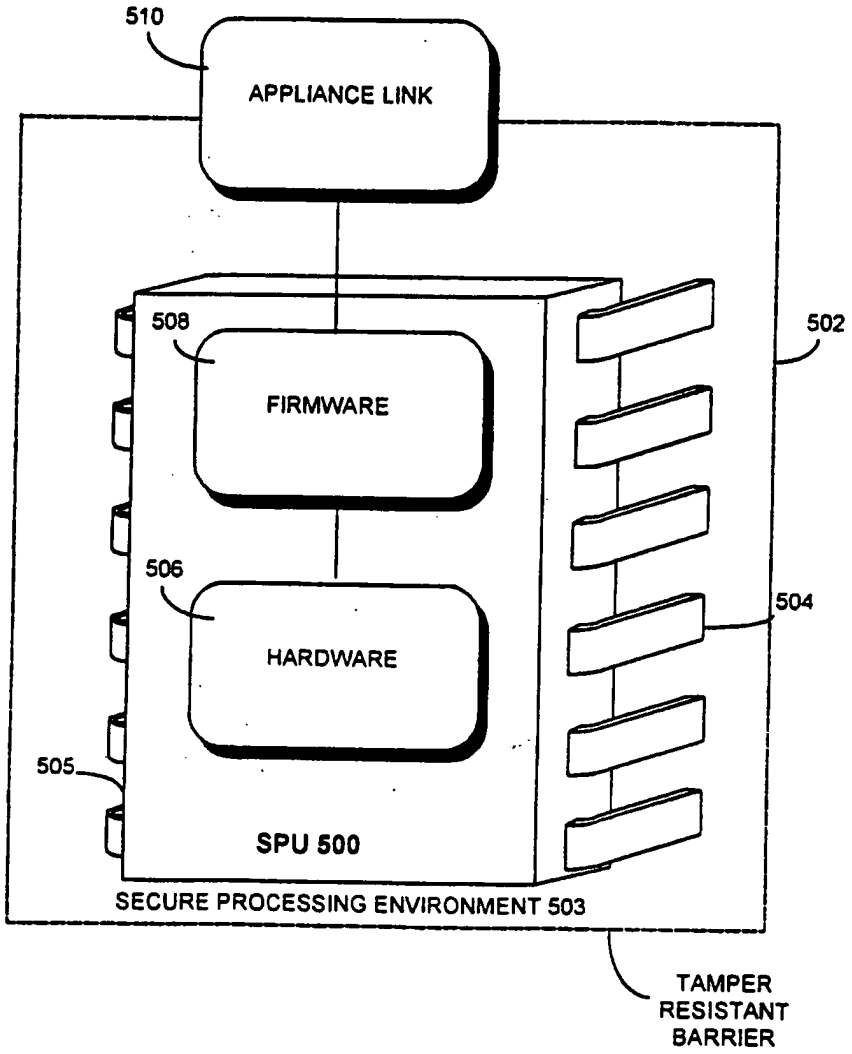


FIG. 5B

FIG. 6



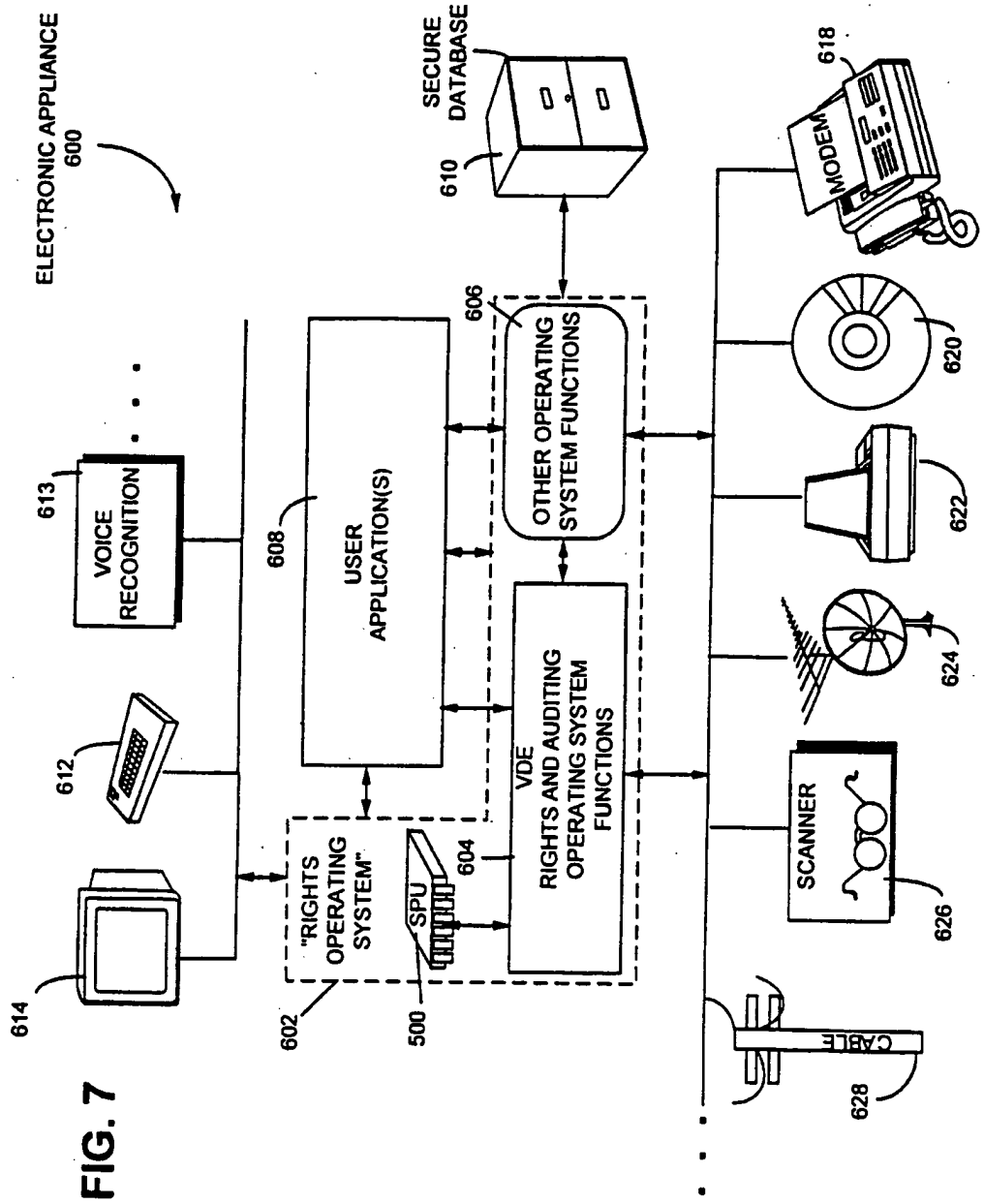
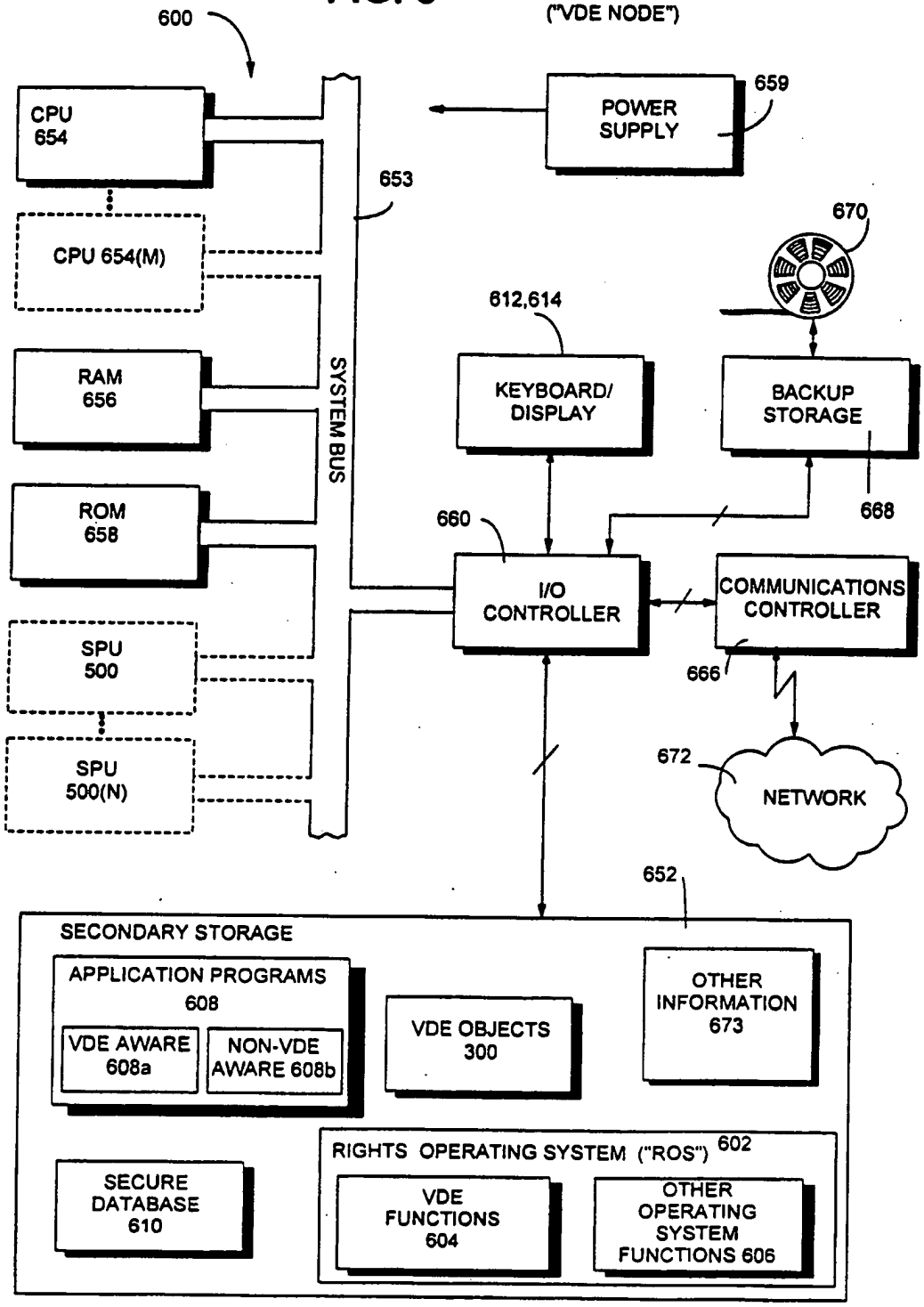


FIG. 7

FIG. 8 ELECTRONIC APPLIANCE 600 ("VDE NODE")



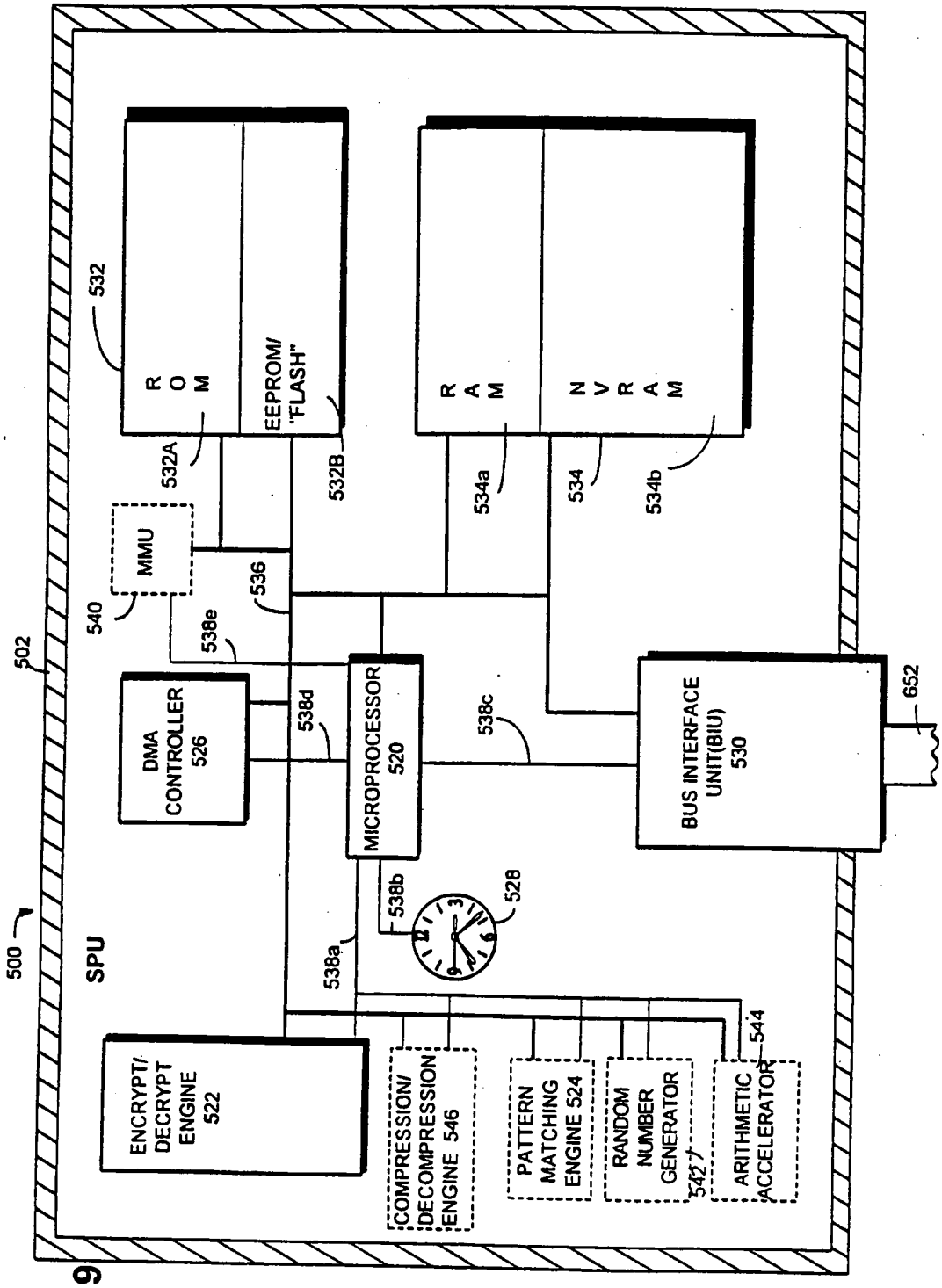


FIG. 9

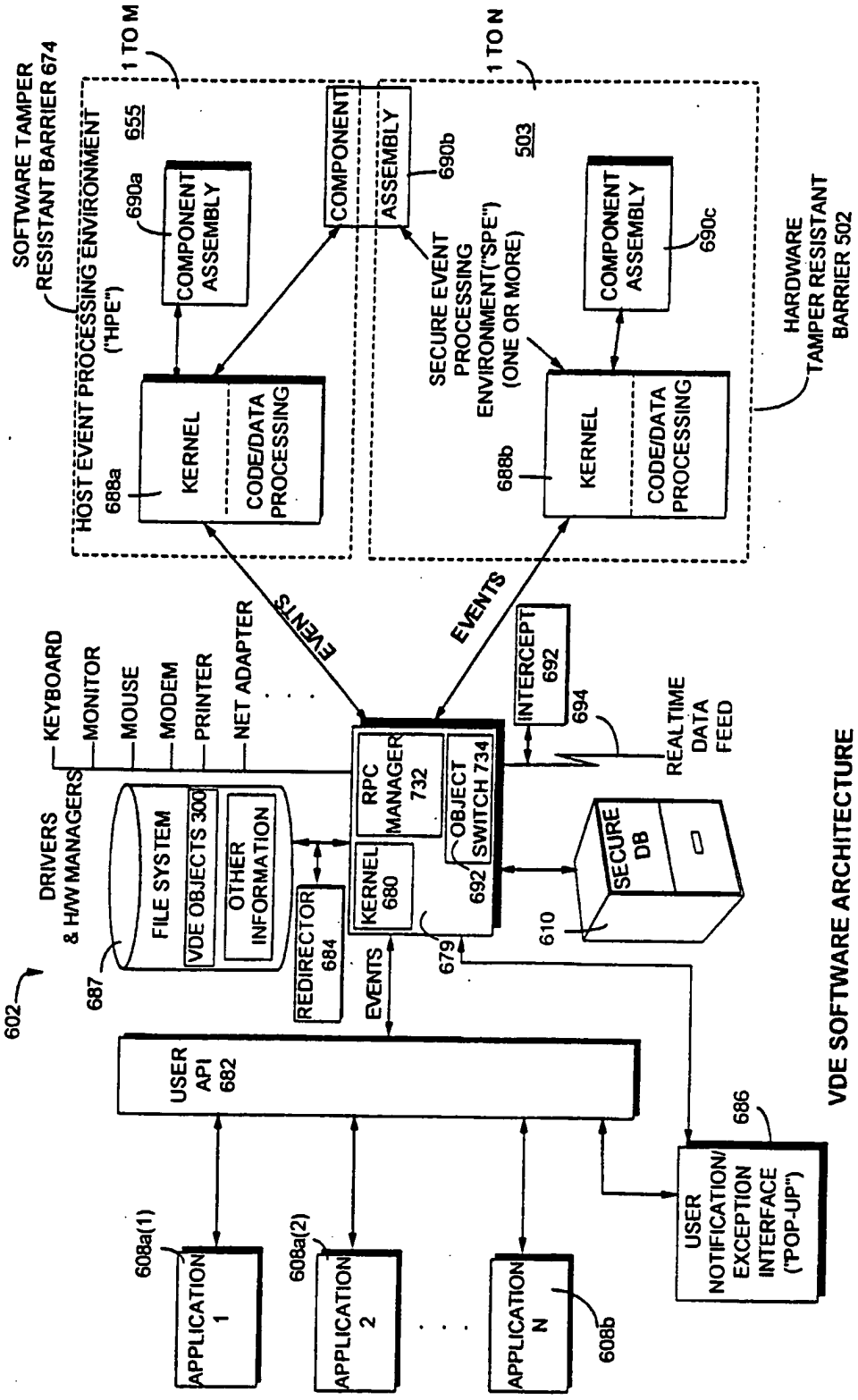


FIG. 10

FIG. 11C

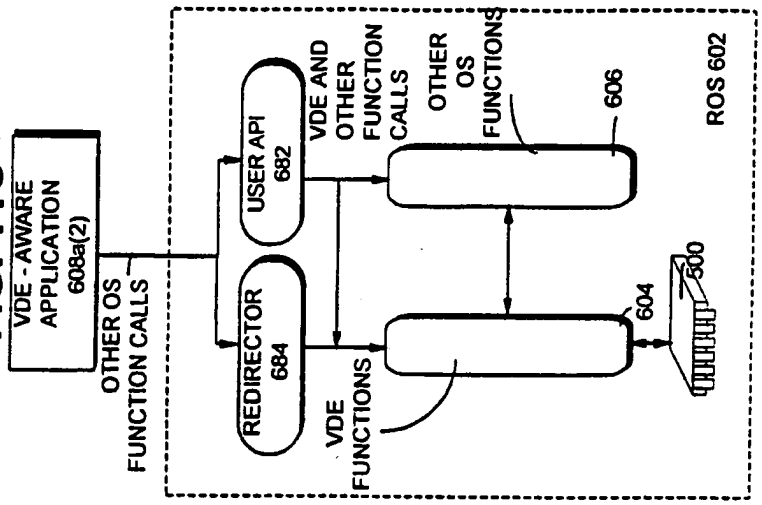


FIG. 11B

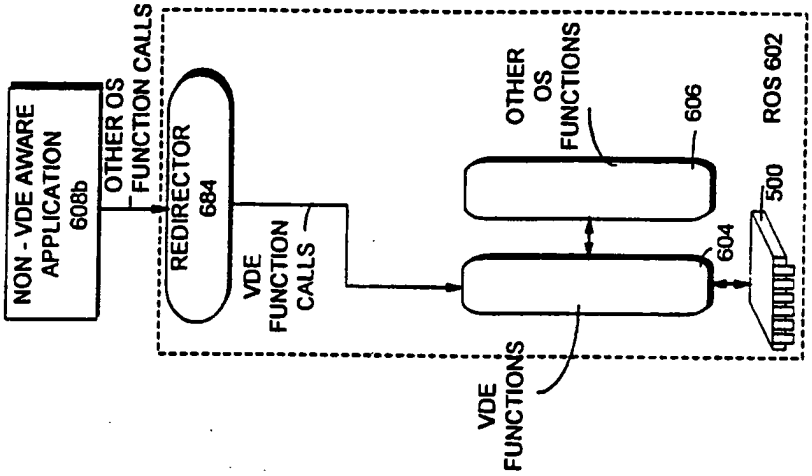
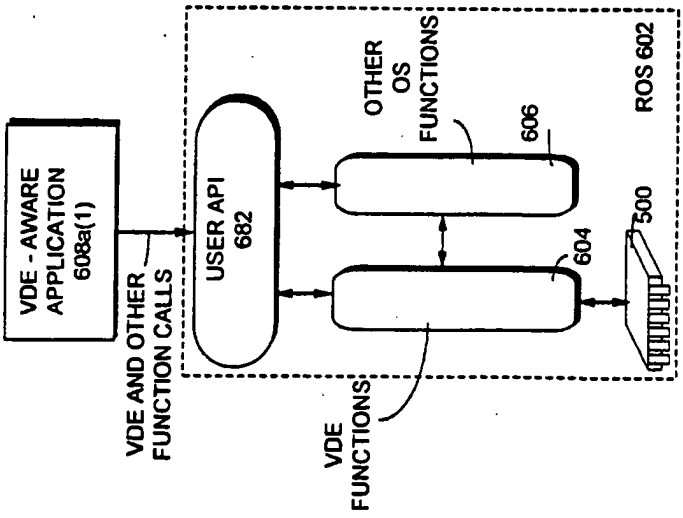


FIG. 11A



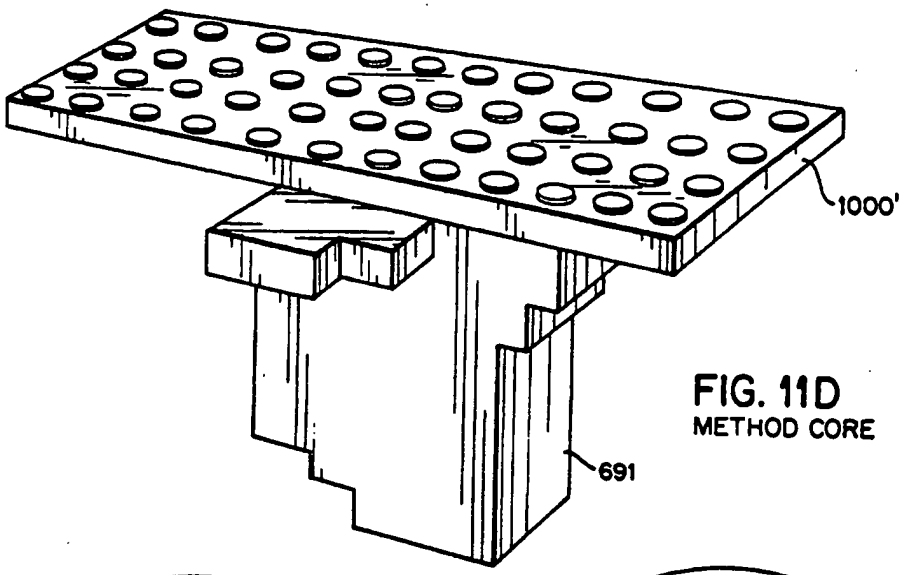


FIG. 11D
METHOD CORE

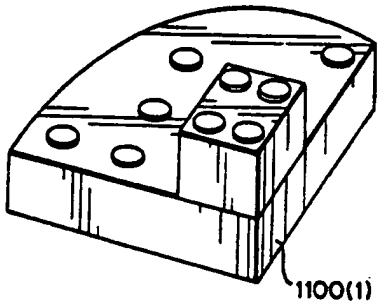


FIG. 11E
LOAD MODULE
WITH DTD

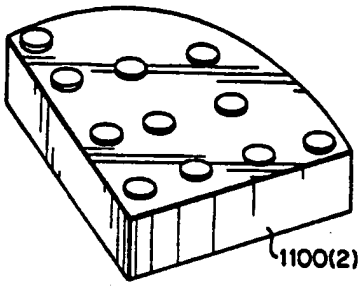


FIG. 11F
LOAD MODULE

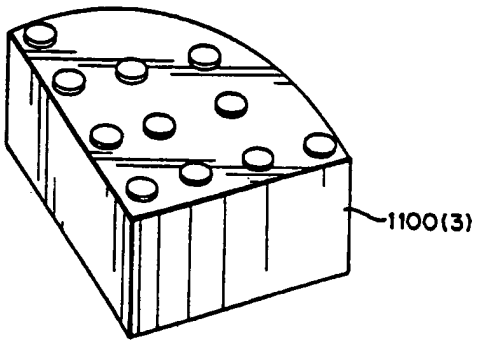


FIG. 11G
LOAD MODULE

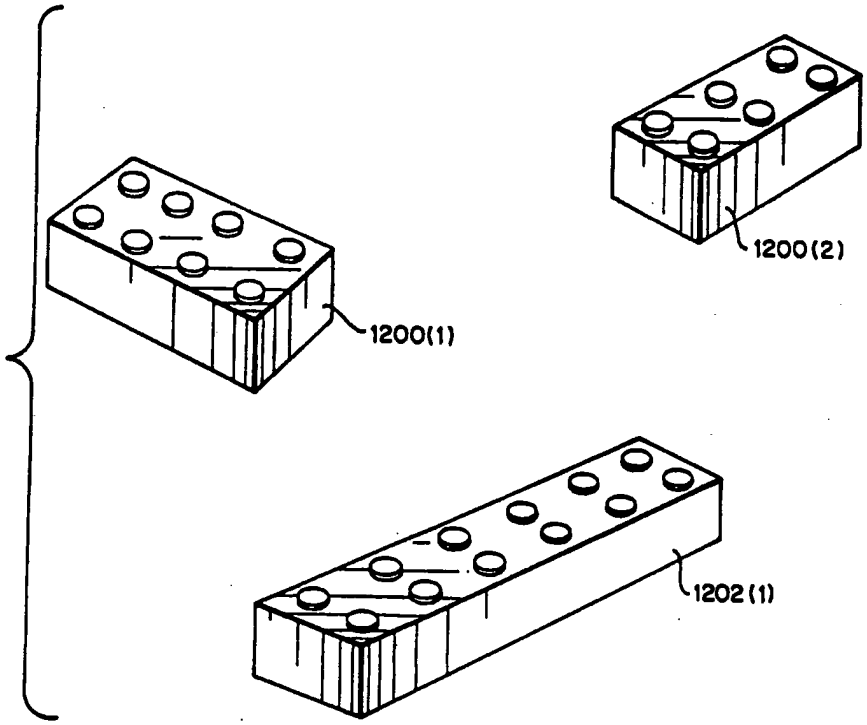
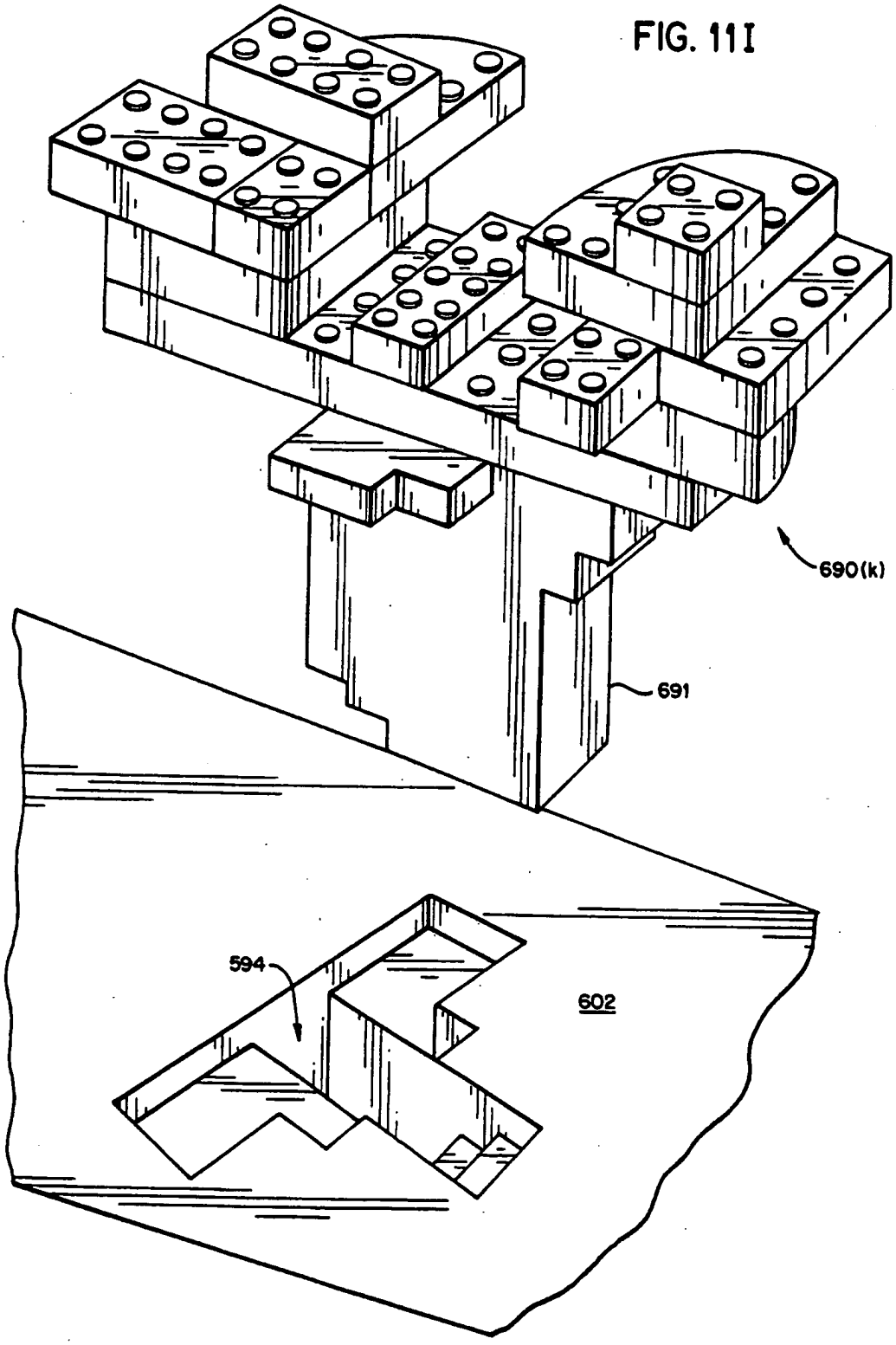


FIG. 11H
DATA STRUCTURES

FIG. 11I



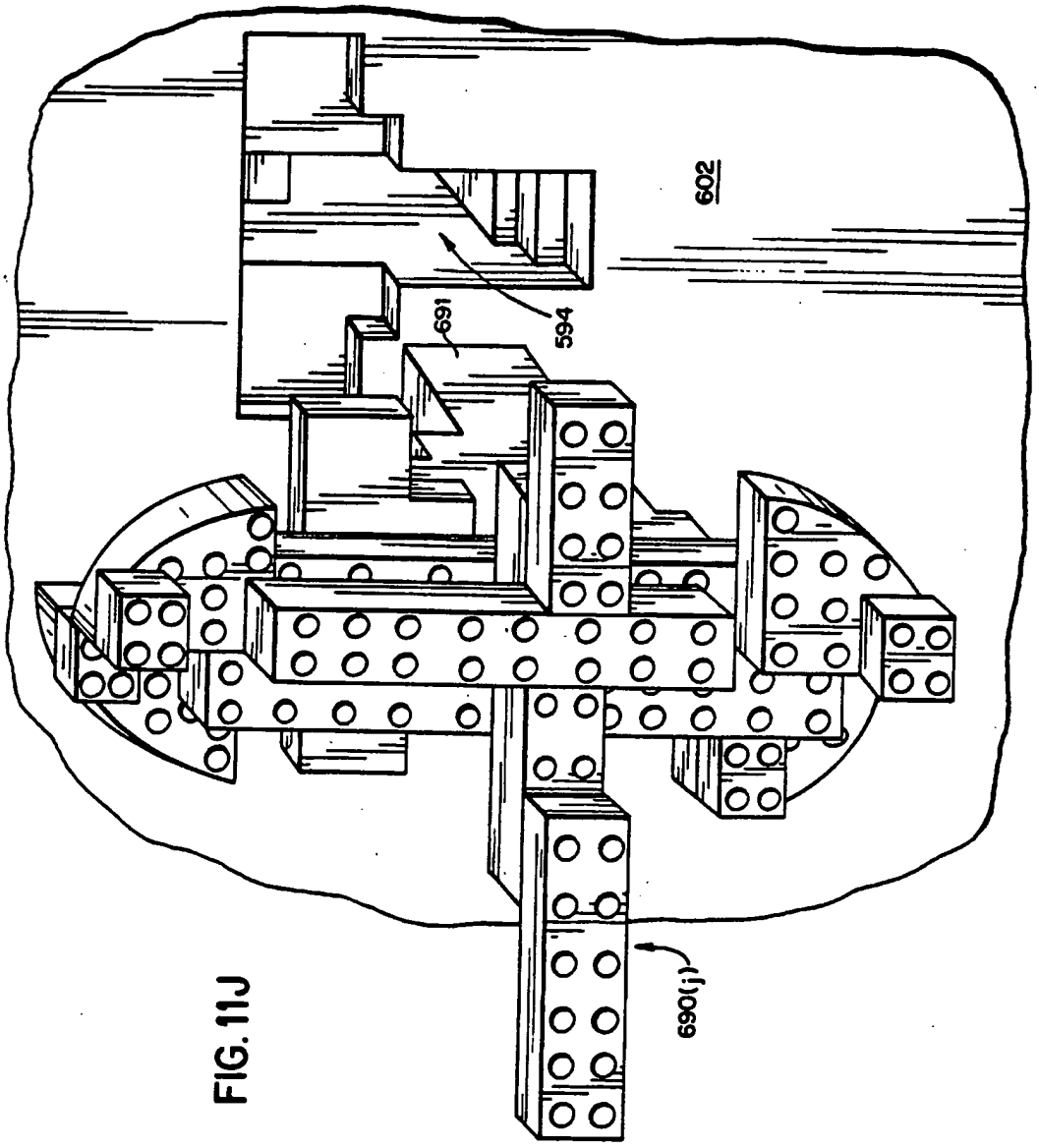


FIG. 11J

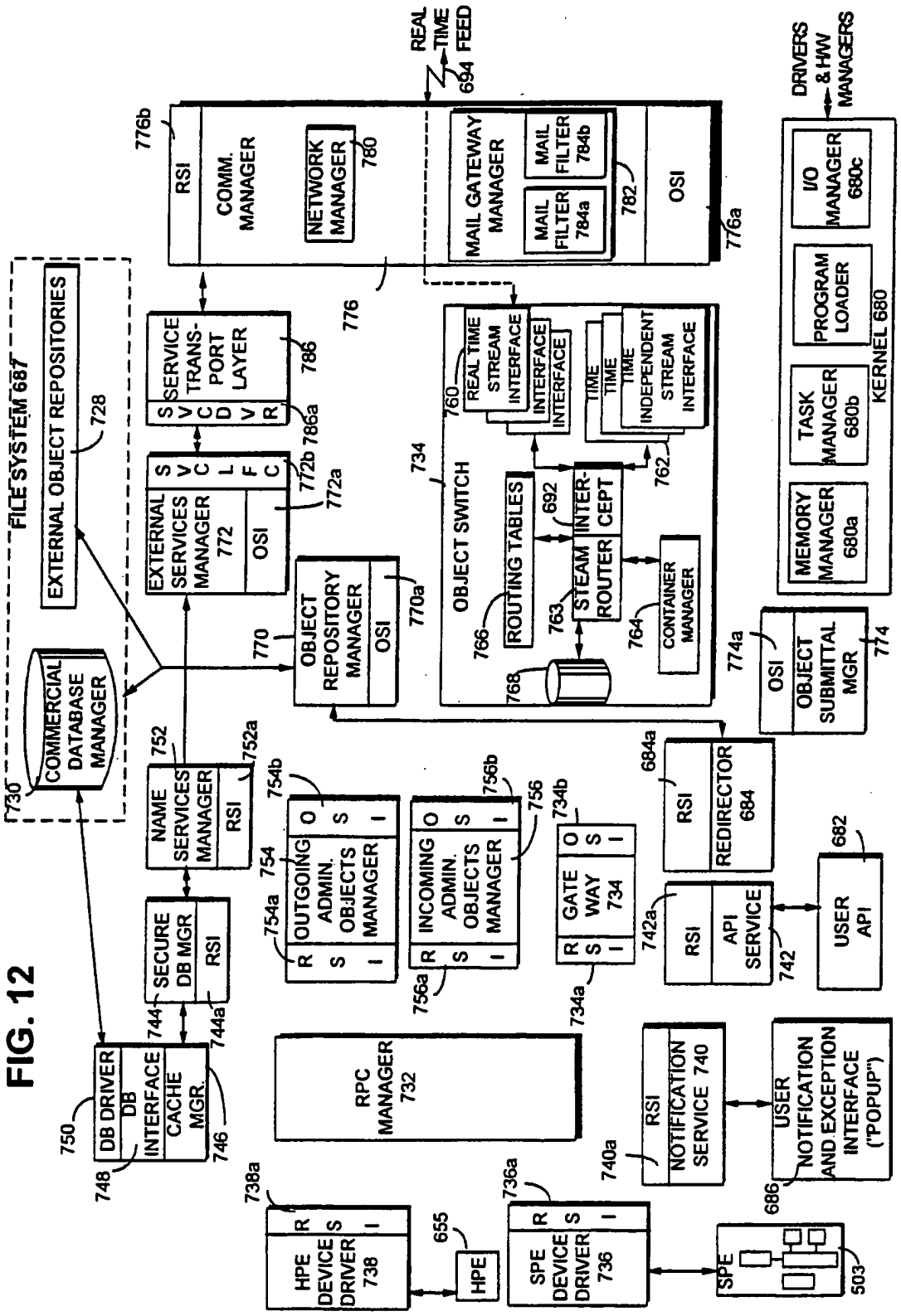


FIG. 12

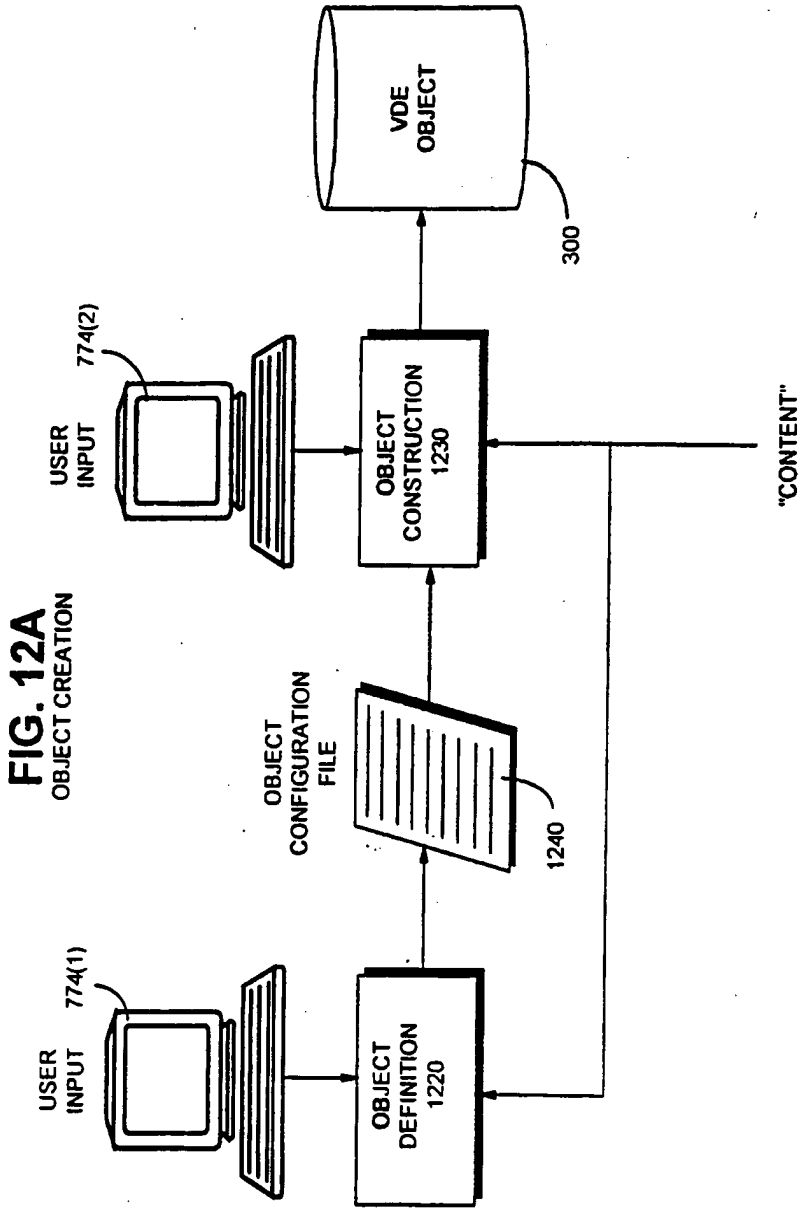


FIG. 12A
OBJECT CREATION

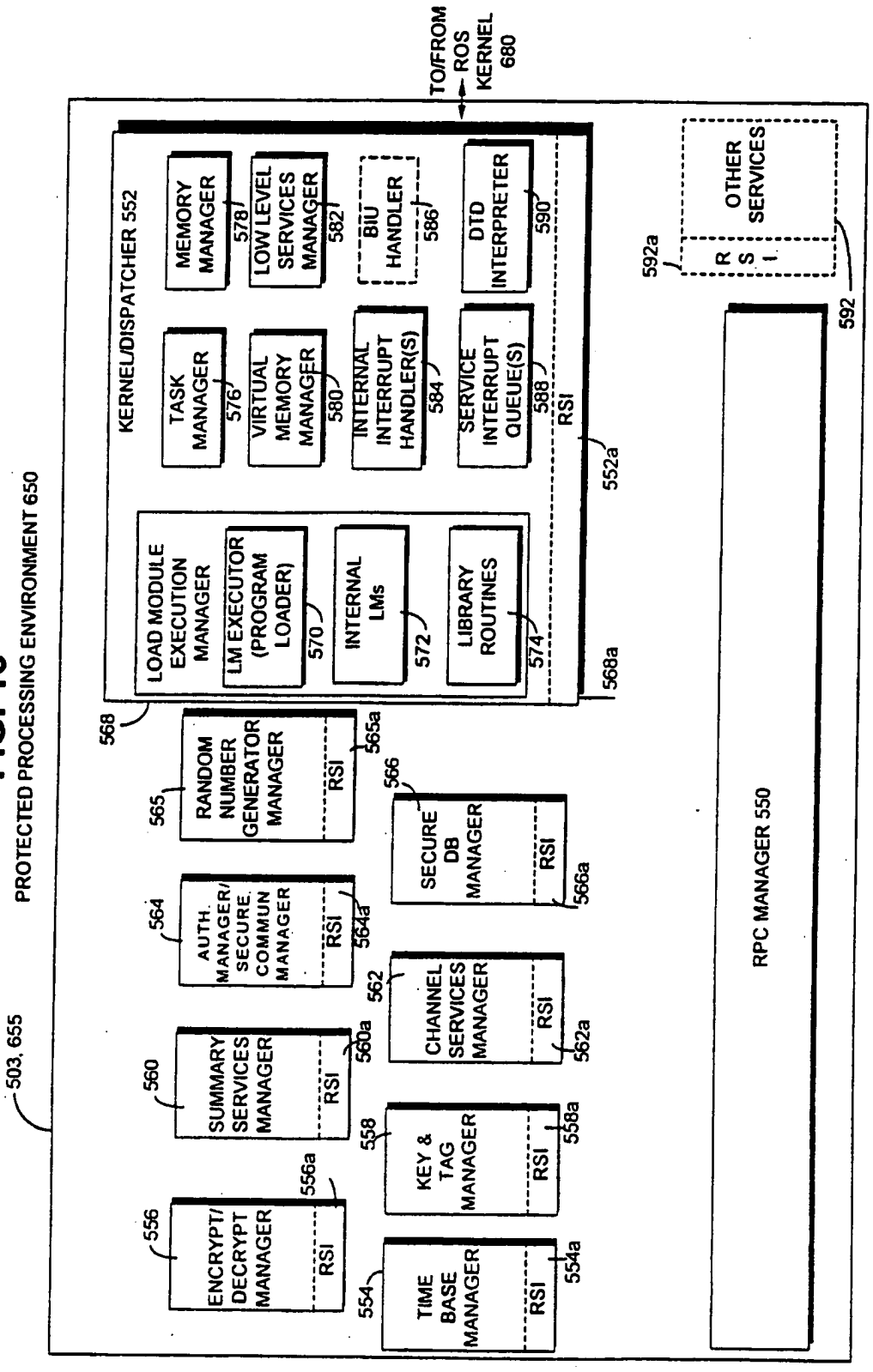


FIG. 13

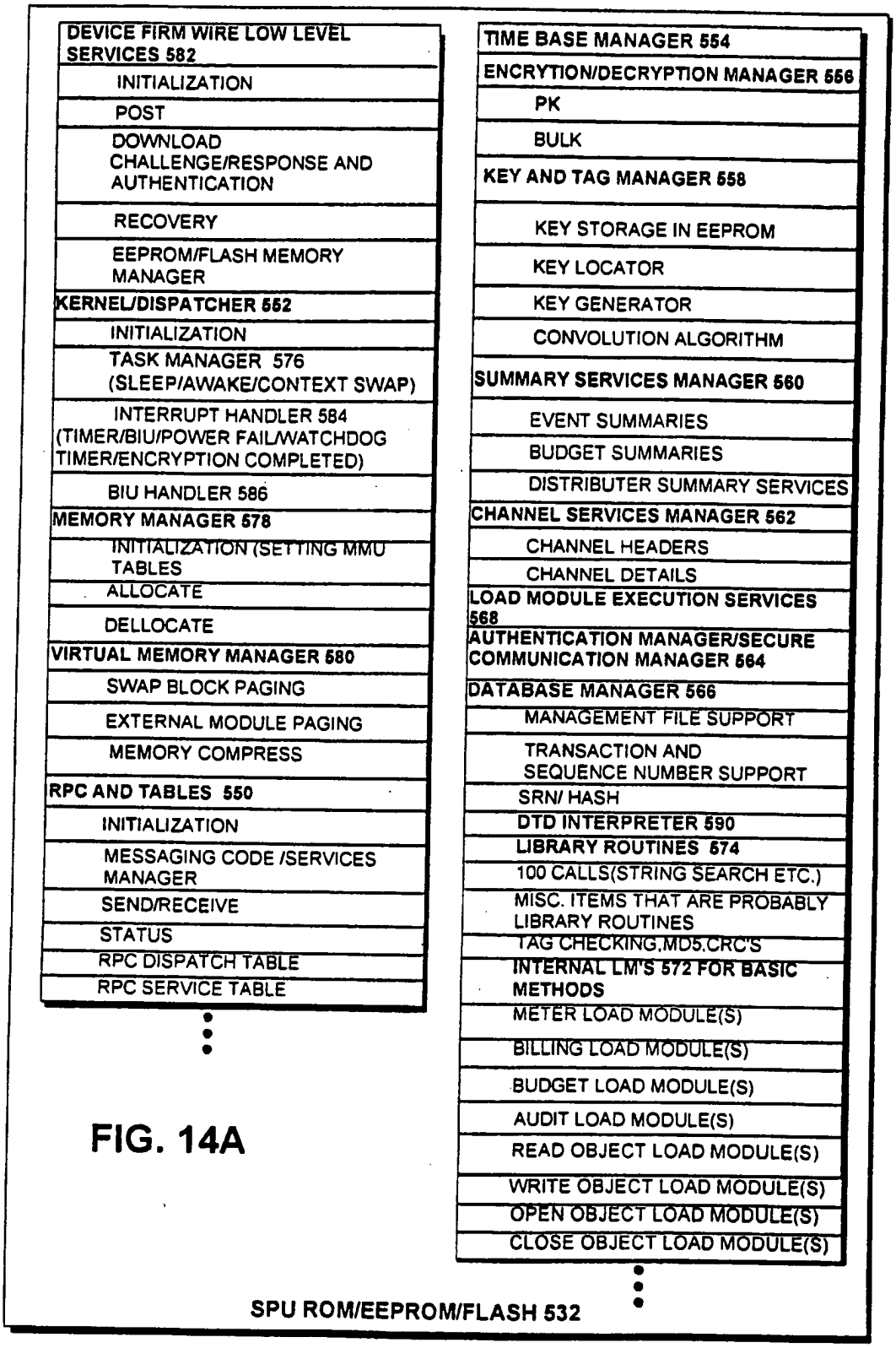


FIG. 14A

FIG. 14B

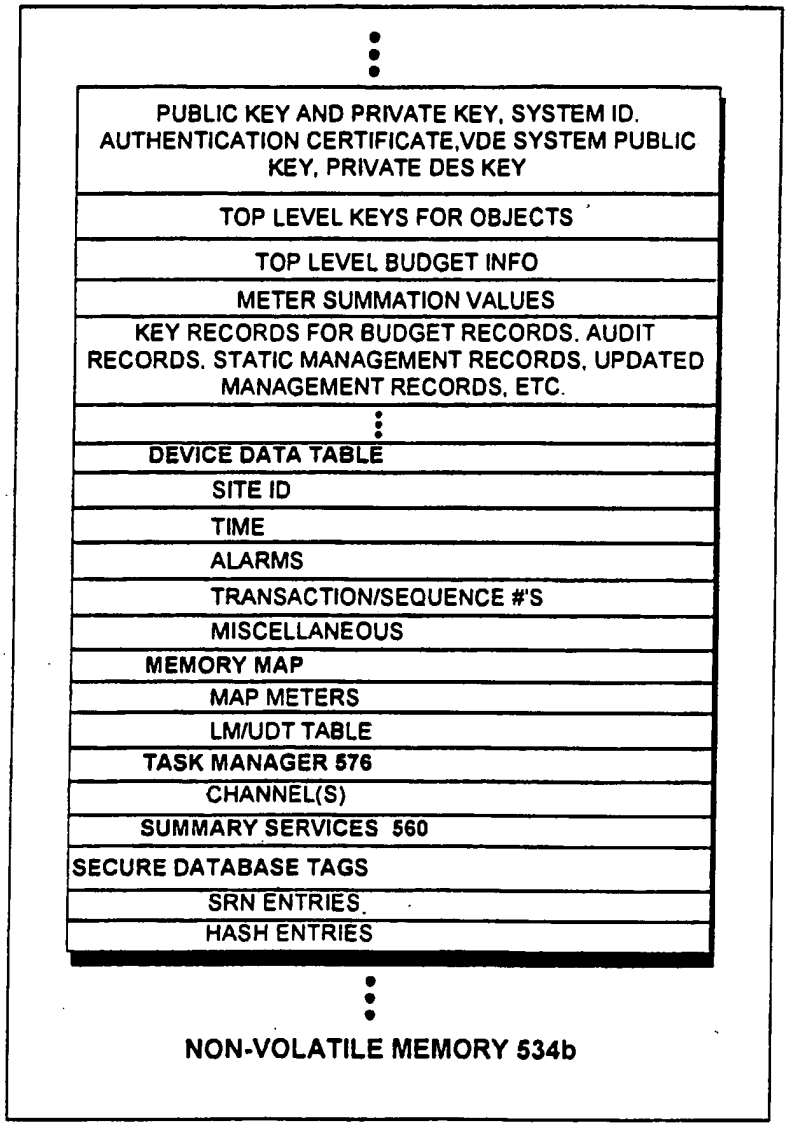


FIG. 14C

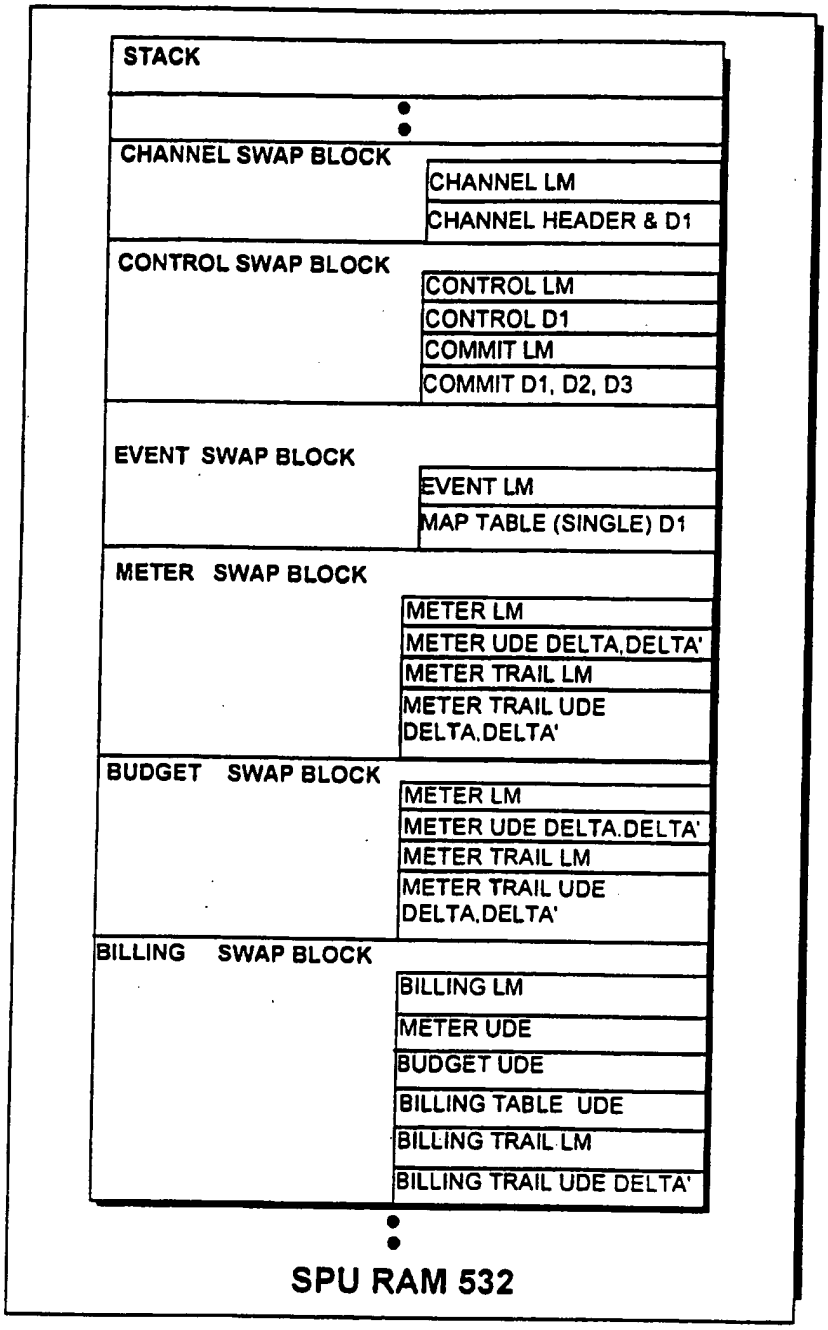


FIG. 15

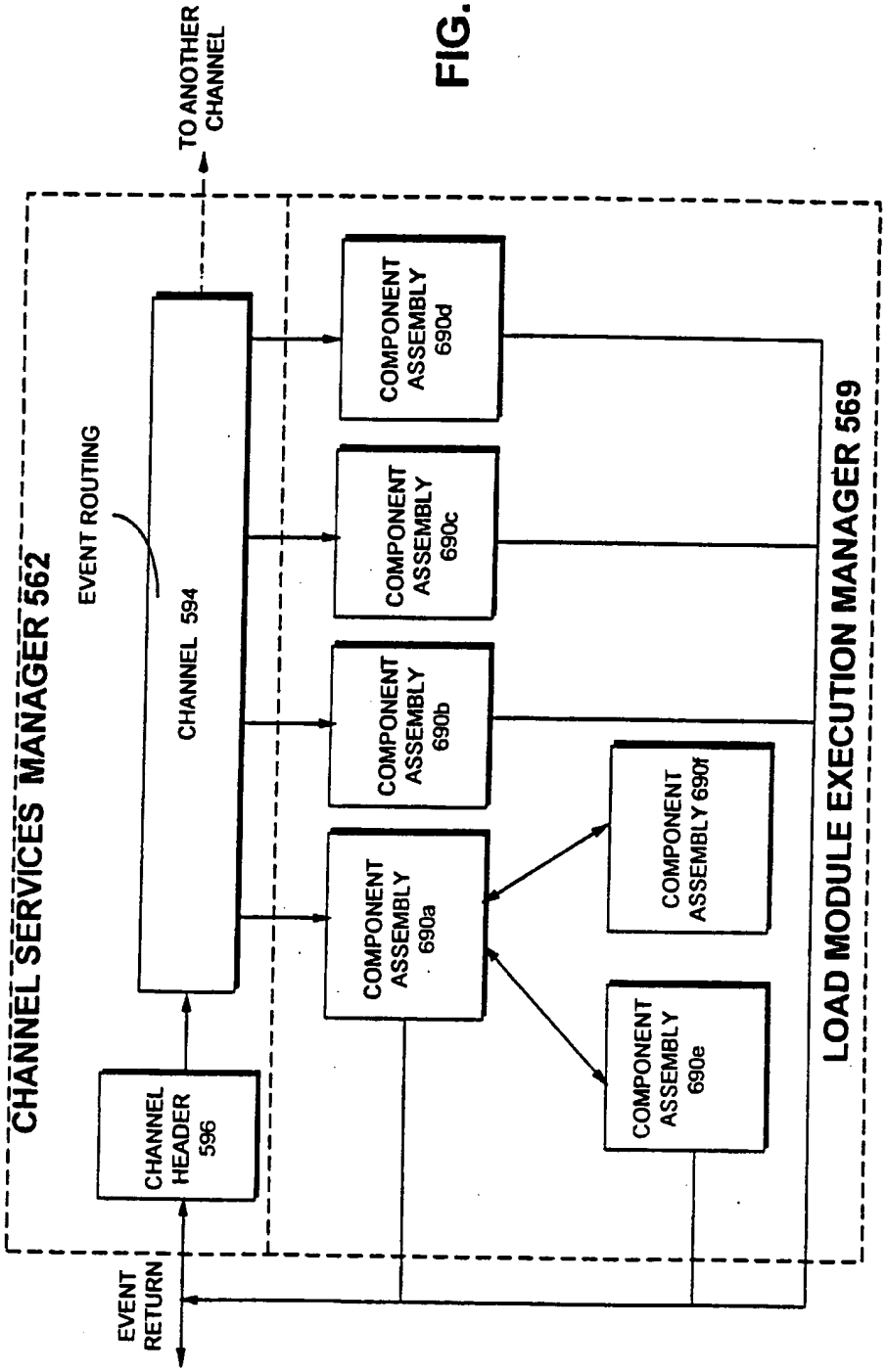


FIG. 15A

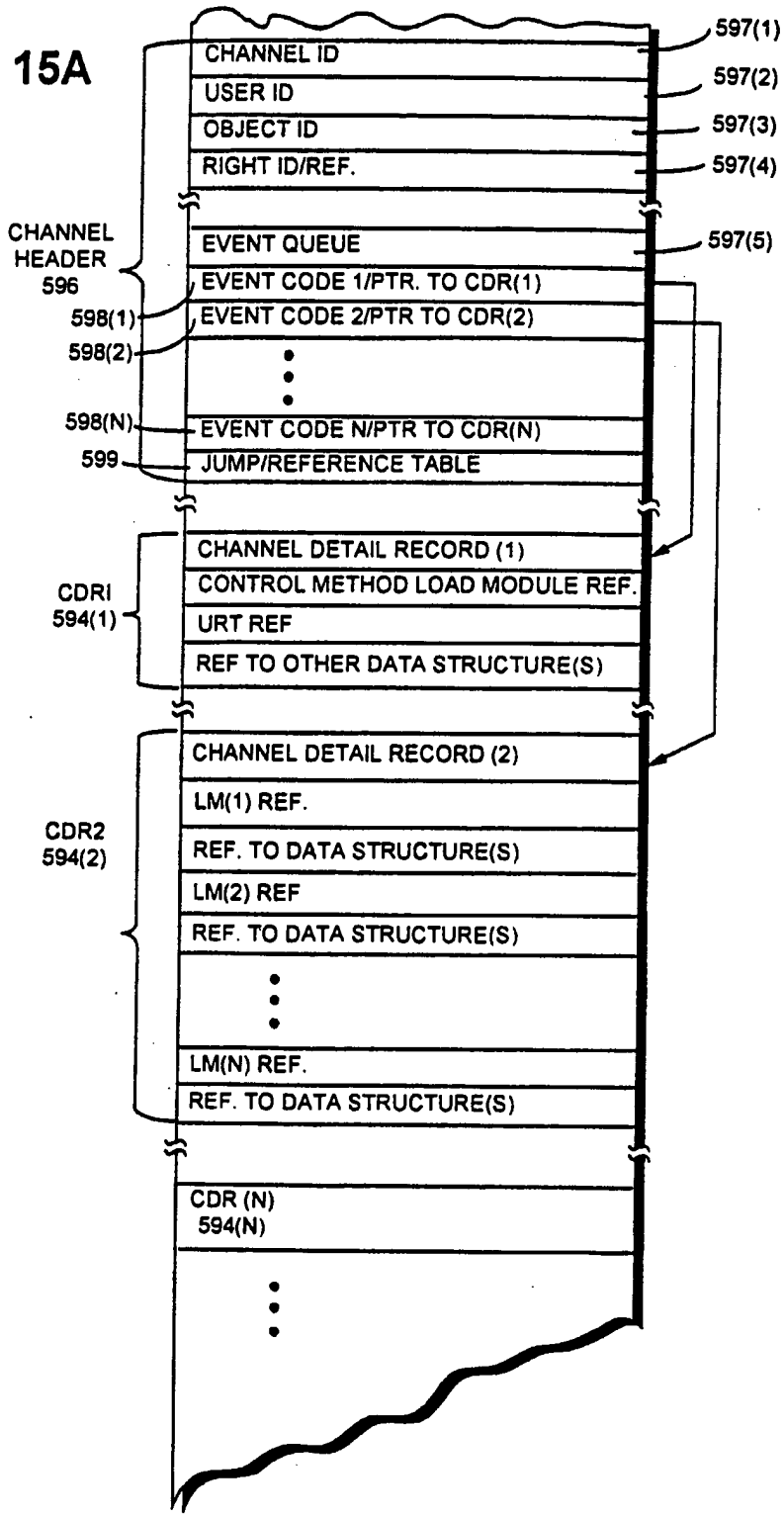


FIG. 15B

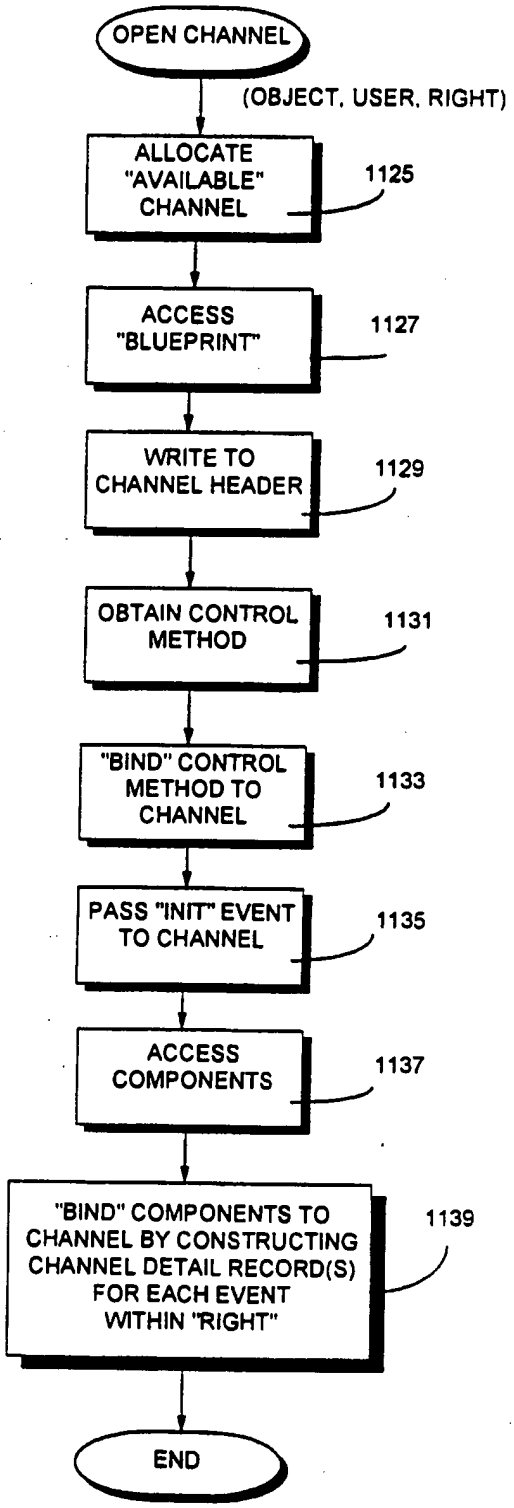
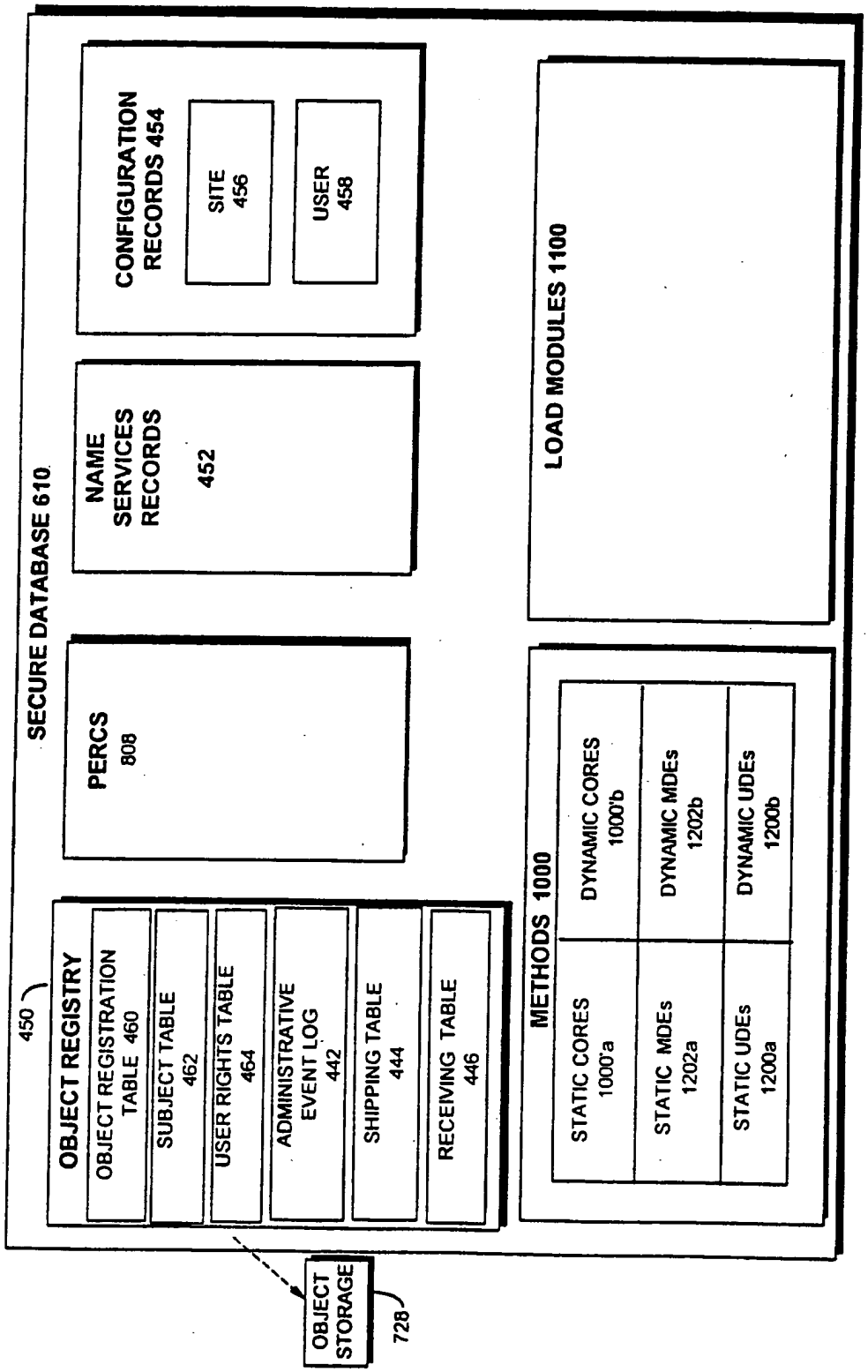


FIG. 16



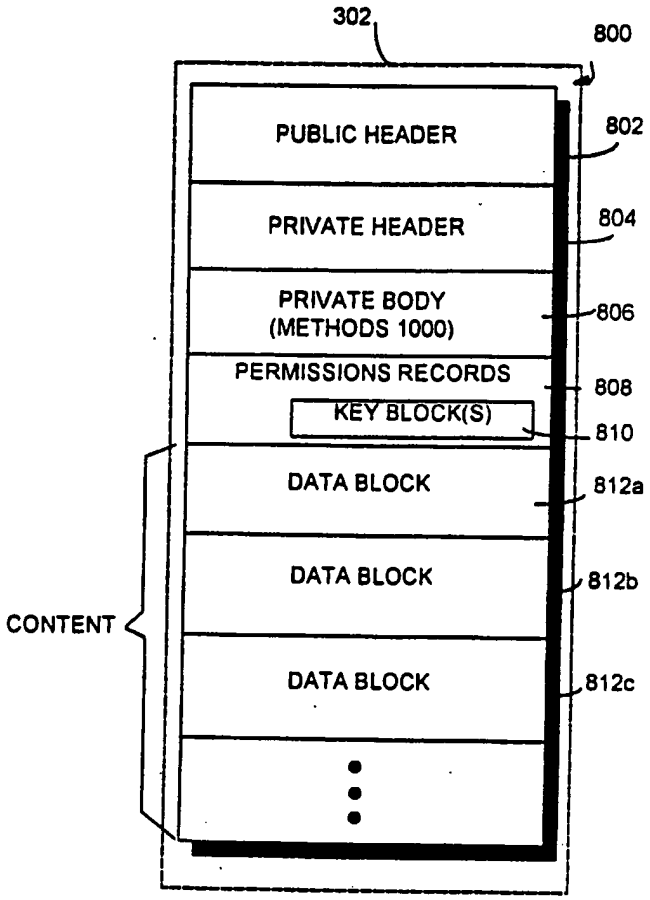
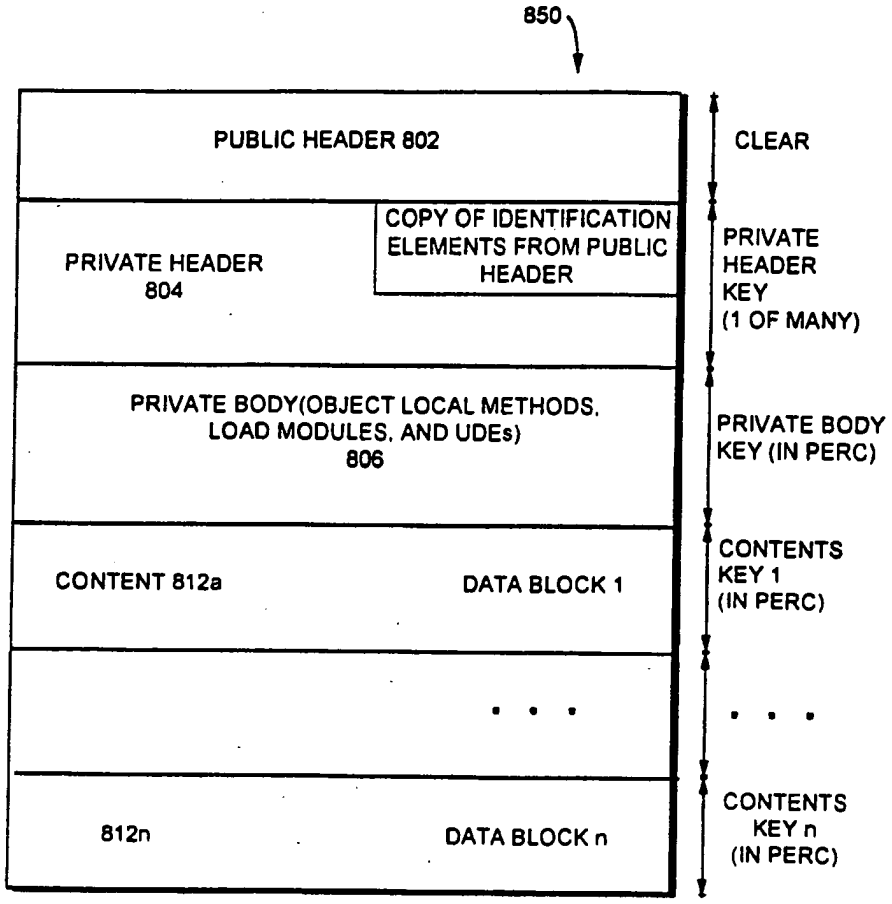
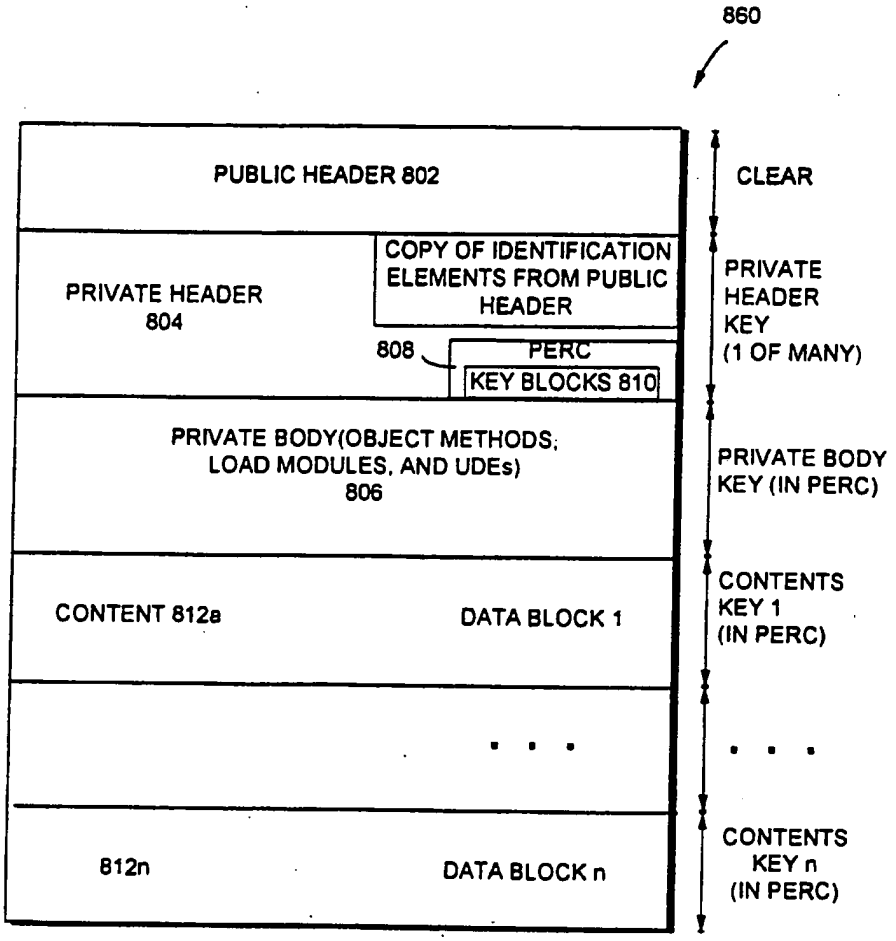


FIG. 17



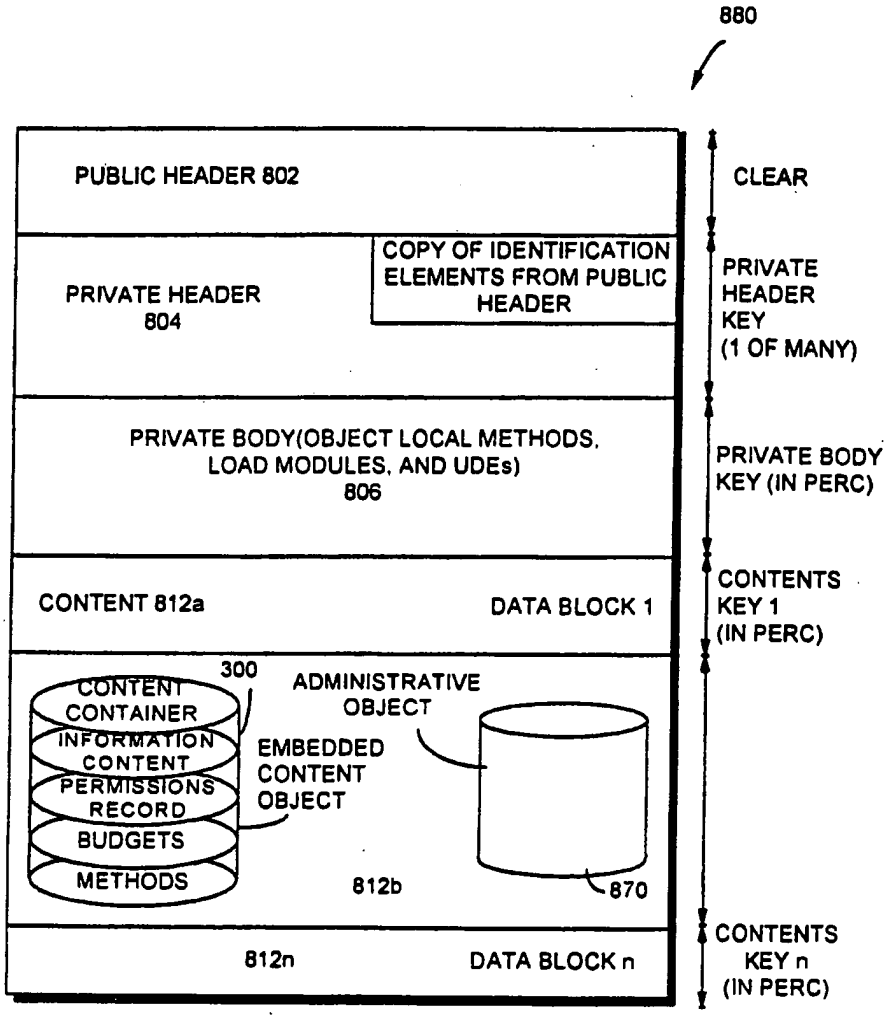
STATIONARY OBJECT

FIG. 18



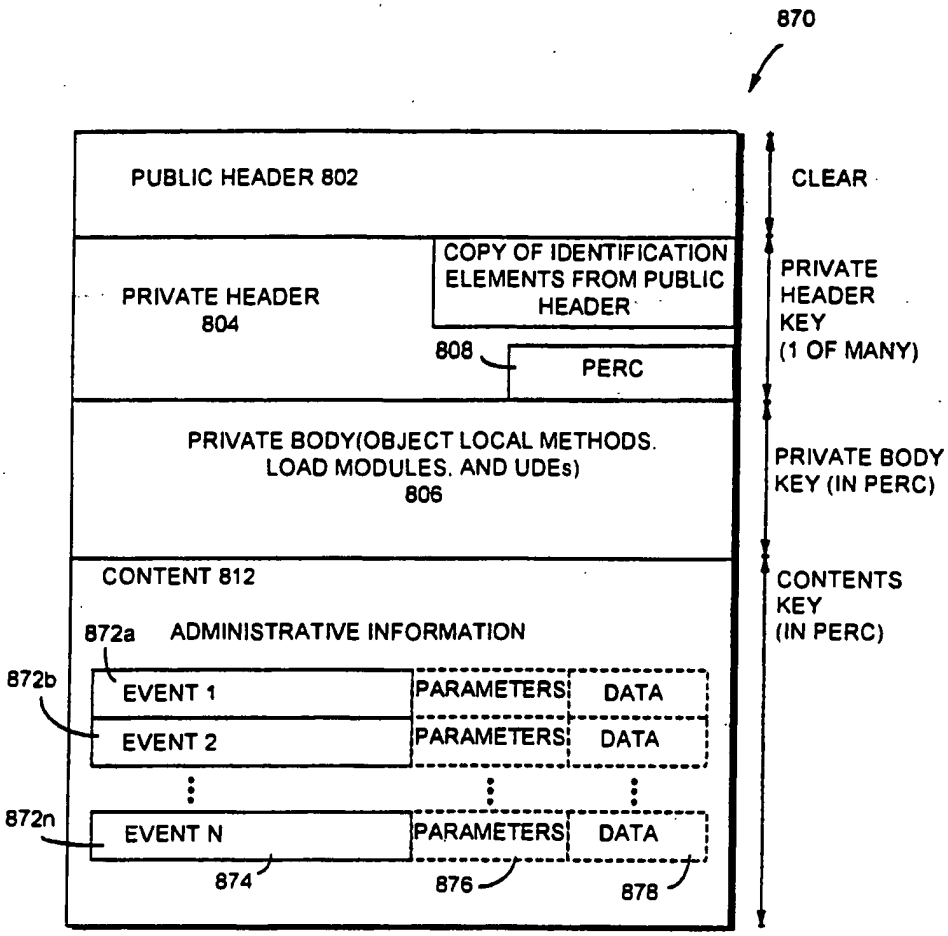
TRAVELING OBJECT

FIG. 19



CONTENT OBJECT

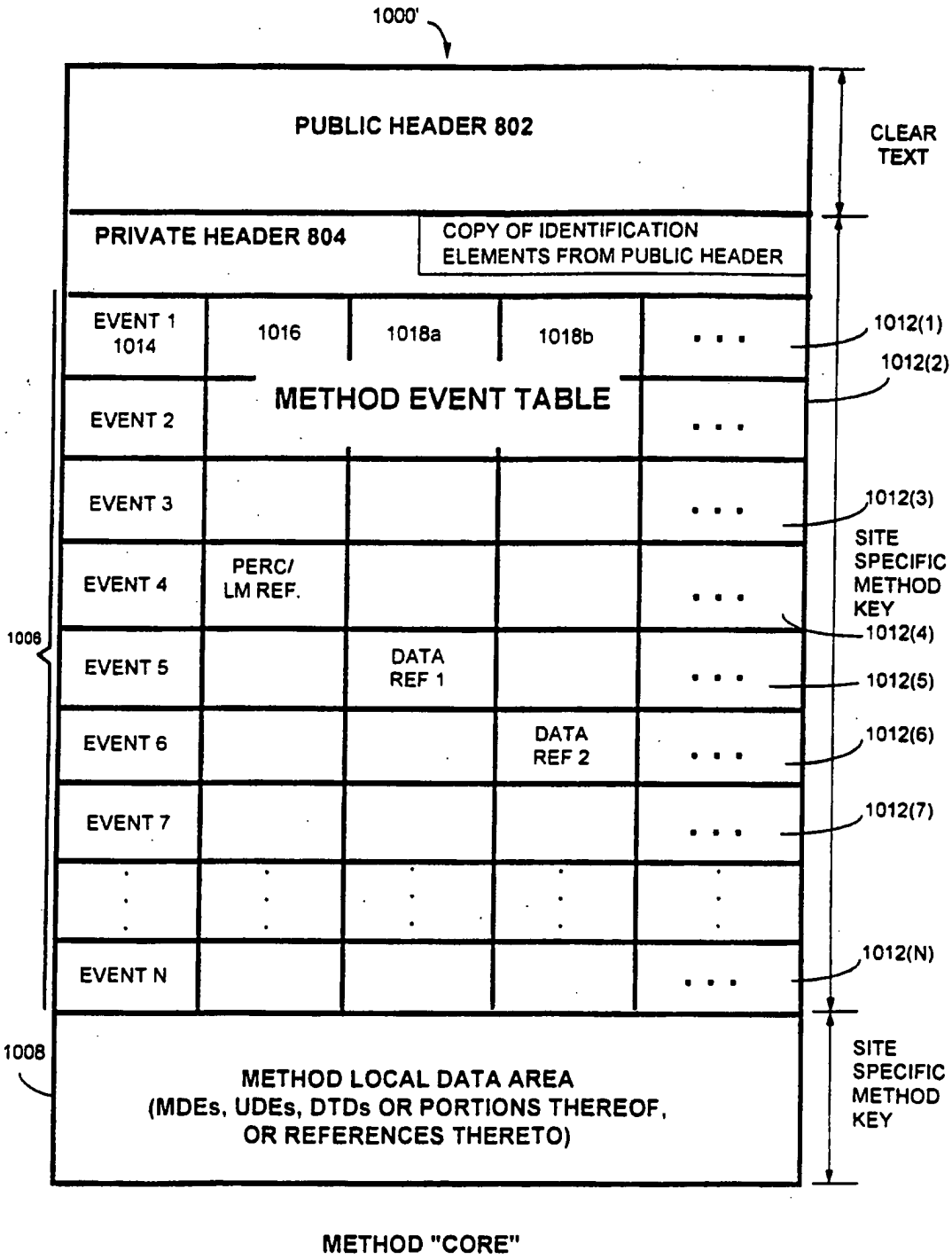
FIG. 20



ADMINISTRATIVE OBJECT

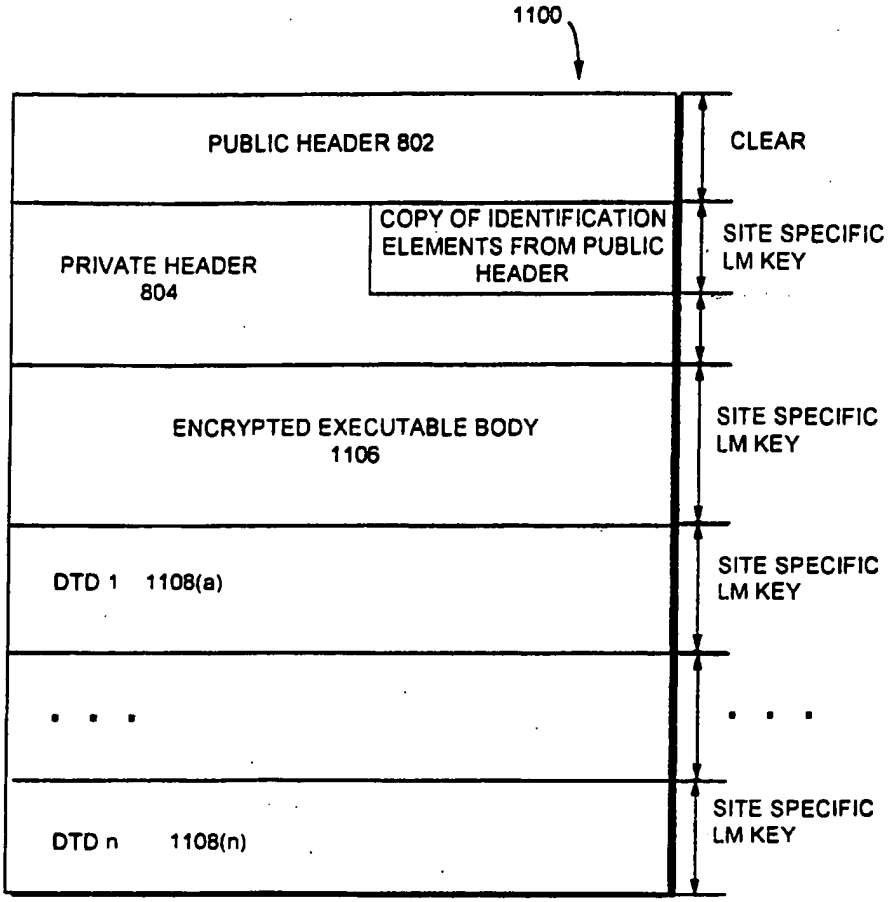
FIG. 21

FIG. 22



METHOD "CORE"

FIG. 23



LOAD MODULE

FIG. 24

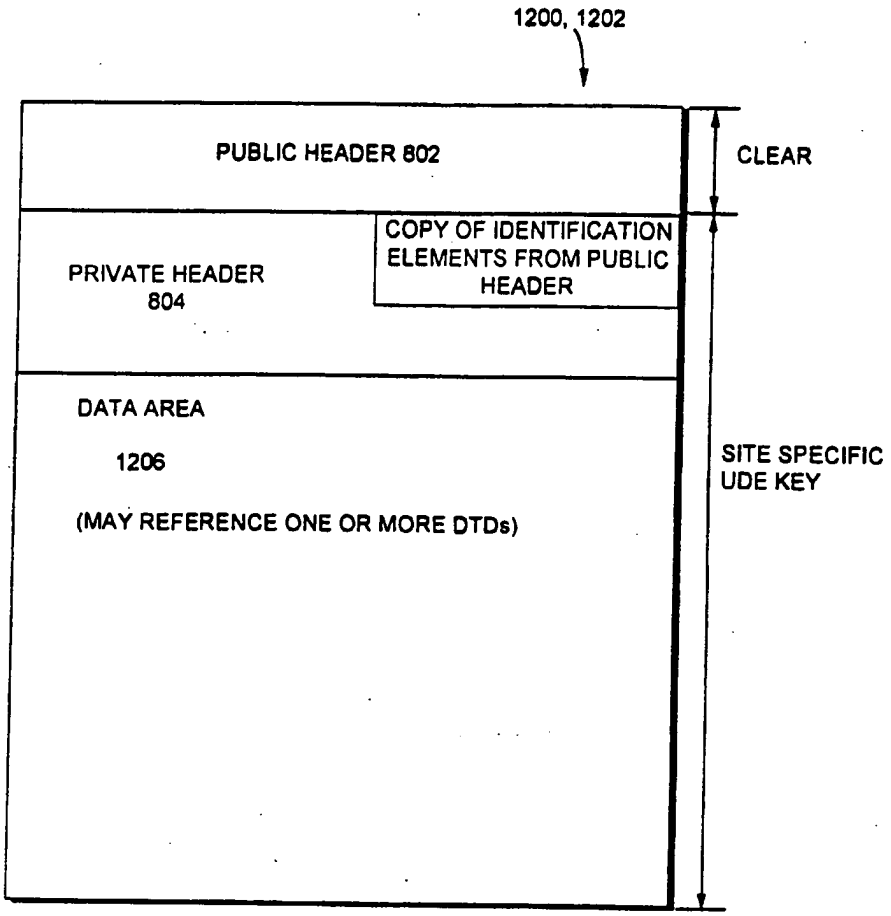


FIG. 25A

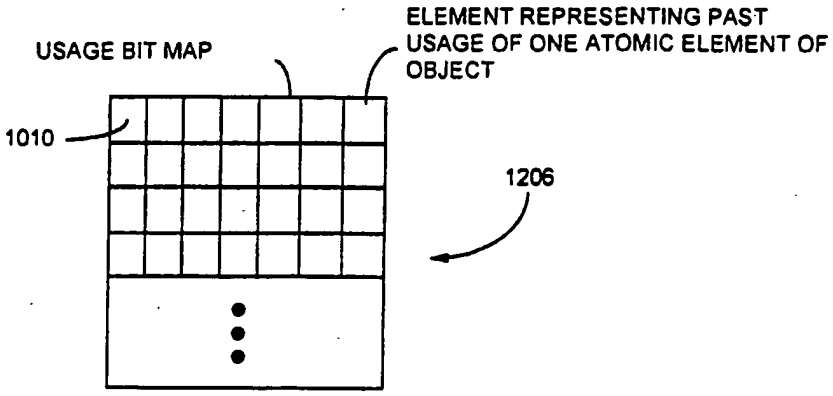


FIG. 25B

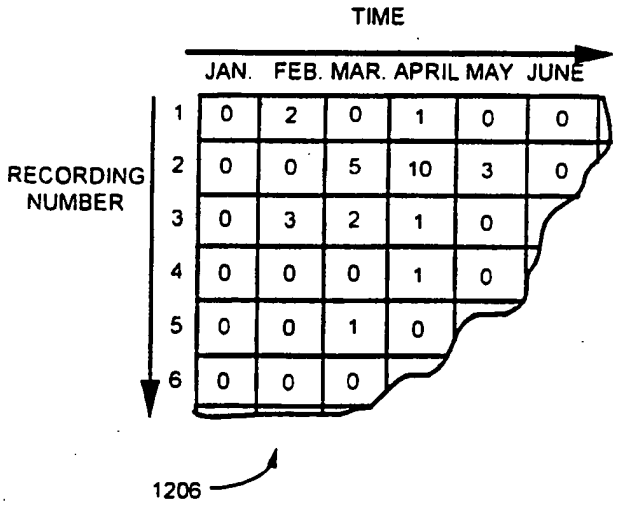


FIG. 25C

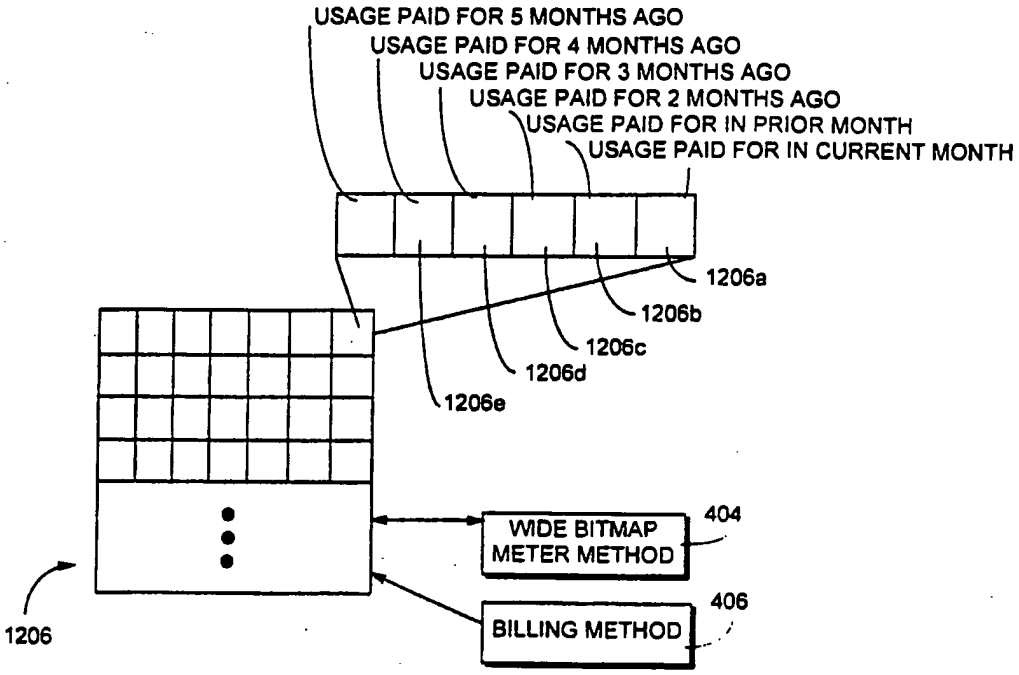


FIG. 26

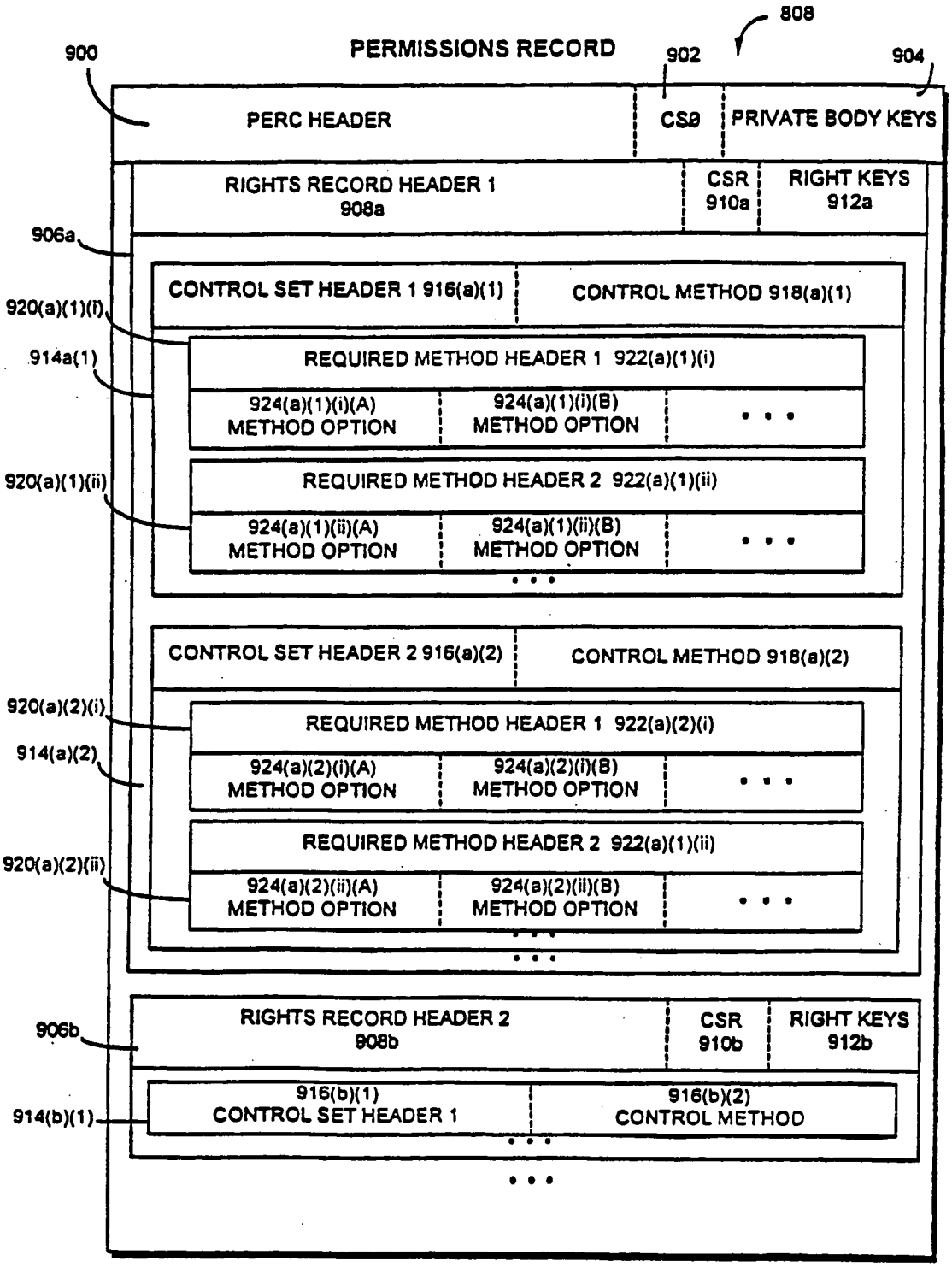


FIG. 26A

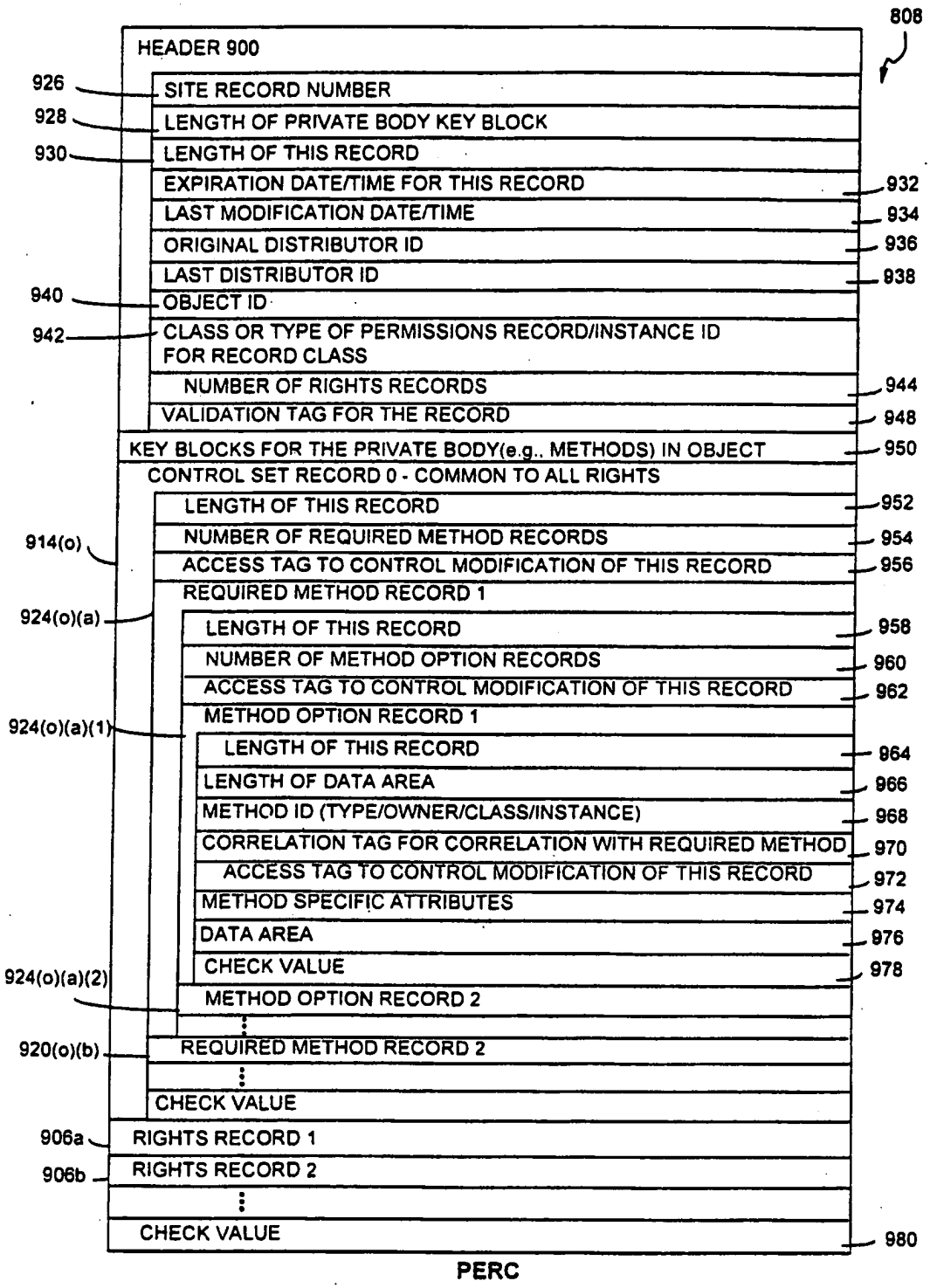
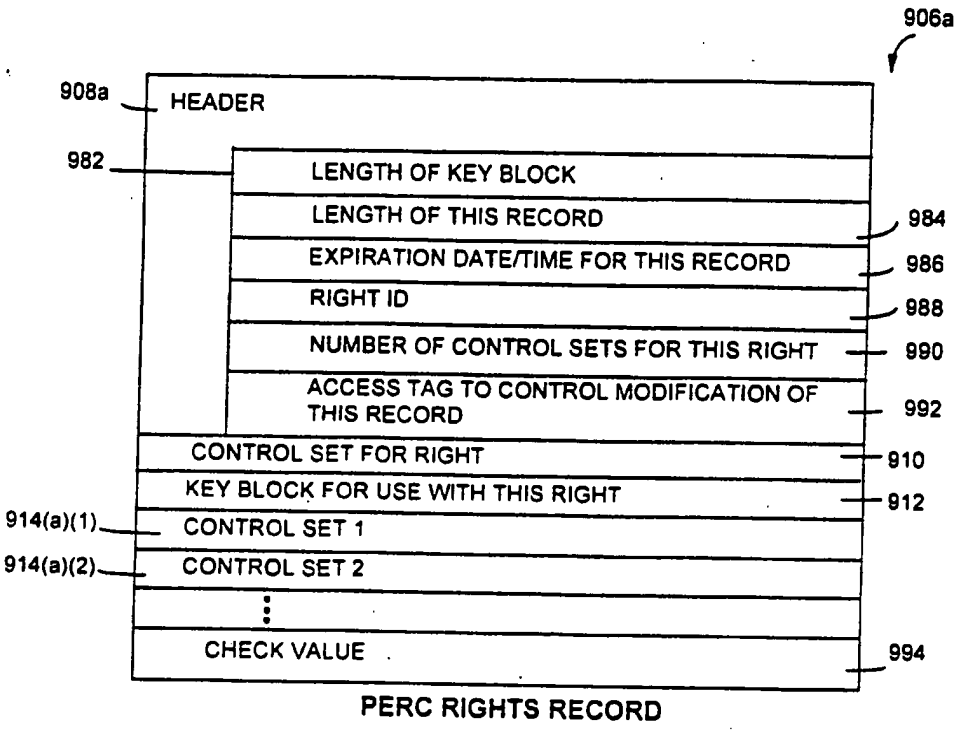


FIG. 26B



PERC RIGHTS RECORD

FIG. 27
SHIPPING TABLE

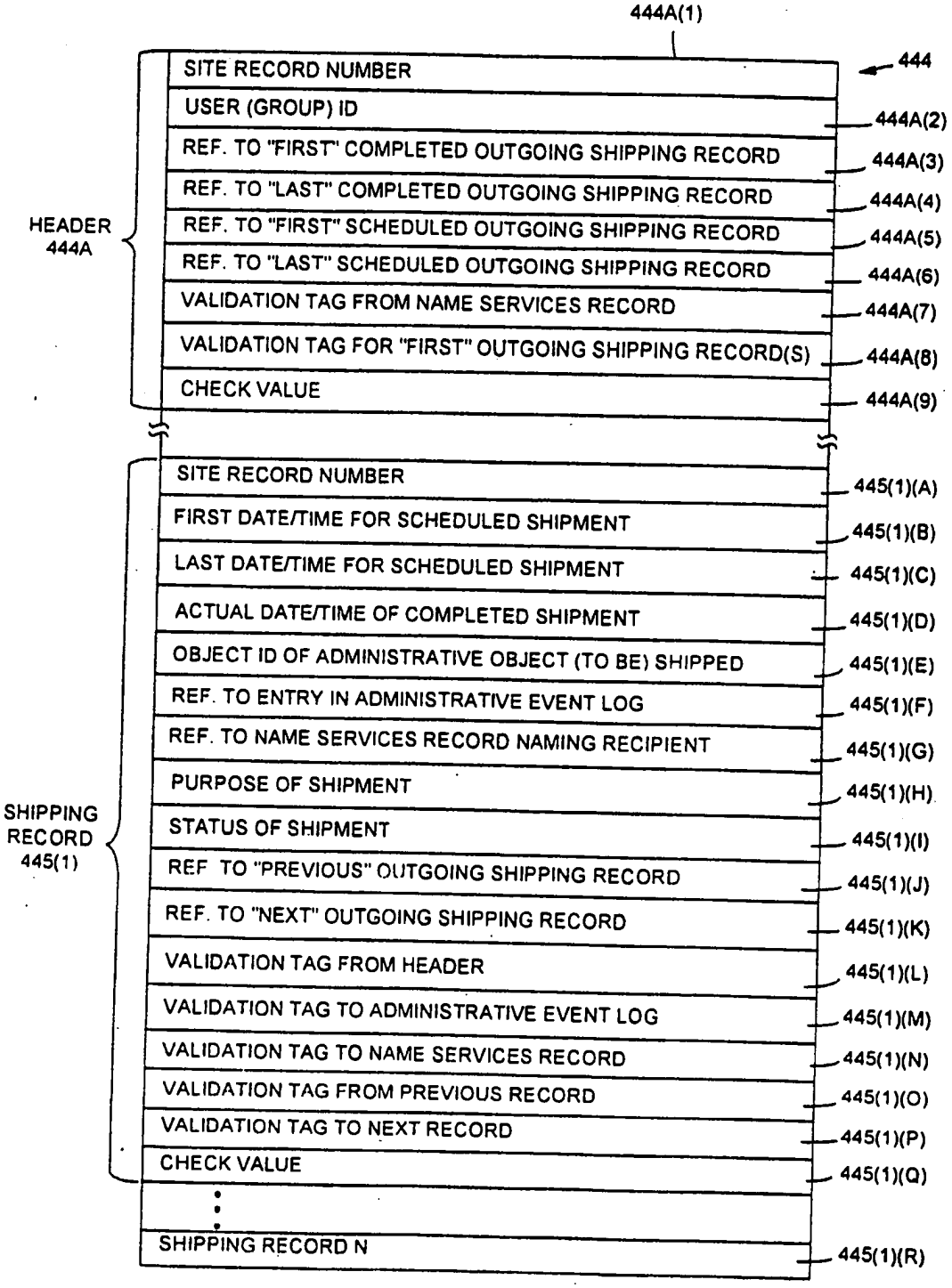


FIG. 28
RECEIVING TABLE

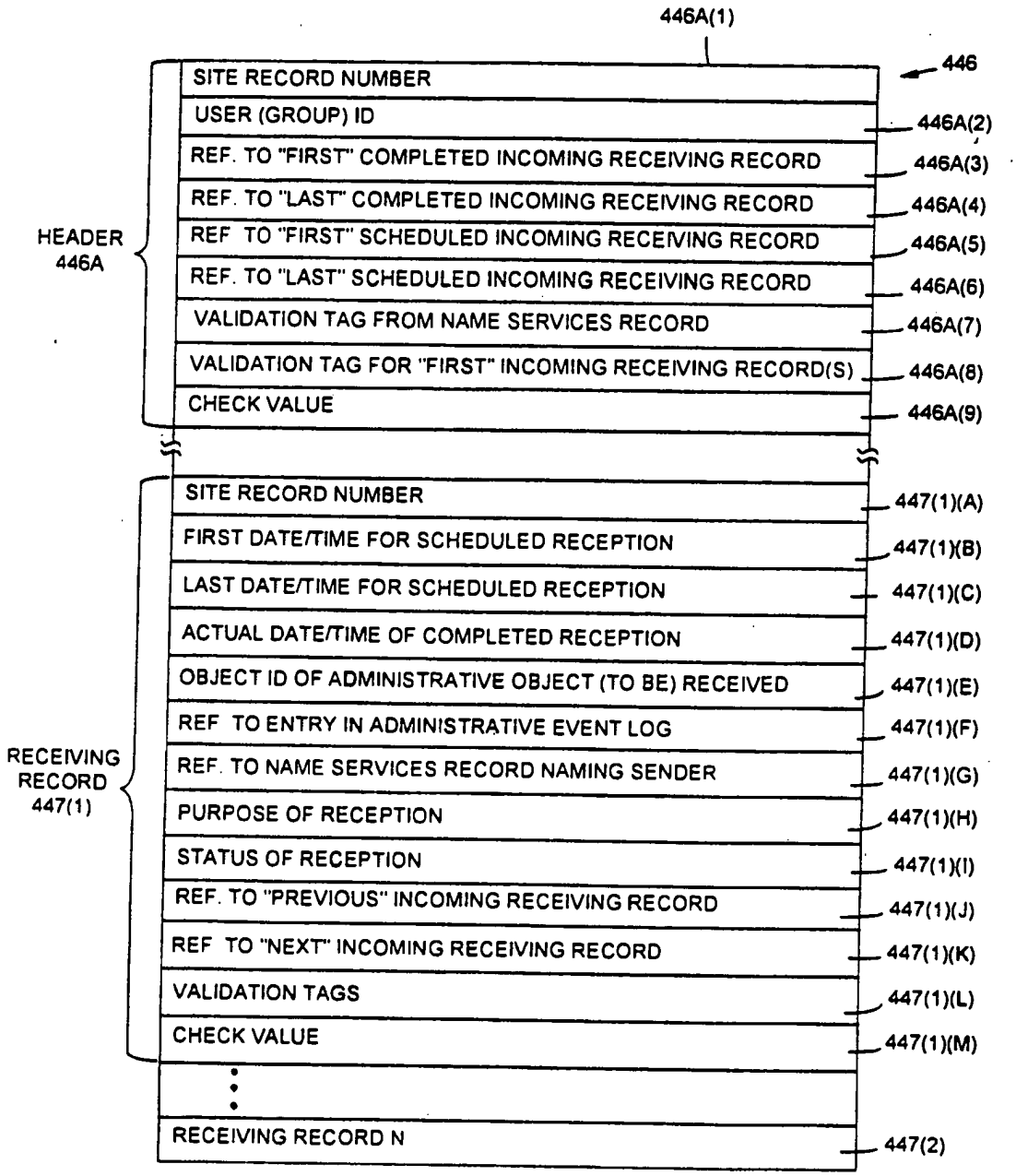
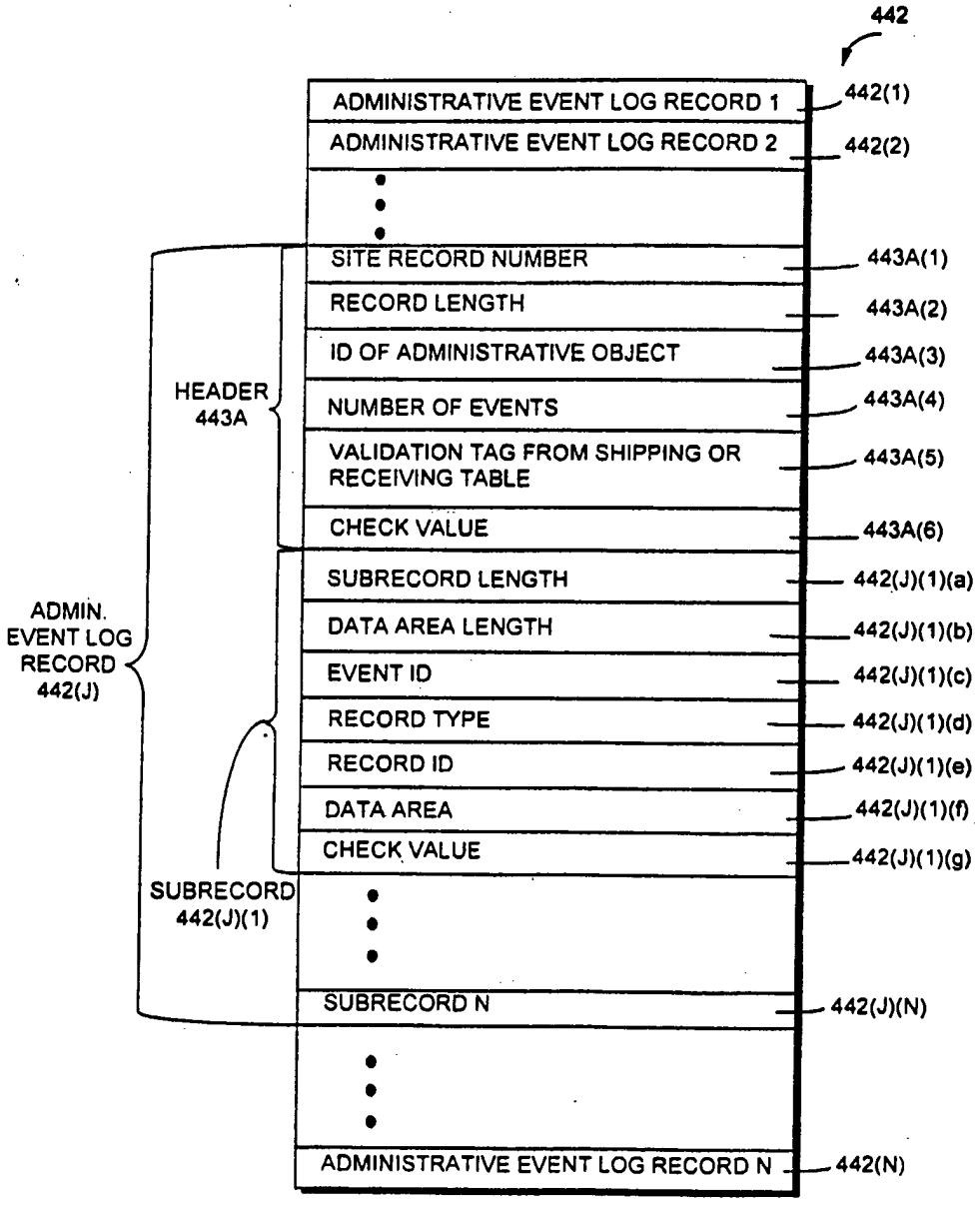


FIG. 29

ADMINISTRATIVE EVENT LOG



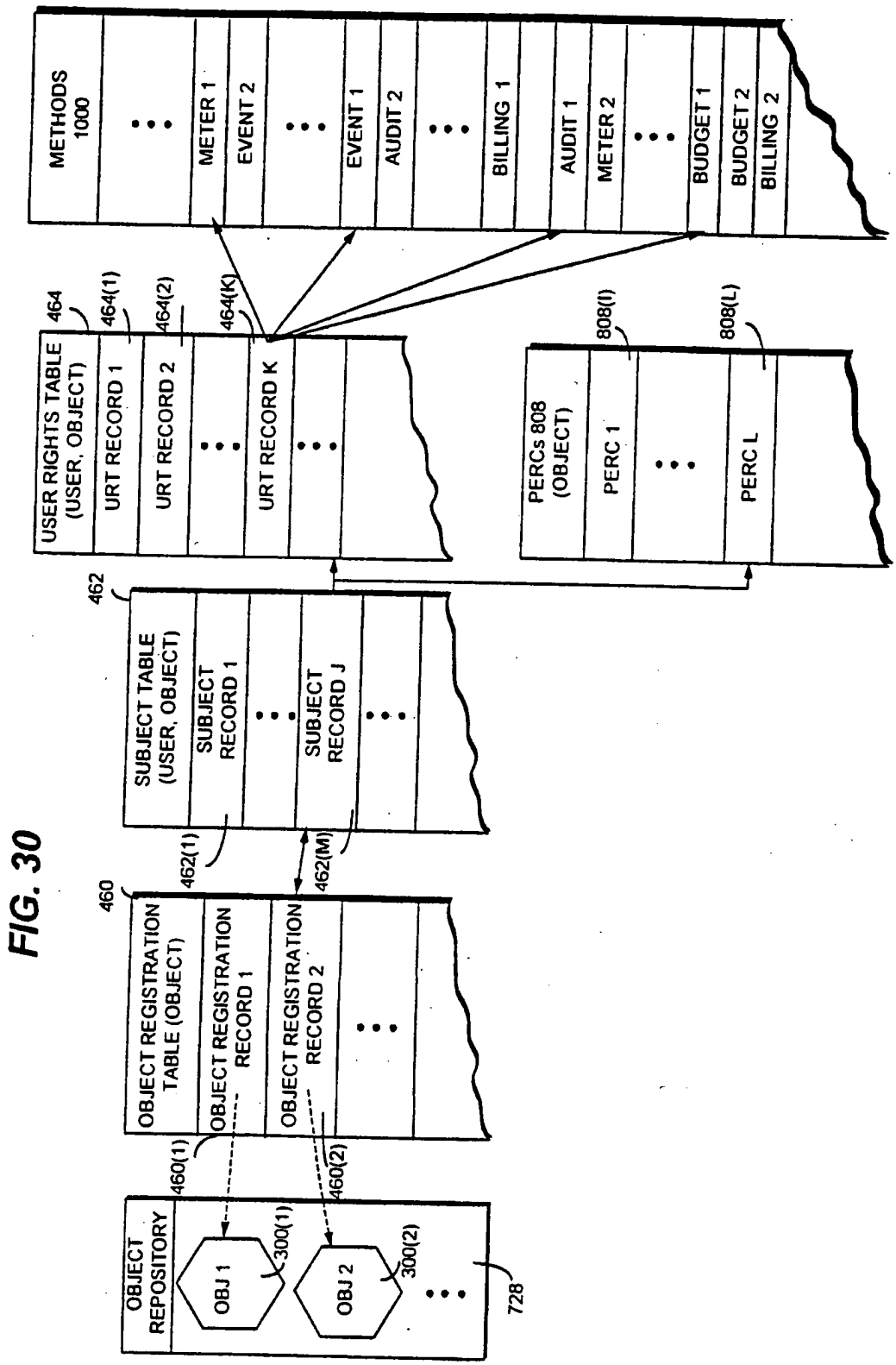


FIG. 30

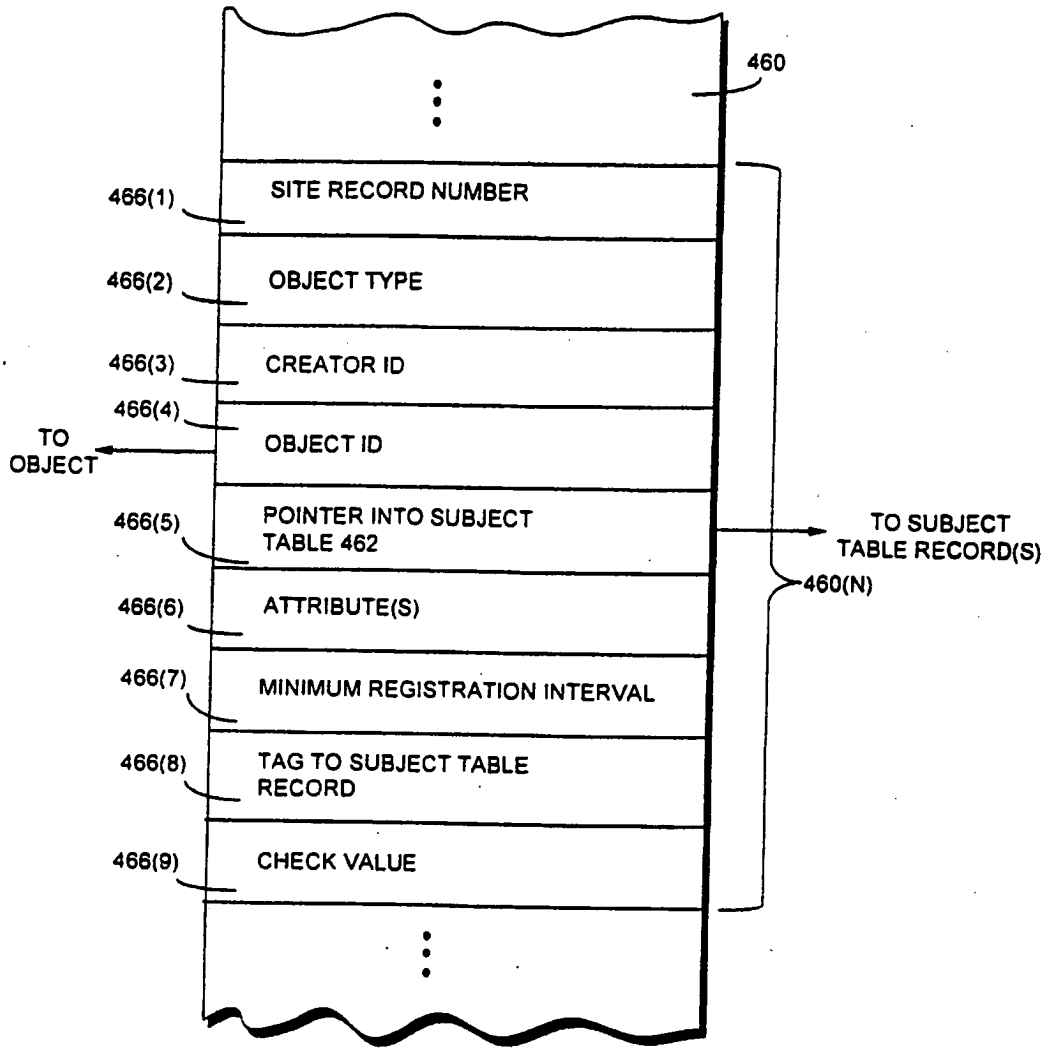


FIG. 31
OBJECT REGISTRATION TABLE

FIG. 32

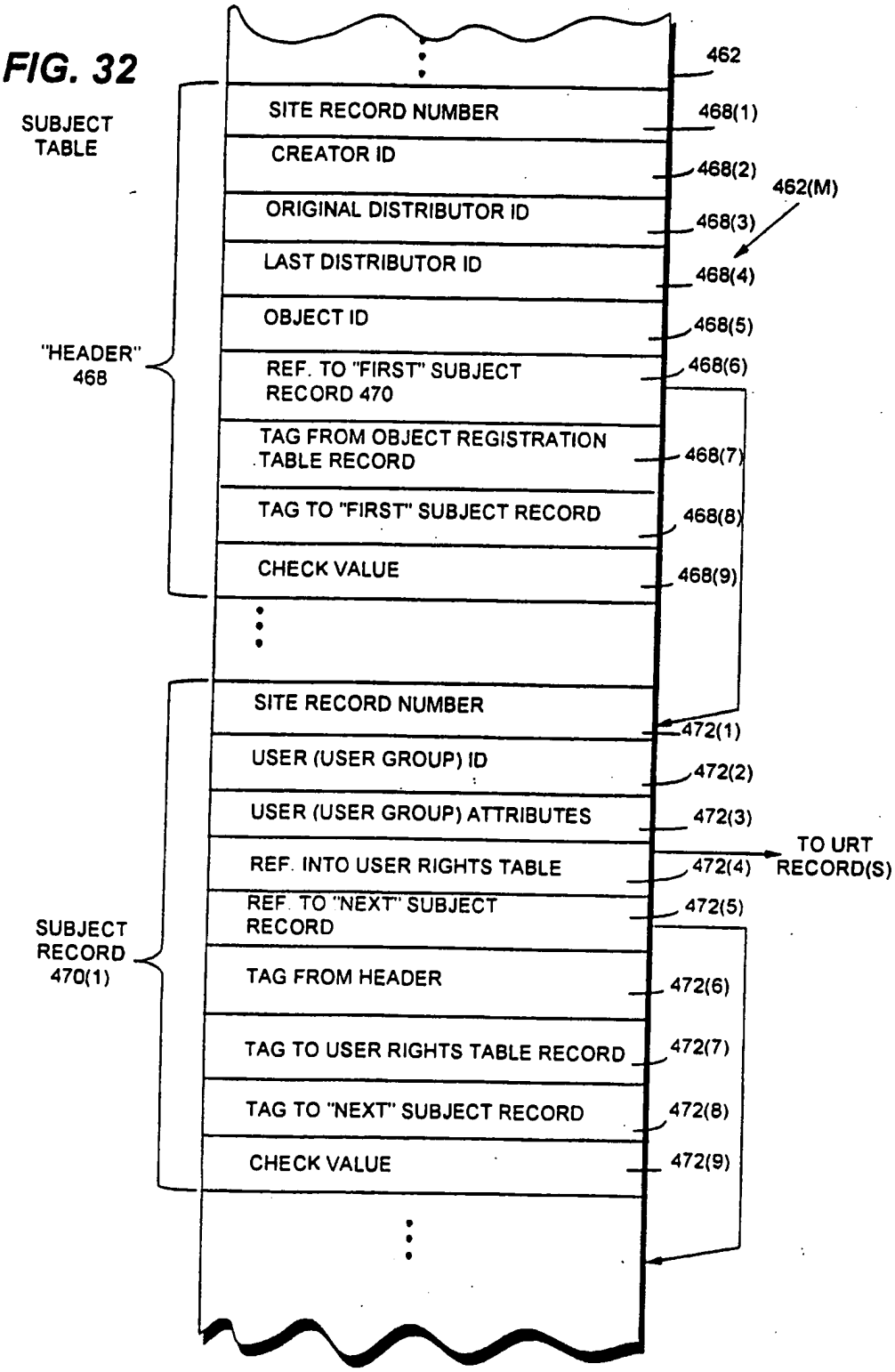


FIG. 33 USER RIGHTS TABLE

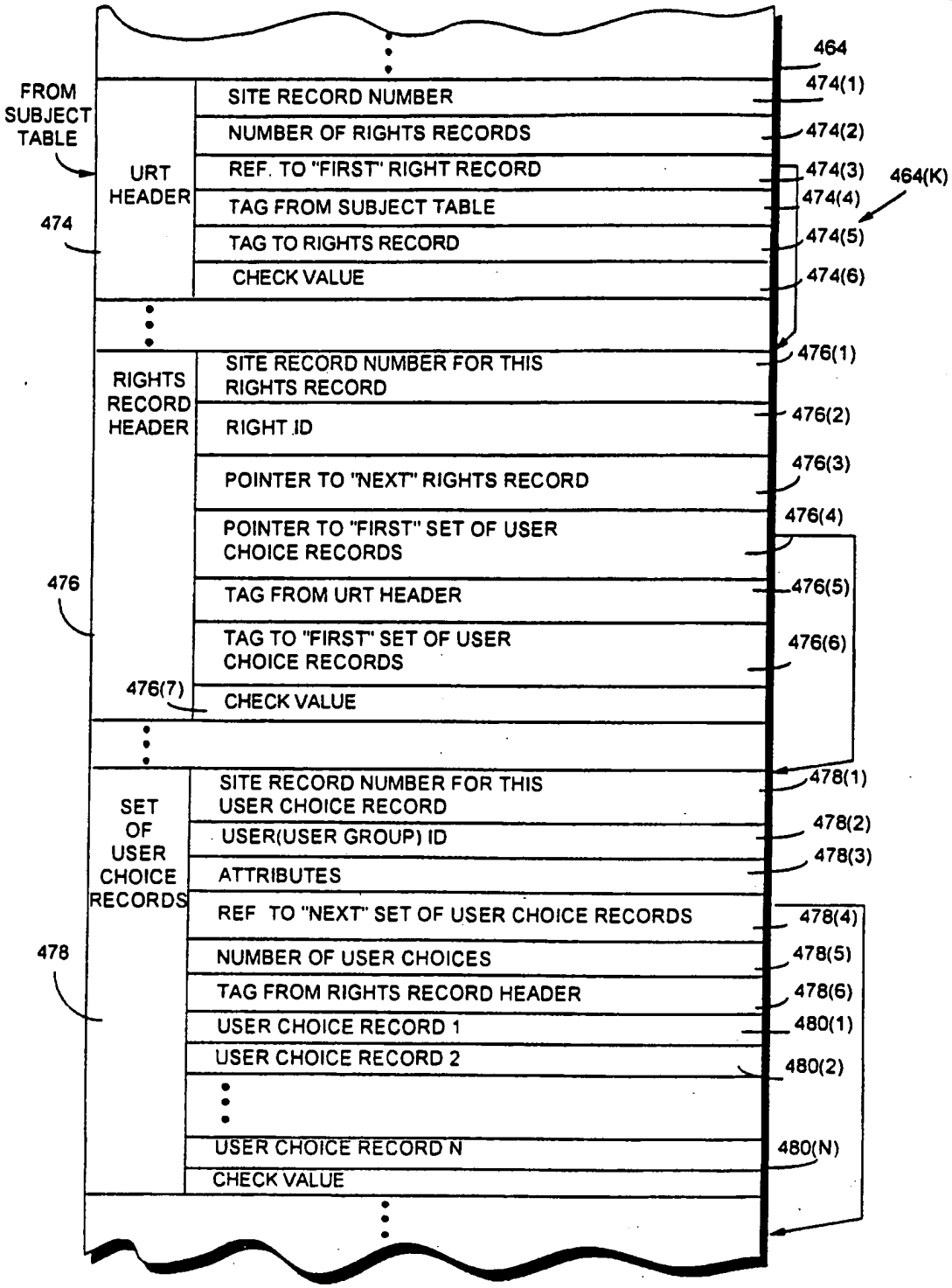


FIG. 34

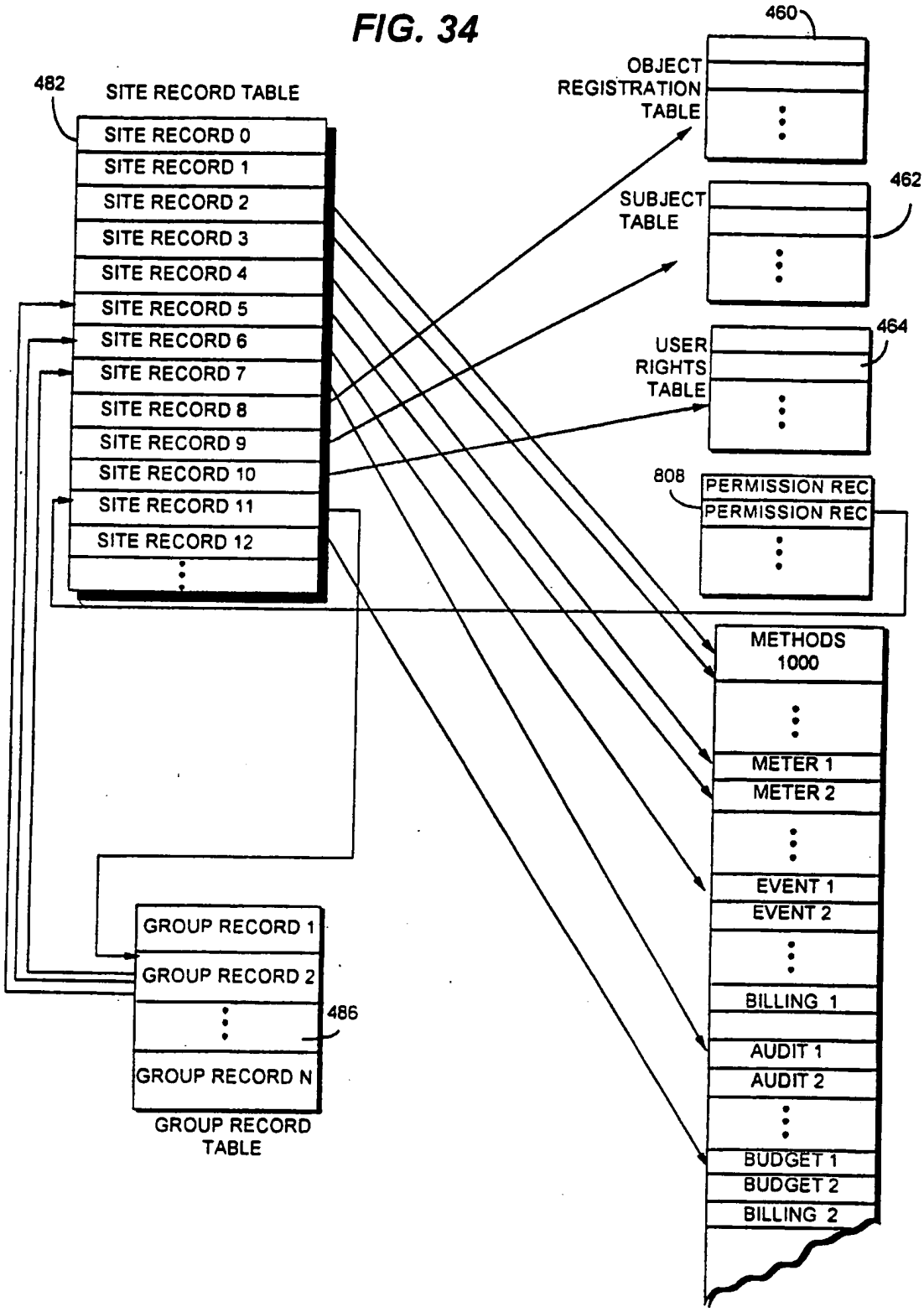


FIG. 34A

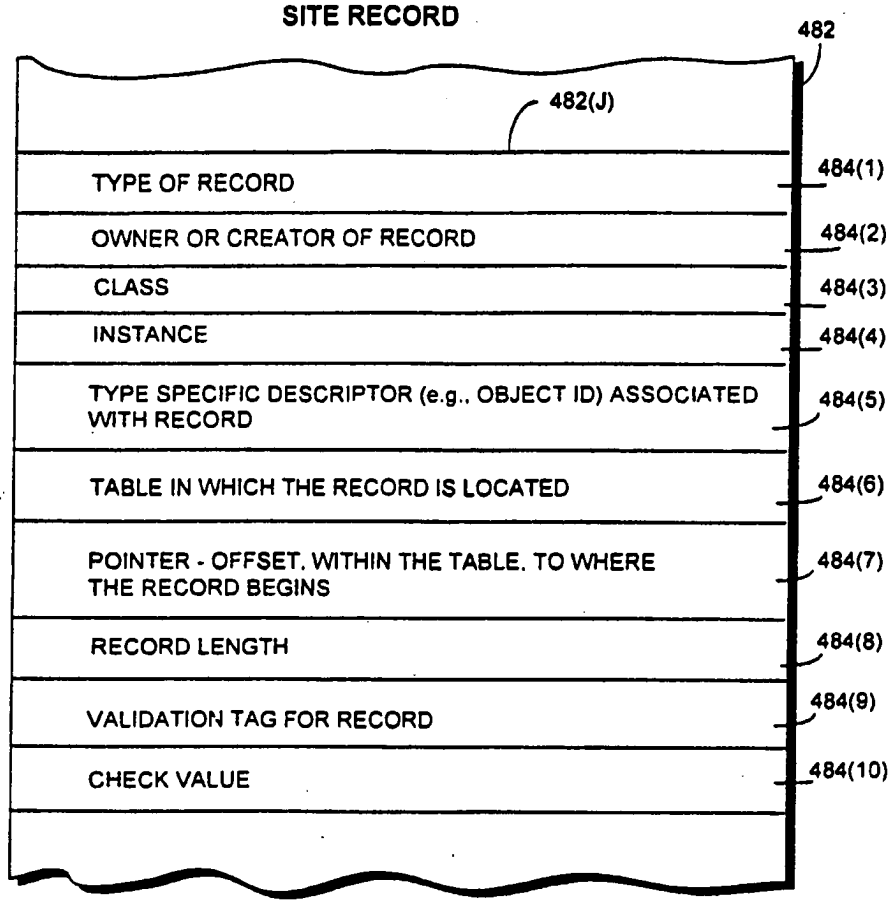


FIG. 34B

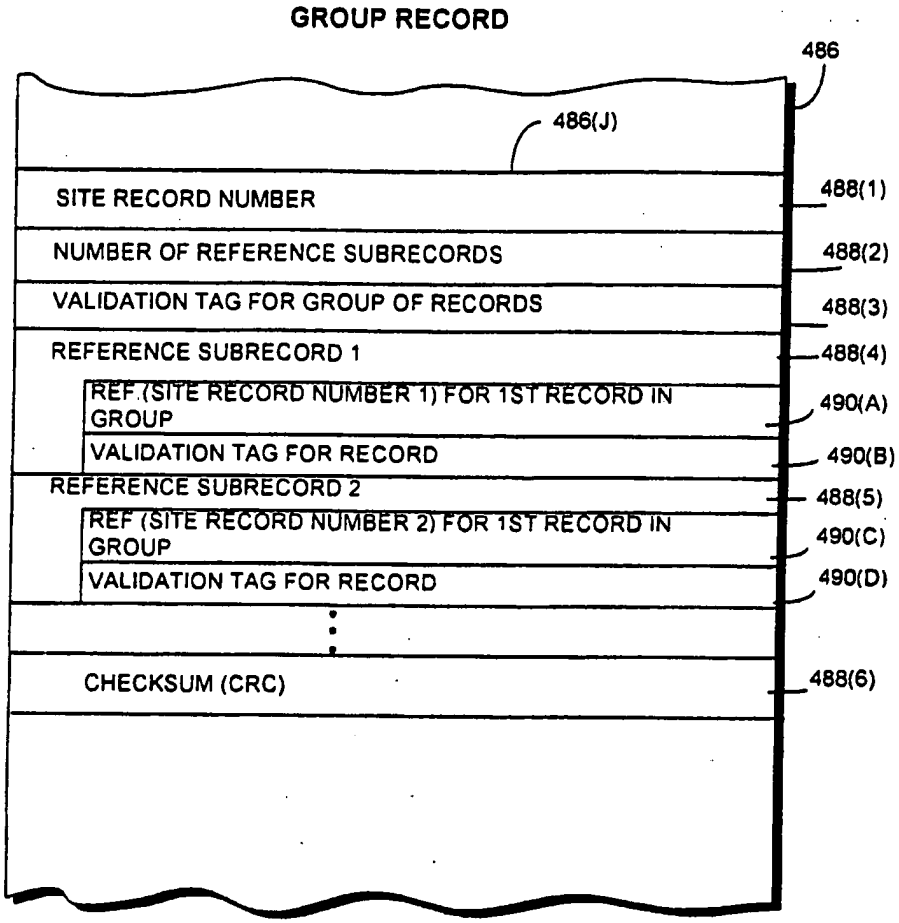
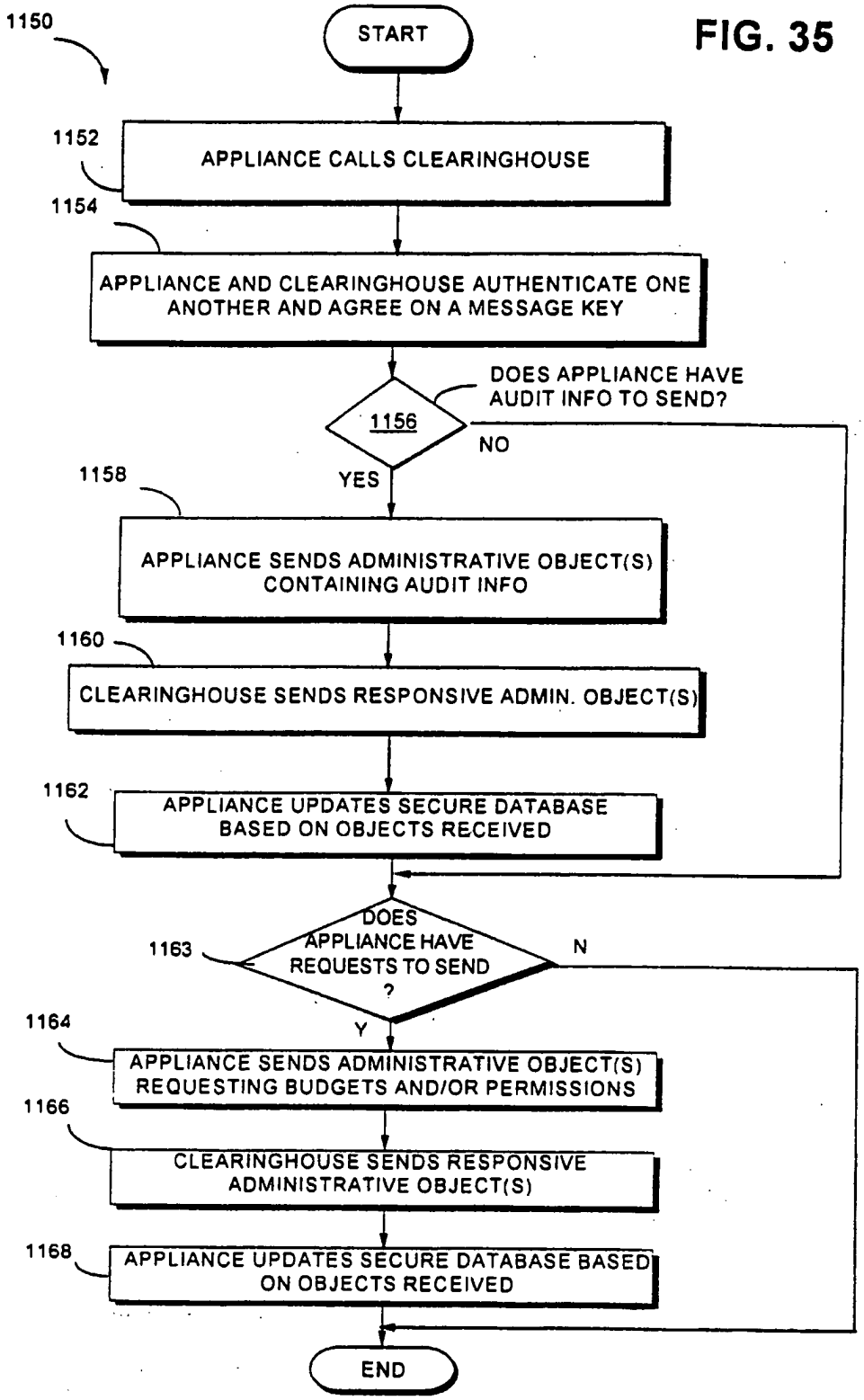


FIG. 35



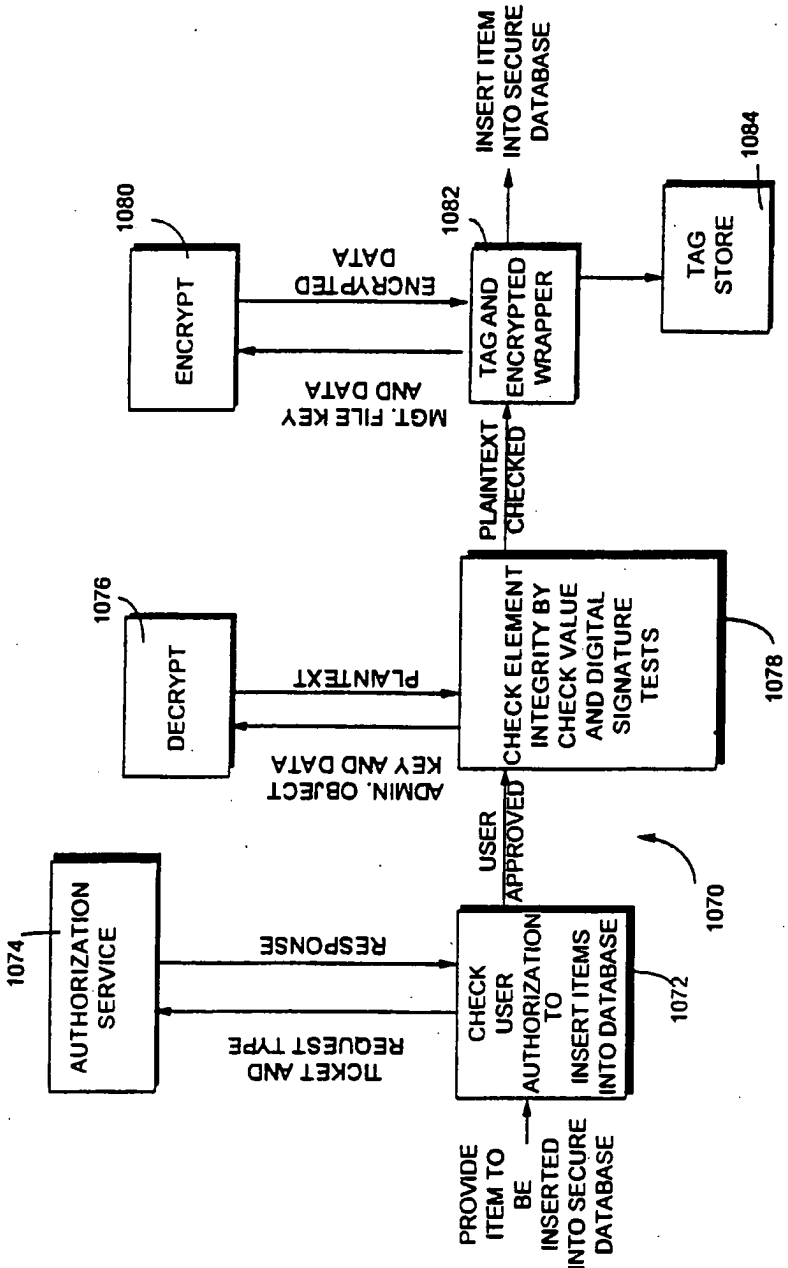


FIG. 36

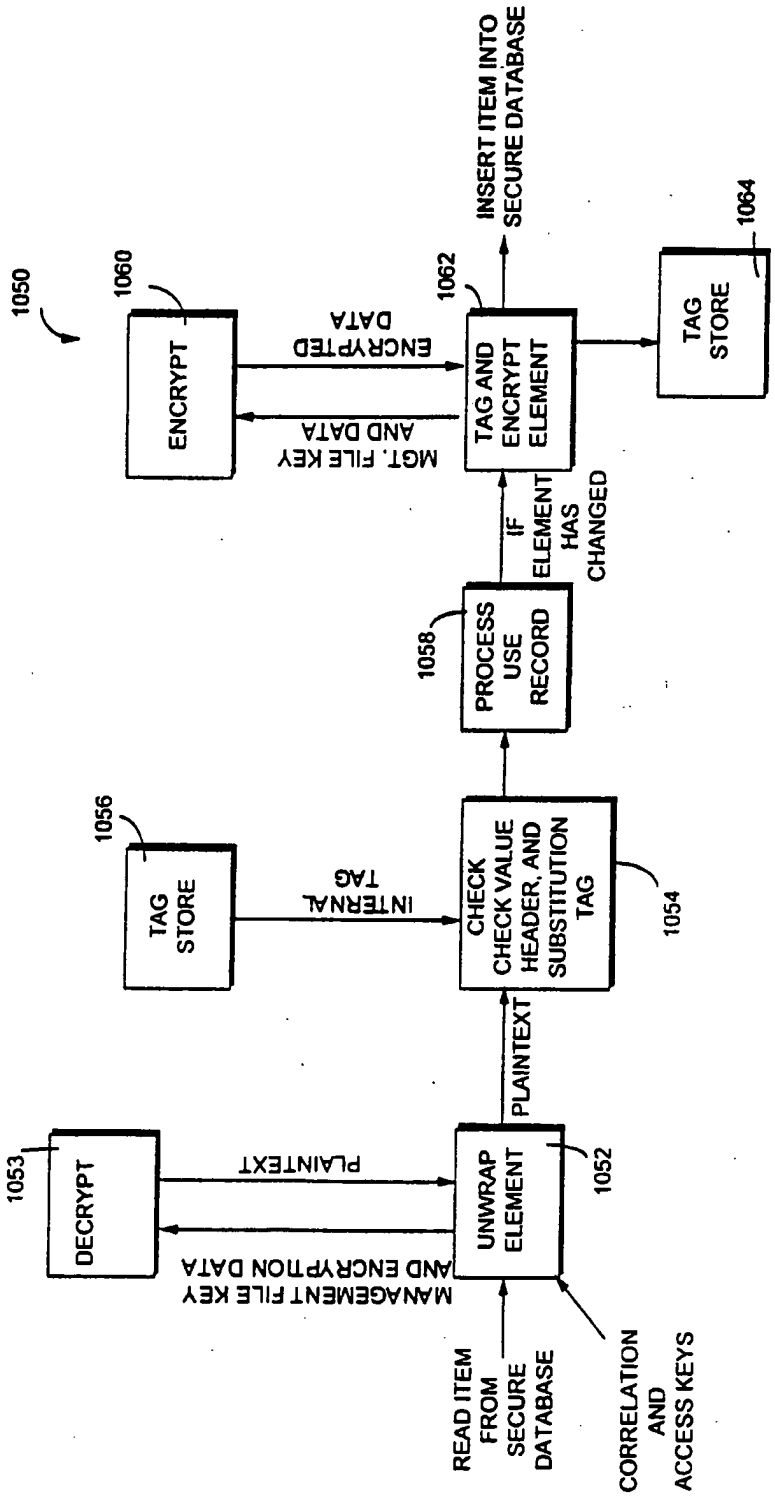


FIG. 37

FIG. 38

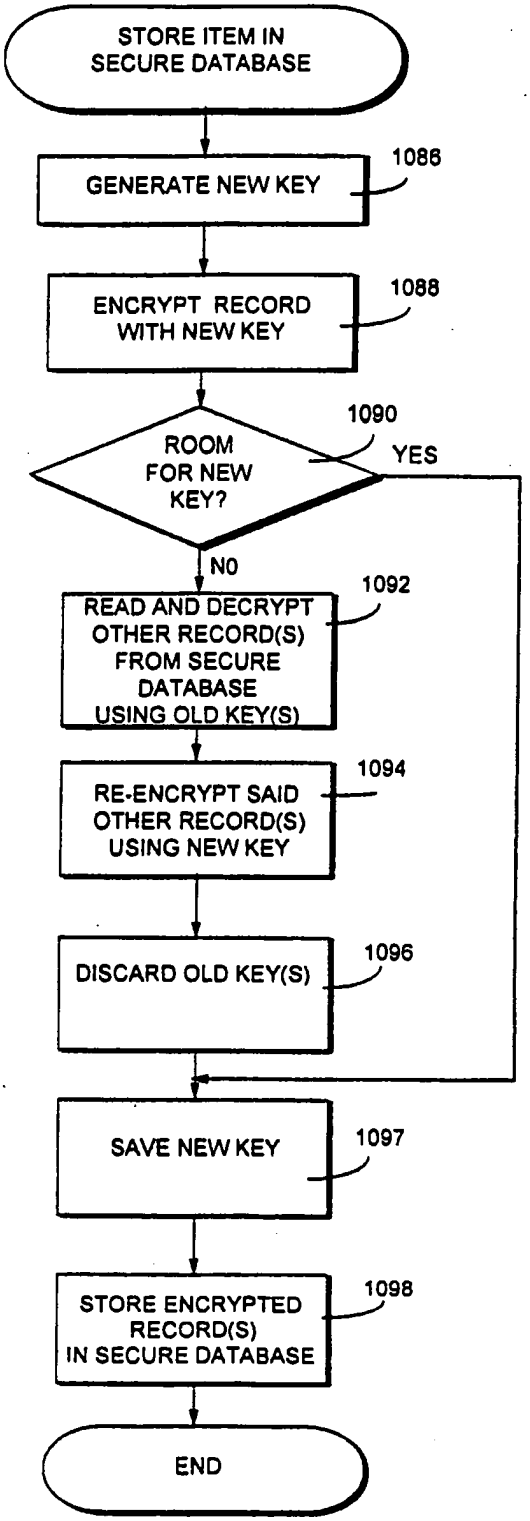


FIG. 39
BACKUP

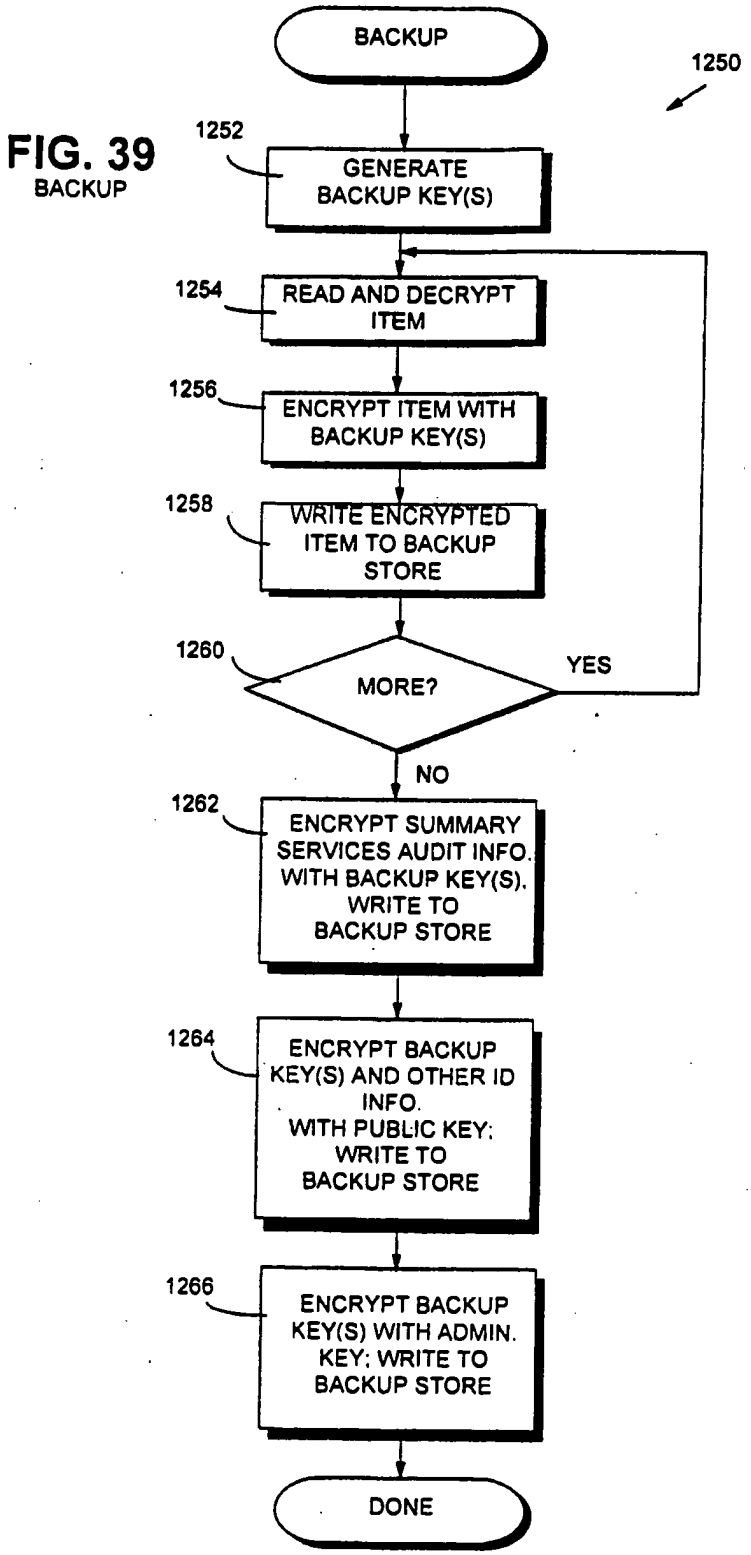
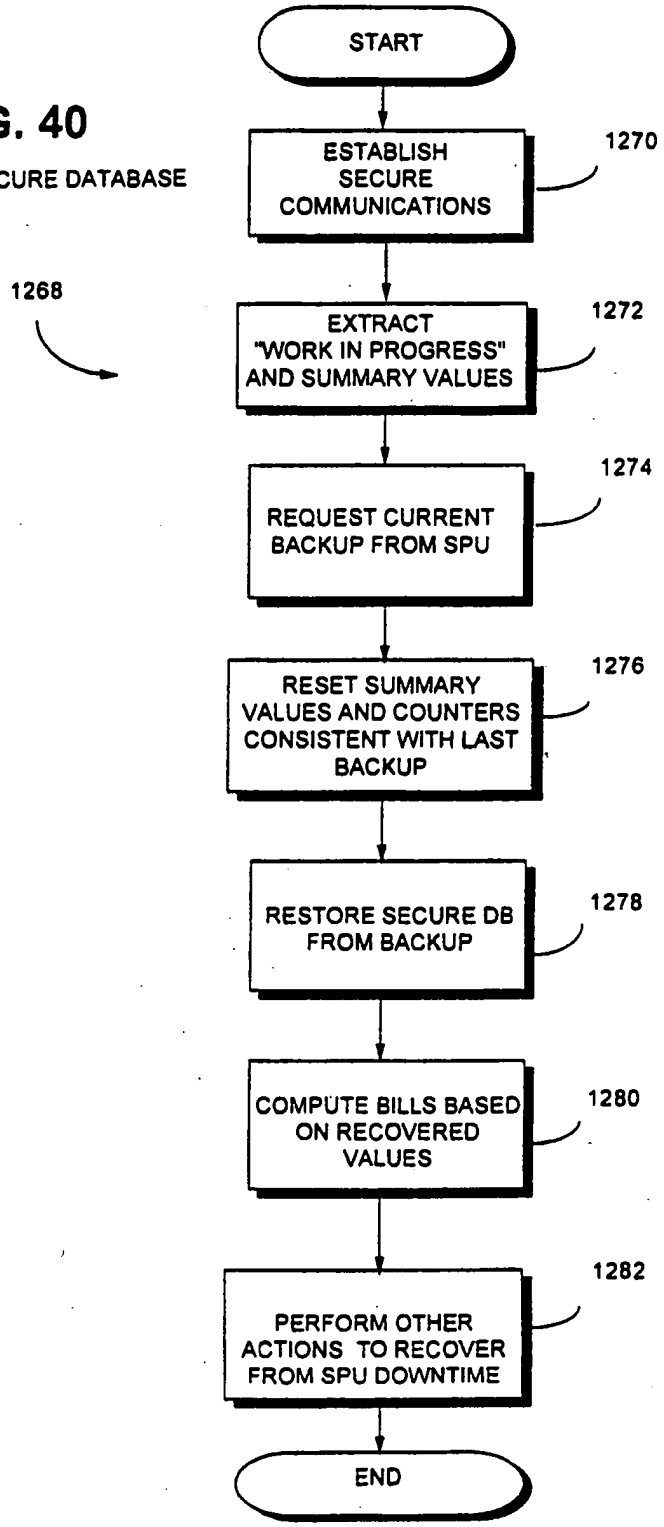


FIG. 40

RECOVER SECURE DATABASE



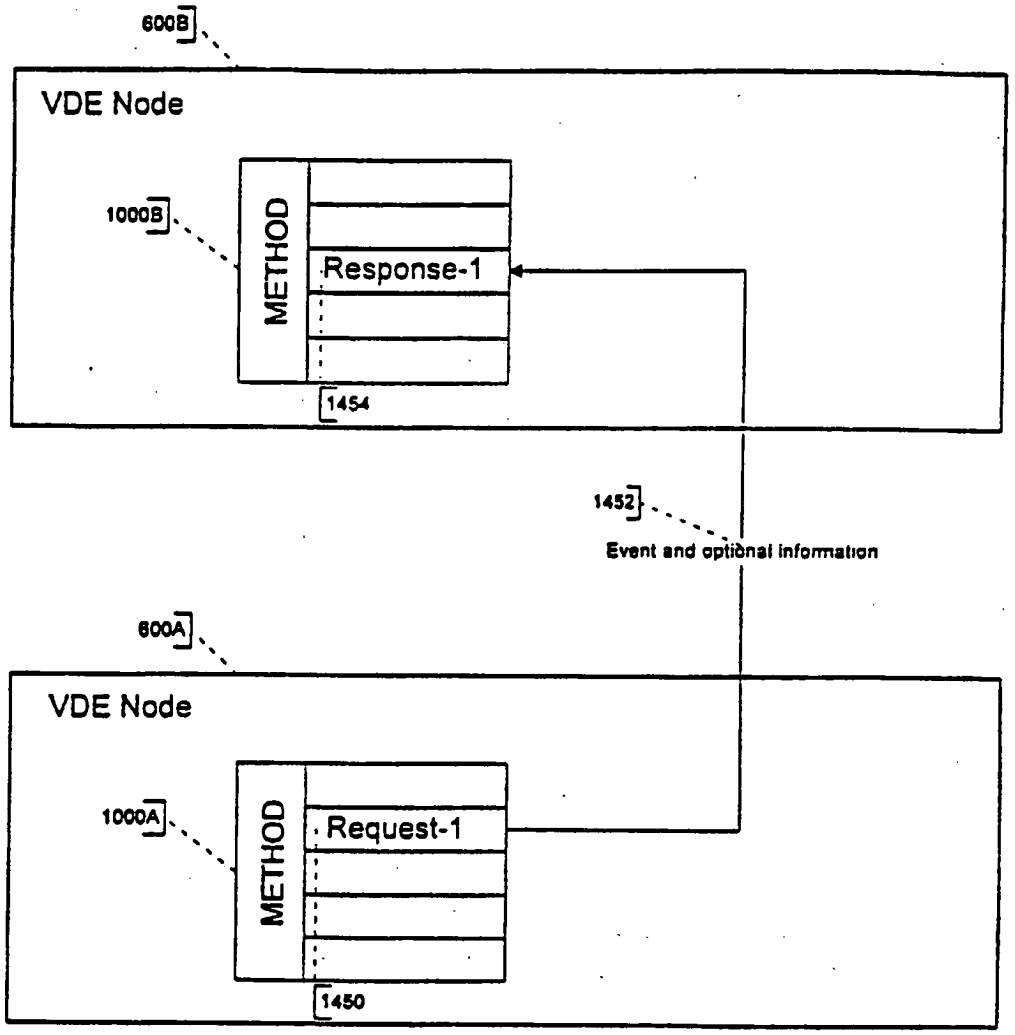


Figure 41a

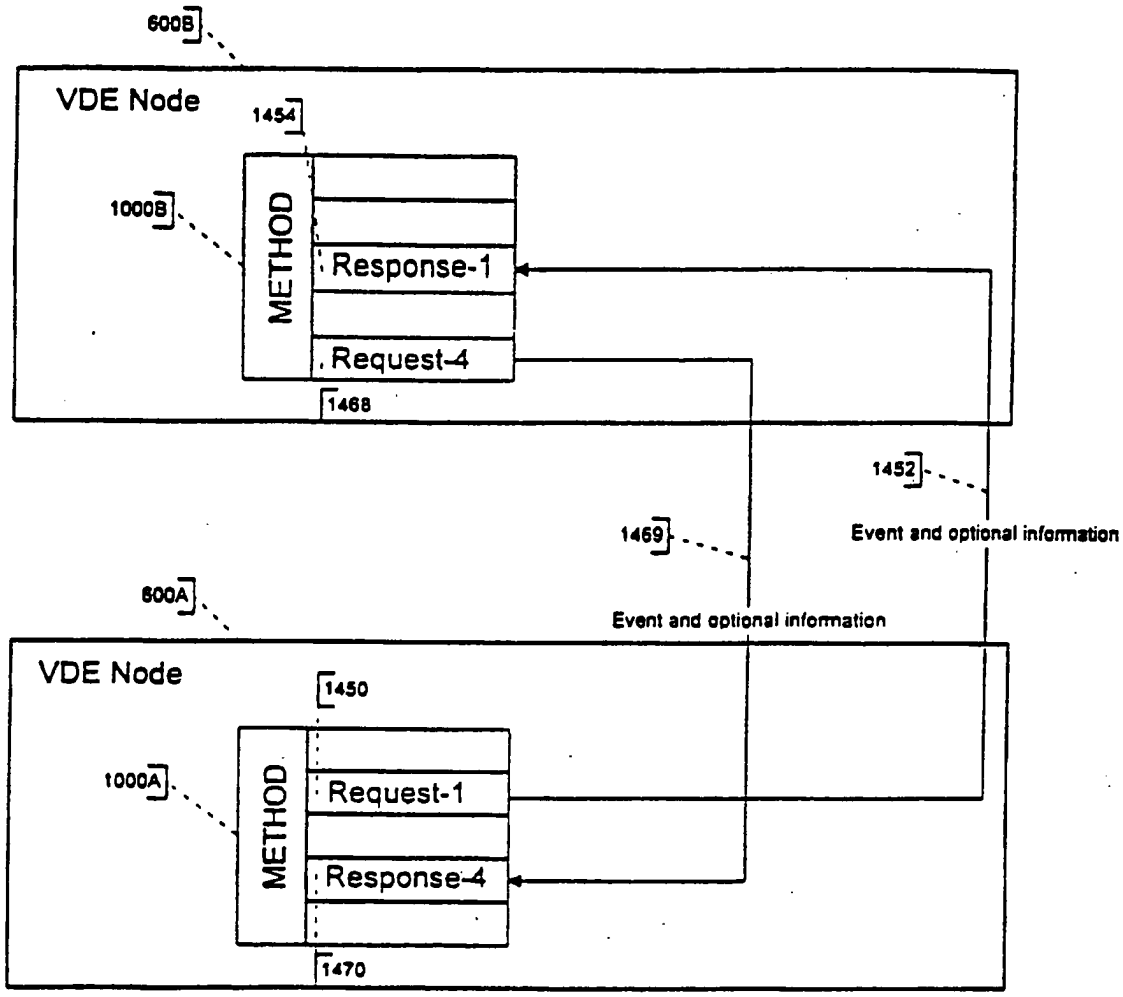


Figure 41b

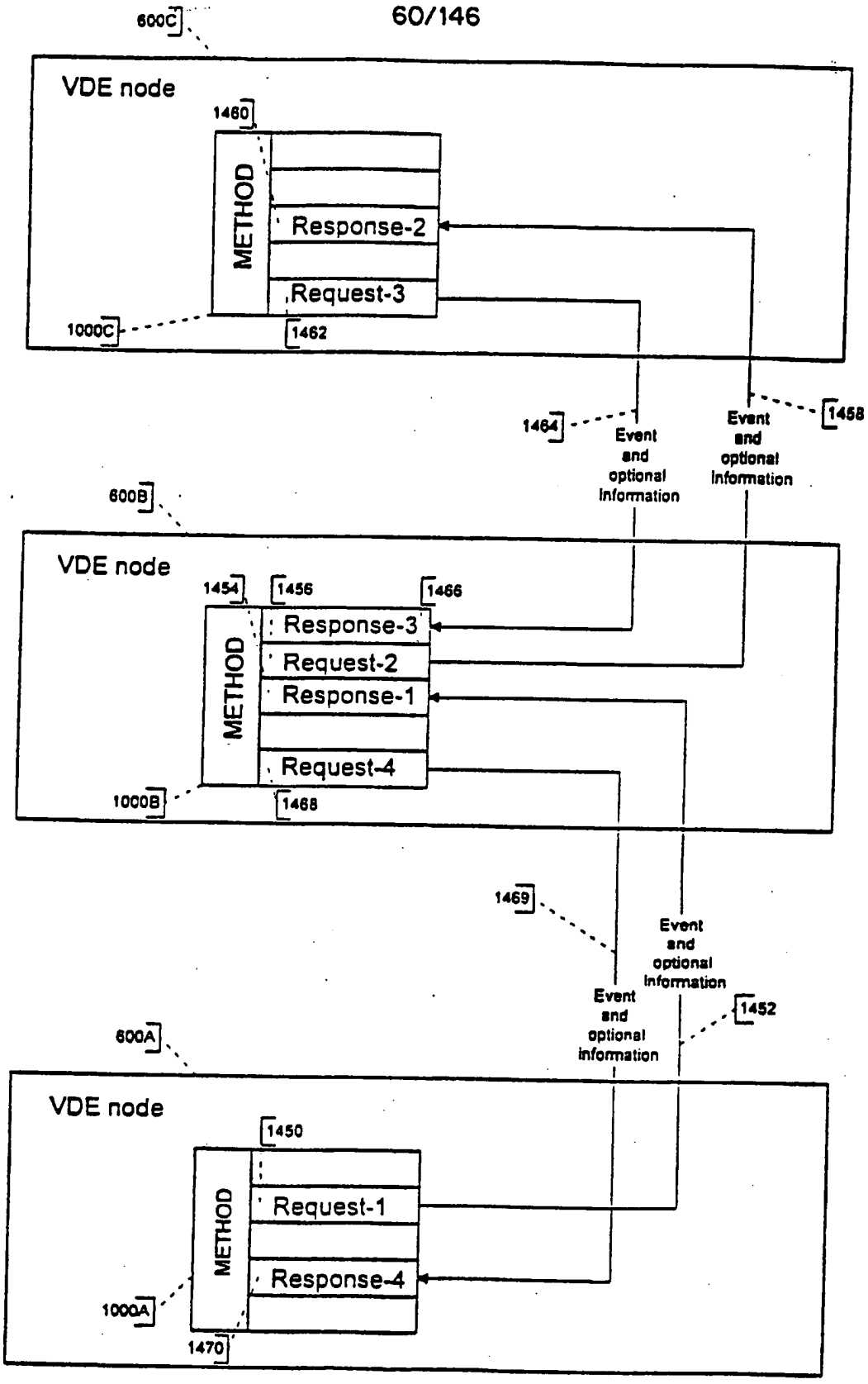


Figure 41c

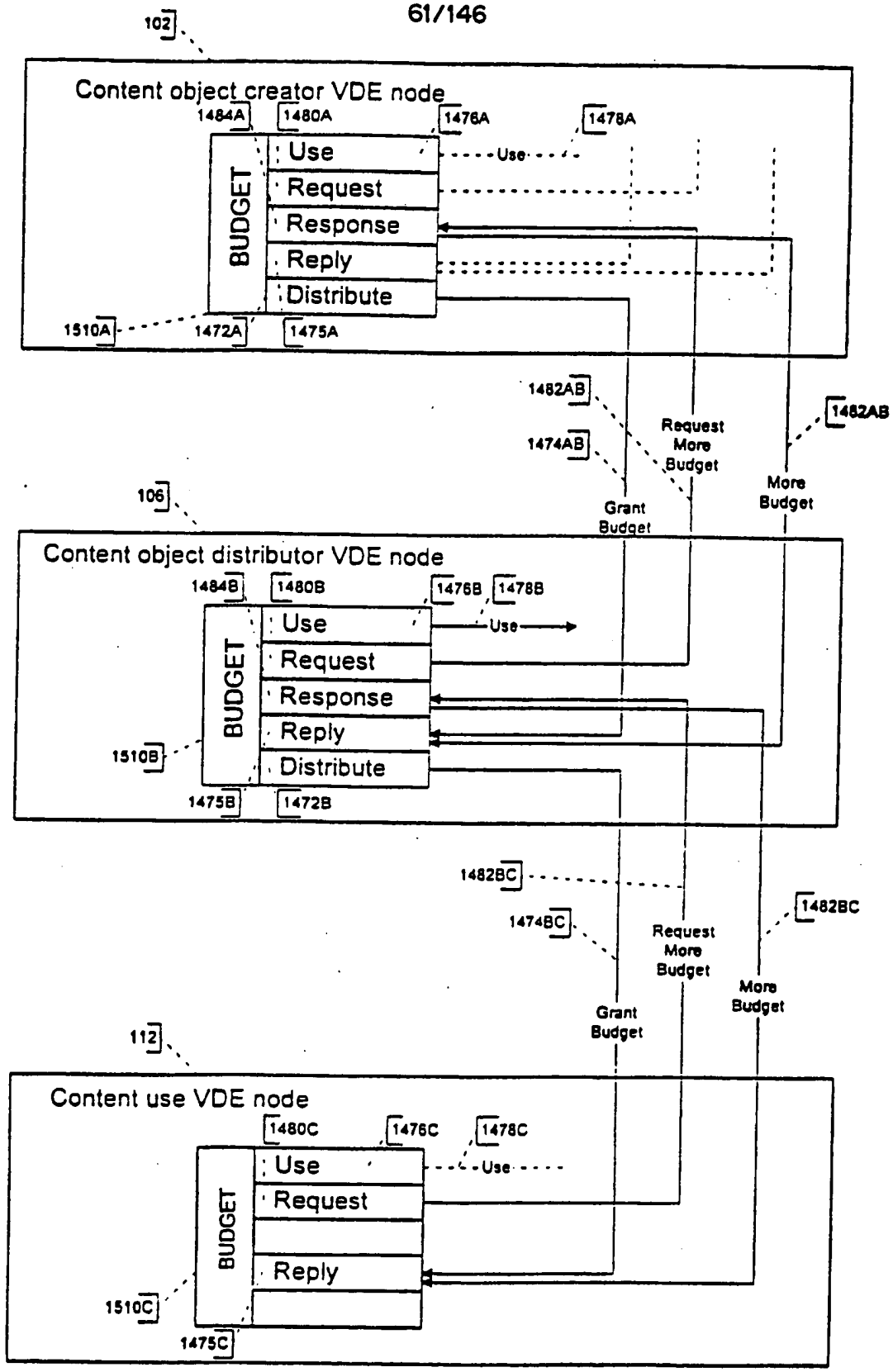


Figure 41d

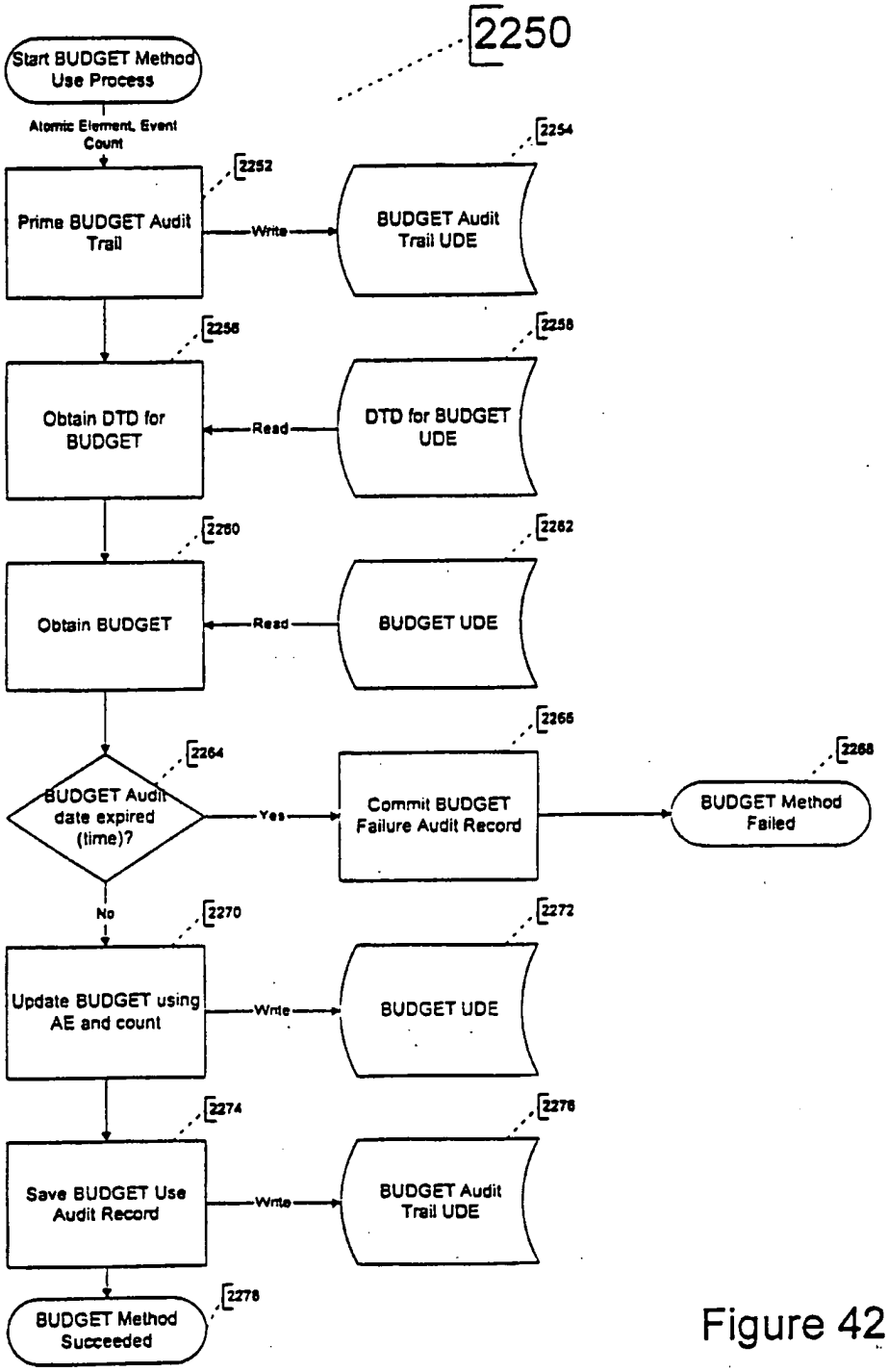


Figure 42a

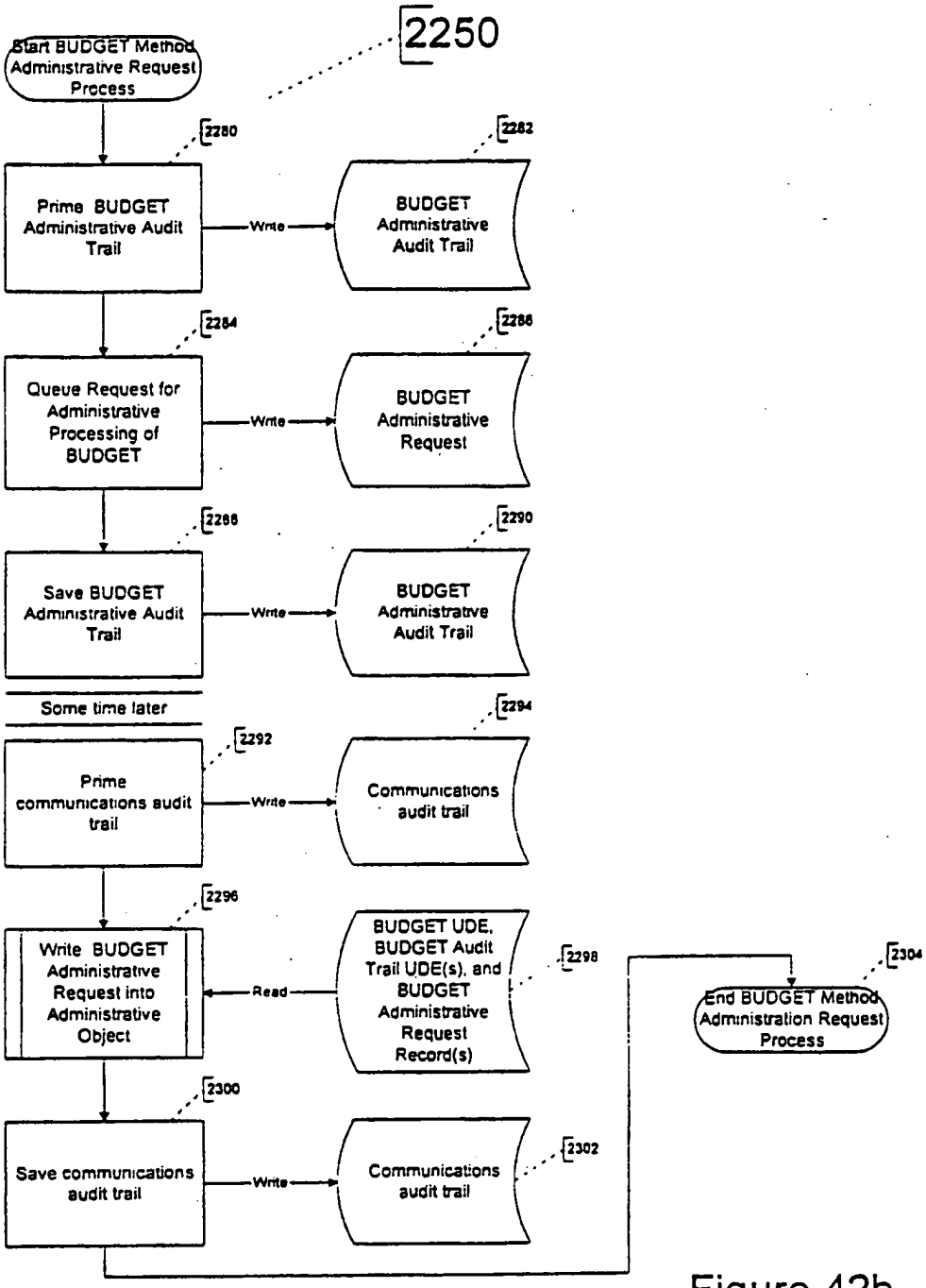

2250
Start BUDGET Method Administrative Request Process
2280
Prime BUDGET Administrative Audit Trail
Write
2282
BUDGET Administrative Audit Trail
2284
Queue Request for Administrative Processing of BUDGET
Write
2286
BUDGET Administrative Request
2288
Save BUDGET Administrative Audit Trail
Write
2290
BUDGET Administrative Audit Trail
Some time later
2292
Prime communications audit trail
Write
2294
Communications audit trail
2296
Write BUDGET Administrative Request into Administrative Object
Read
BUDGET UDE, BUDGET Audit Trail UDE(s), and BUDGET Administrative Request Record(s)
2298
2300
Save communications audit trail
Write
Communications audit trail
2302
2304
End BUDGET Method Administration Request Process

Figure 42b

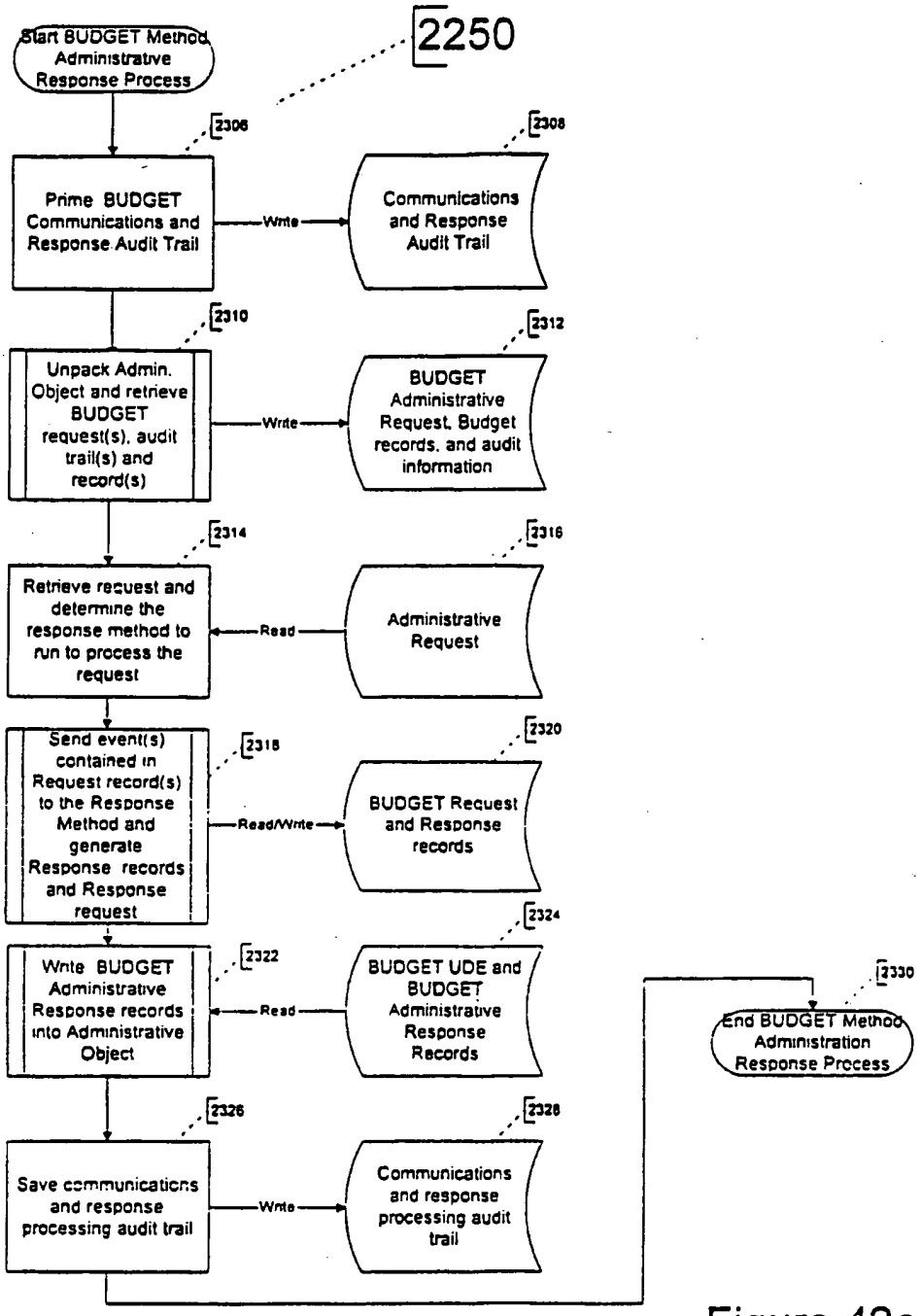


Figure 42c

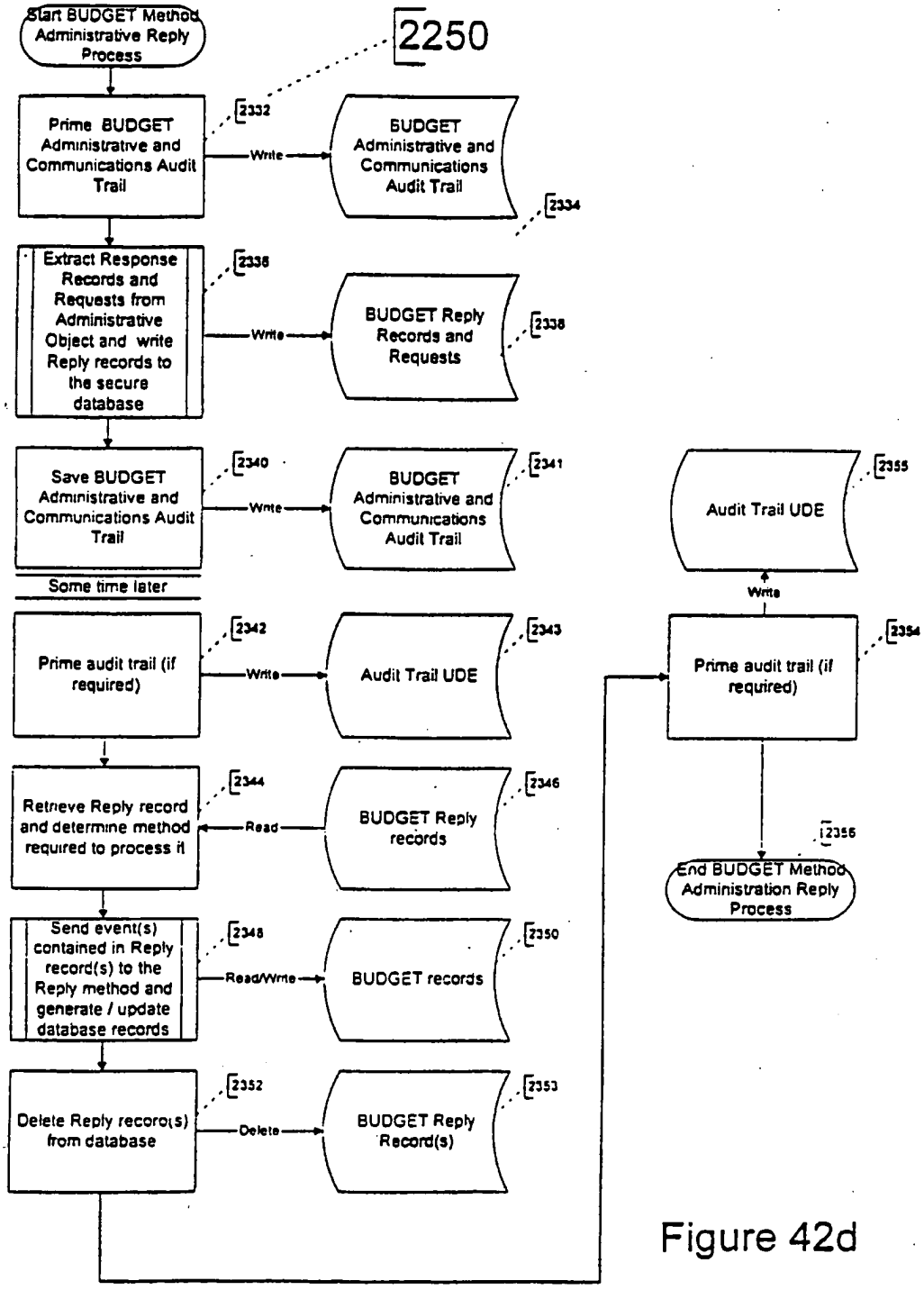


Figure 42d

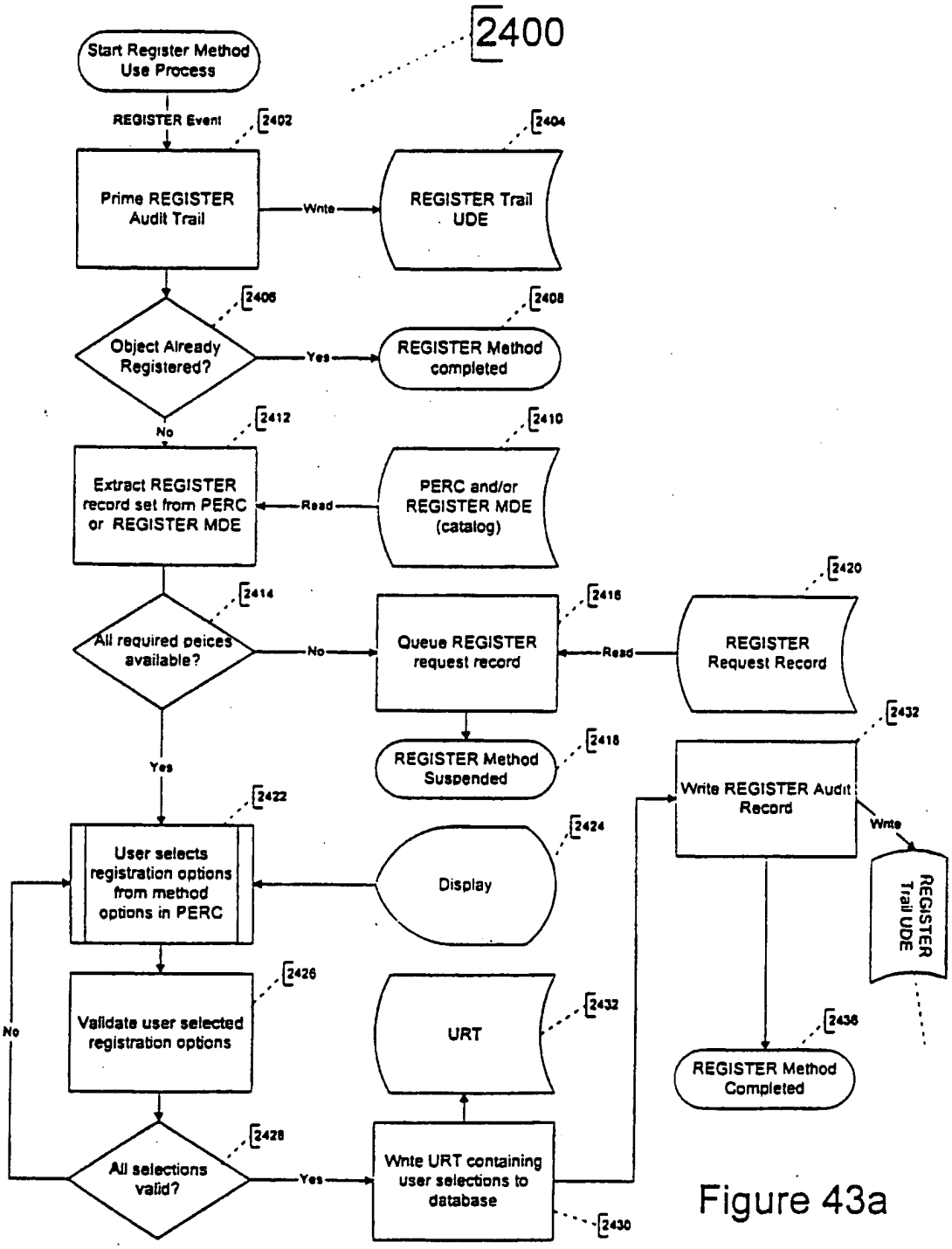


Figure 43a

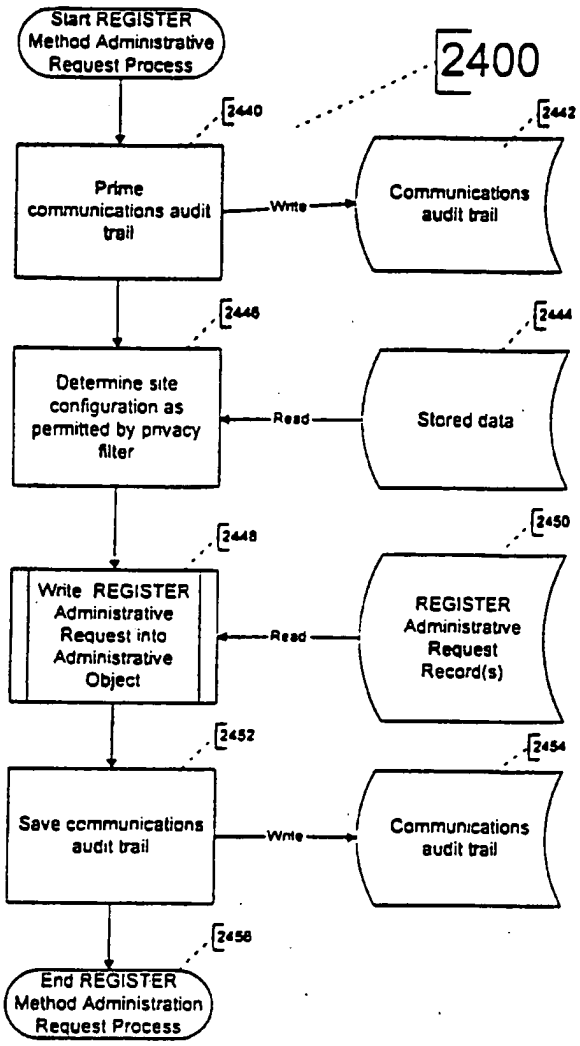


Figure 43b

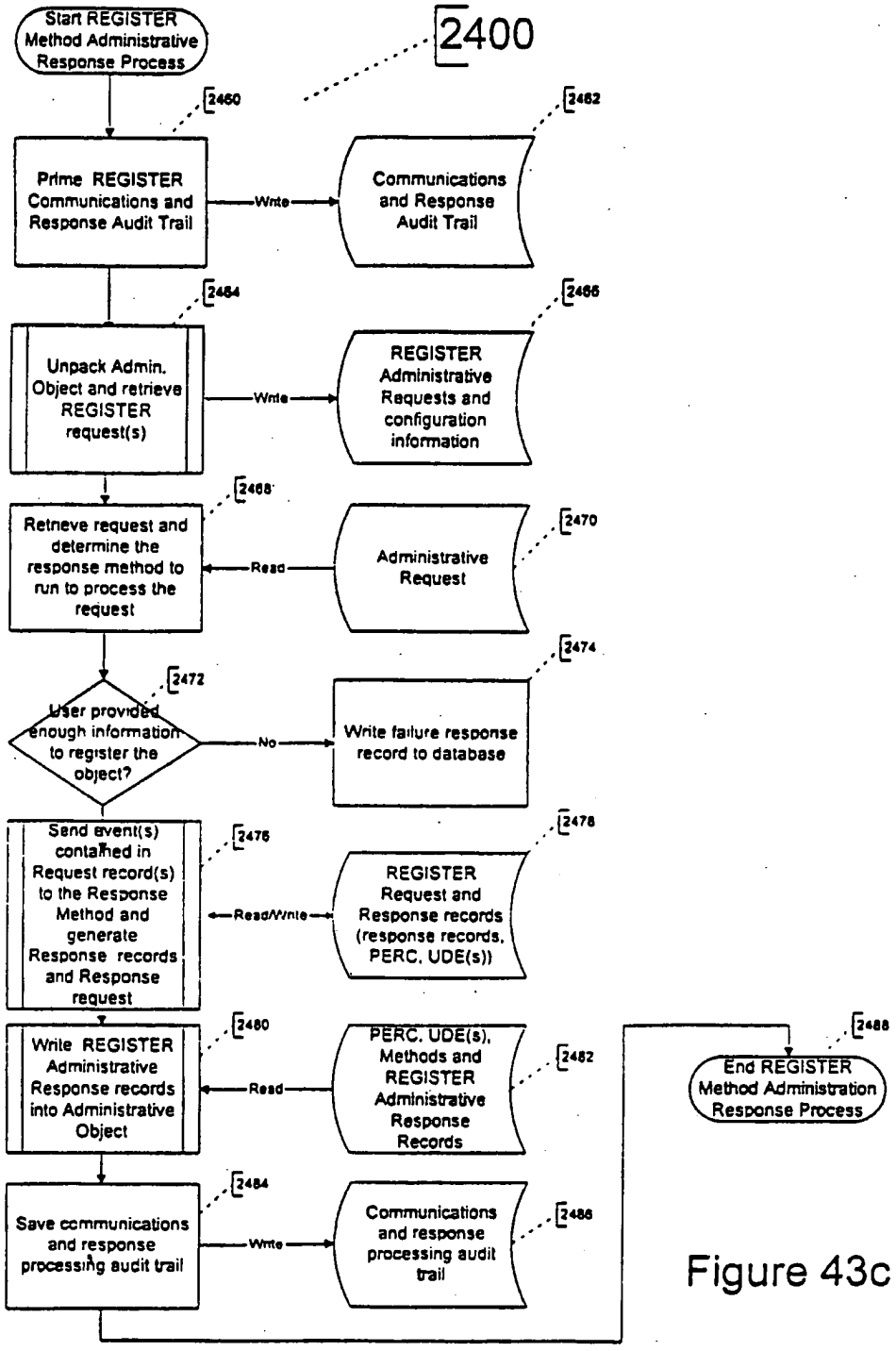

Start REGISTER Method Administrative Response Process
2400
2460
Prime REGISTER Communications and Response Audit Trail
Write
2462
Communications and Response Audit Trail
2464
Unpack Admin. Object and retrieve REGISTER request(s)
Write
2466
REGISTER Administrative Requests and configuration information
2468
Retneve request and determine the response method to run to process the request
Read
2470
Administrative Request
2472
User provided enough information to register the object?
No
2474
Write failure response record to database
Send event(s) contained in Request record(s) to the Response Method and generate Response records and Response request
2476
Read/Write
2478
REGISTER Request and Response records (response records, PERC. UDE(s))
Write REGISTER Administrative Response records into Administrative Object
2480
Read
PERC. UDE(s), Methods and REGISTER Administrative Response Records
2482
Save communications and response processing audit trail
2484
Write
Communications and response processing audit trail
2486
End REGISTER Method Administration Response Process
2488

Figure 43c

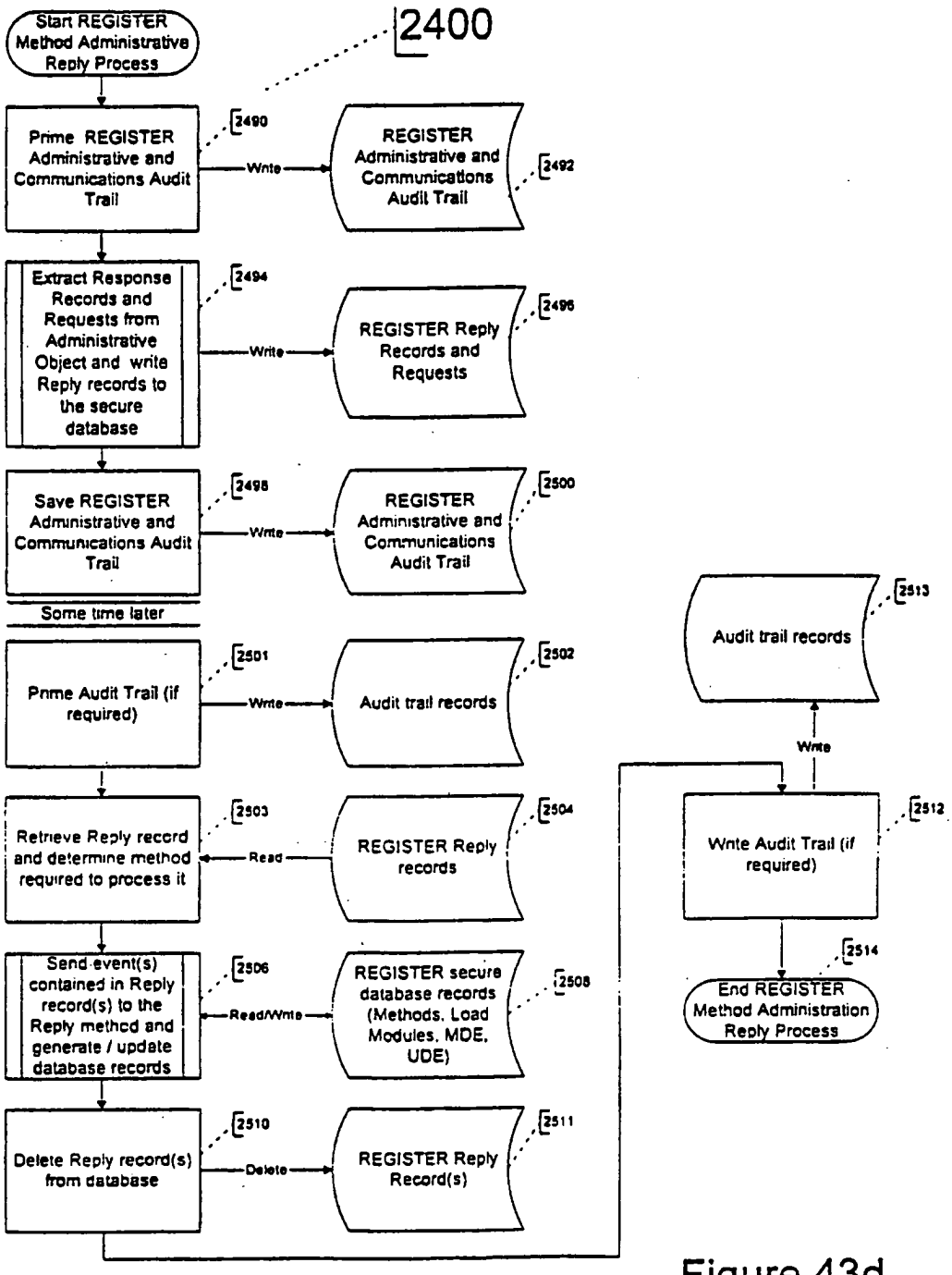


Figure 43d

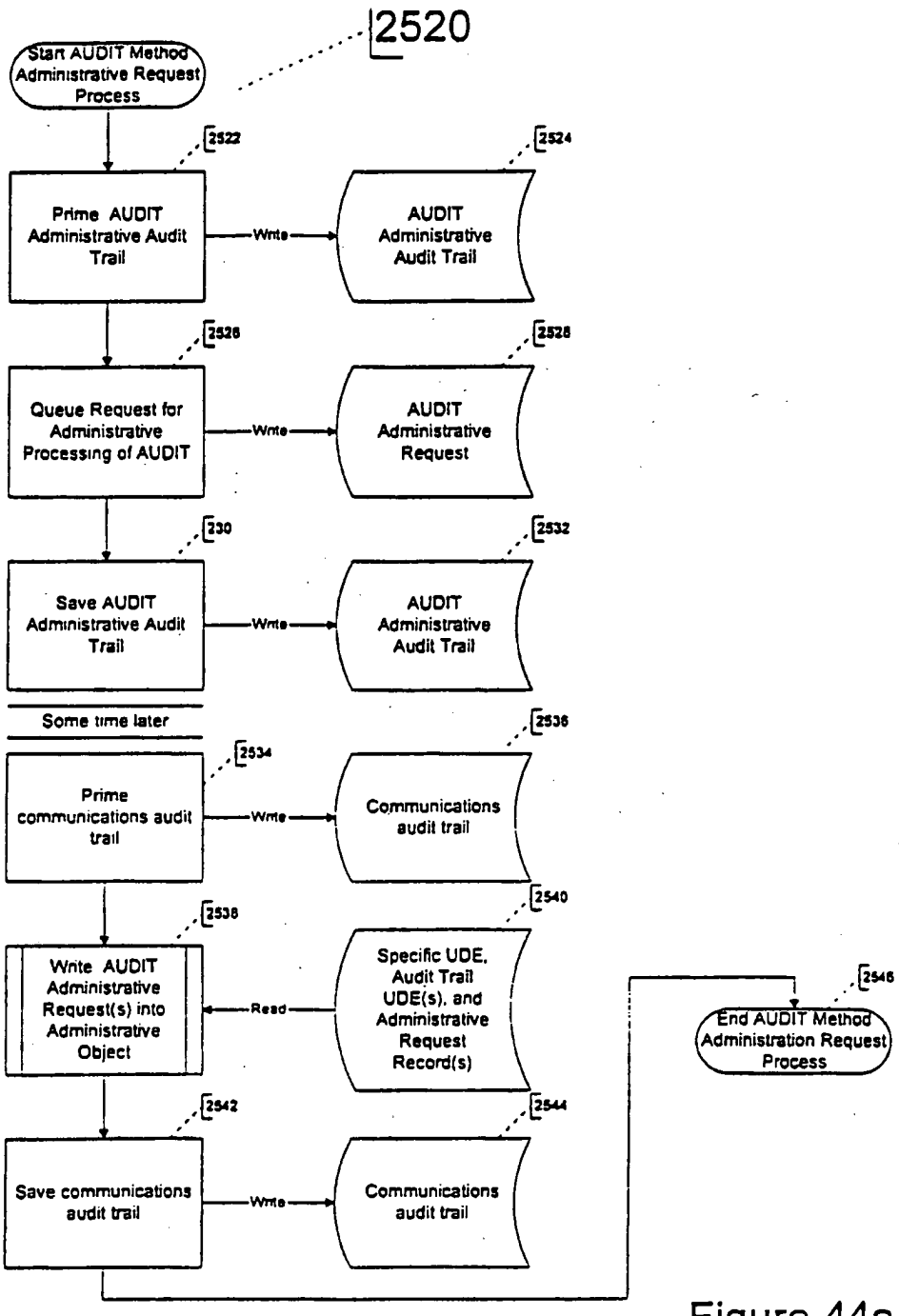


Figure 44a

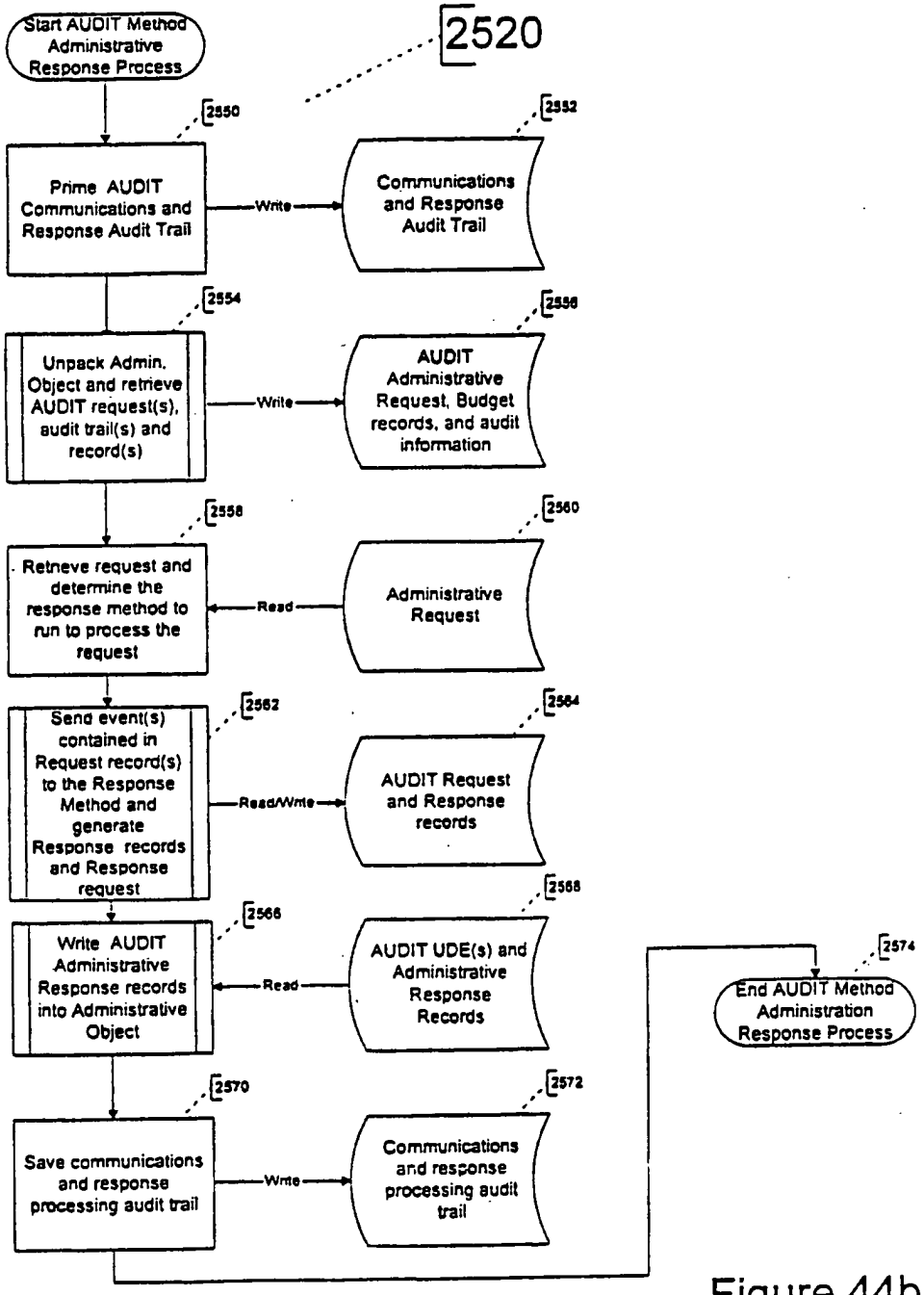


Figure 44b

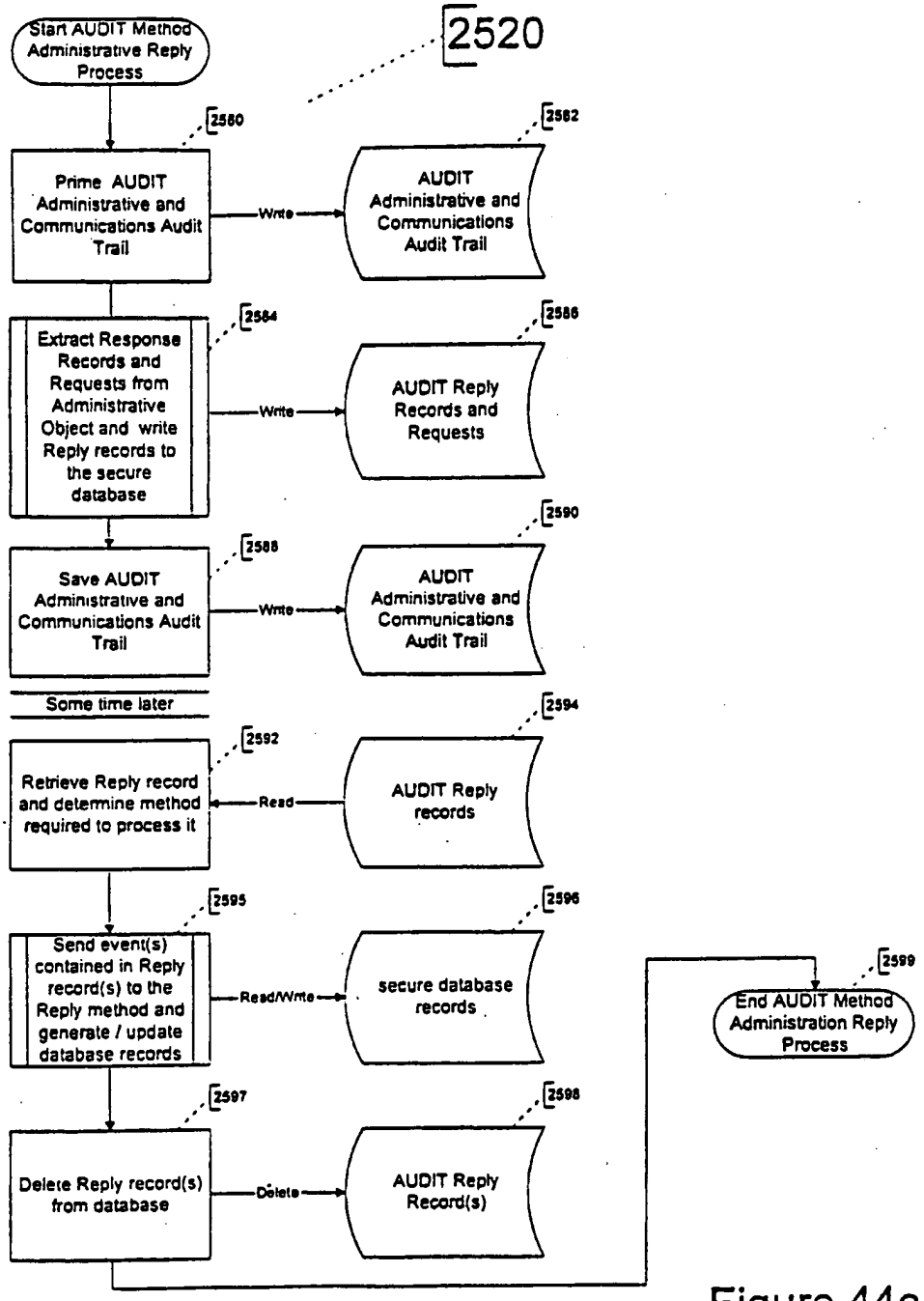

2520
Start AUDIT Method Administrative Reply Process
2580
Prime AUDIT Administrative and Communications Audit Trail
Write
2582
AUDIT Administrative and Communications Audit Trail
2584
Extract Response Records and Requests from Administrative Object and write Reply records to the secure database
Write
2586
AUDIT Reply Records and Requests
2588
Save AUDIT Administrative and Communications Audit Trail
Write
2590
AUDIT Administrative and Communications Audit Trail
Some time later
2592
Retrieve Reply record and determine method required to process it
Read
2594
AUDIT Reply records
2595
Send event(s) contained in Reply record(s) to the Reply method and generate / update database records
Read/Write
2596
secure database records
2597
Delete Reply record(s) from database
Delete
2598
AUDIT Reply Record(s)
2599
End AUDIT Method Administration Reply Process

Figure 44c

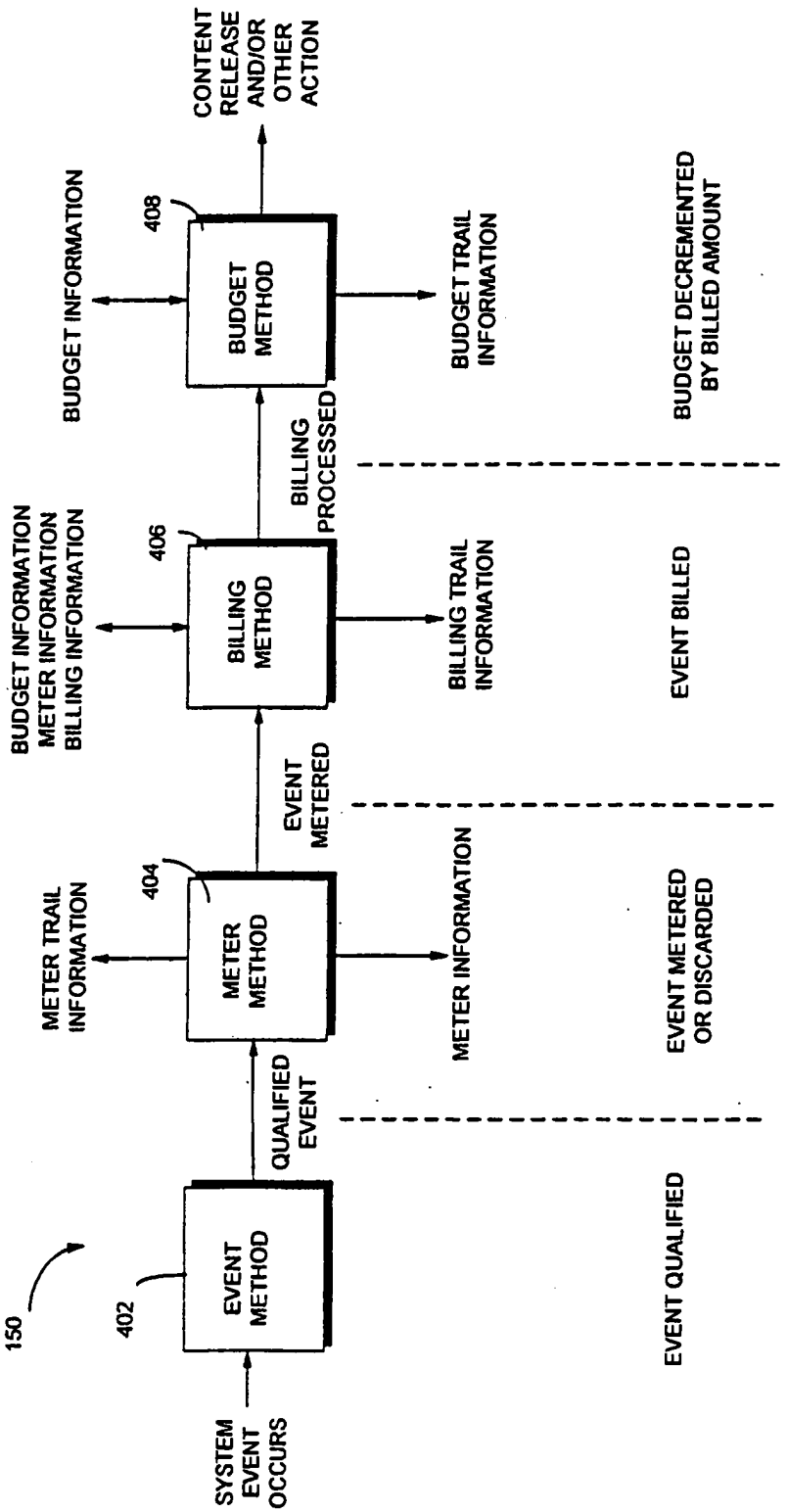
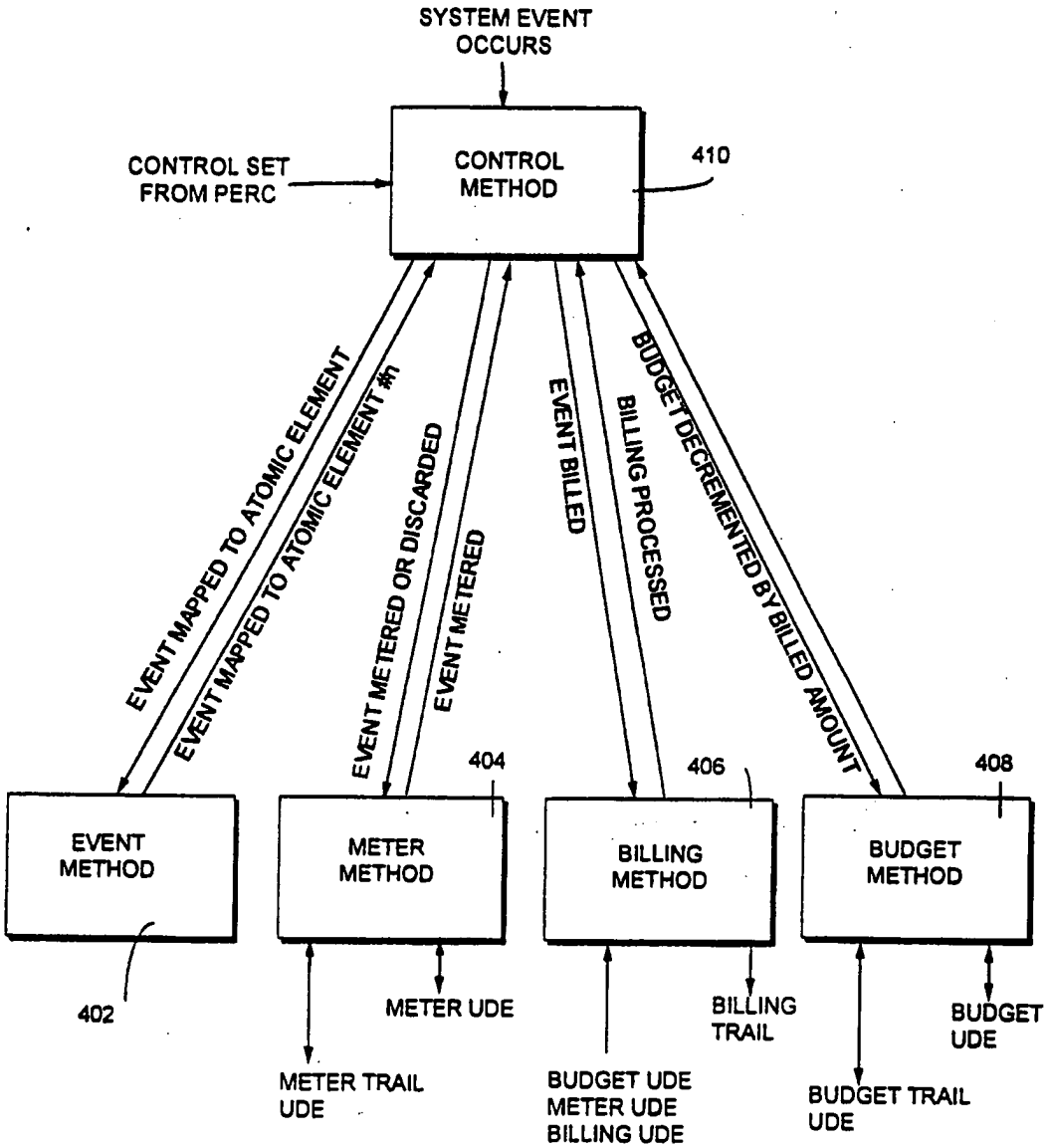


FIG. 45

FIG. 46



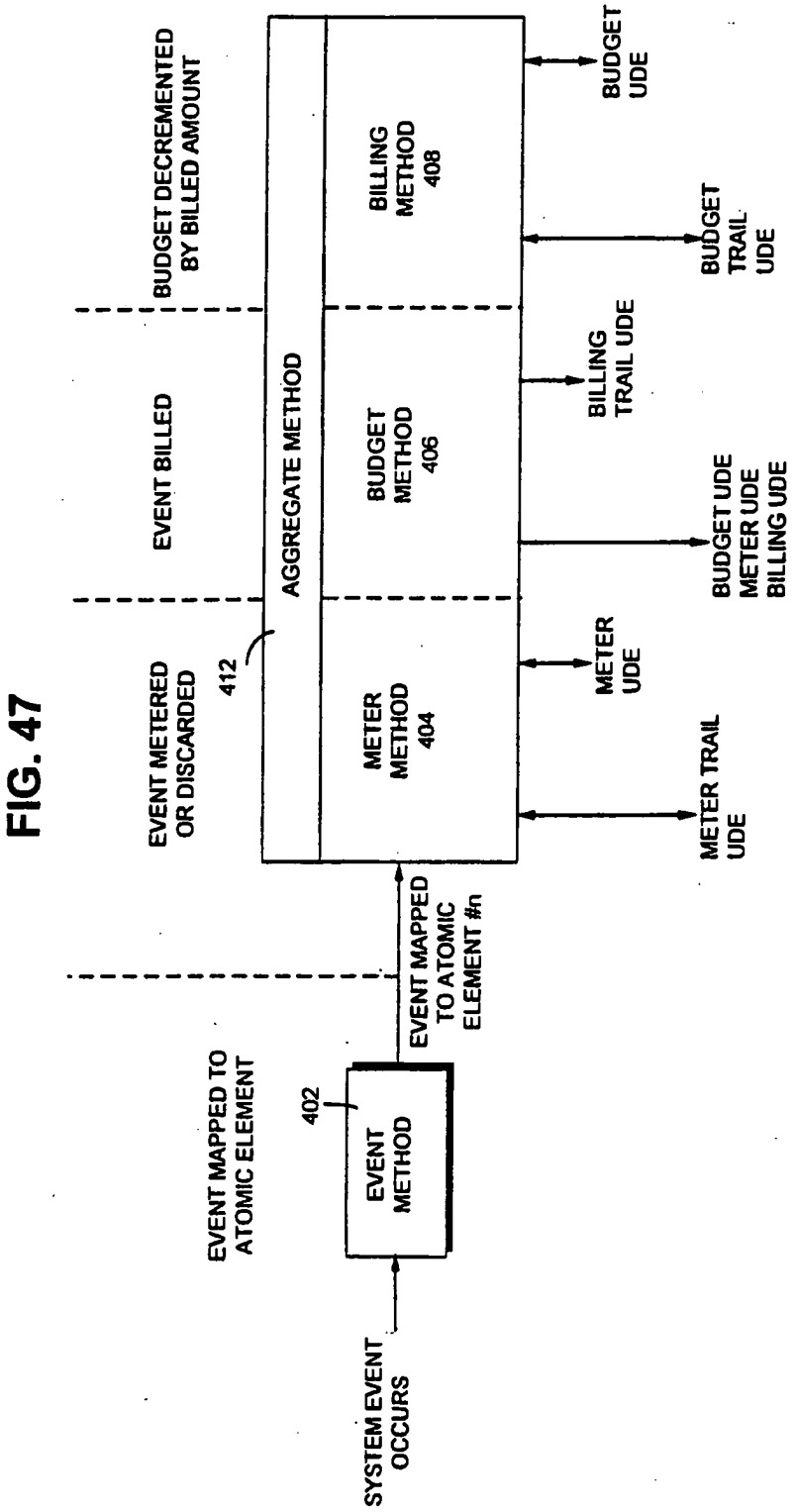


FIG. 47

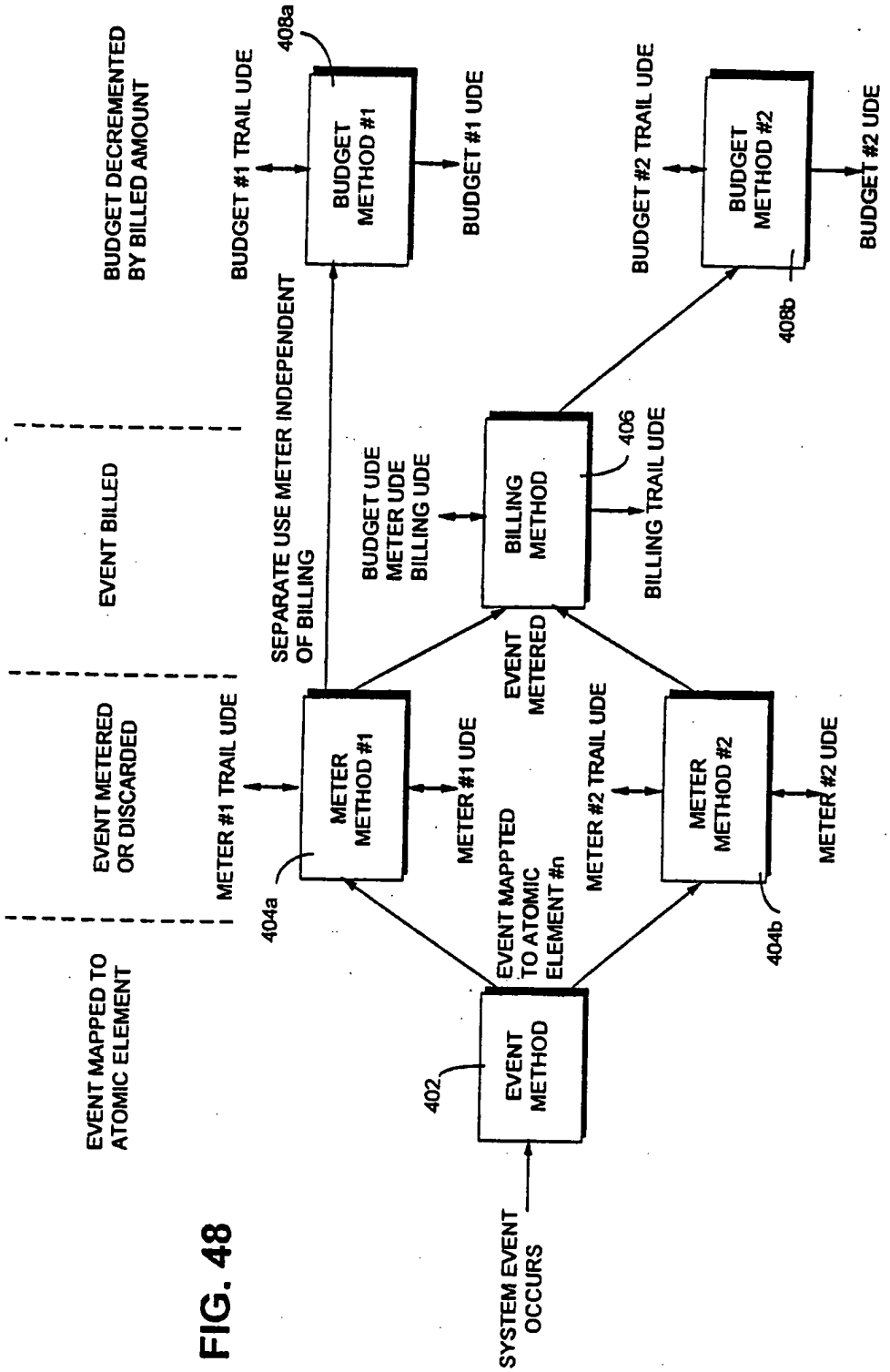


FIG. 48

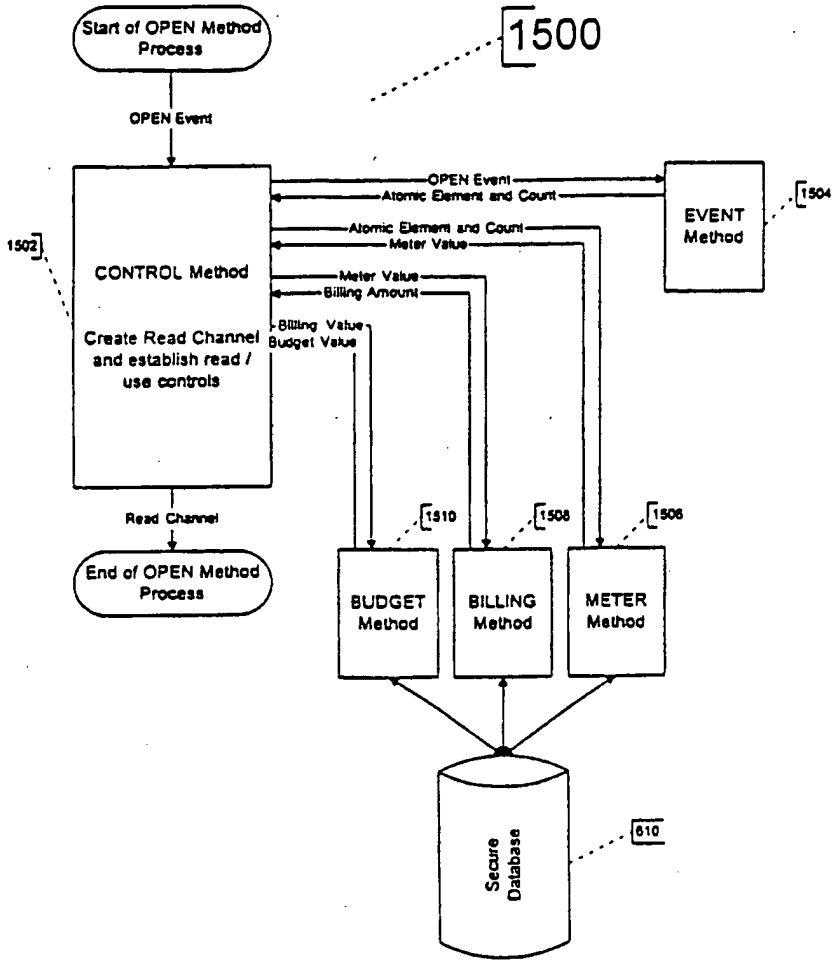

Start of OPEN Method Process
1500
OPEN Event
CONTROL Method
Create Read Channel and establish read / use controls
1502
OPEN Event
Atomic Element and Count
Atomic Element and Count
Meter Value
Meter Value
Billing Amount
Billing Value
Budget Value
EVENT Method
1504
Read Channel
End of OPEN Method Process
1510
1508
1506
BUDGET Method
BILLING Method
METER Method
Secure Database
610

Figure 49

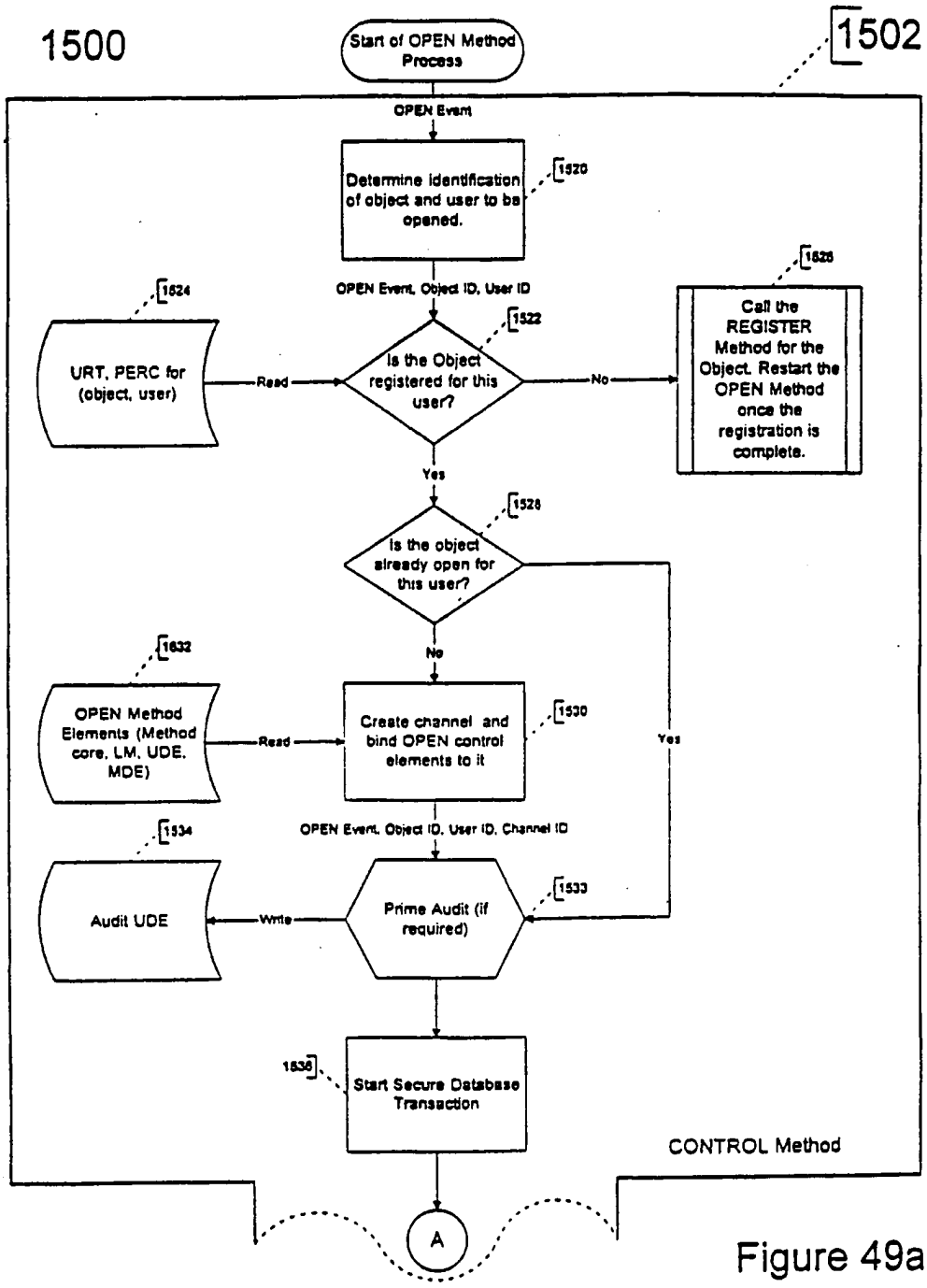


Figure 49a

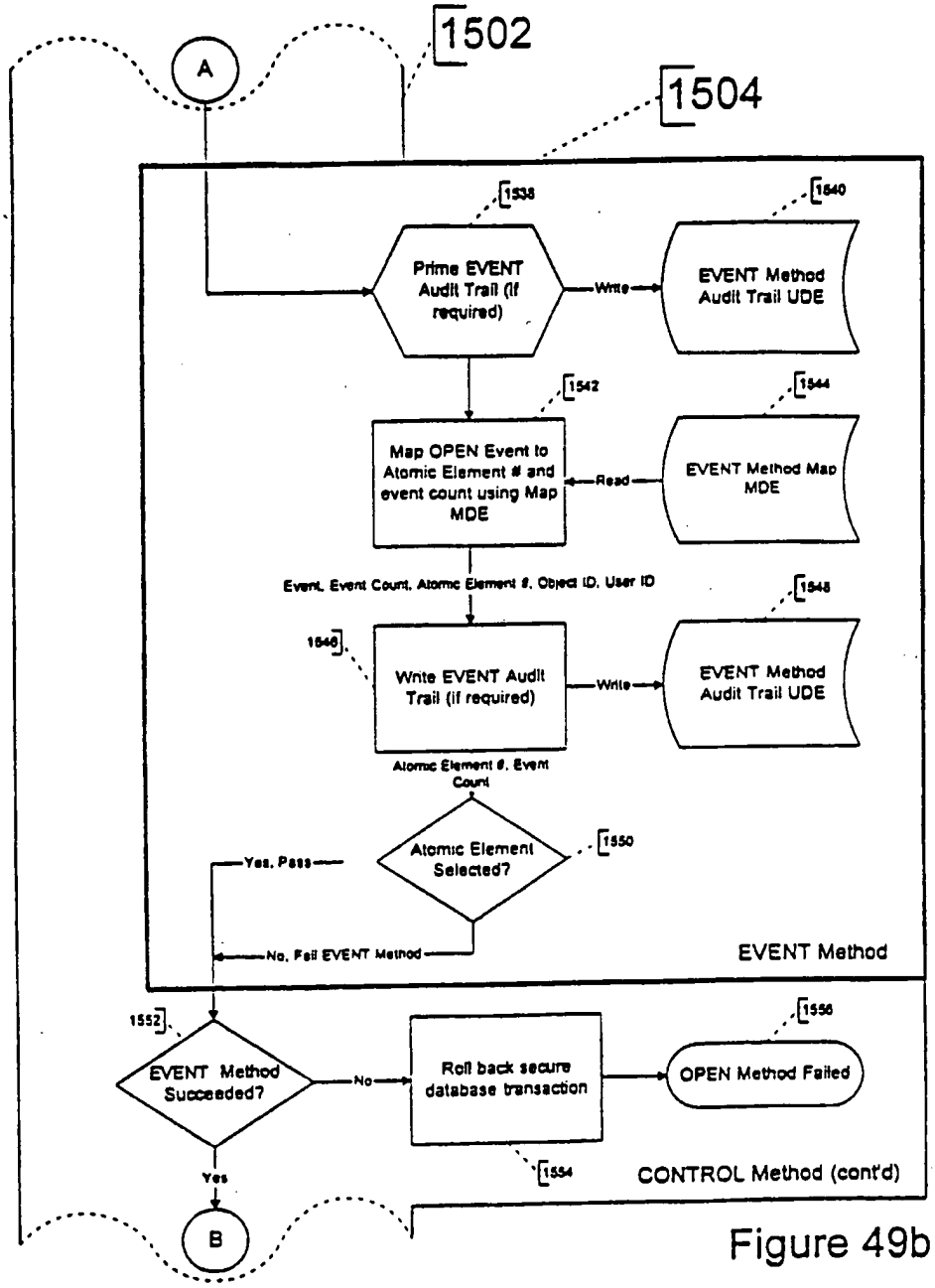


Figure 49b

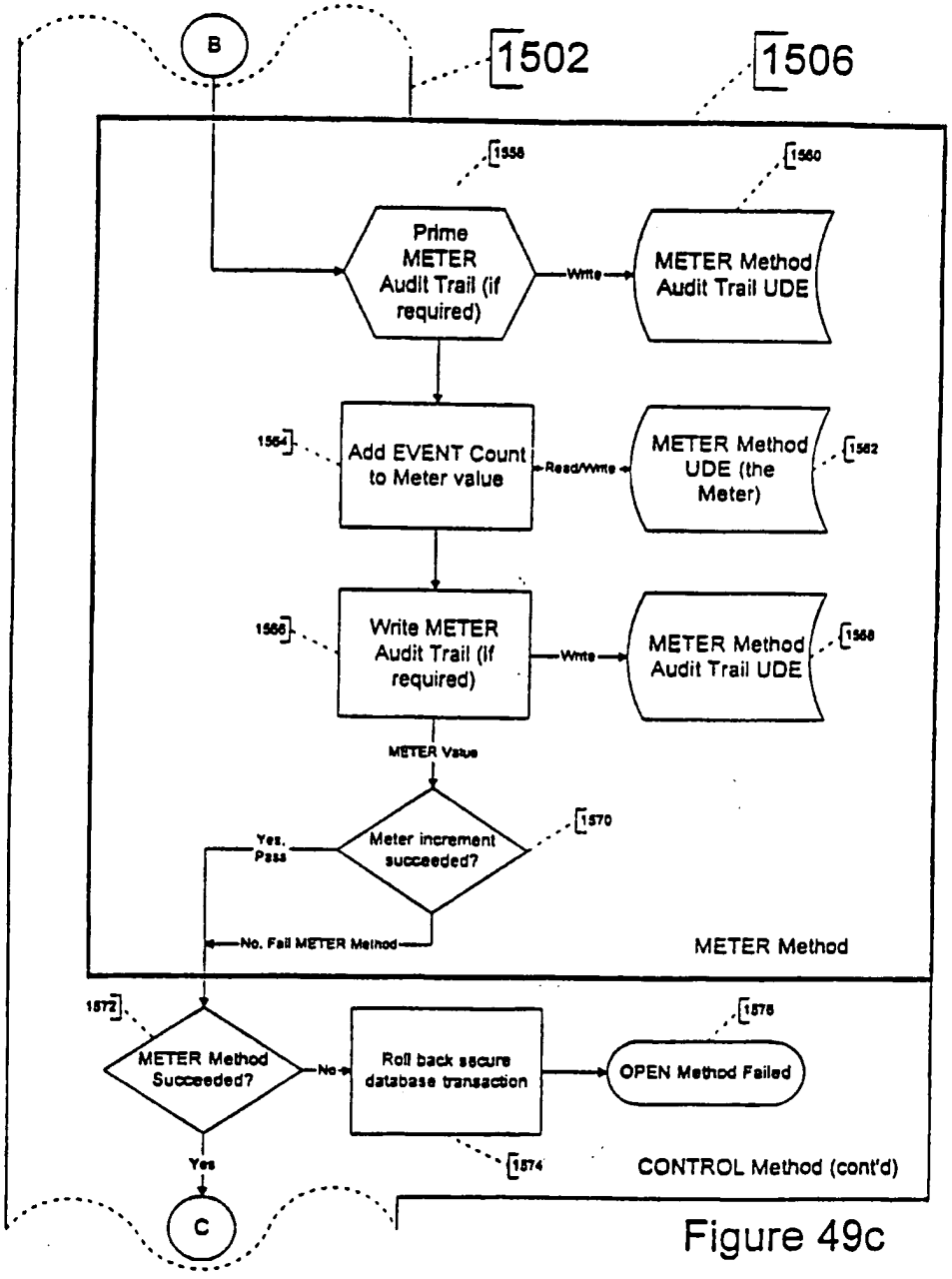


Figure 49c

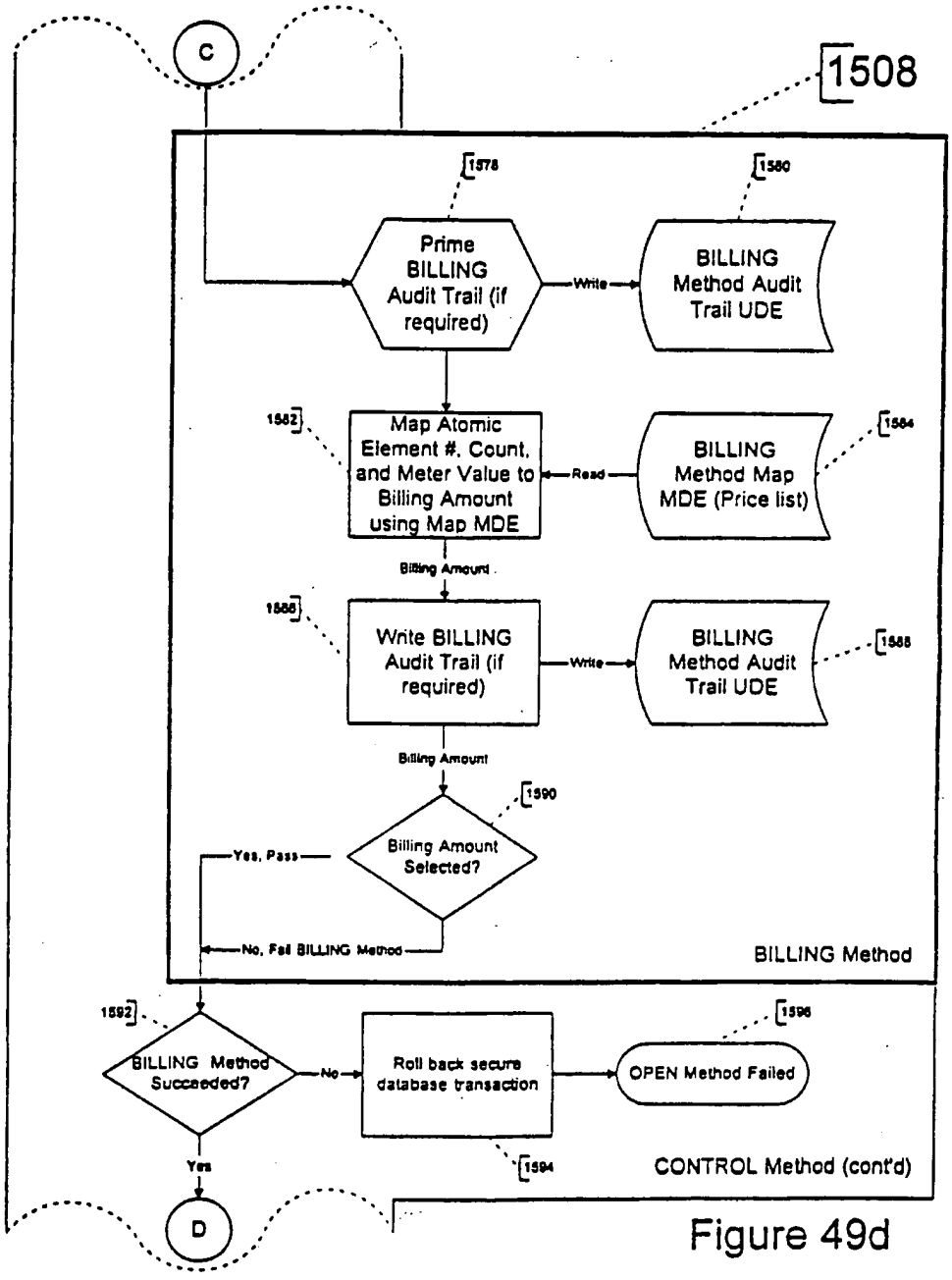


Figure 49d

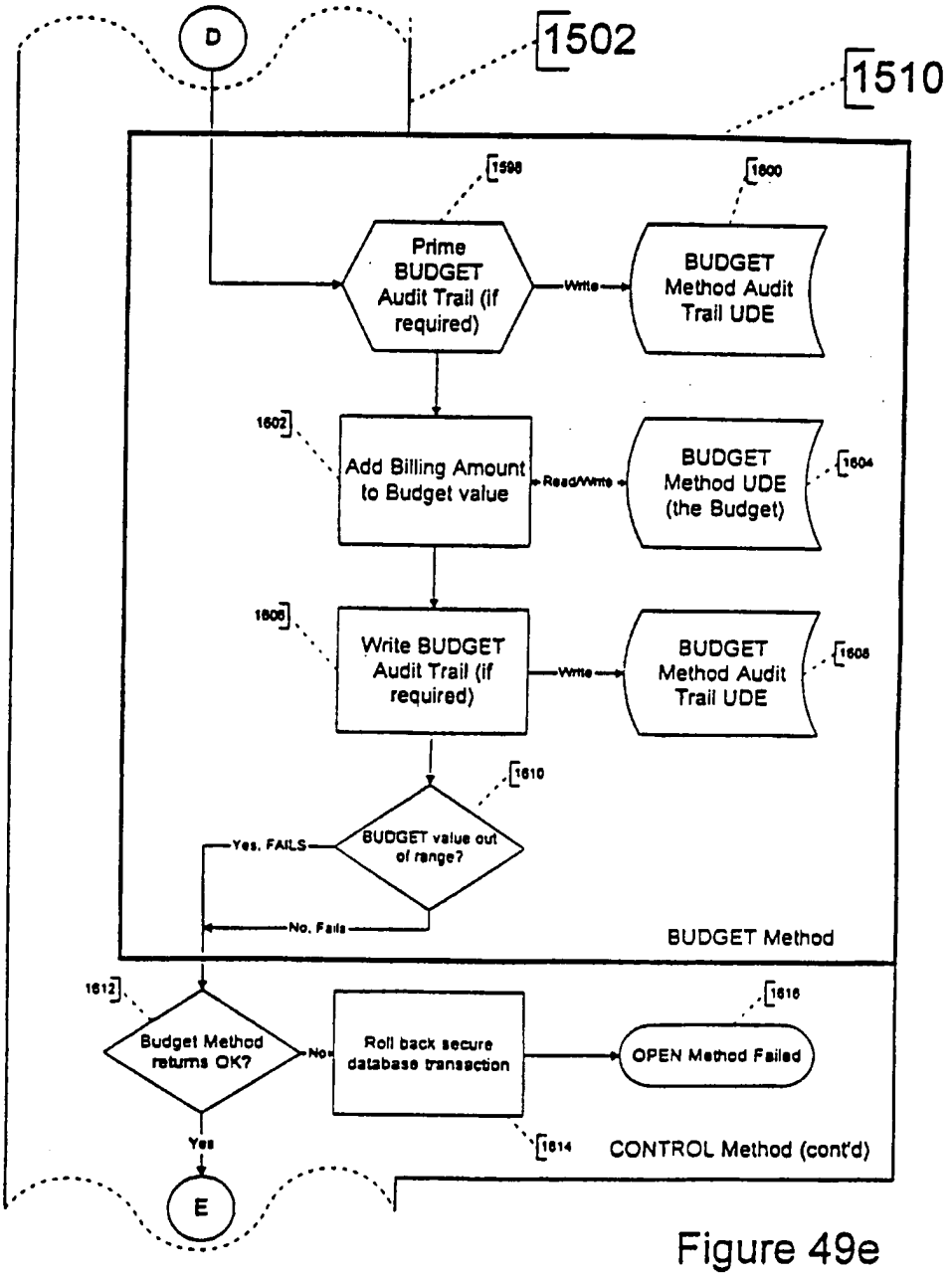


Figure 49e

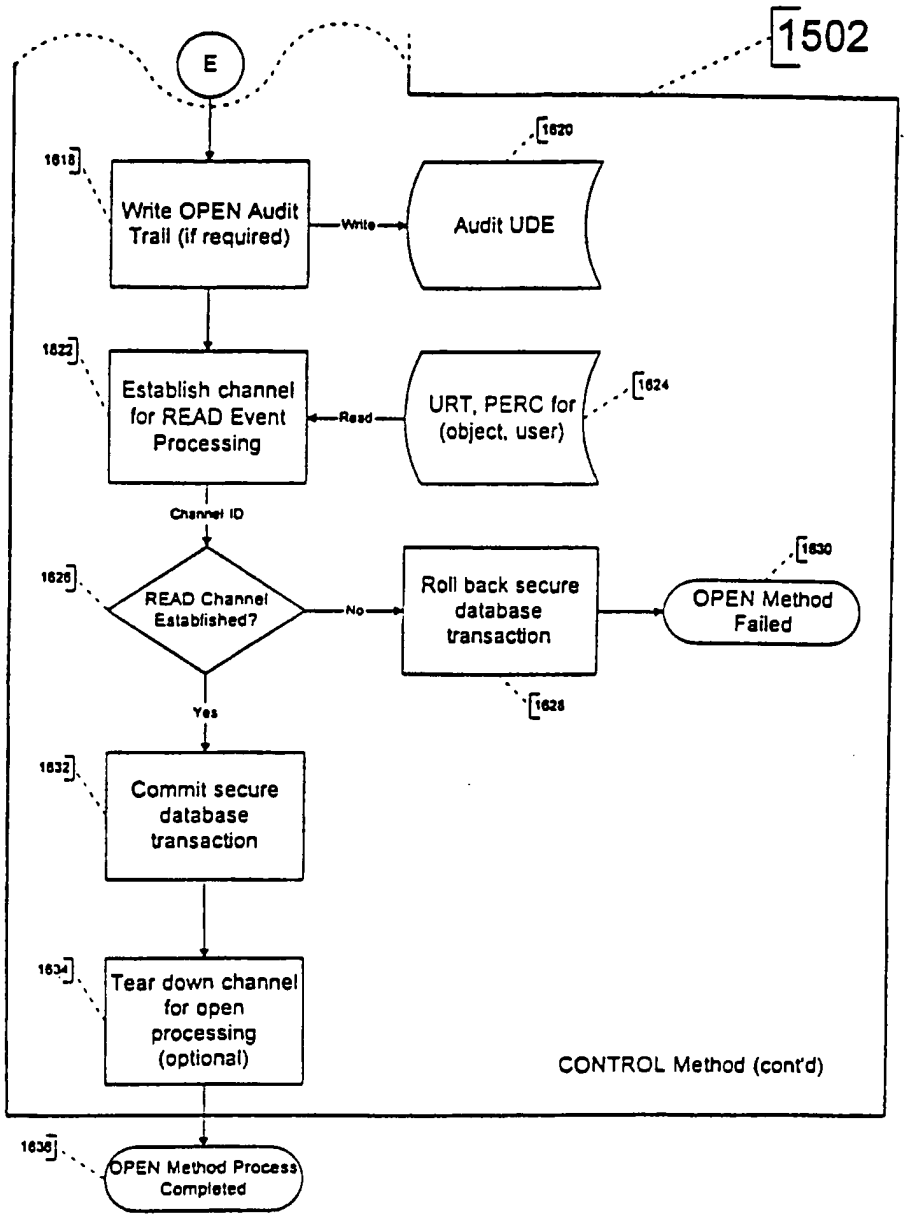

1502
E
1618
Write OPEN Audit Trail (if required)
Write
1620
Audit UDE
1622
Establish channel for READ Event Processing
Read
URT, PERC for (object, user)
1624
Channel ID
1626
READ Channel Established?
No
Roll back secure database transaction
1628
1630
OPEN Method Failed
Yes
1632
Commit secure database transaction
1634
Tear down channel for open processing (optional)
CONTROL Method (cont'd)
1636
OPEN Method Process Completed

Figure 49f

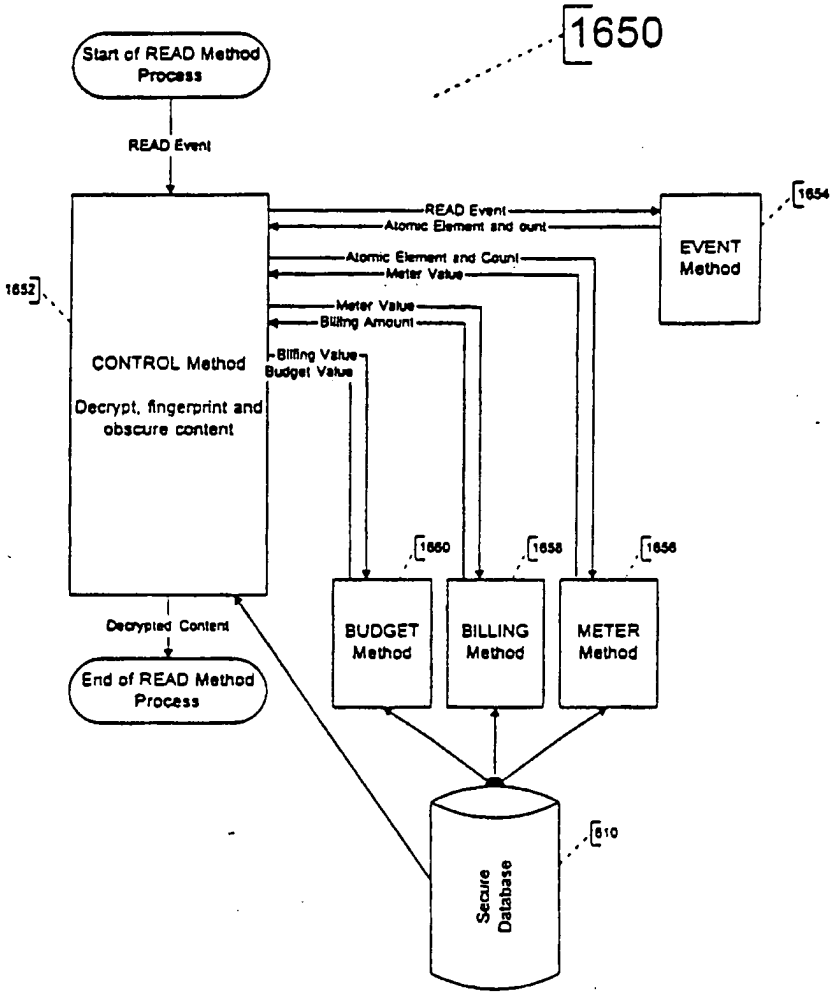

1650
Start of READ Method Process
READ Event
1652
CONTROL Method
Decrypt, fingerprint and obscure content
Decrypted Content
End of READ Method Process
READ Event
Atomic Element and ount
Atomic Element and Count
Meter Value
Meter Value
Billing Amount
Billing Value
Budget Value
1654
EVENT Method
1660
1658
1656
BUDGET Method
BILLING Method
METER Method
610
Secure Database

Figure 50

1650

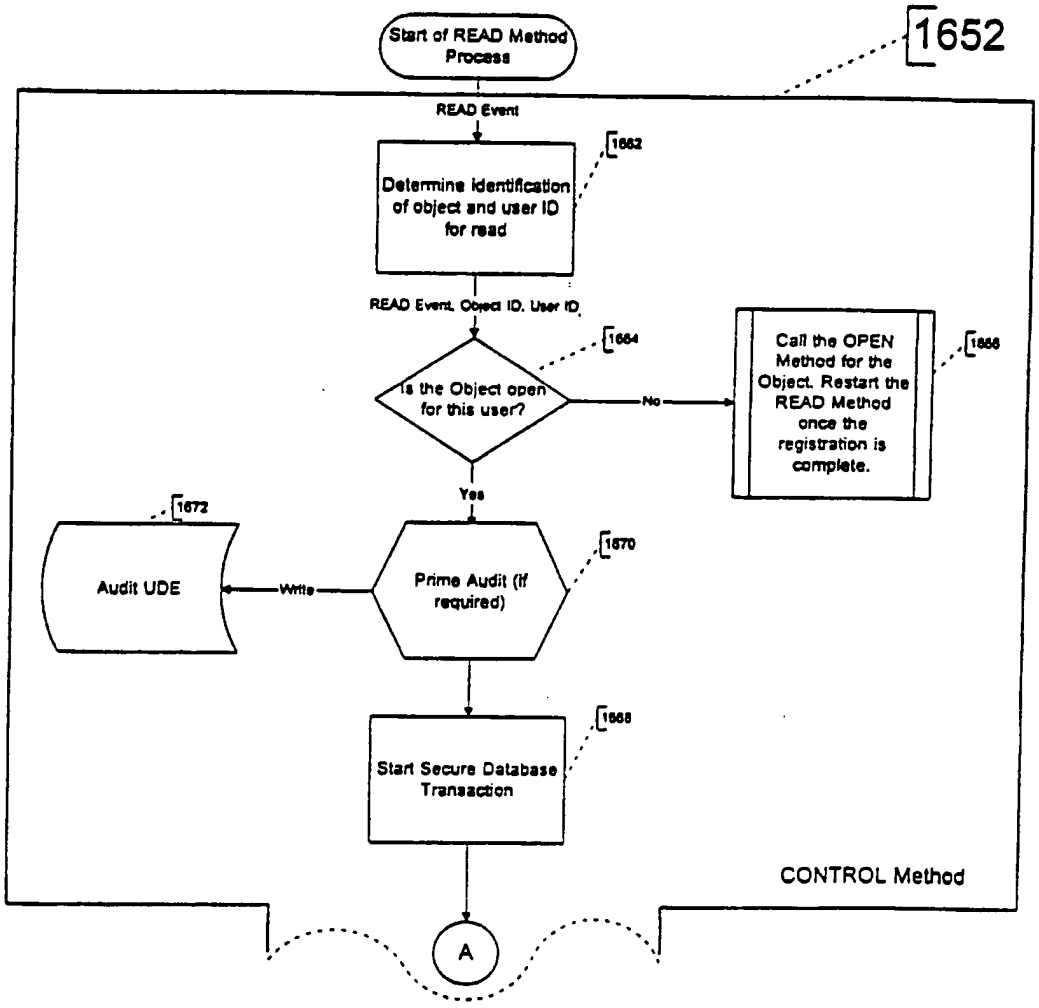


Figure 50a

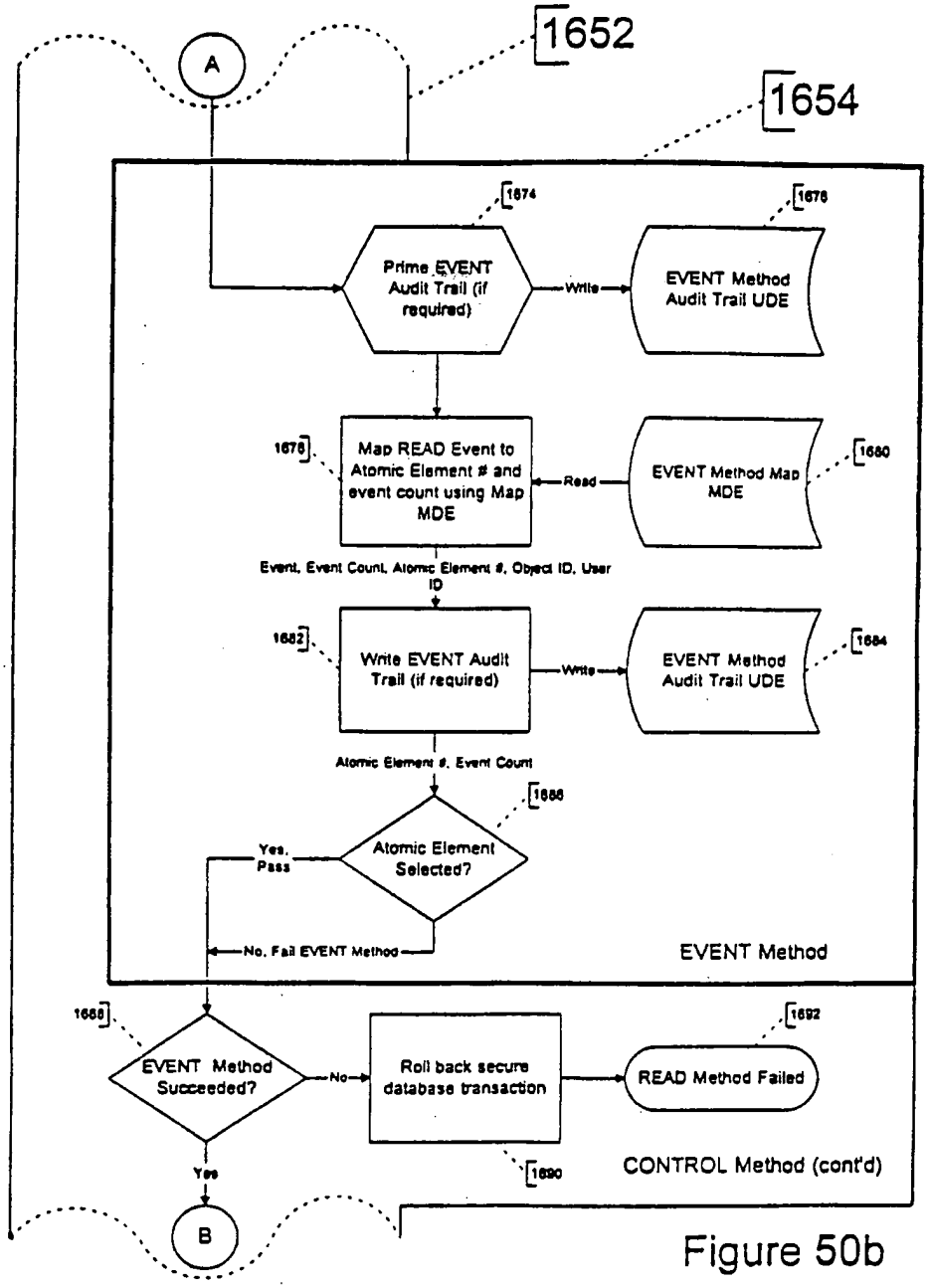


Figure 50b

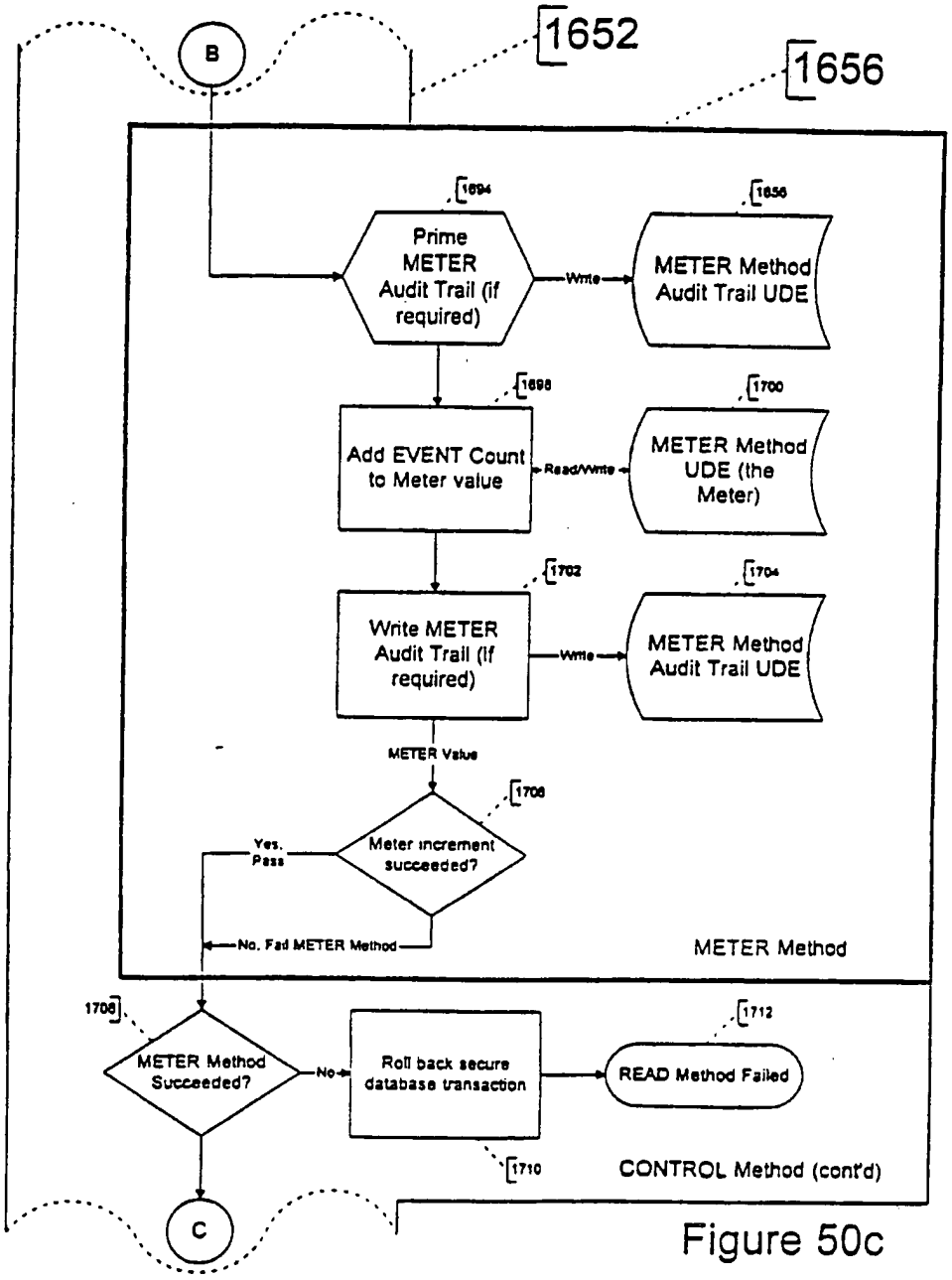


Figure 50c

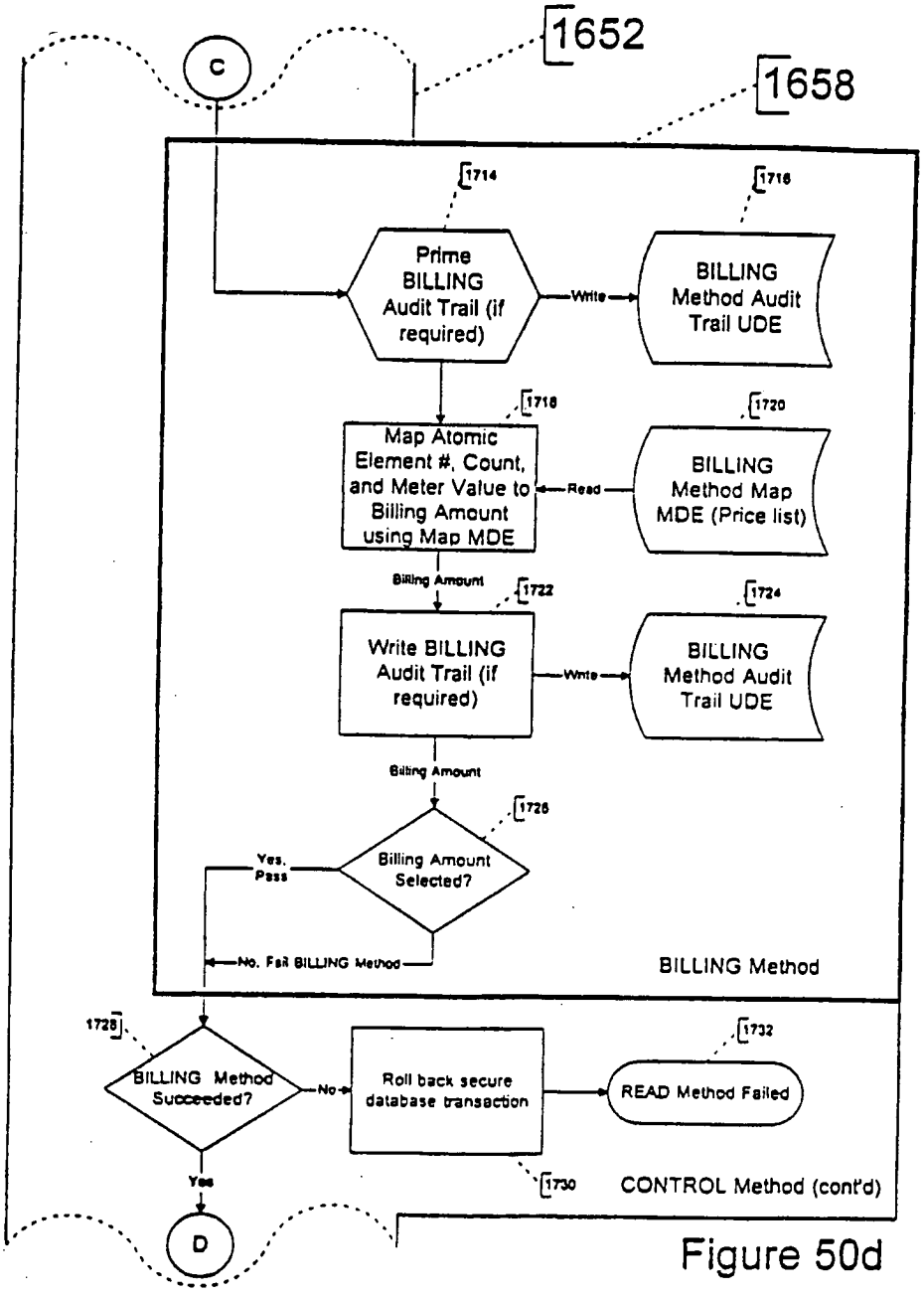


Figure 50d

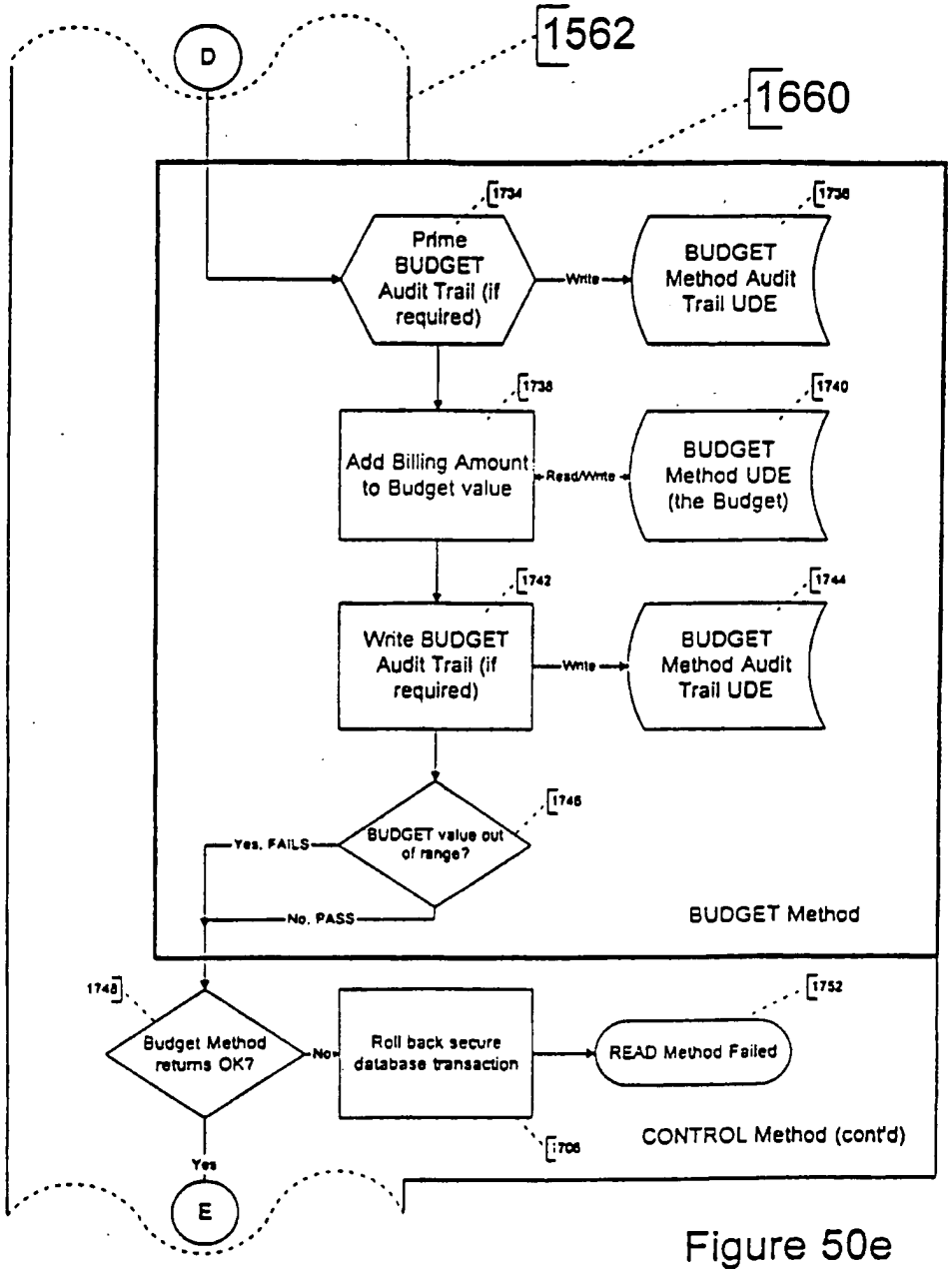
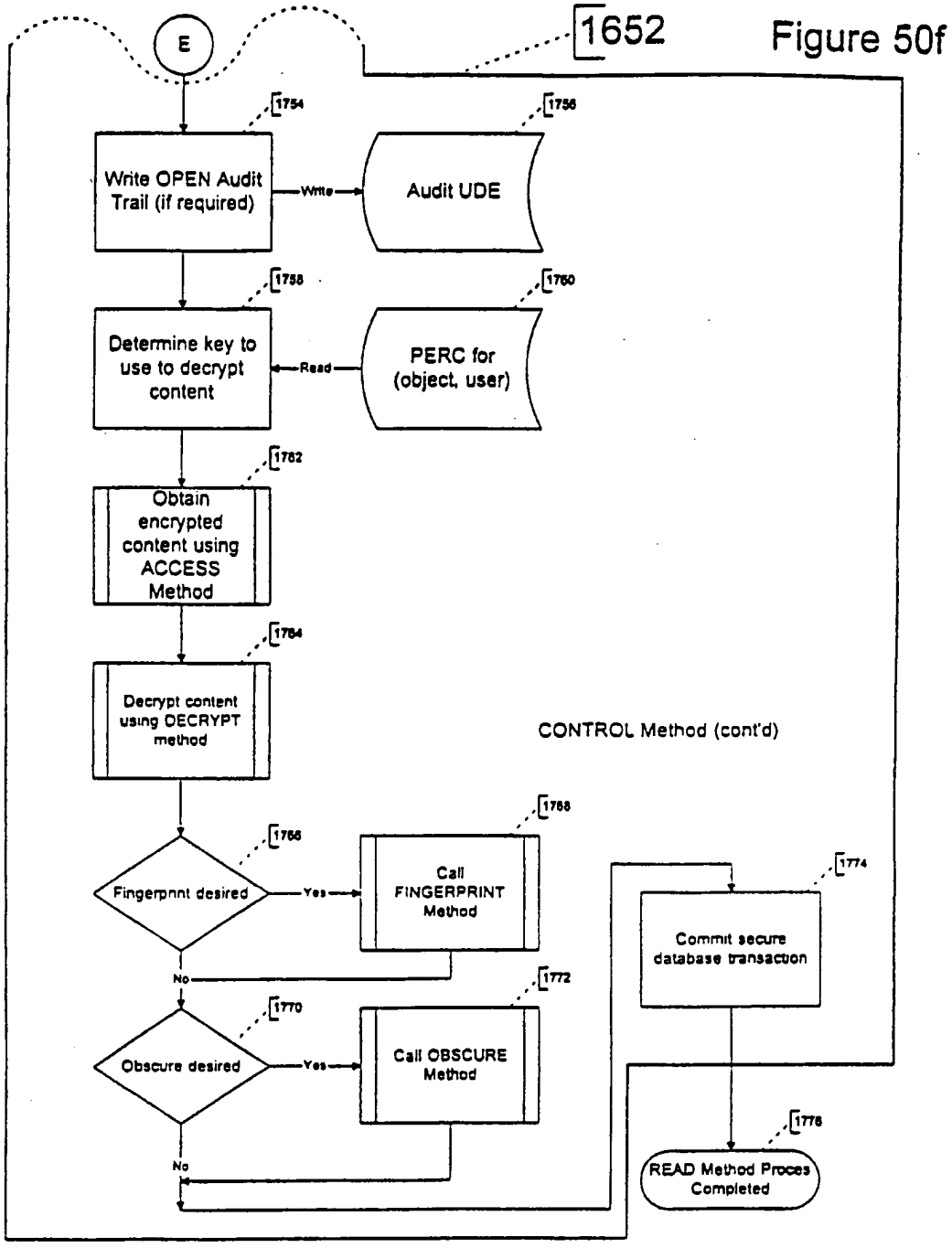


Figure 50e



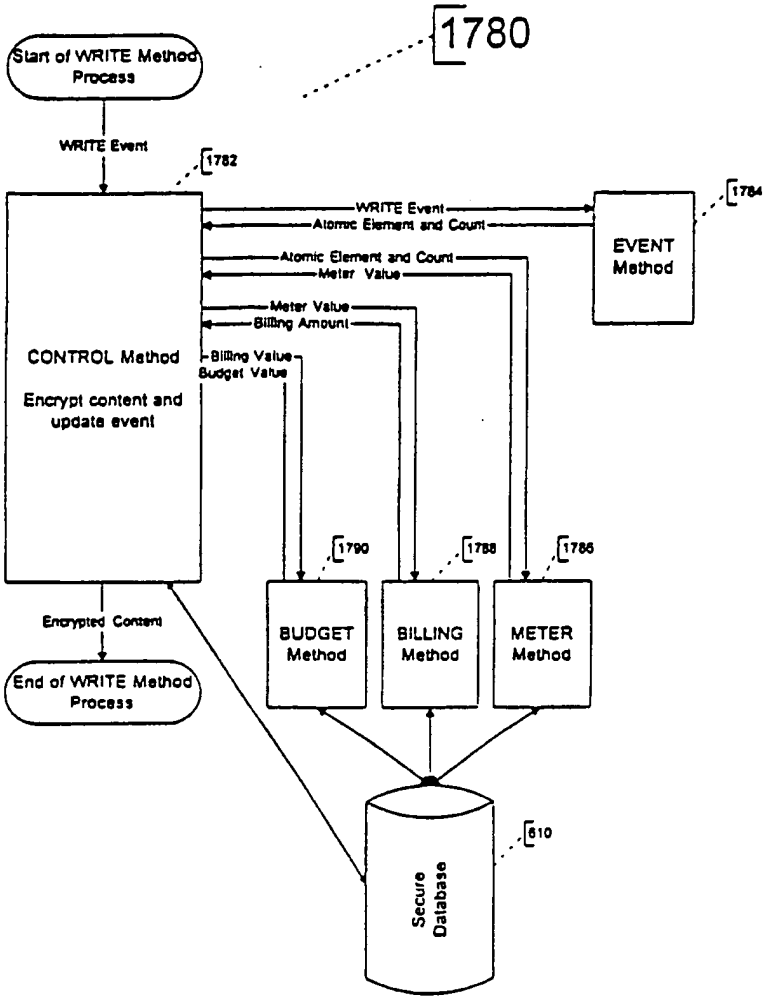


Figure 51

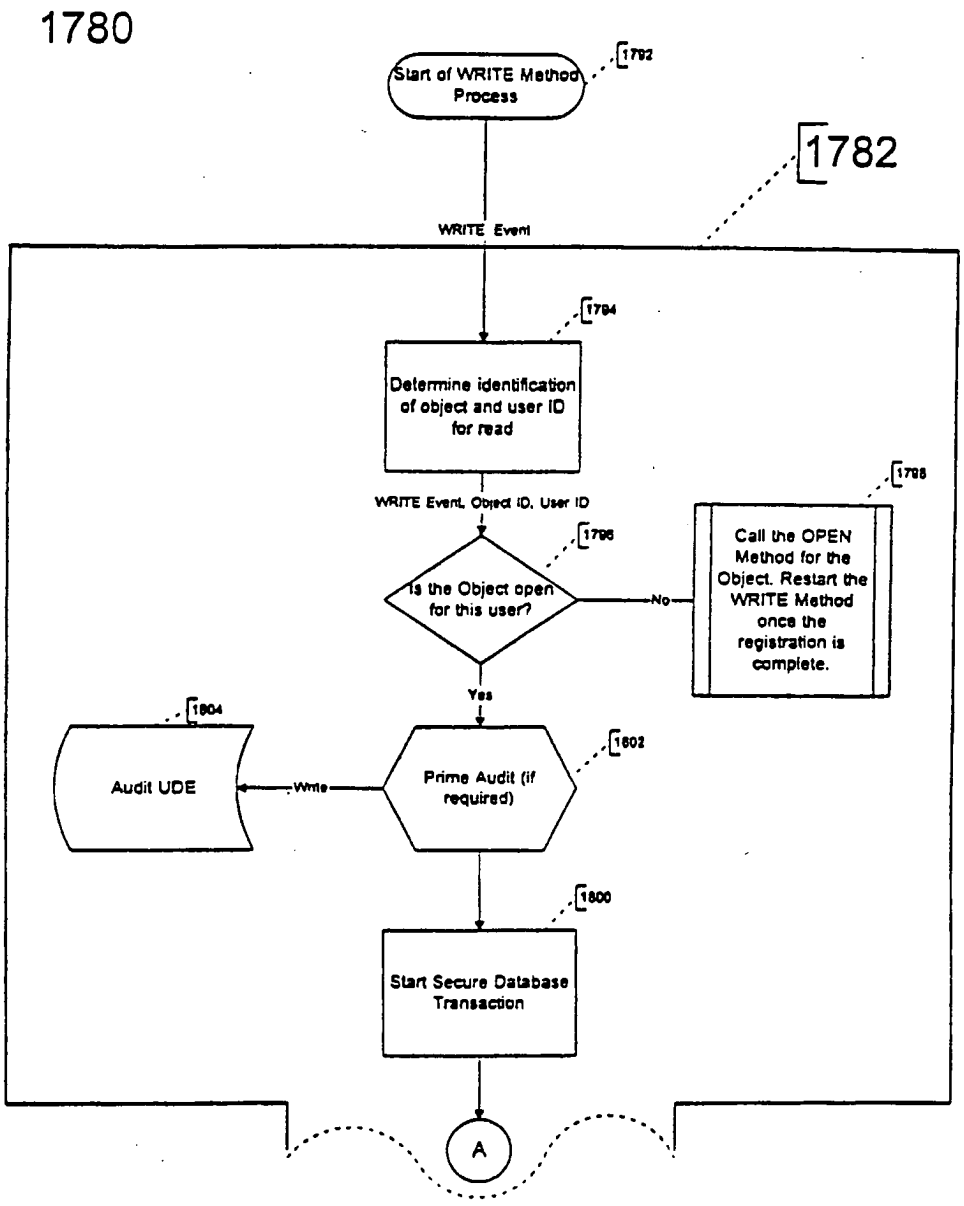


Figure 51a

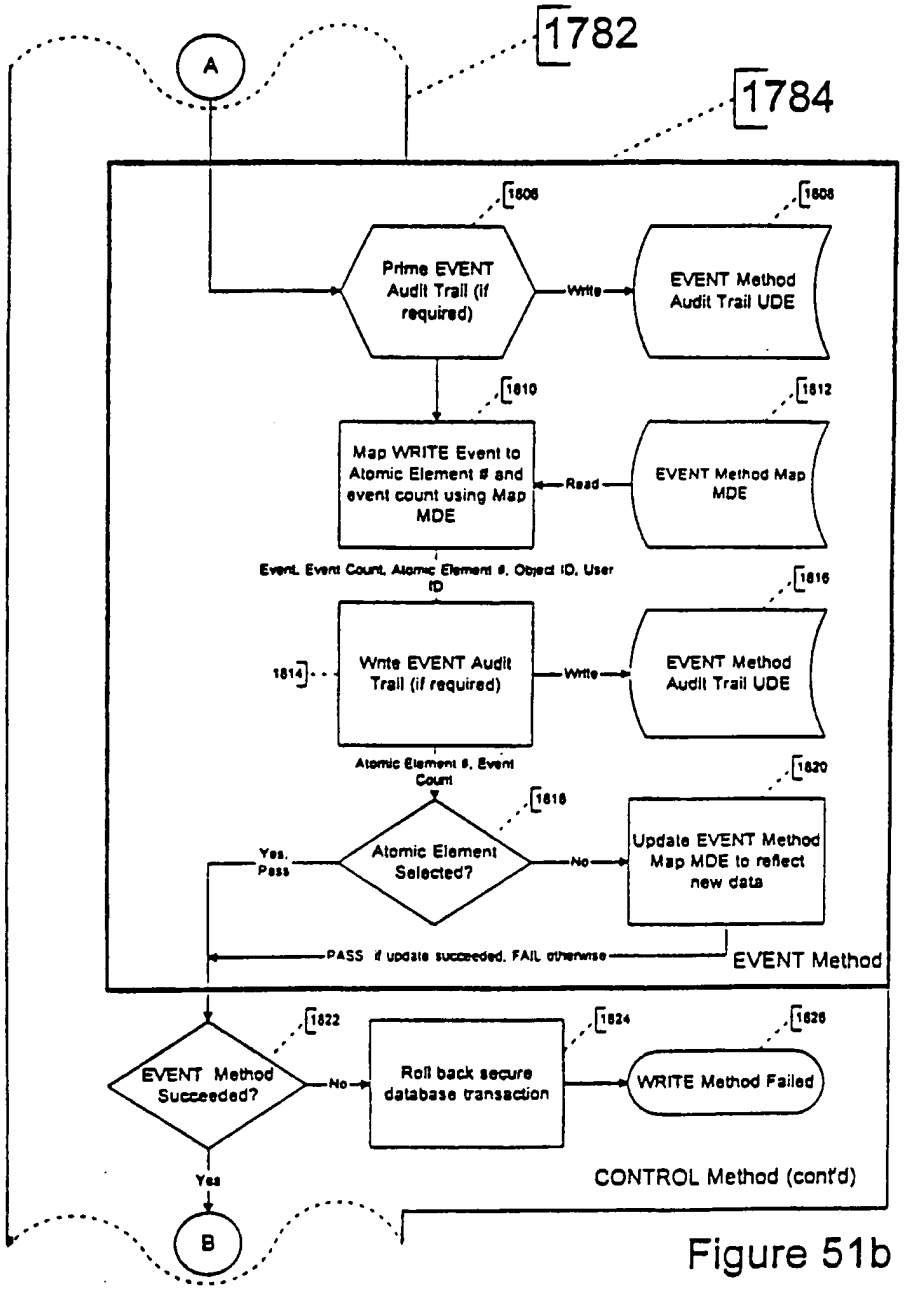


Figure 51b

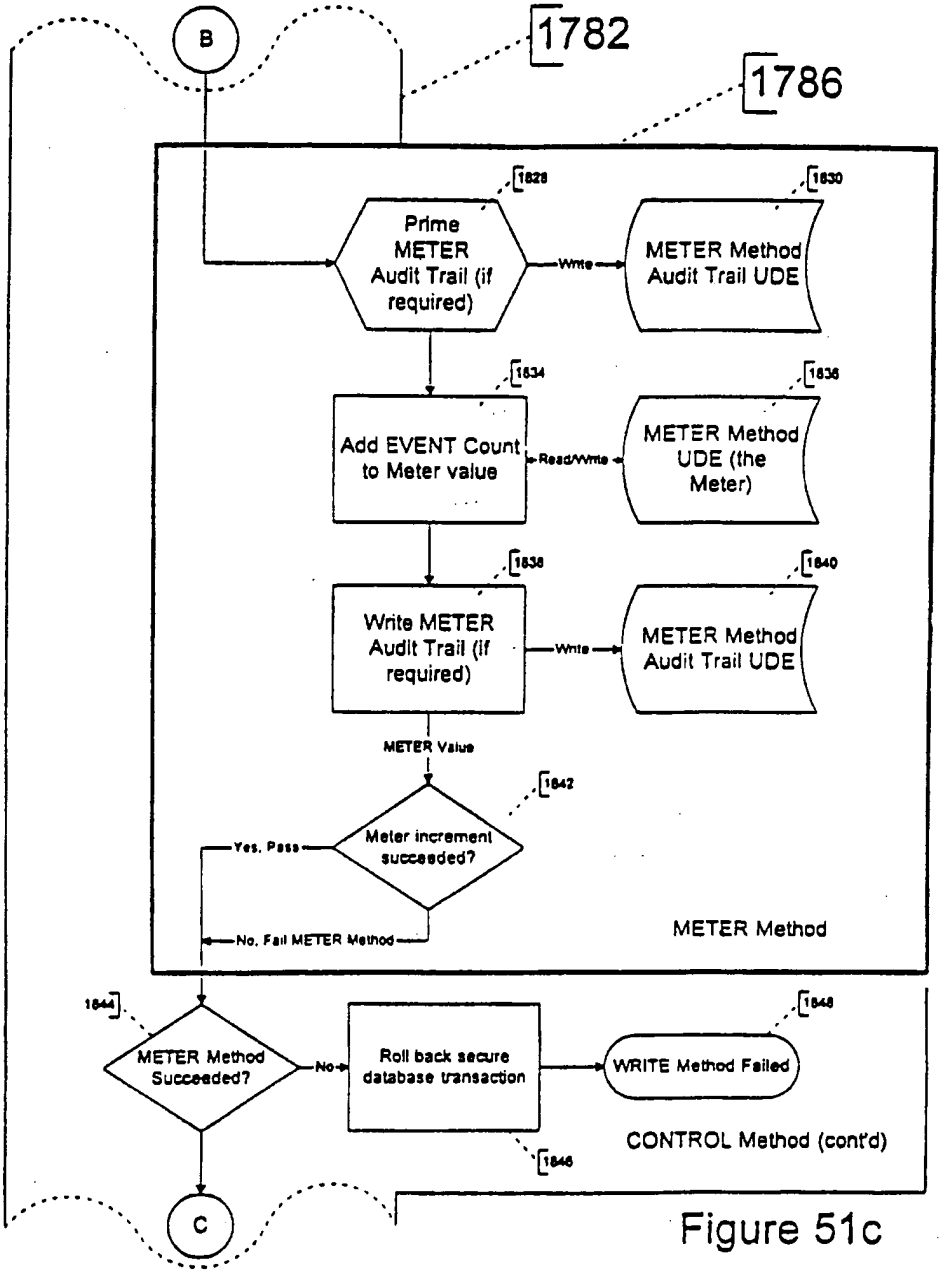


Figure 51c

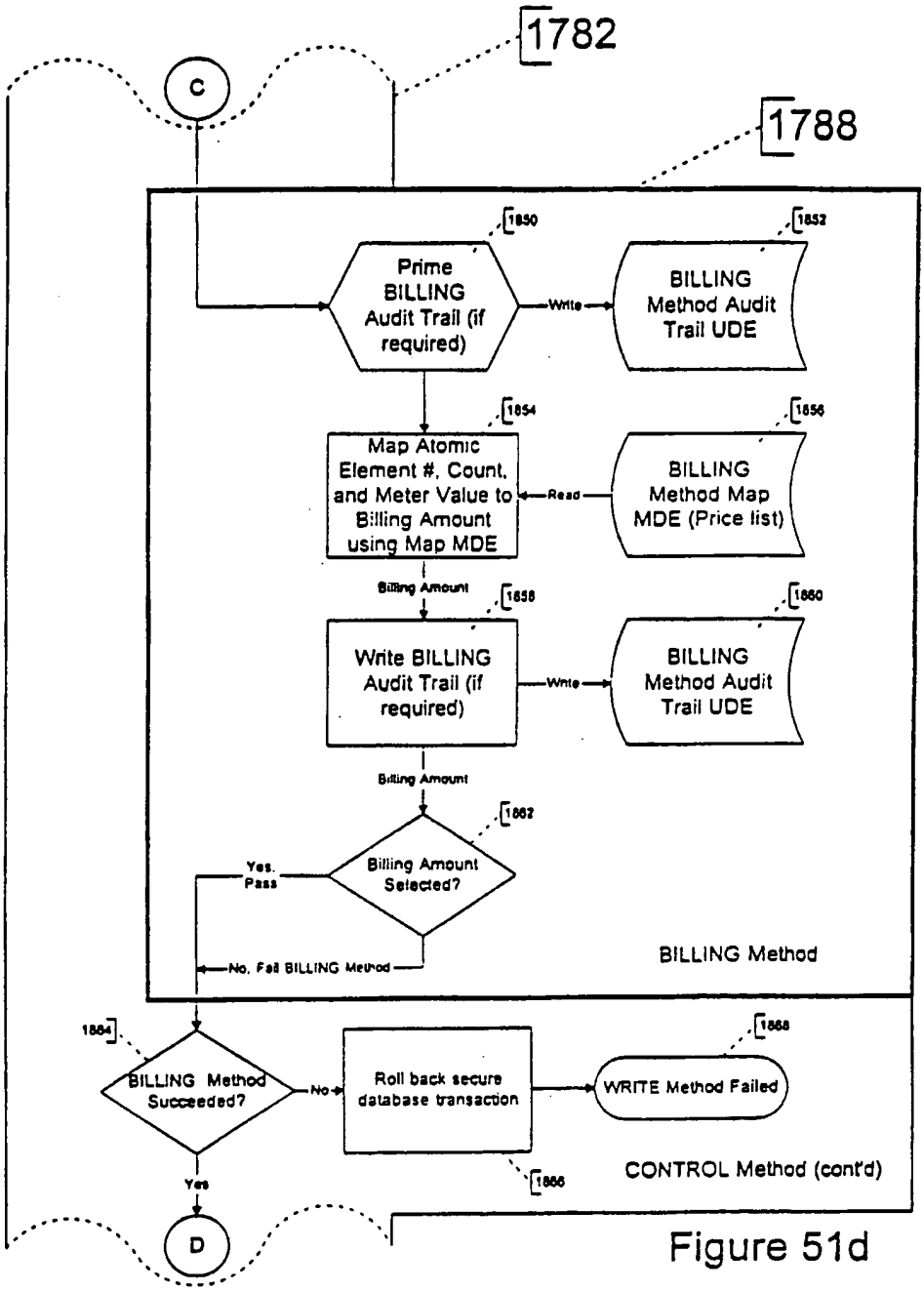


Figure 51d

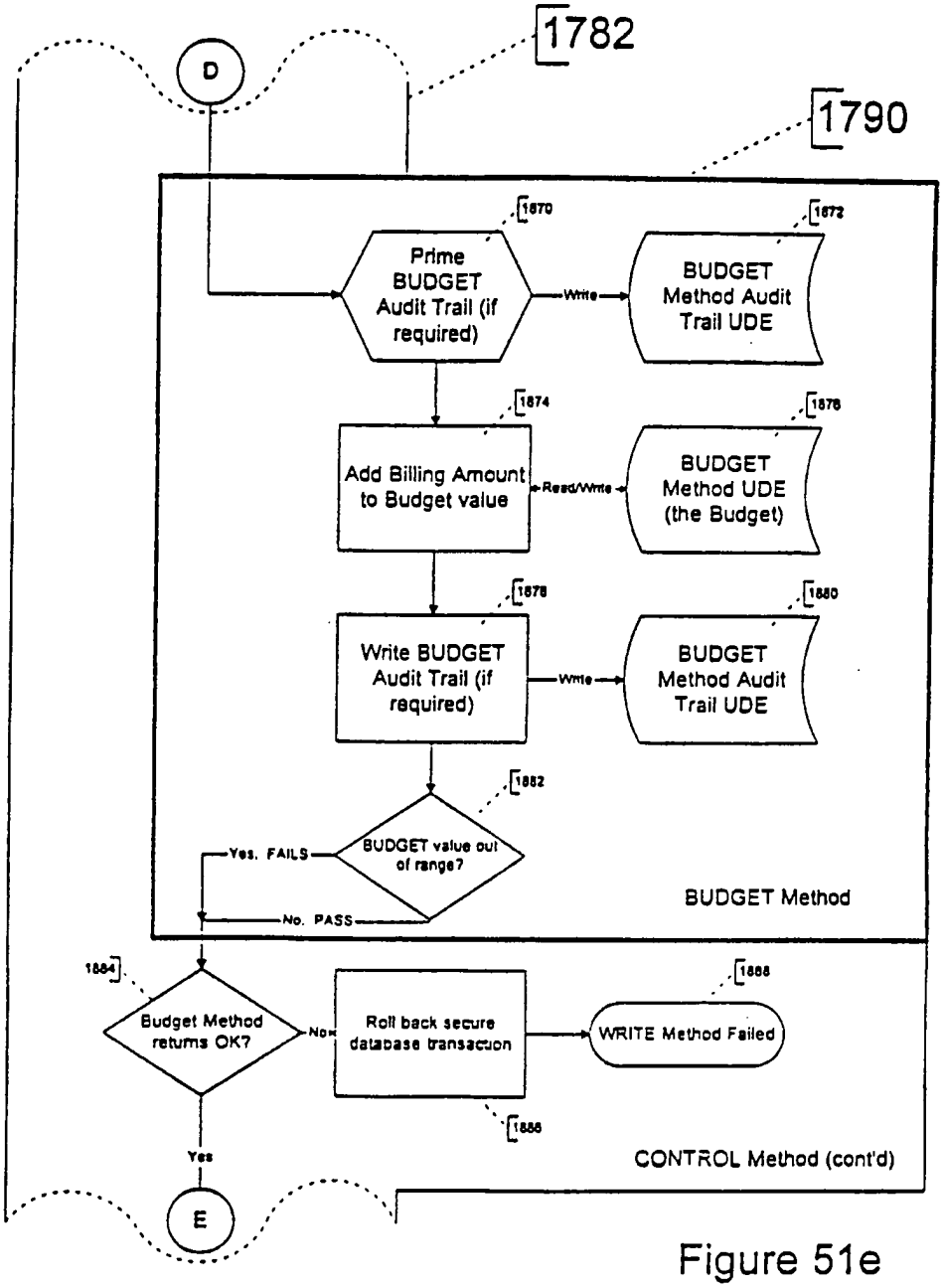


Figure 51e

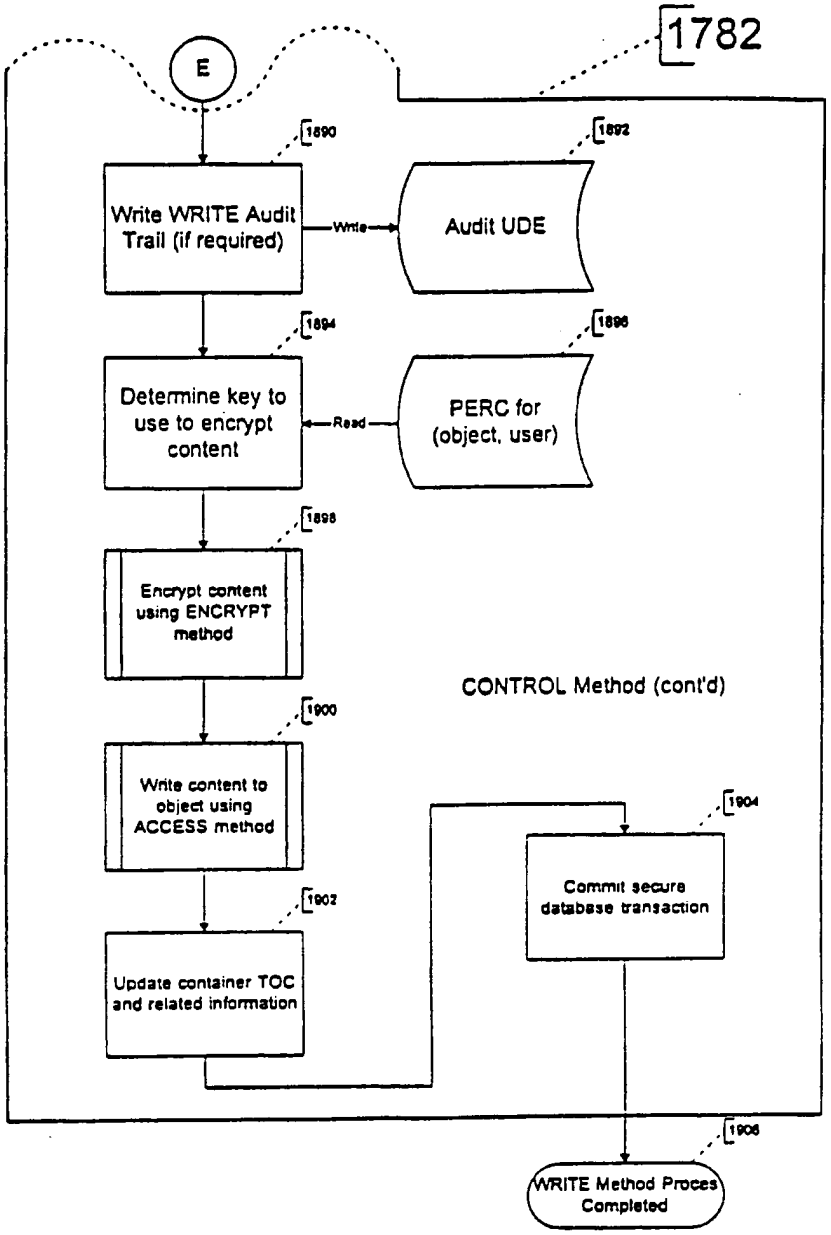


Figure 51f

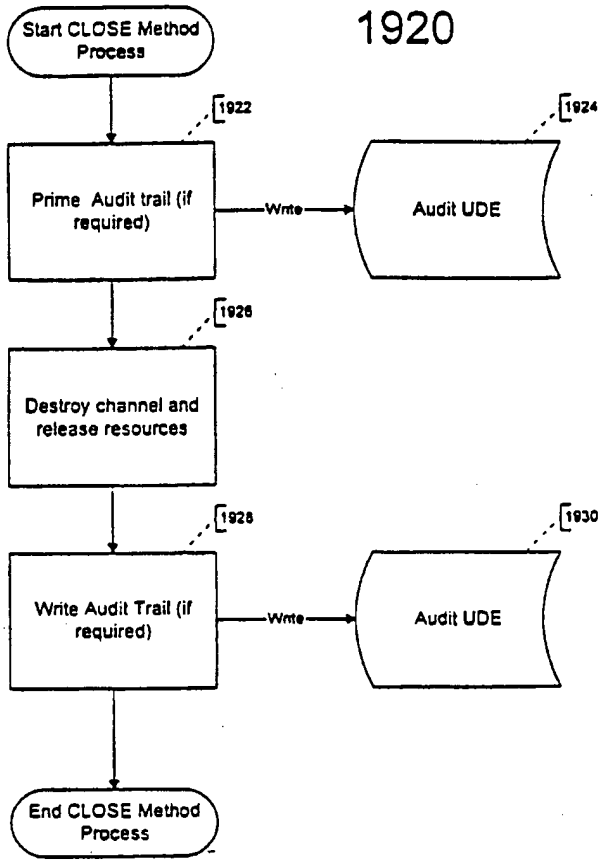


Figure 52

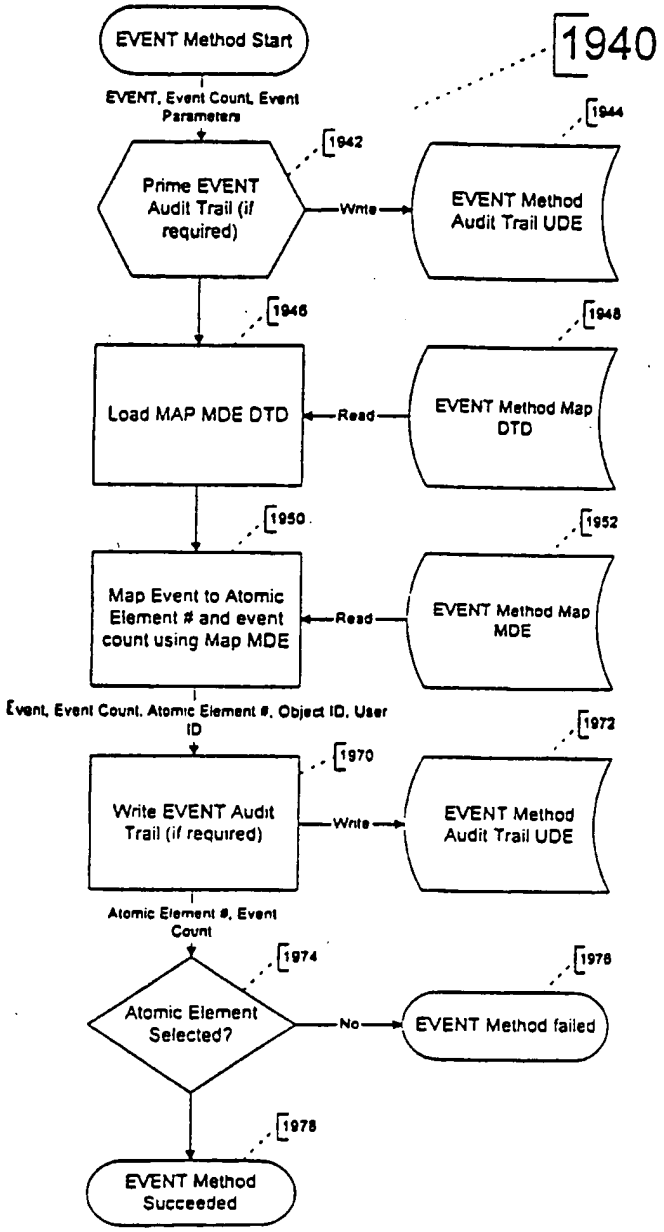


Figure 53a

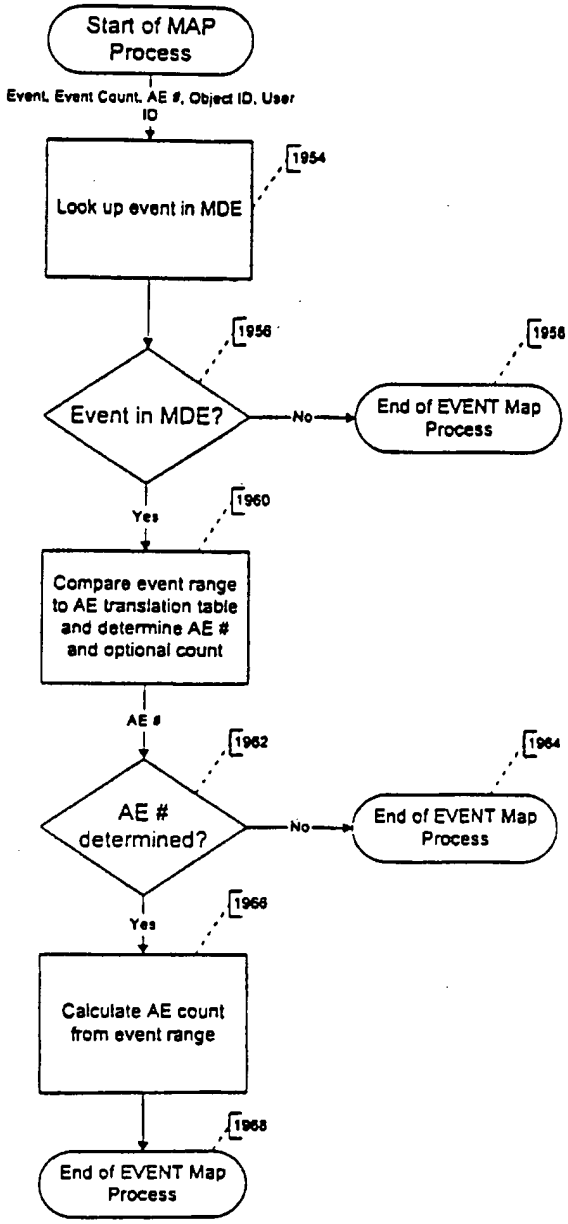


Figure 53b

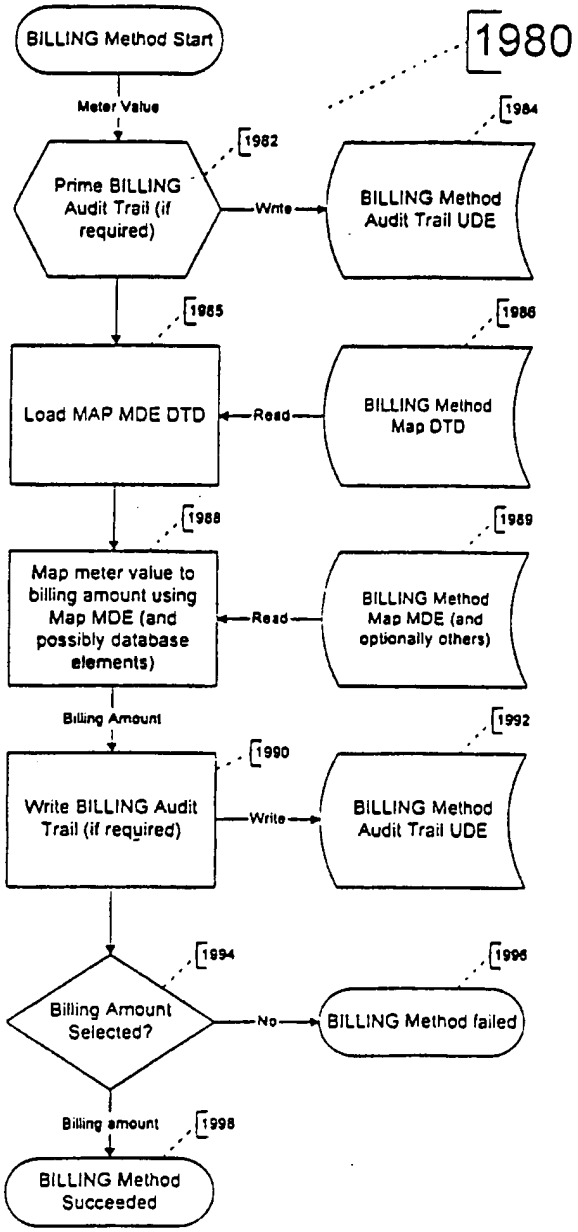


Figure 53c

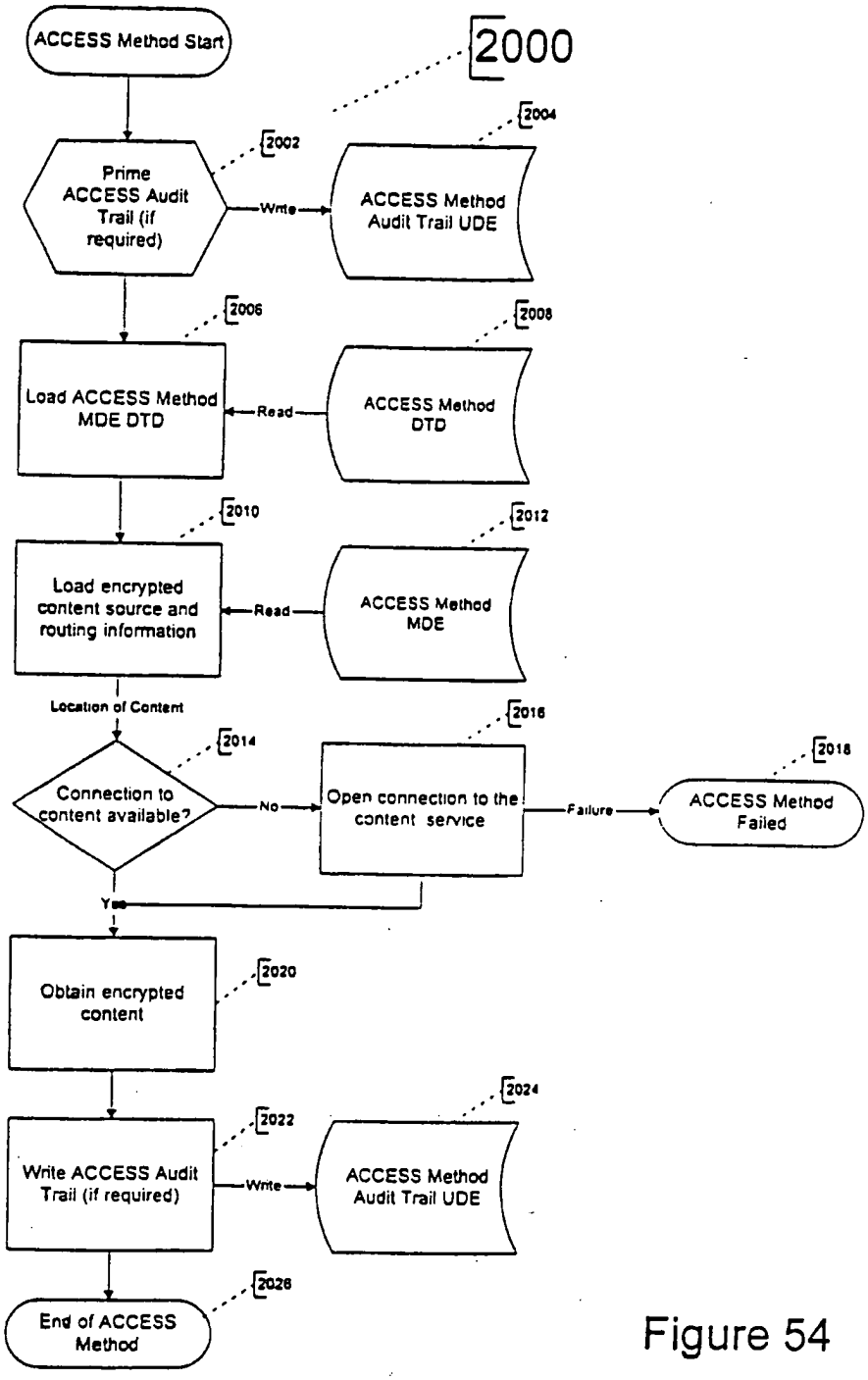

ACCESS Method Start
2000
2002
Prime ACCESS Audit Trail (if required)
Write
2004
ACCESS Method Audit Trail UDE
2006
Load ACCESS Method MDE DTD
Read
2008
ACCESS Method DTD
2010
Load encrypted content source and routing information
Read
2012
ACCESS Method MDE
Location of Content
2014
Connection to content available?
No
2016
Open connection to the content service
Failure
2018
ACCESS Method Failed
Yes
2020
Obtain encrypted content
2022
Write ACCESS Audit Trail (if required)
Write
2024
ACCESS Method Audit Trail UDE
2026
End of ACCESS Method

Figure 54

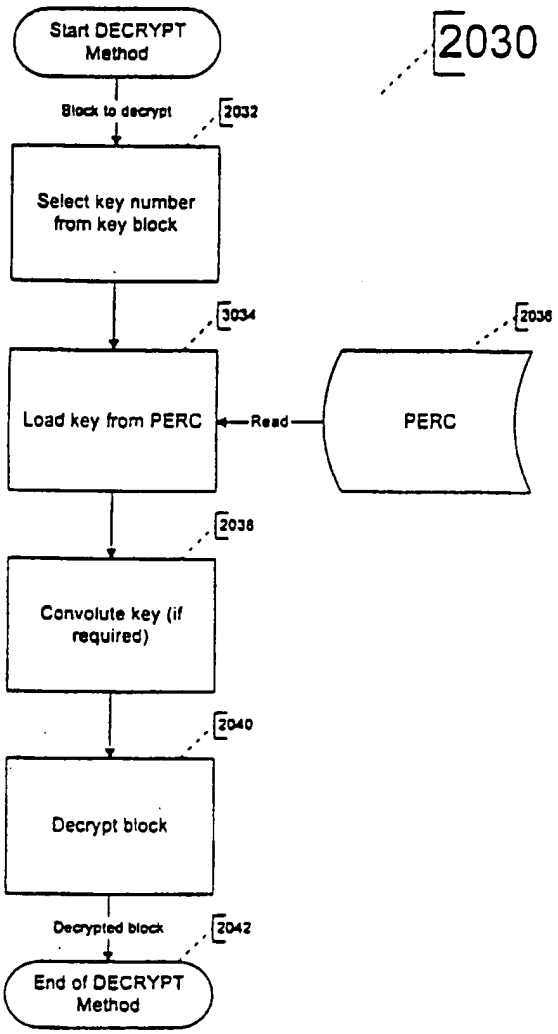

Start DECRYPT Method
2030
Block to decrypt
2032
Select key number from key block
2034
Load key from PERC
Read
2036
PERC
2038
Convolute key (if required)
2040
Decrypt block
Decrypted block
2042
End of DECRYPT Method

Figure 55a

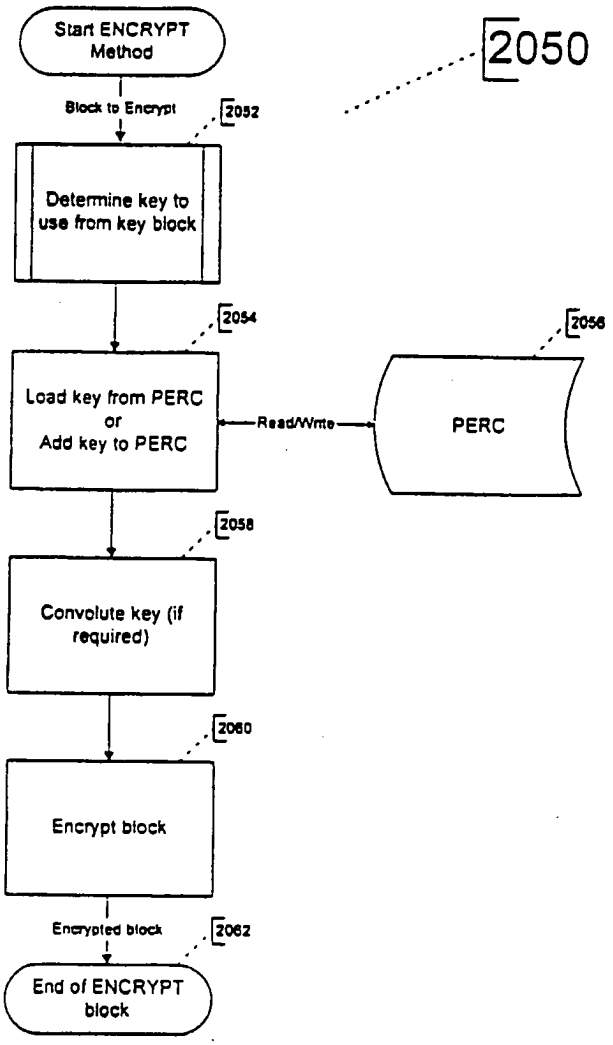

Start ENCRYPT Method
2050
Block to Encrypt
2052
Determine key to use from key block
2054
2056
Load key from PERC or Add key to PERC
Read/Write
PERC
2058
Convolute key (if required)
2060
Encrypt block
Encrypted block
2062
End of ENCRYPT block

Figure 55b

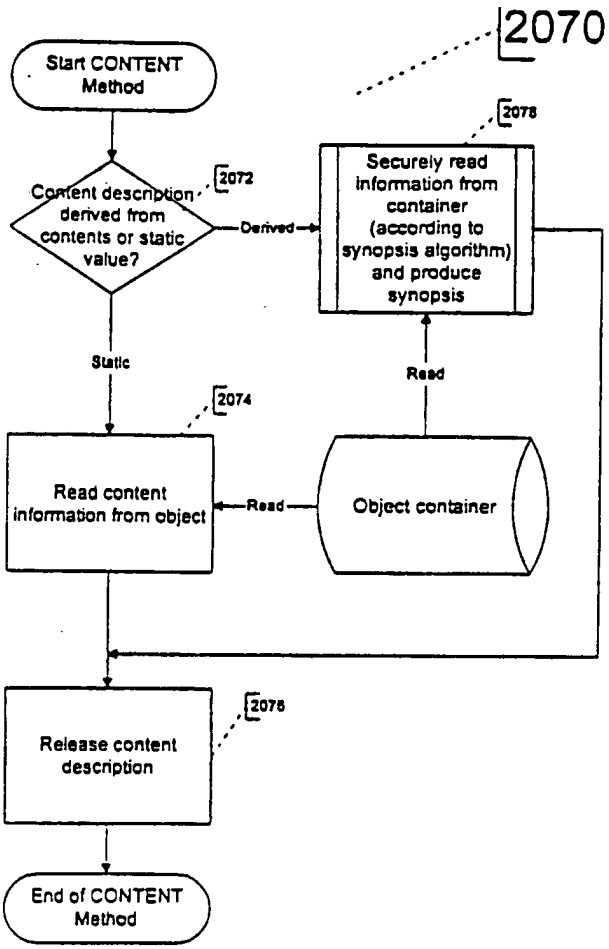

2070
Start CONTENT Method
2078
Securely read information from container (according to synopsis algorithm) and produce synopsis
2072
Content description derived from contents or static value?
Derived
Static
Read
2074
Read content information from object
Read
Object container
2076
Release content description
End of CONTENT Method

Figure 56

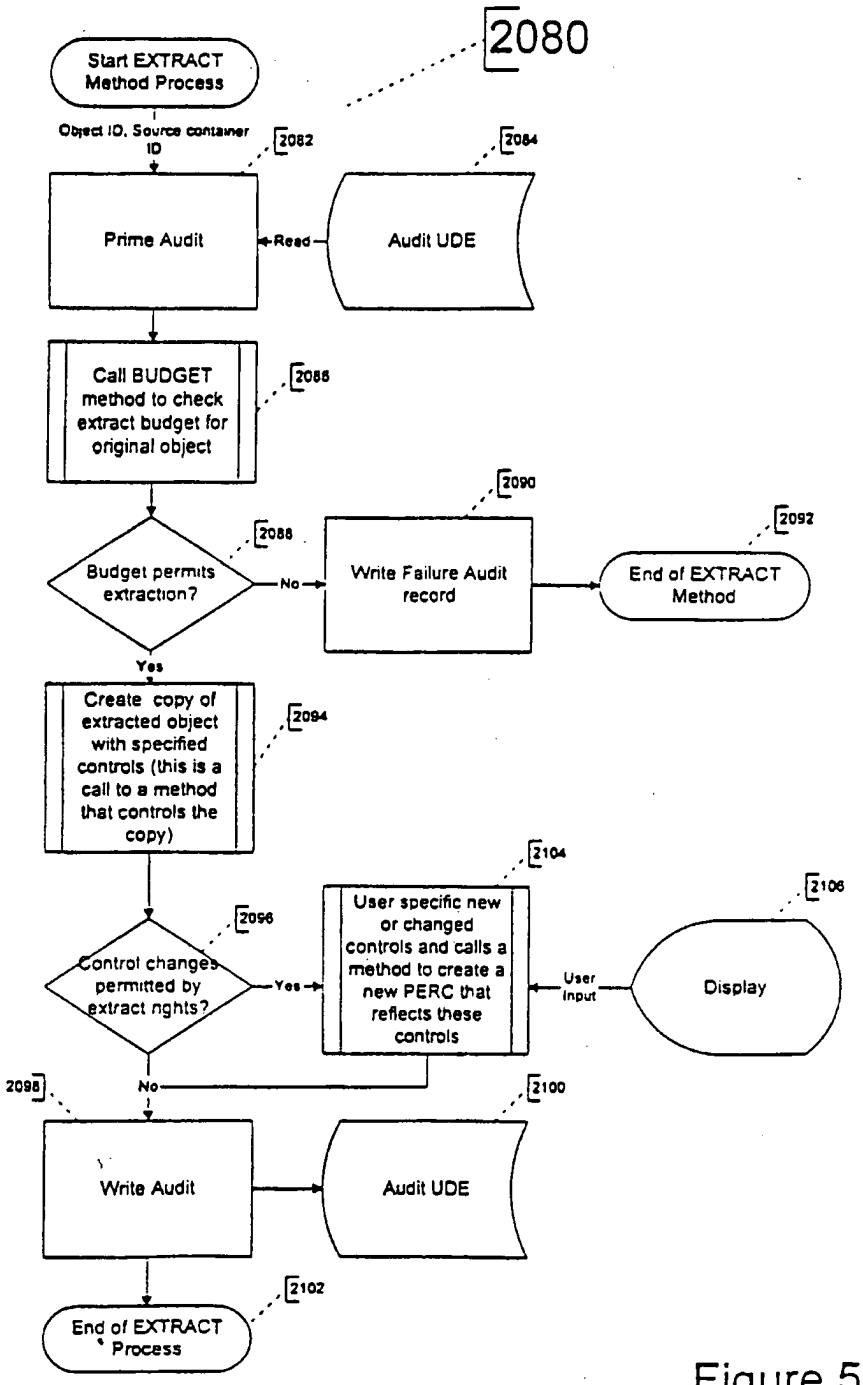

2080
Start EXTRACT Method Process
Object ID, Source container ID
2082
2084
Prime Audit
Read
Audit UDE
Call BUDGET method to check extract budget for original object
2086
2090
2088
2092
Budget permits extraction?
No
Write Failure Audit record
End of EXTRACT Method
Yes
Create copy of extracted object with specified controls (this is a call to a method that controls the copy)
2094
2104
2106
2096
Control changes permitted by extract rights?
Yes
User specific new or changed controls and calls a method to create a new PERC that reflects these controls
User Input
Display
2098
No
2100
Write Audit
Audit UDE
2102
End of EXTRACT Process

Figure 57a

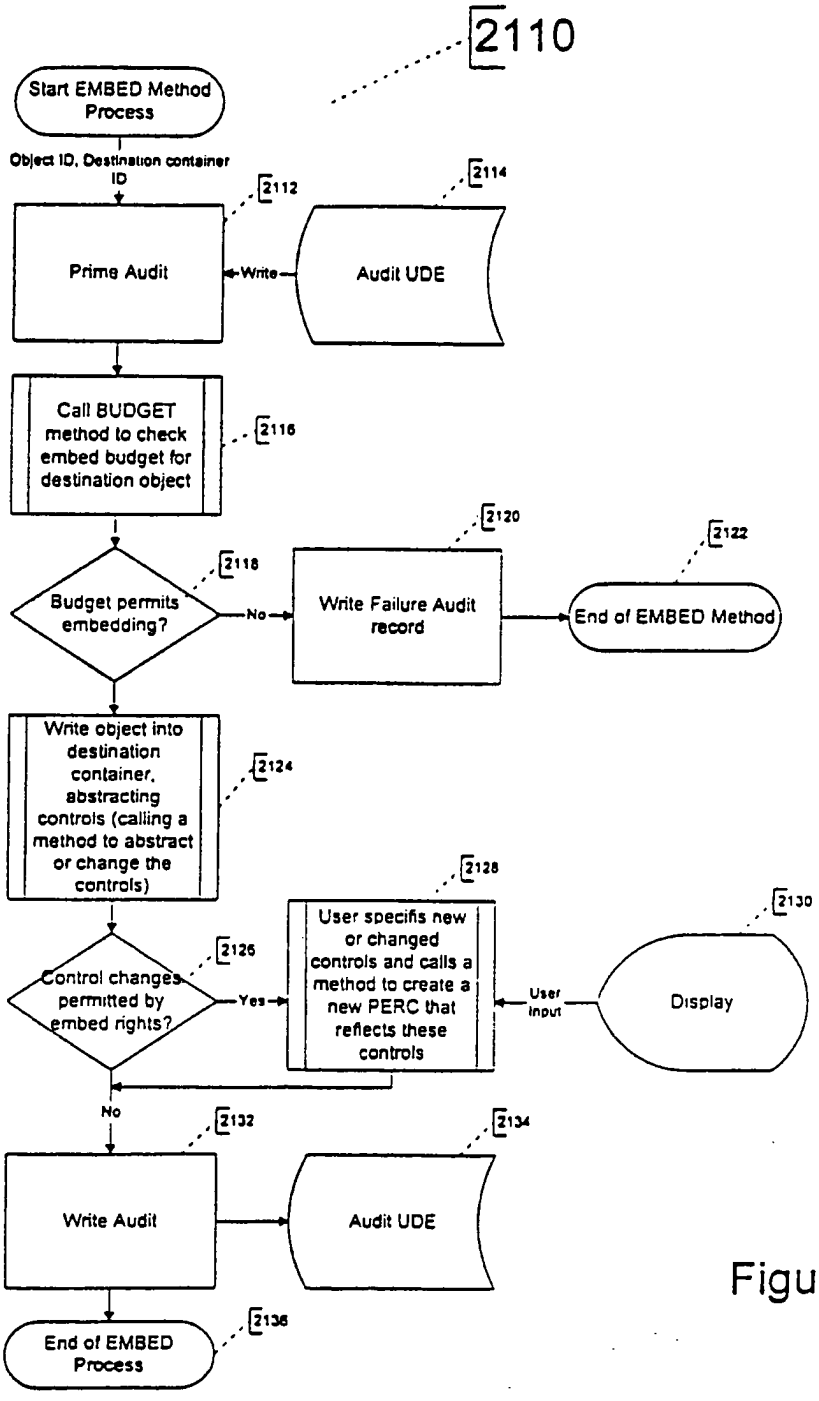


Figure 57b

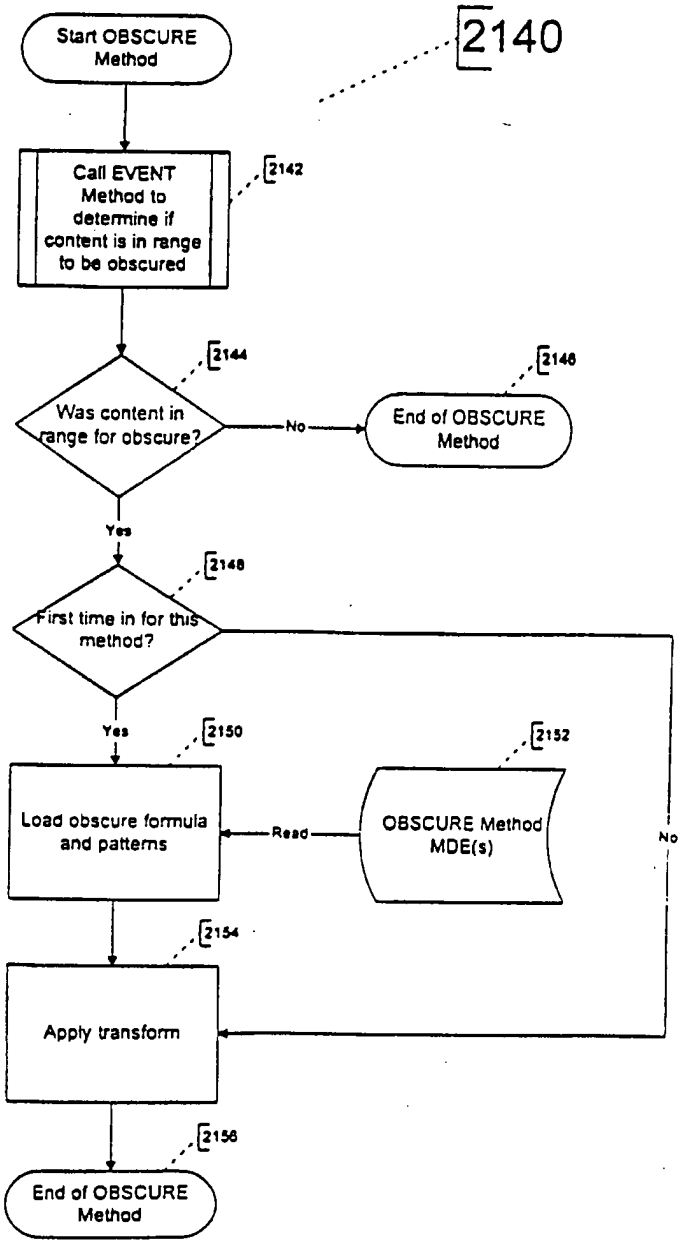

2140
Start OBSCURE Method
Call EVENT Method to determine if content is in range to be obscured
2142
2144
Was content in range for obscure?
No
2146
End of OBSCURE Method
Yes
2148
First time in for this method?
Yes
2150
Load obscure formula and patterns
Read
2152
OBSCURE Method MDE(s)
No
2154
Apply transform
2156
End of OBSCURE Method

Figure 58a

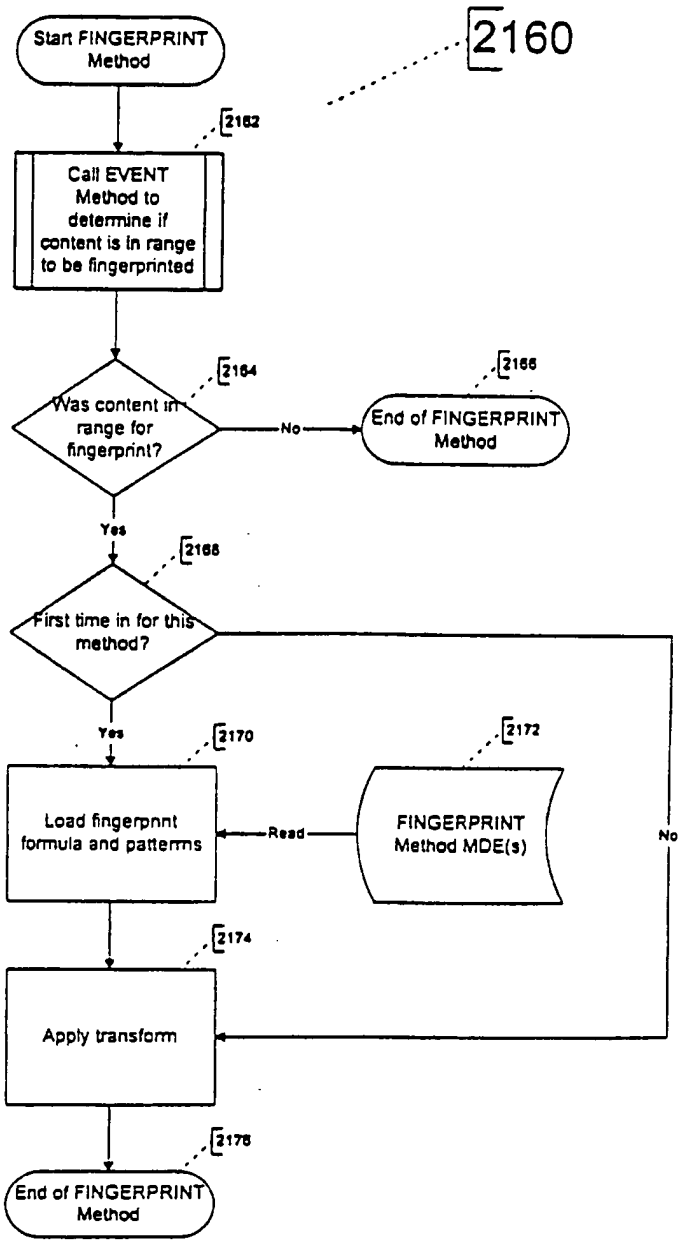

2160
Start FINGERPRINT Method
2162
Call EVENT Method to determine if content is in range to be fingerprinted
2164
Was content in range for fingerprint?
No
2166
End of FINGERPRINT Method
Yes
2168
First time in for this method?
Yes
No
2170
Load fingerprnt formula and patterns
Read
2172
FINGERPRINT Method MDE(s)
2174
Apply transform
2176
End of FINGERPRINT Method

Figure 58b

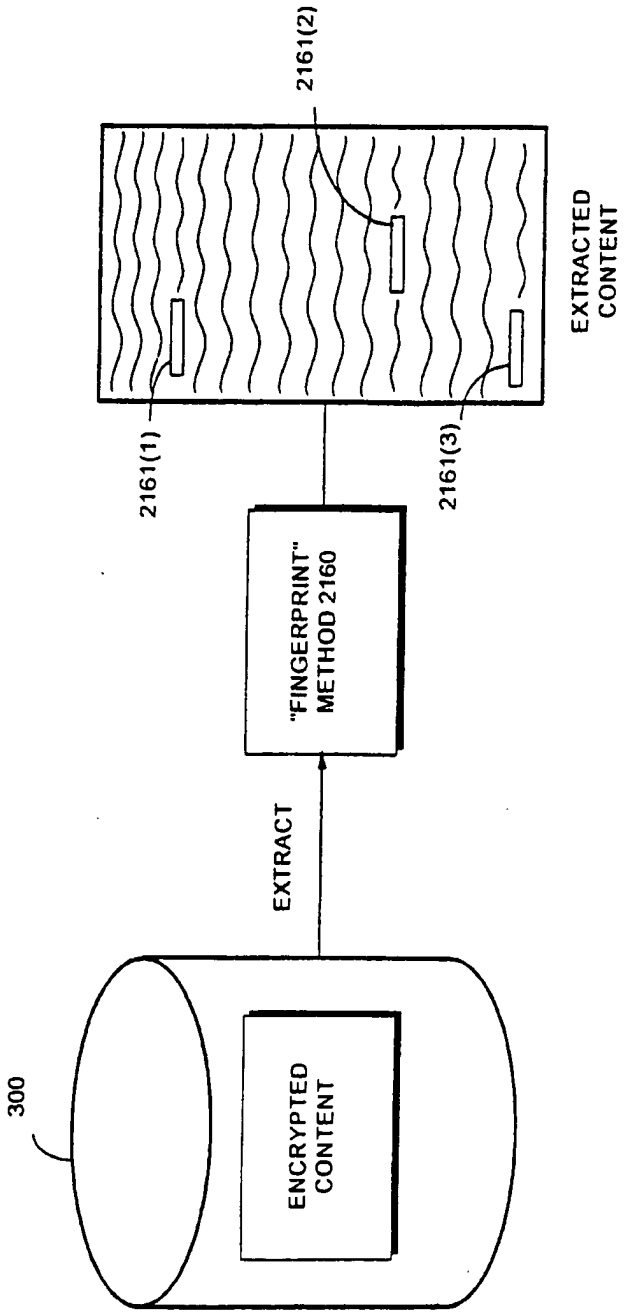

2161(2)
EXTRACTED CONTENT
2161(1)
2161(3)
"FINGERPRINT" METHOD 2160
EXTRACT
300
ENCRYPTED CONTENT

FIG. 58C

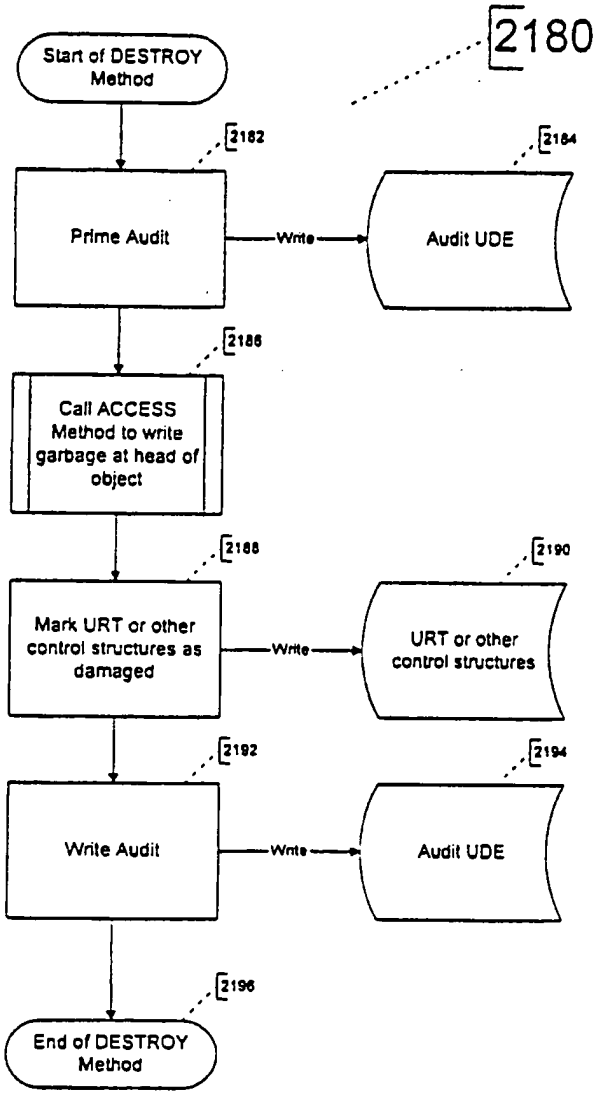


Figure 59

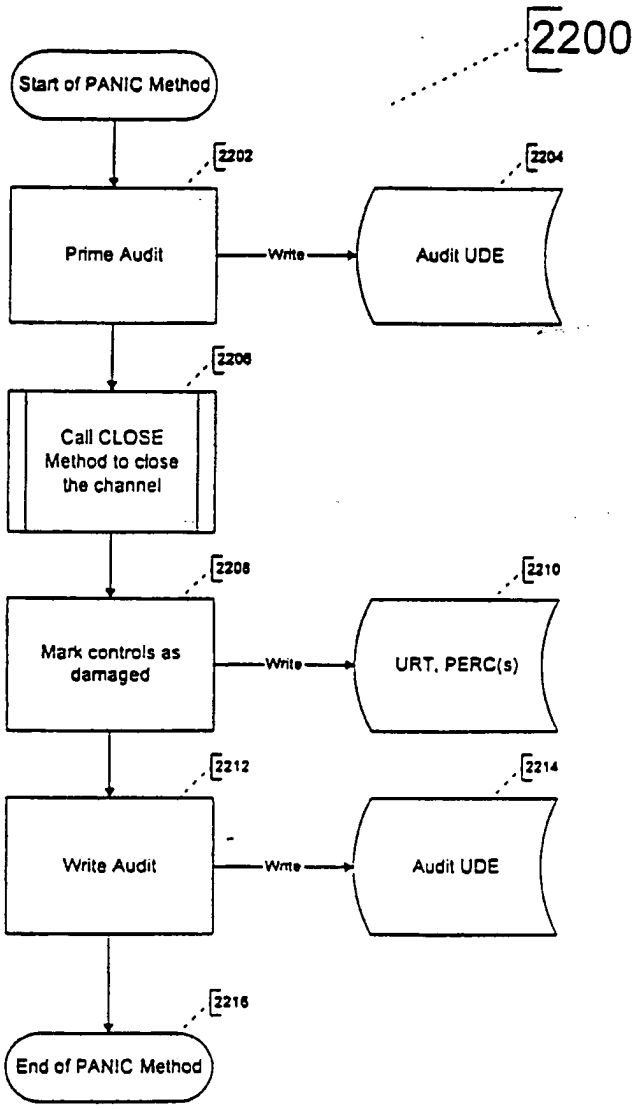


Figure 60

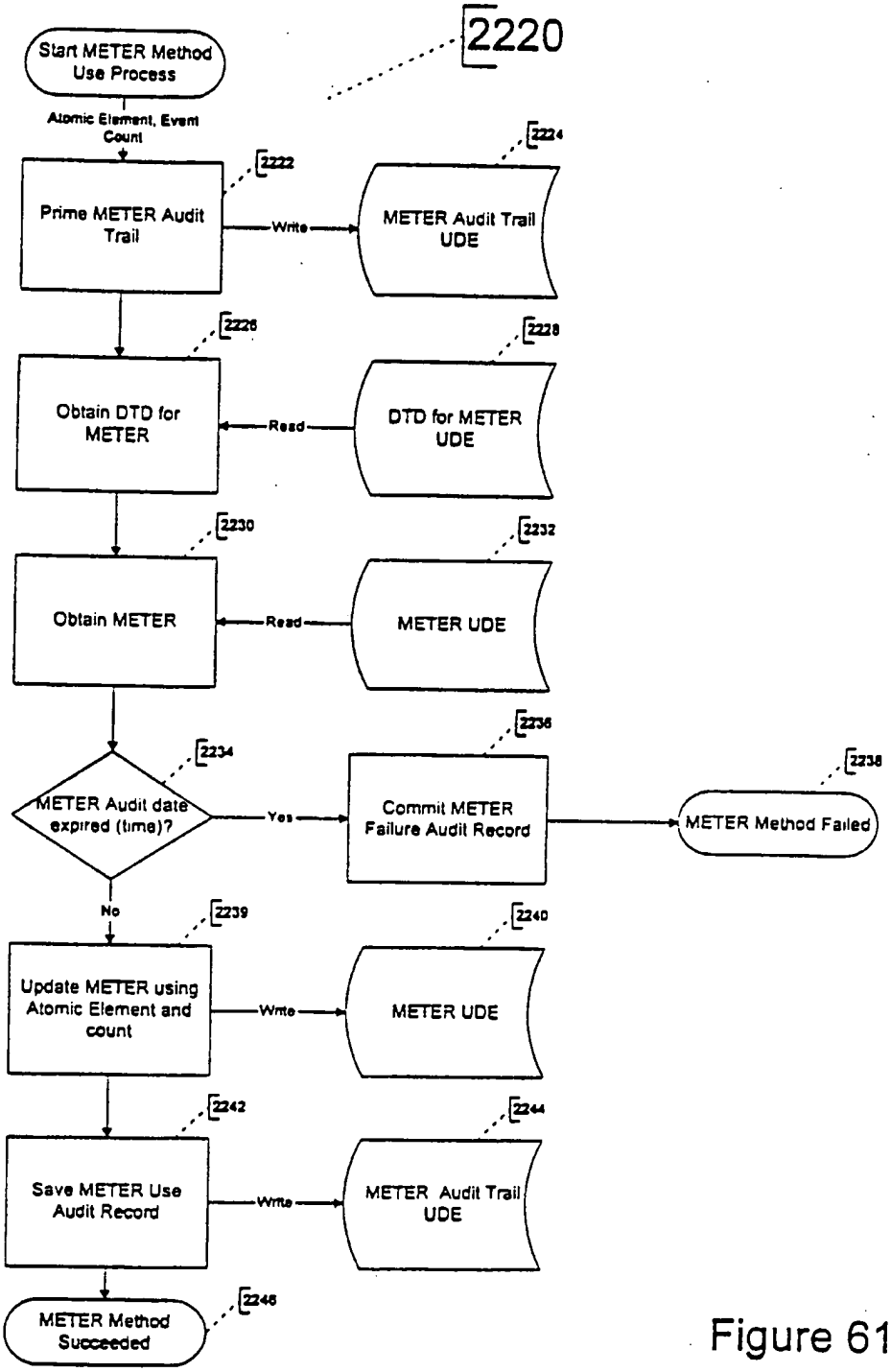
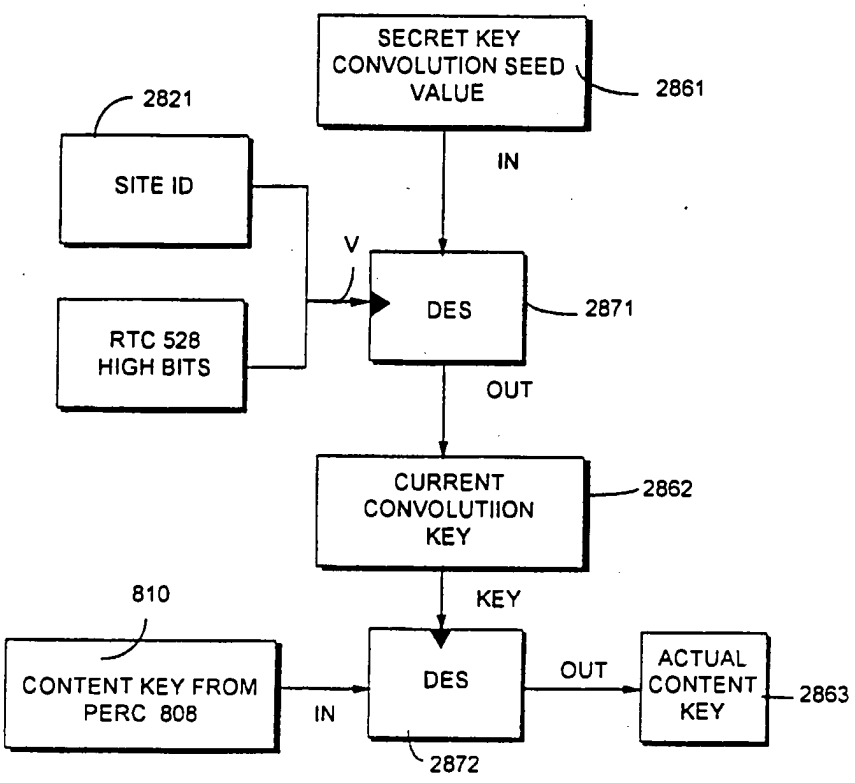

2220
Start METER Method Use Process
Atomic Element, Event Count
2222
Prime METER Audit Trail
Write
2224
METER Audit Trail UDE
2226
Obtain DTD for METER
Read
2228
DTD for METER UDE
2230
Obtain METER
Read
2232
METER UDE
2234
METER Audit date expired (time)?
Yes
2236
Commit METER Failure Audit Record
2238
METER Method Failed
No
2239
Update METER using Atomic Element and count
Write
2240
METER UDE
2242
Save METER Use Audit Record
Write
2244
METER Audit Trail UDE
2246
METER Method Succeeded

Figure 61

FIG. 62



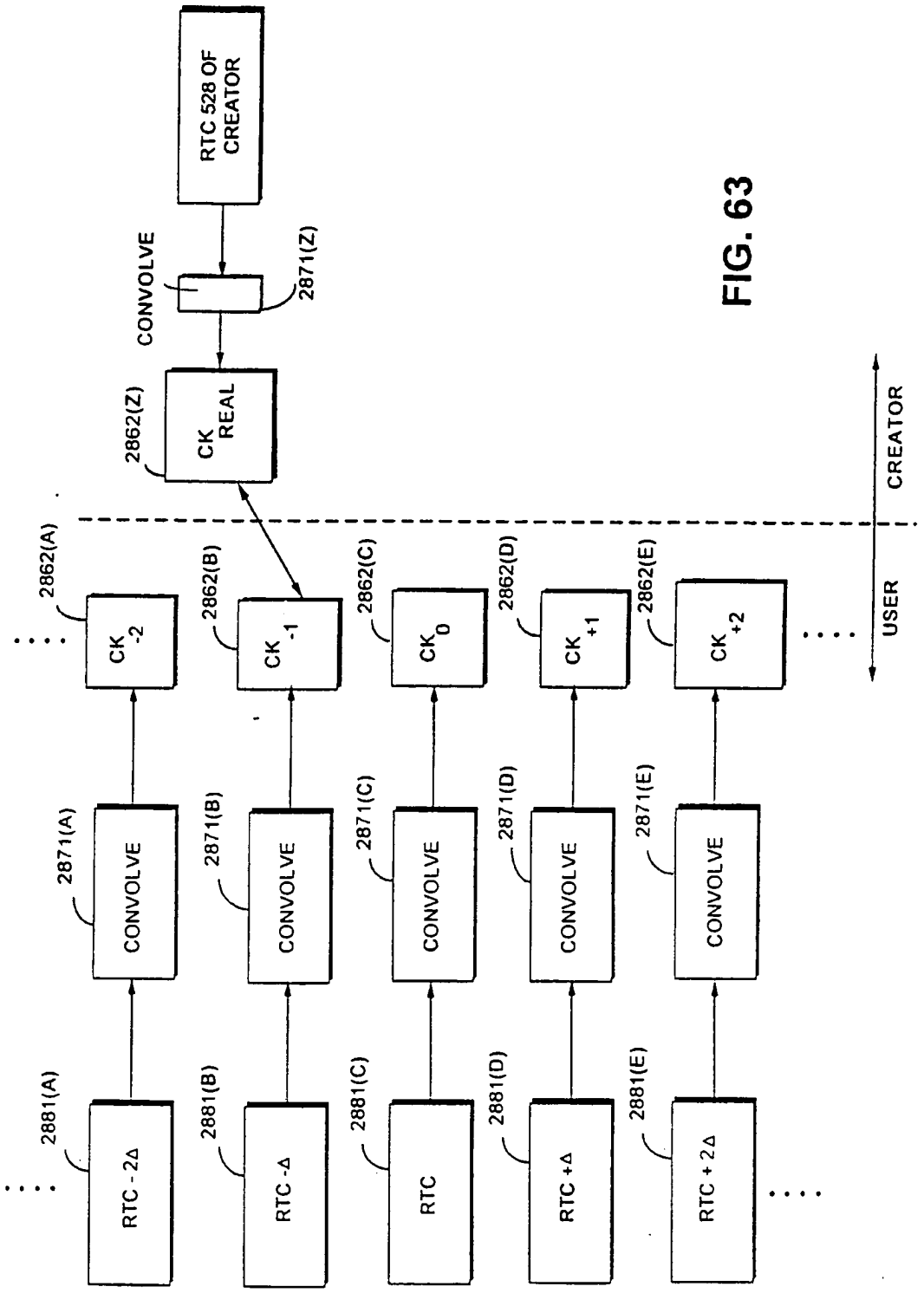


FIG. 63

FIG. 64

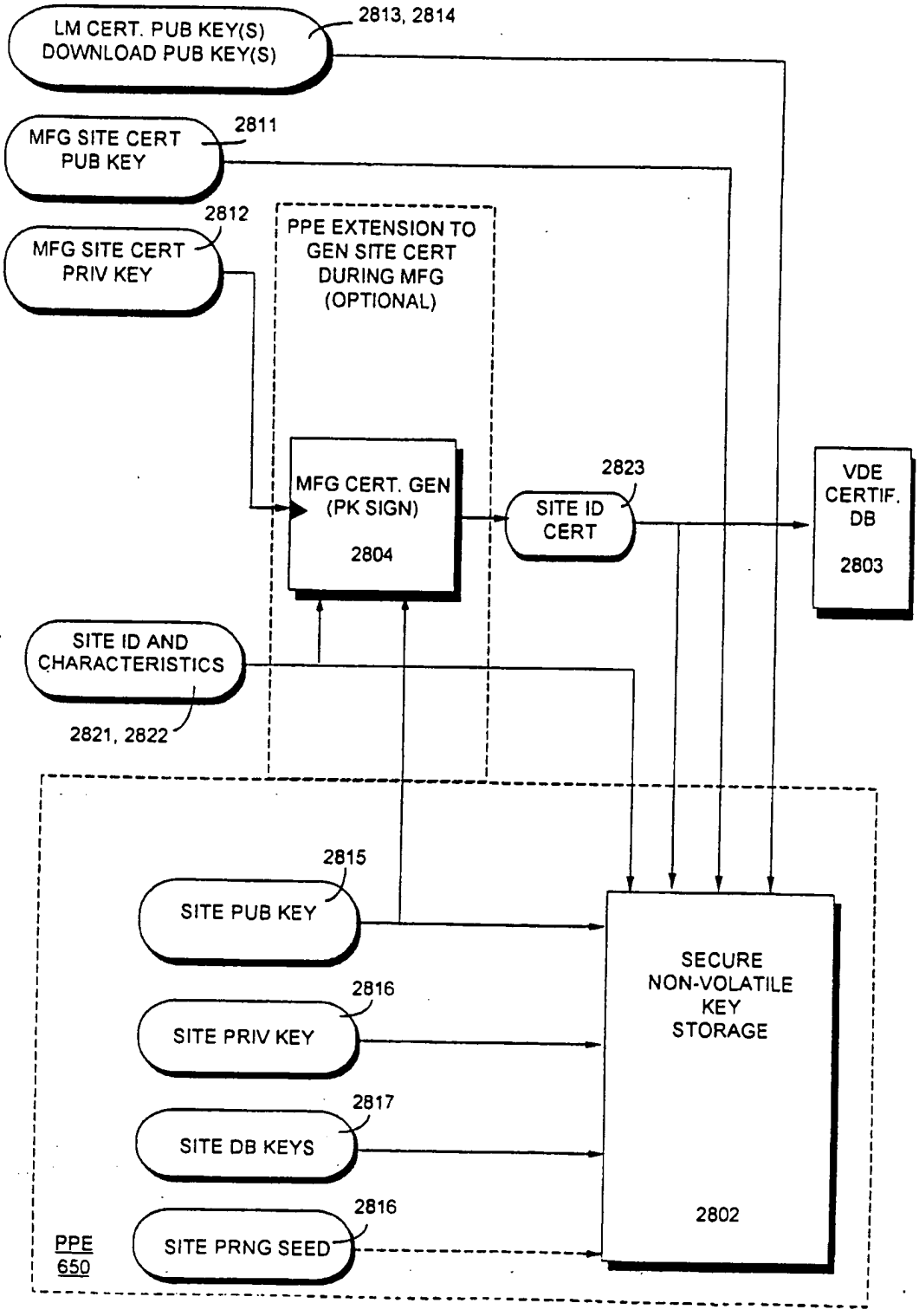
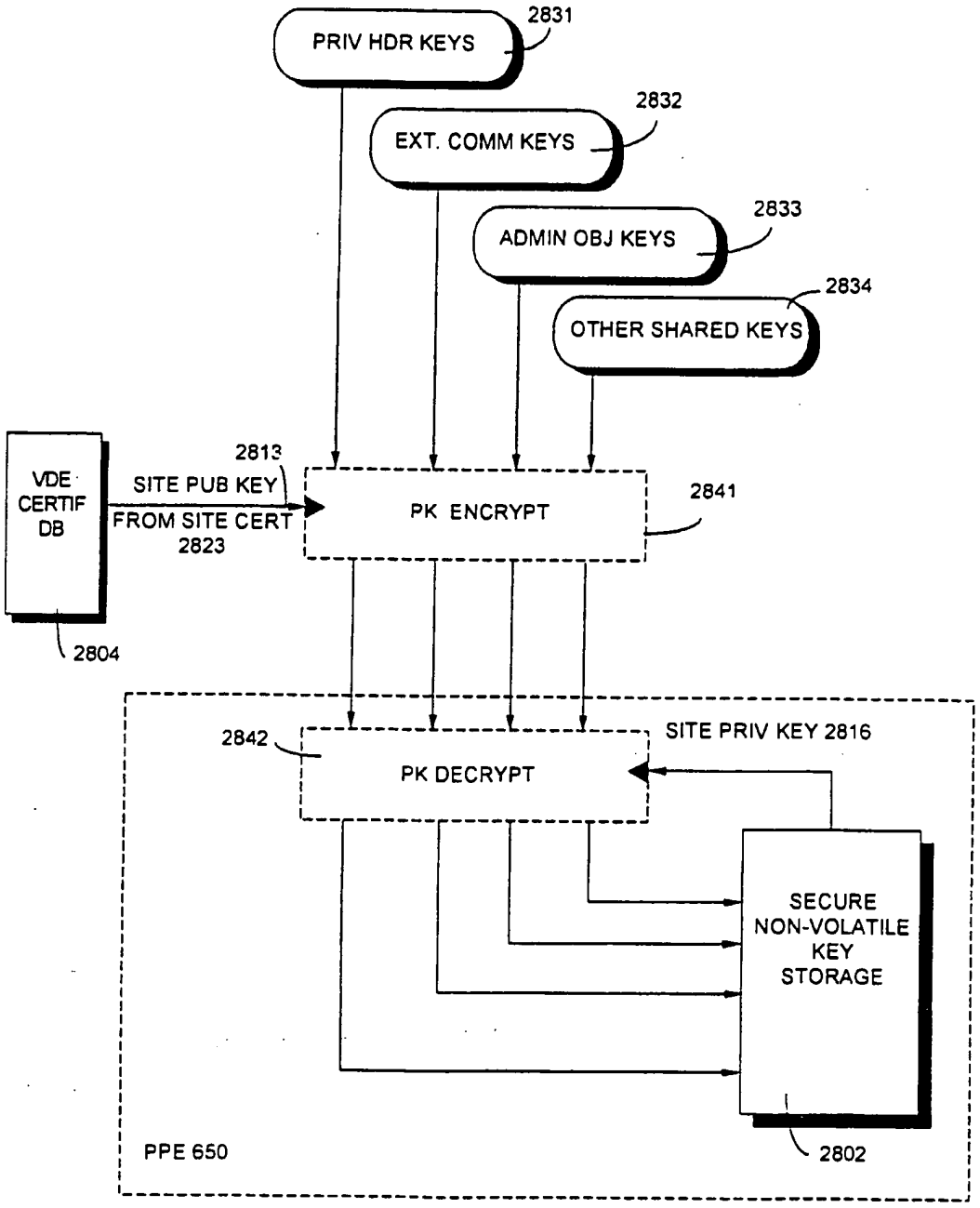


FIG. 65



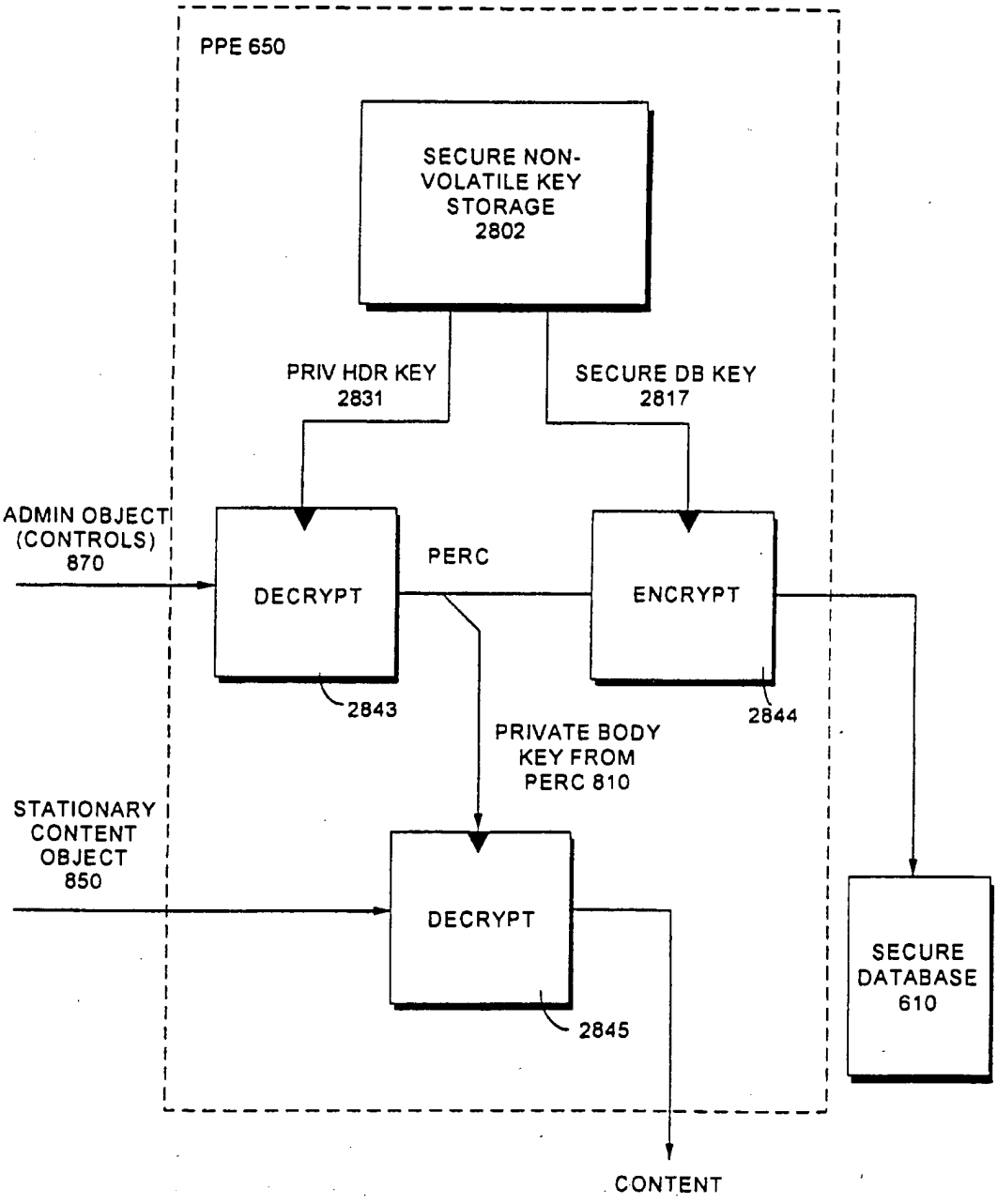


FIG. 66

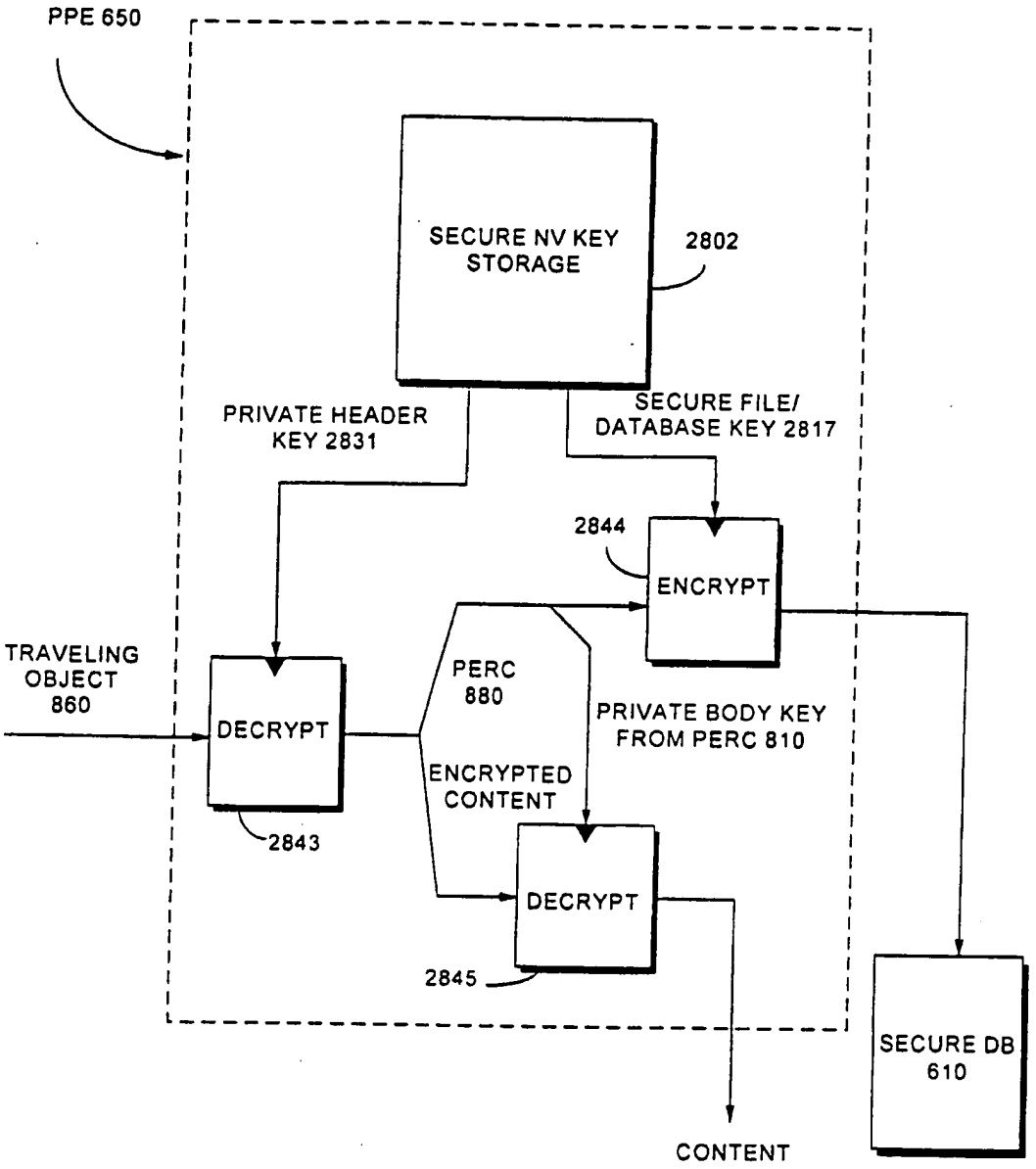
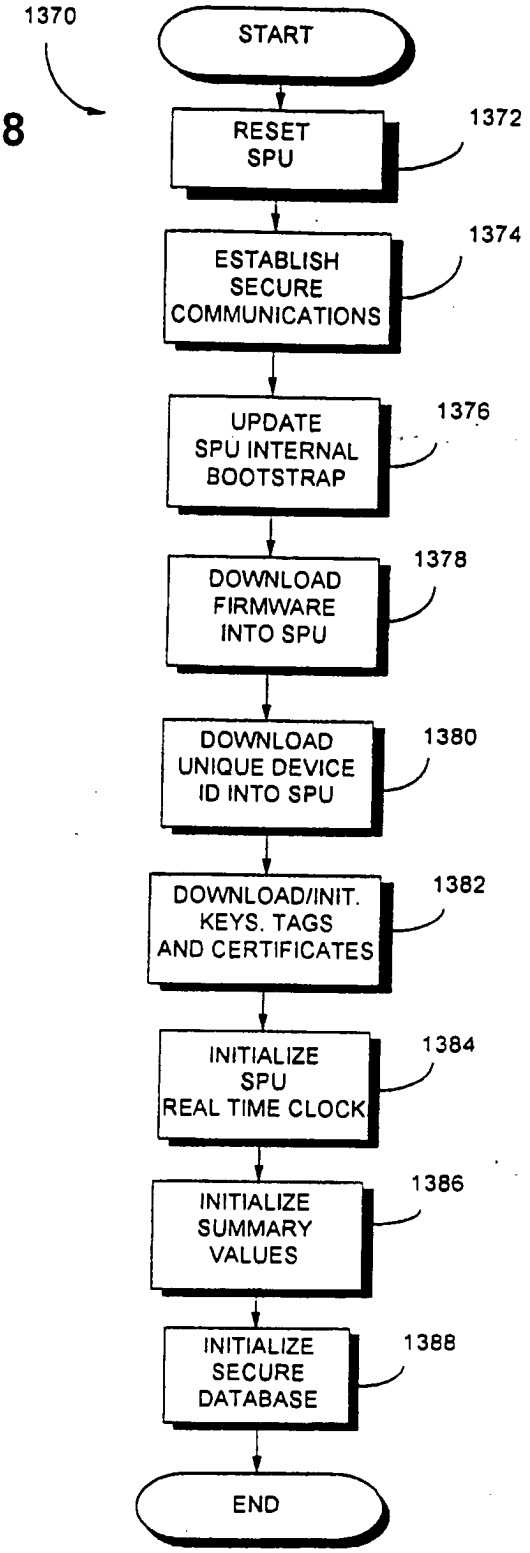


FIG. 67

FIG. 68


1370
START
RESET SPU
1372
ESTABLISH SECURE COMMUNICATIONS
1374
UPDATE SPU INTERNAL BOOTSTRAP
1376
DOWNLOAD FIRMWARE INTO SPU
1378
DOWNLOAD UNIQUE DEVICE ID INTO SPU
1380
DOWNLOAD/INIT. KEYS. TAGS AND CERTIFICATES
1382
INITIALIZE SPU REAL TIME CLOCK
1384
INITIALIZE SUMMARY VALUES
1386
INITIALIZE SECURE DATABASE
1388
END

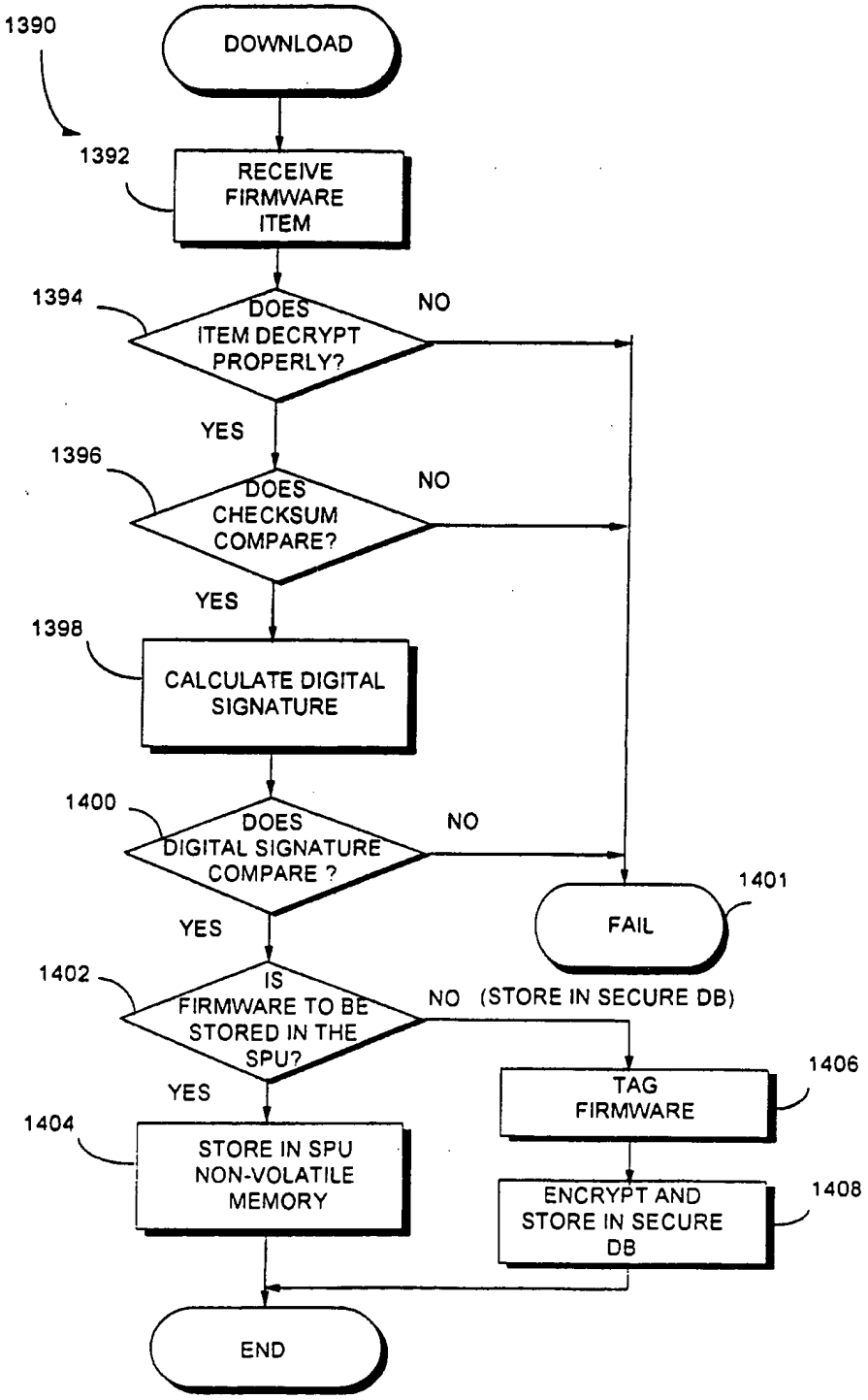


FIG. 69

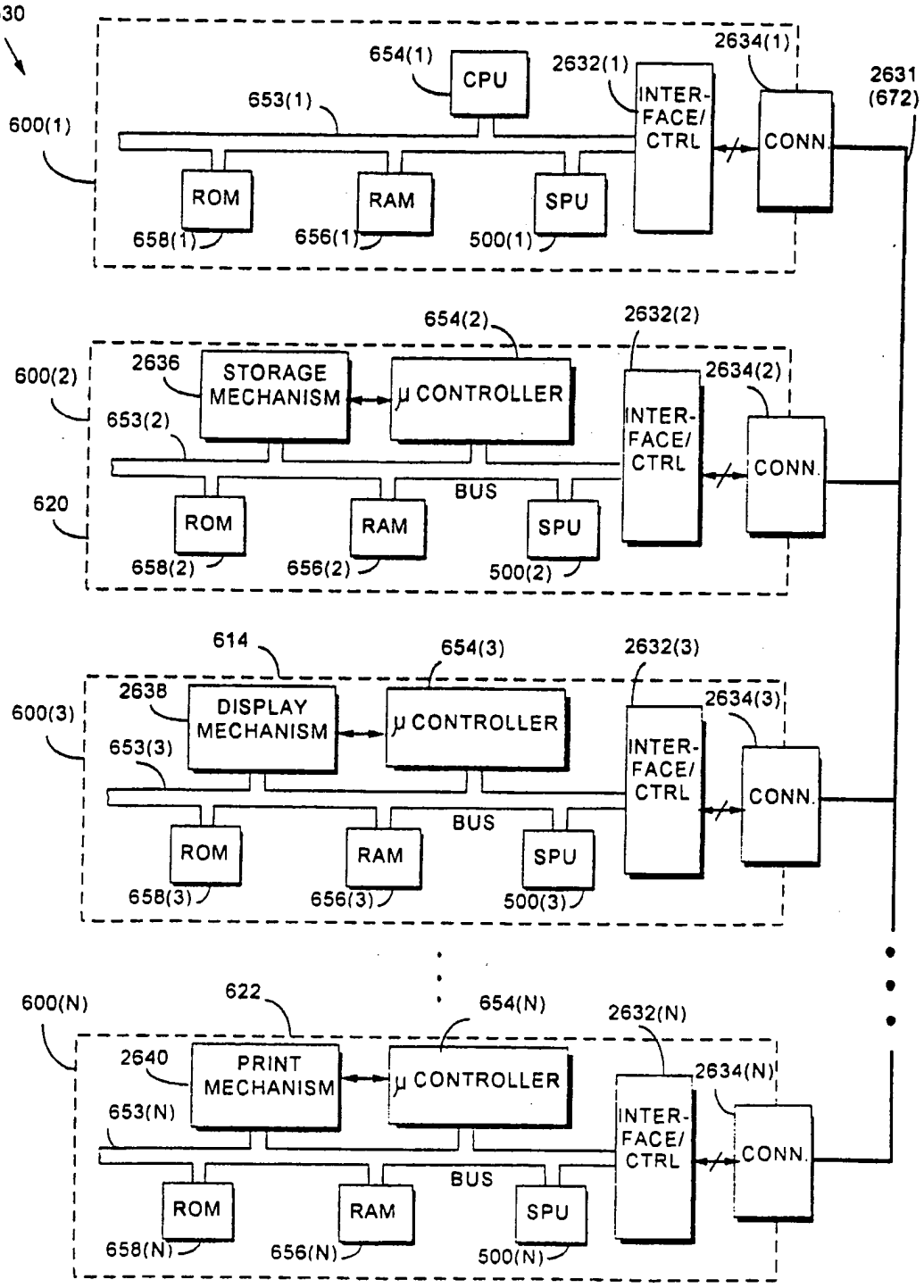
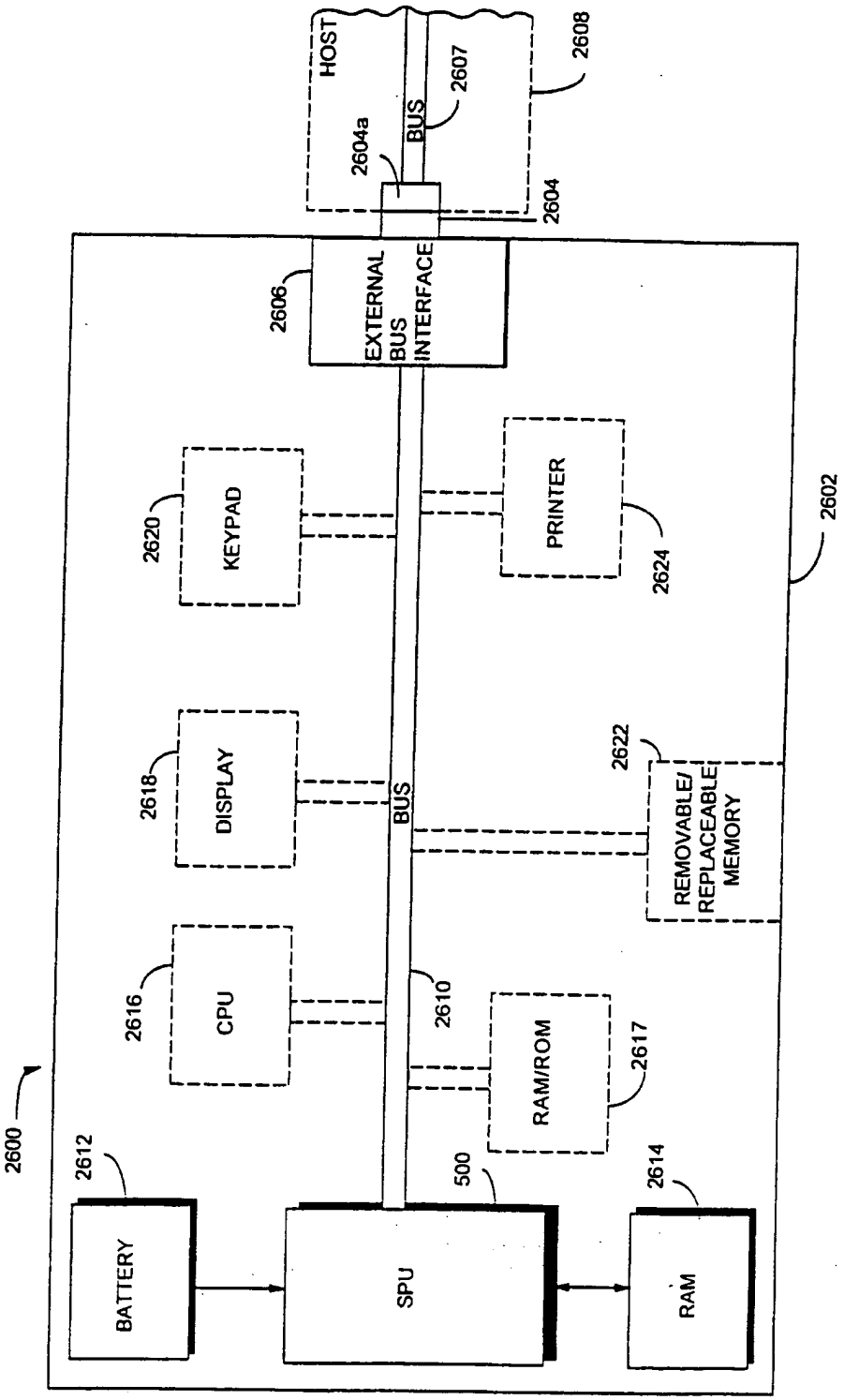


FIG. 70

FIG. 71


HOST
2608
2607
BUS
2604a
2604
2606
EXTERNAL BUS INTERFACE
2602
2620
KEYPAD
PRINTER
2624
2618
DISPLAY
BUS
2622
REMOVABLE/ REPLACEABLE MEMORY
2616
CPU
2610
RAM/ROM
2617
2600
2612
500
2614
BATTERY
SPU
RAM

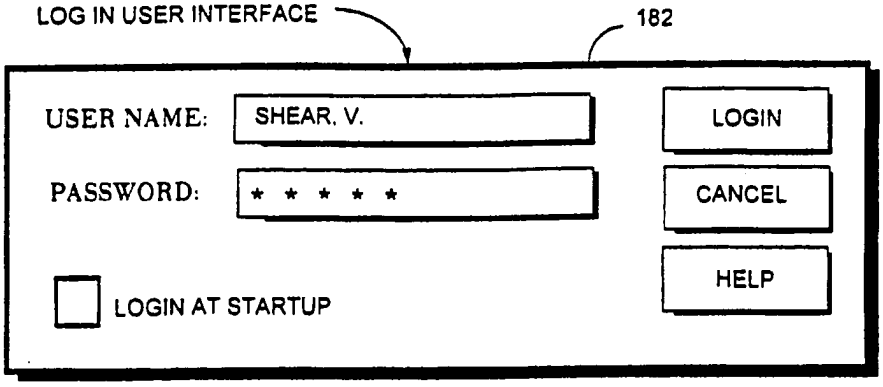


FIG. 72A

FIG. 72B

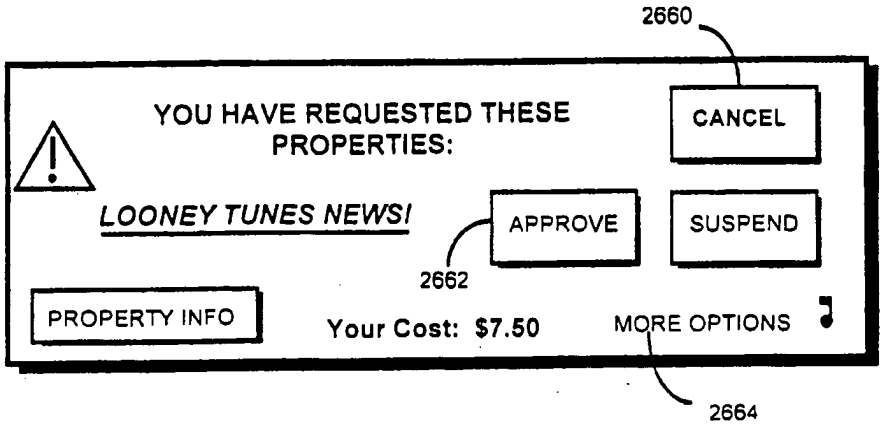


FIG. 72C

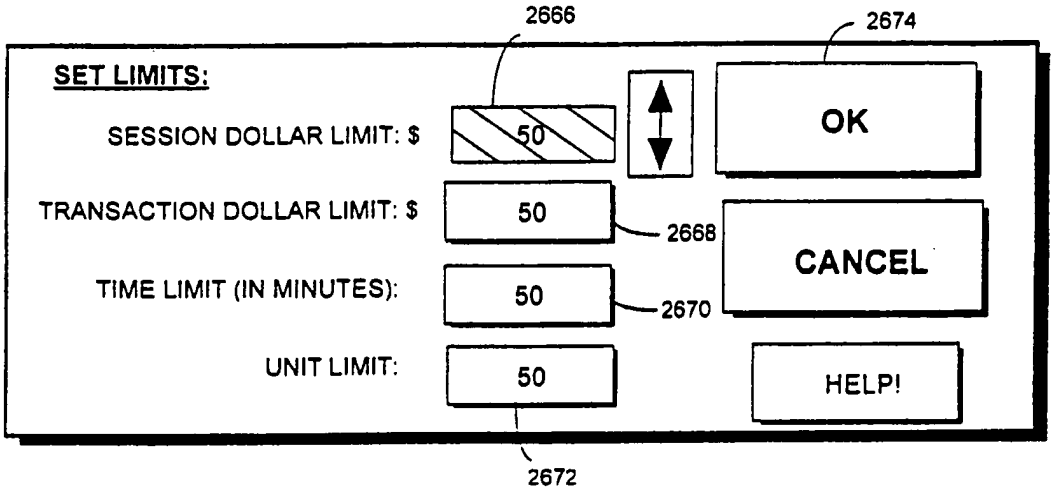


FIG. 72D

FIG. 73

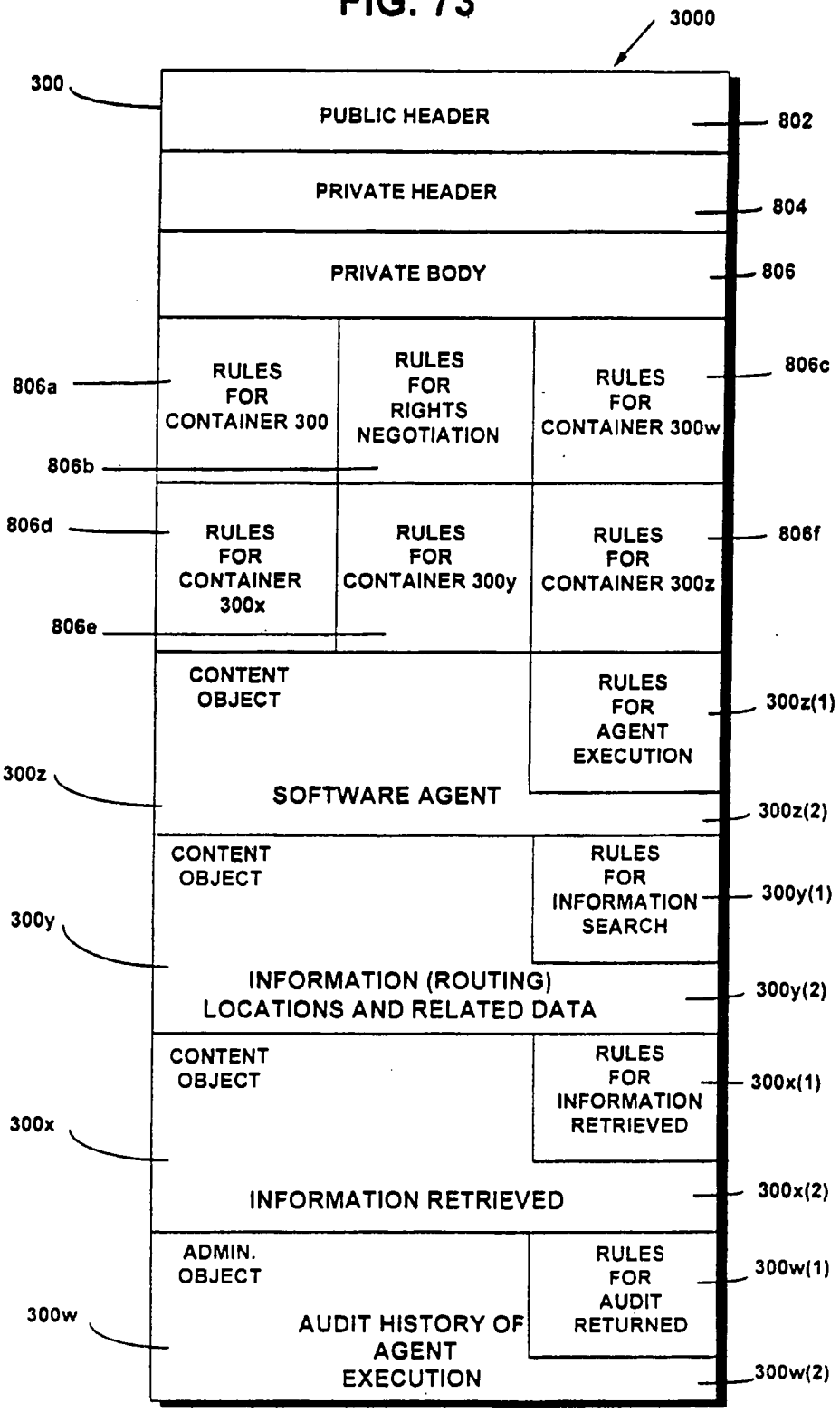


FIG. 74

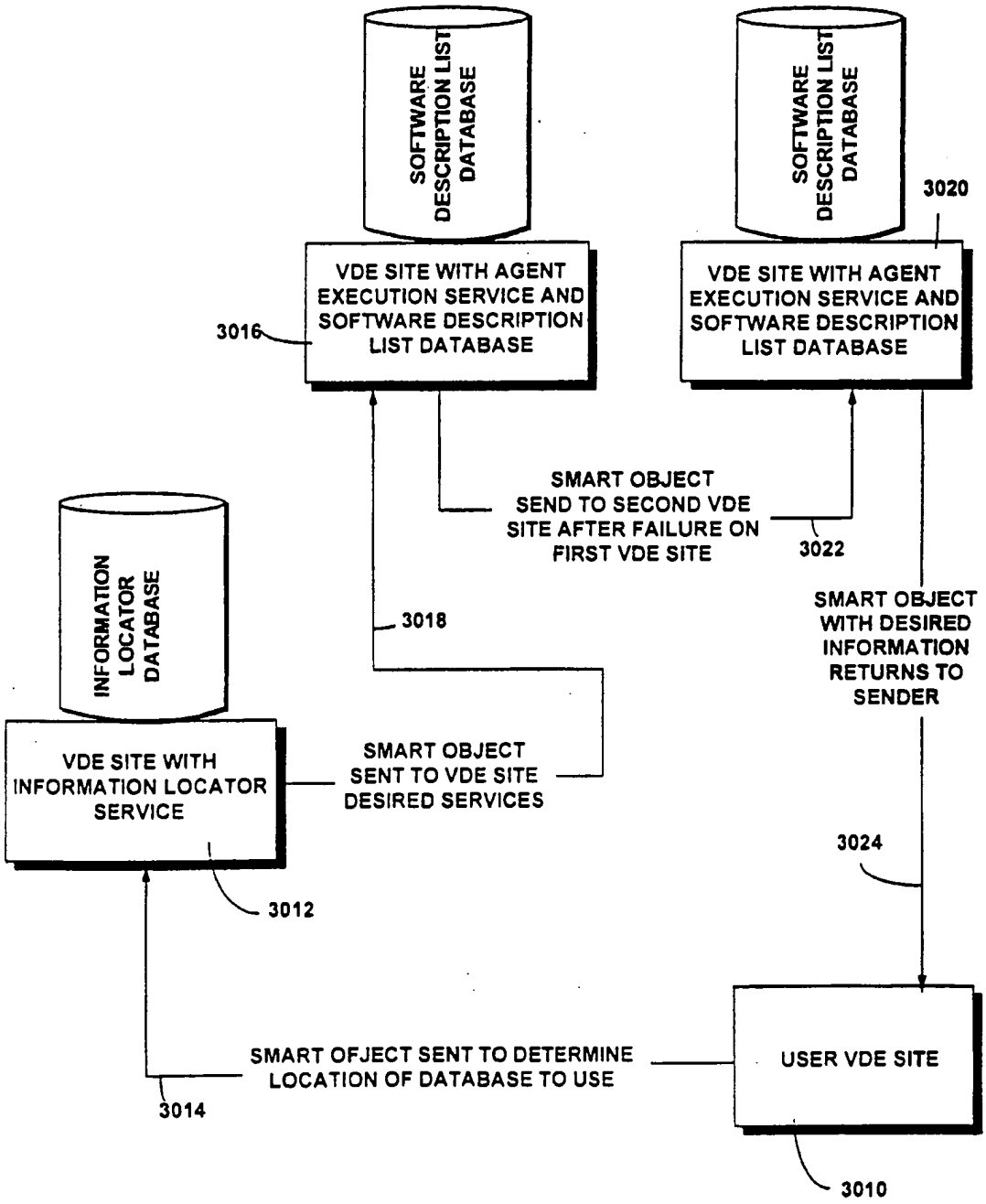


FIG. 75A

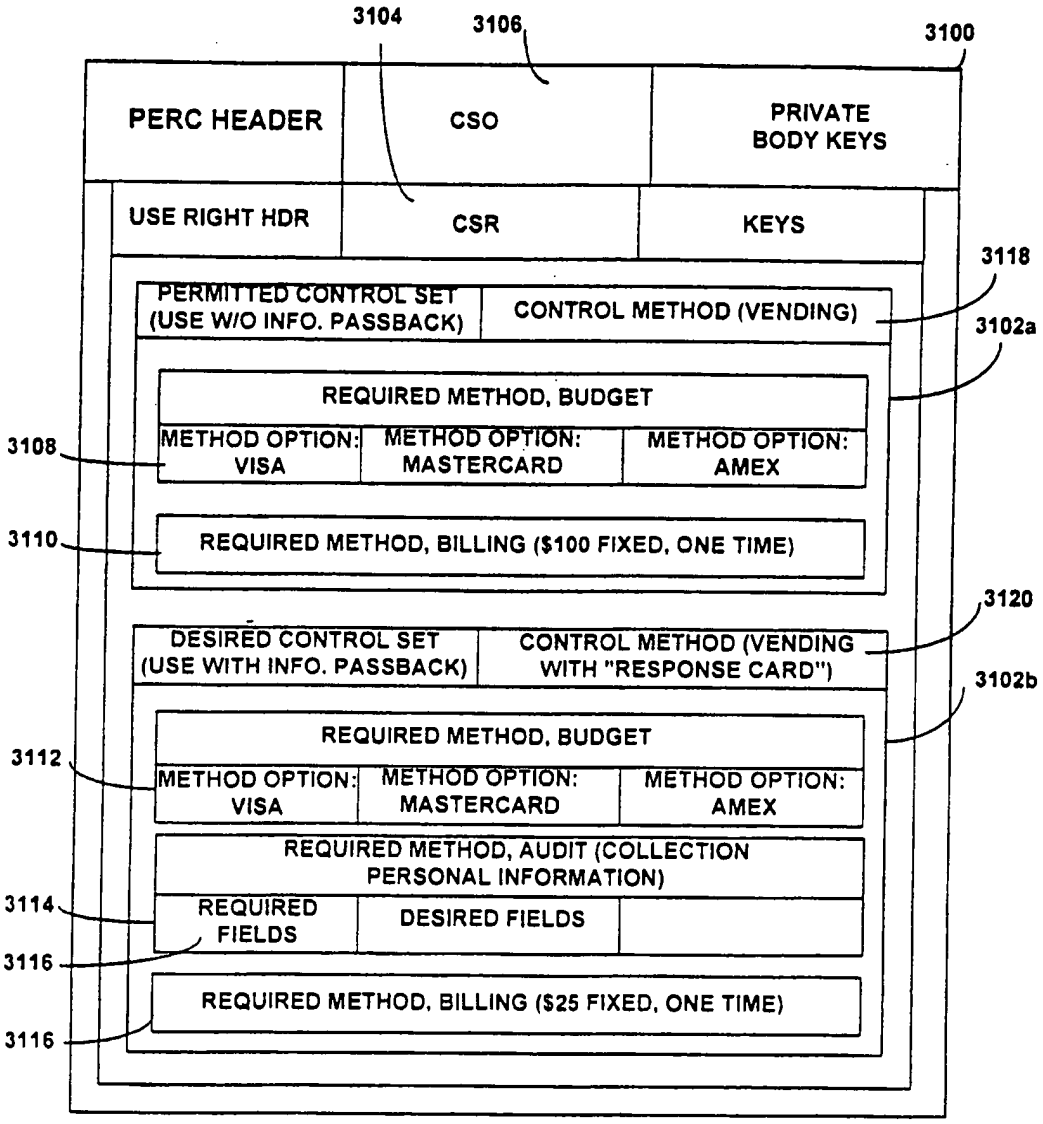


FIG. 75B

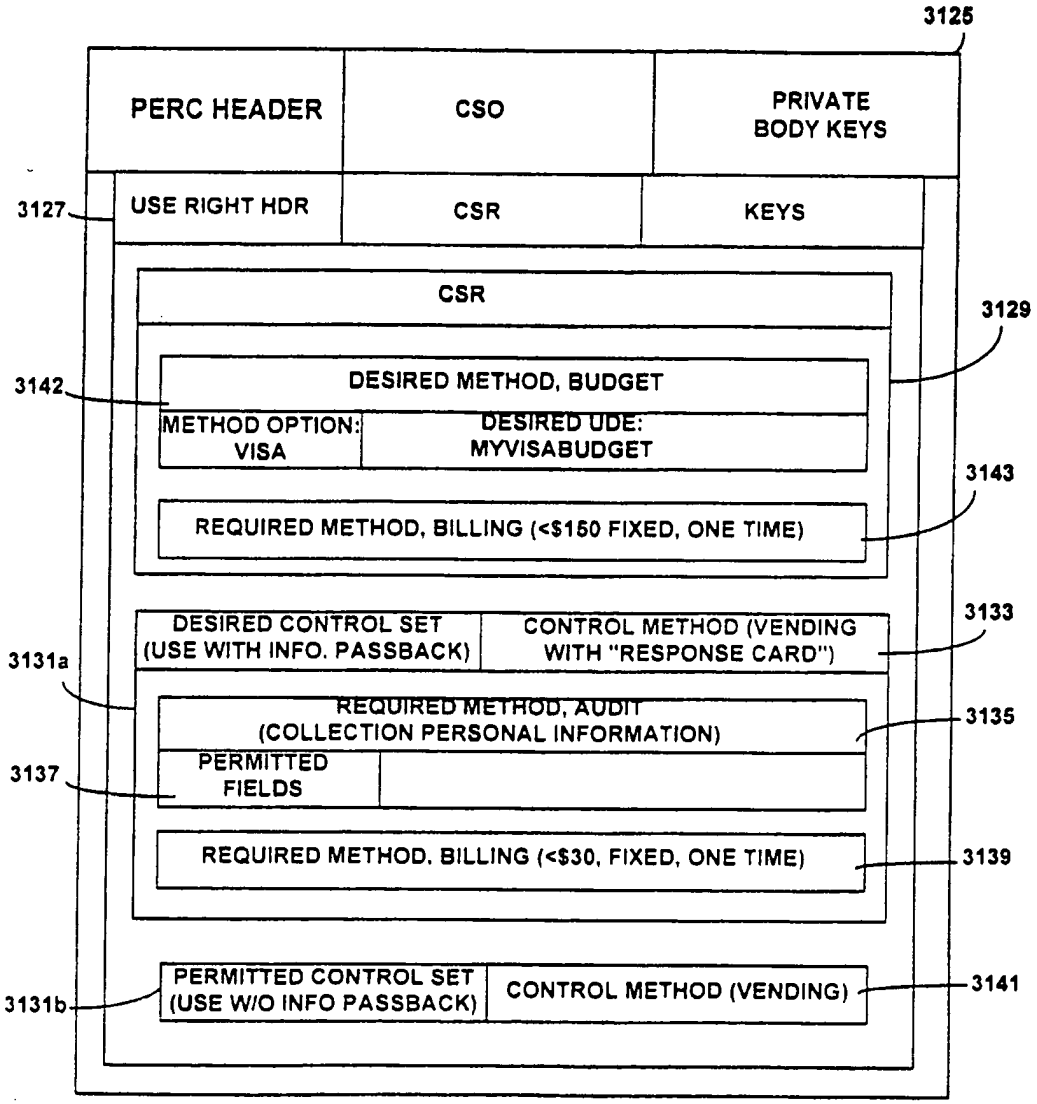


FIG. 75C

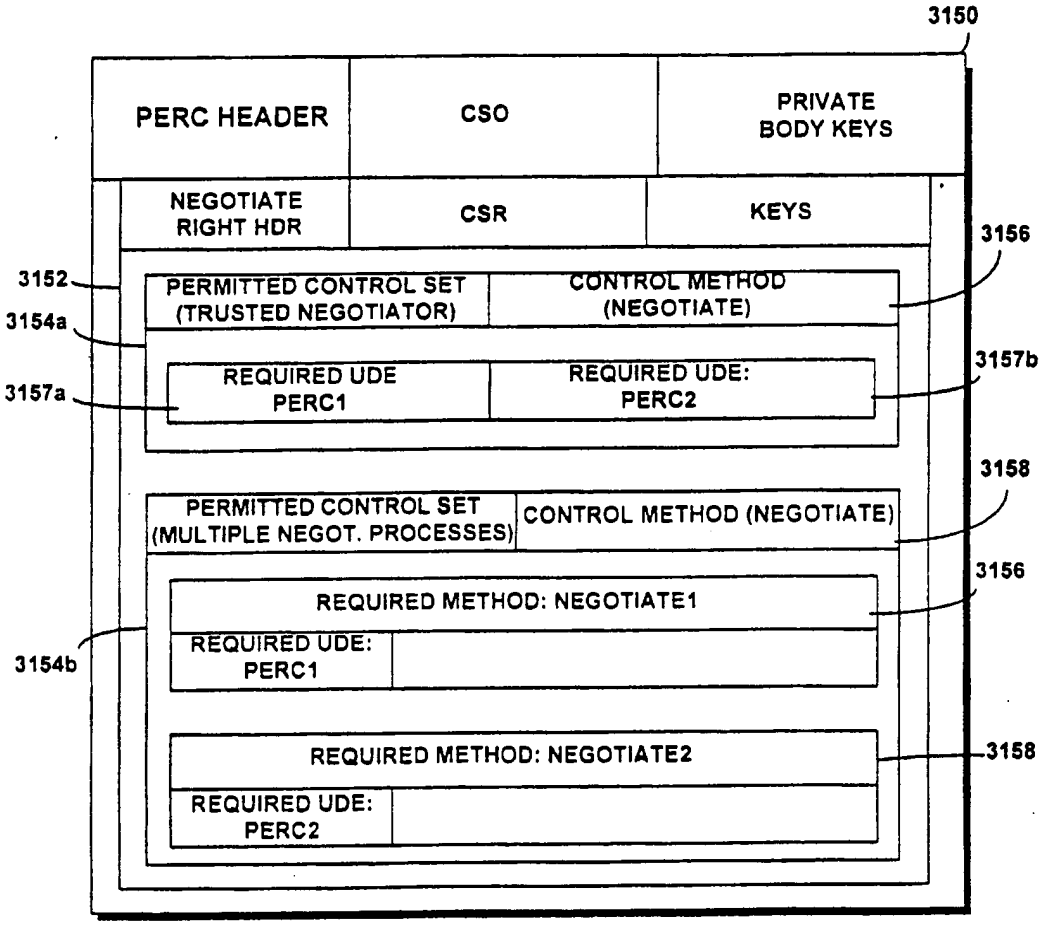
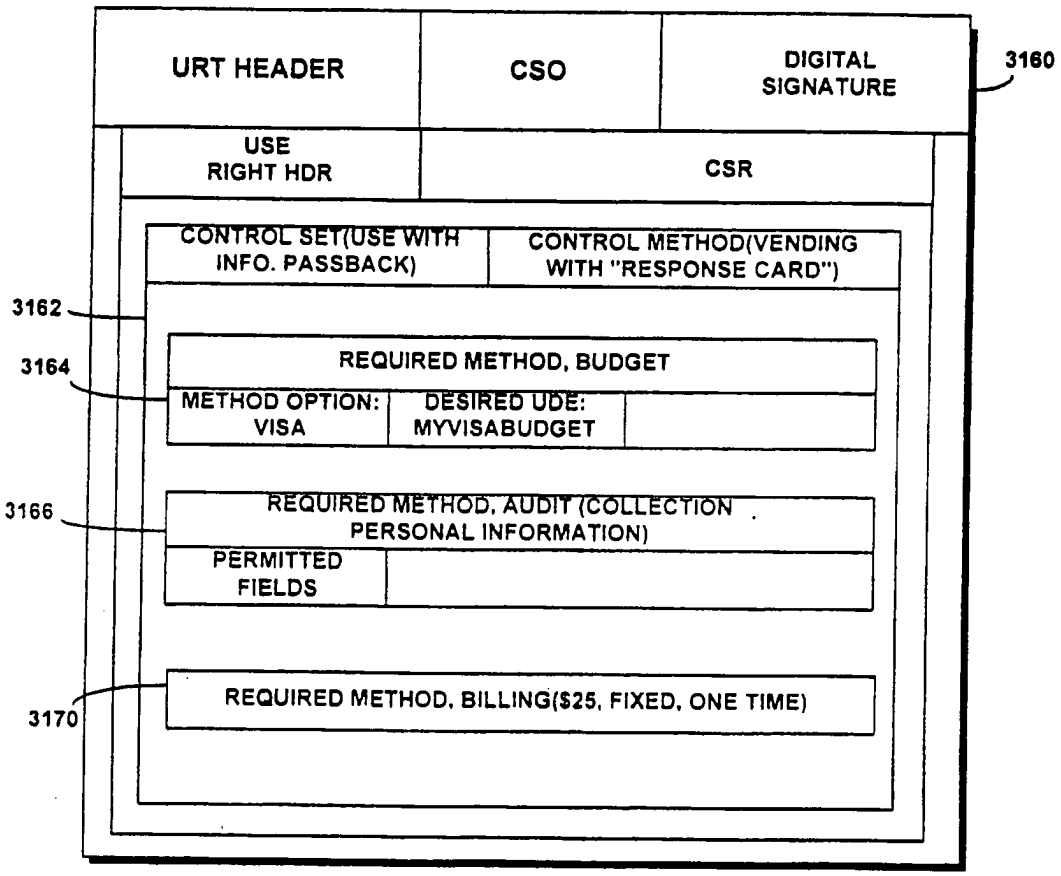


FIG. 75D



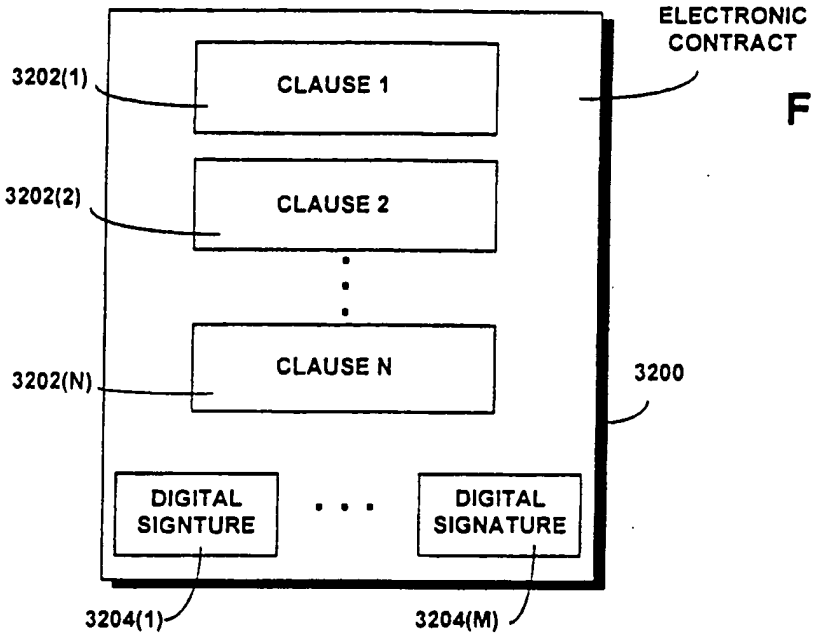


FIG. 75E

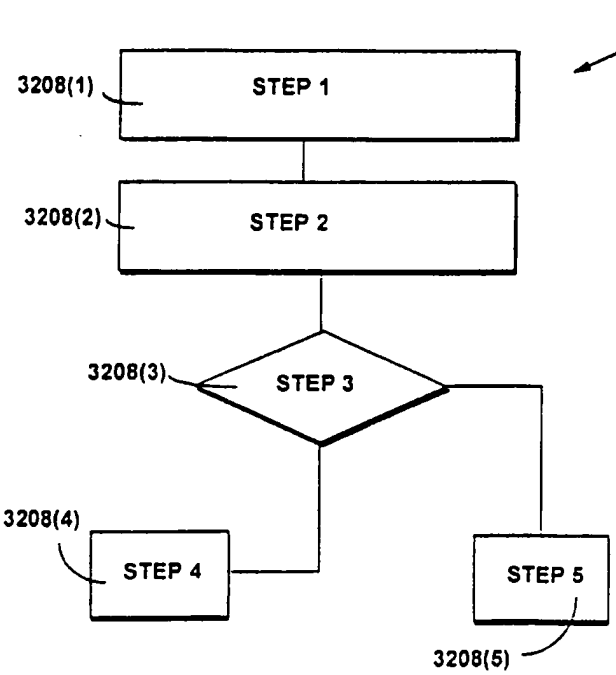


FIG. 75F

FIG. 76A

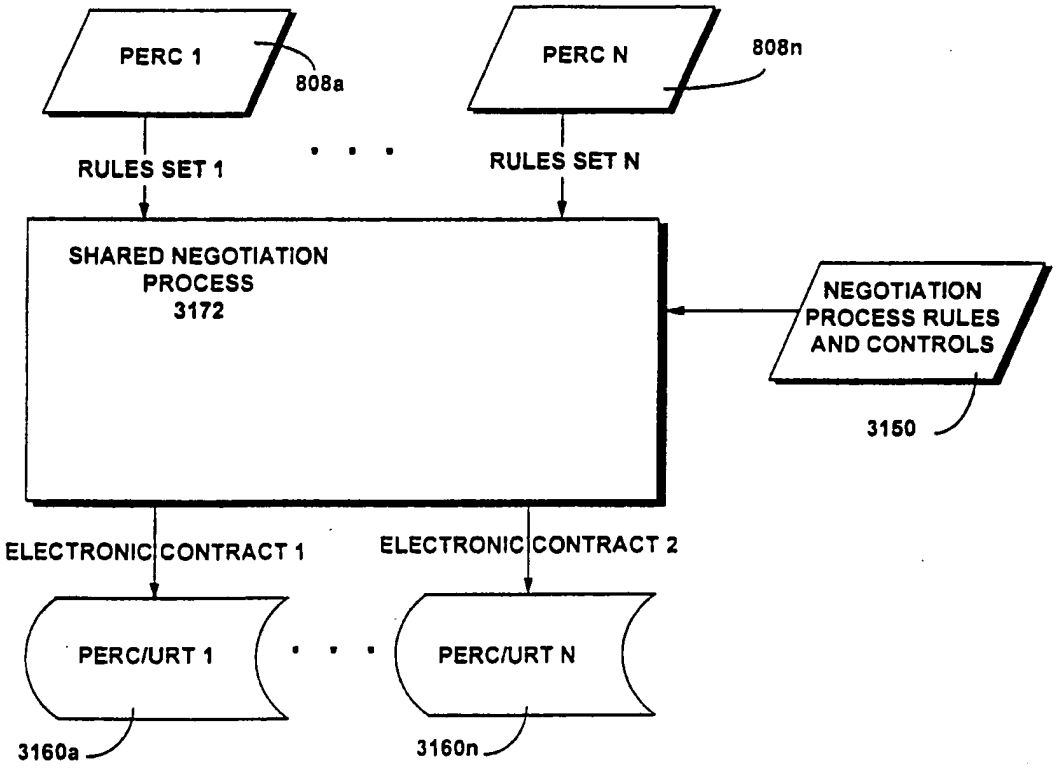

PERC 1
808a
PERC N
808n
RULES SET 1
RULES SET N
SHARED NEGOTIATION PROCESS 3172
NEGOTIATION PROCESS RULES AND CONTROLS
3150
ELECTRONIC CONTRACT 1
ELECTRONIC CONTRACT 2
PERC/URT 1
PERC/URT N
3160a
3160n

FIG. 76B

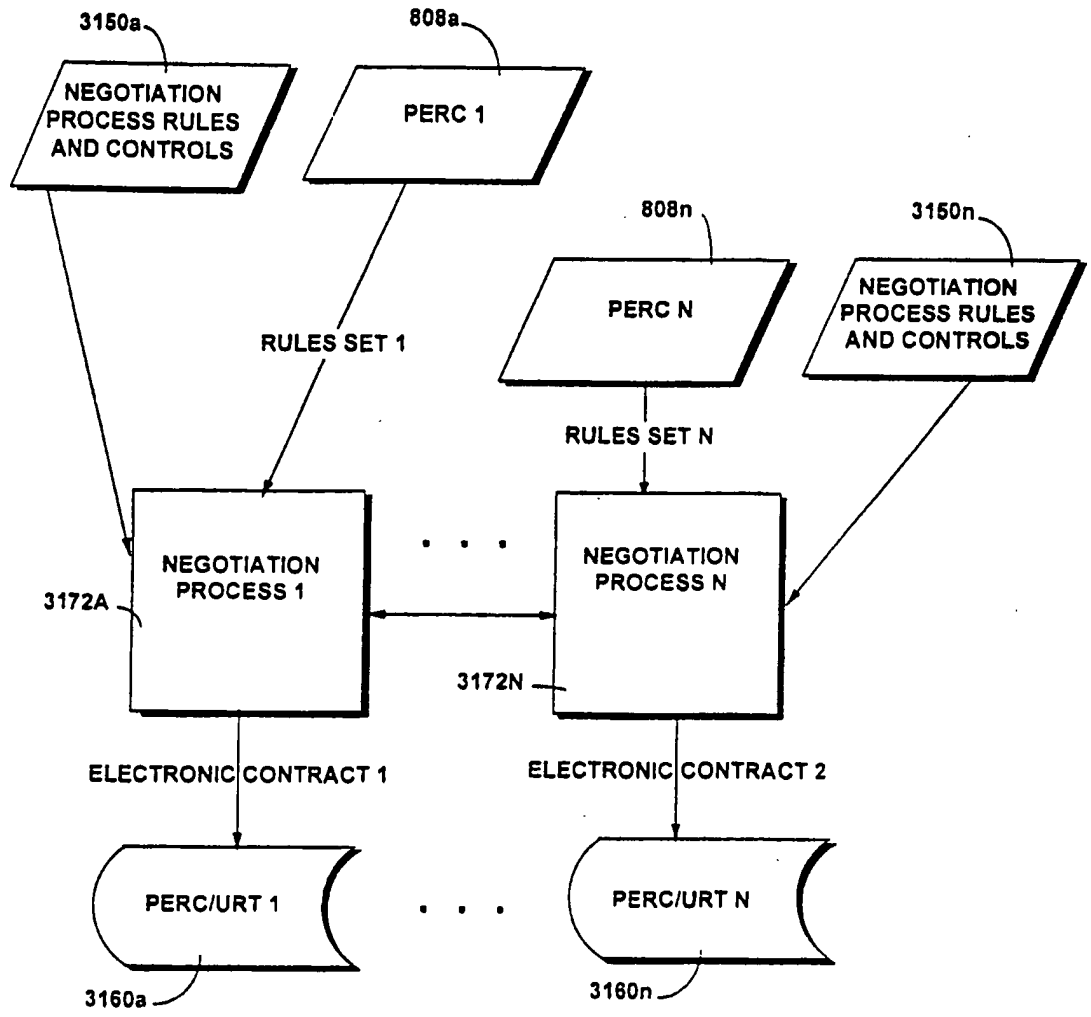
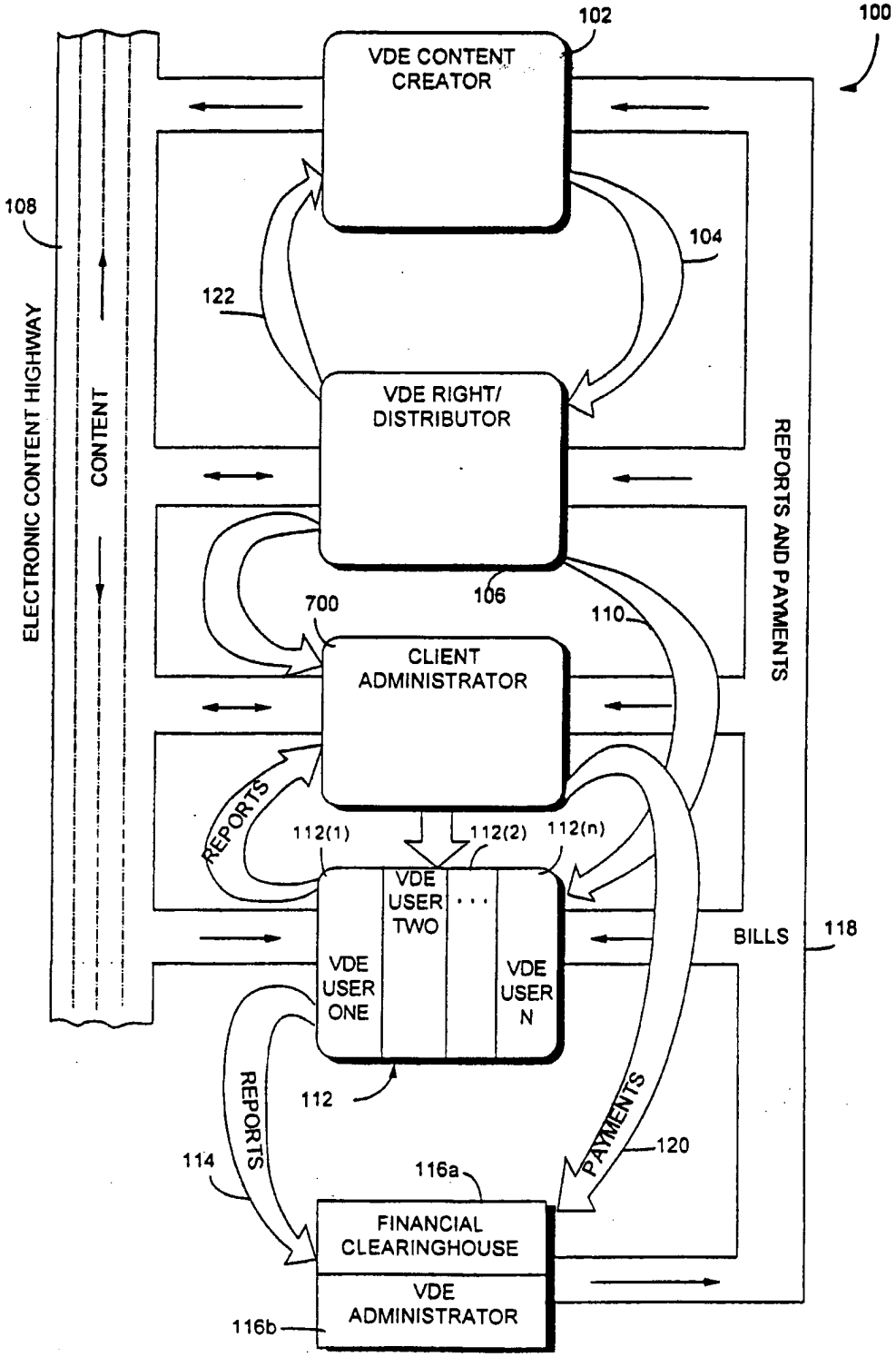


FIG. 77



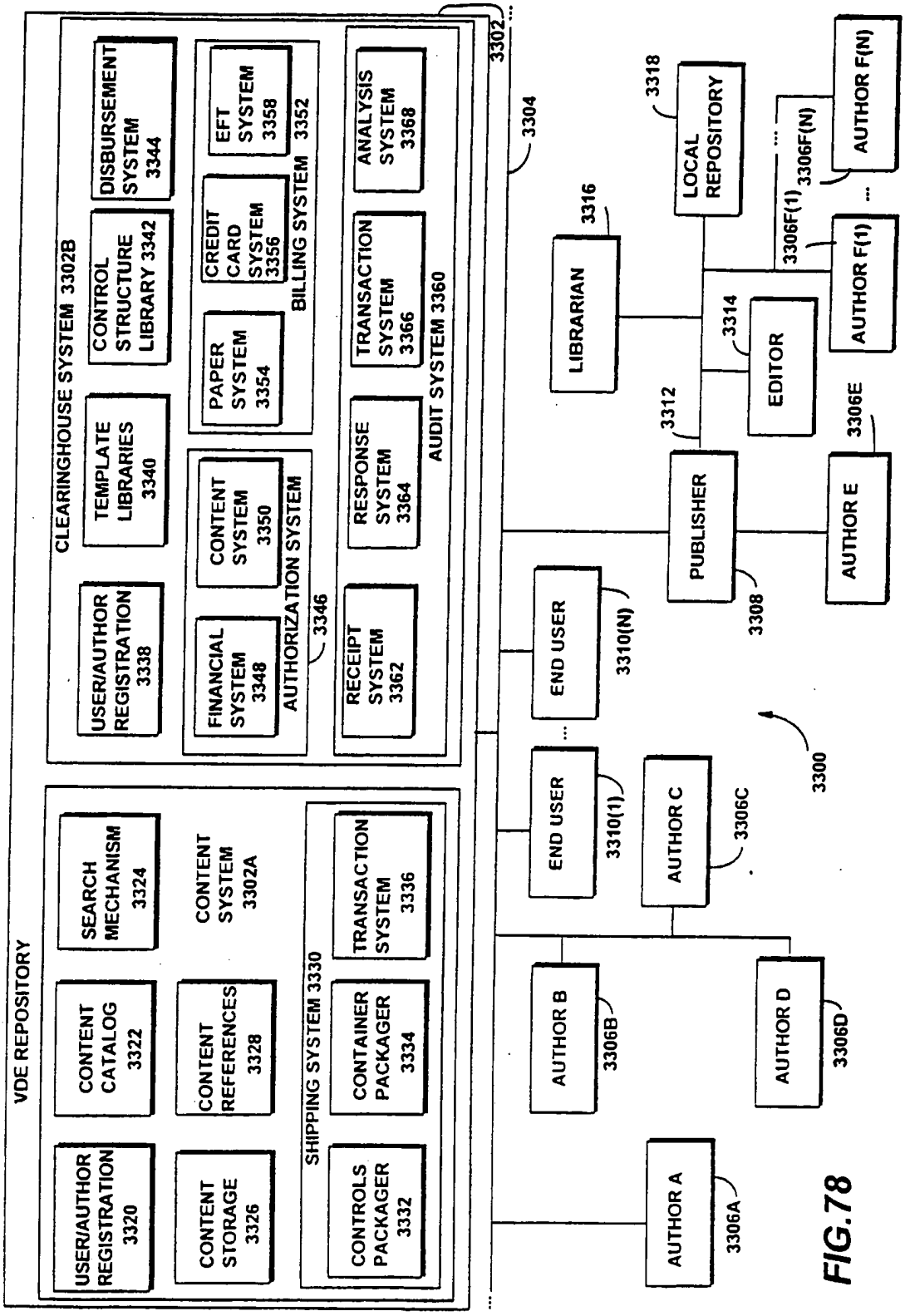


FIG.78

FIG. 79

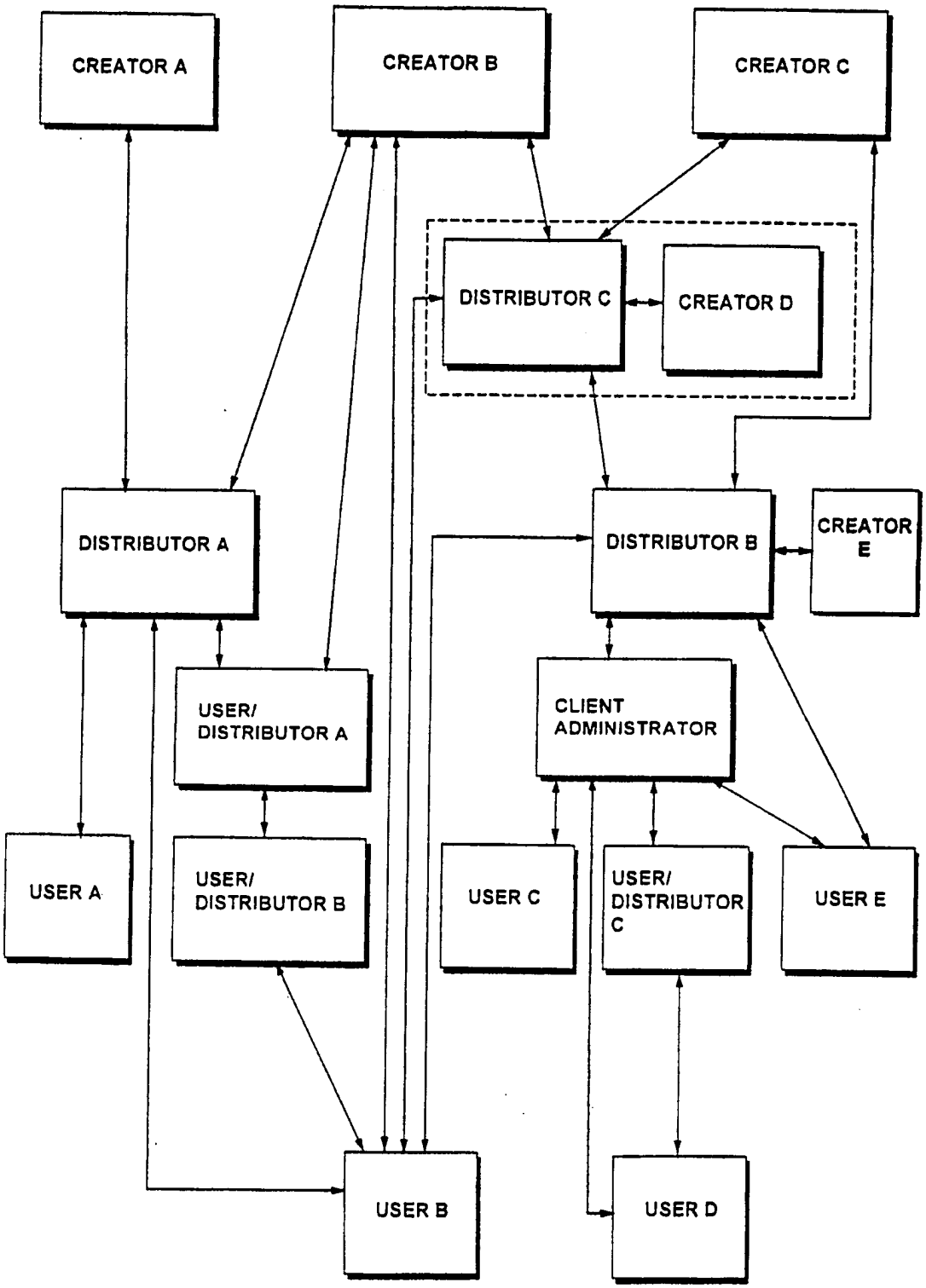
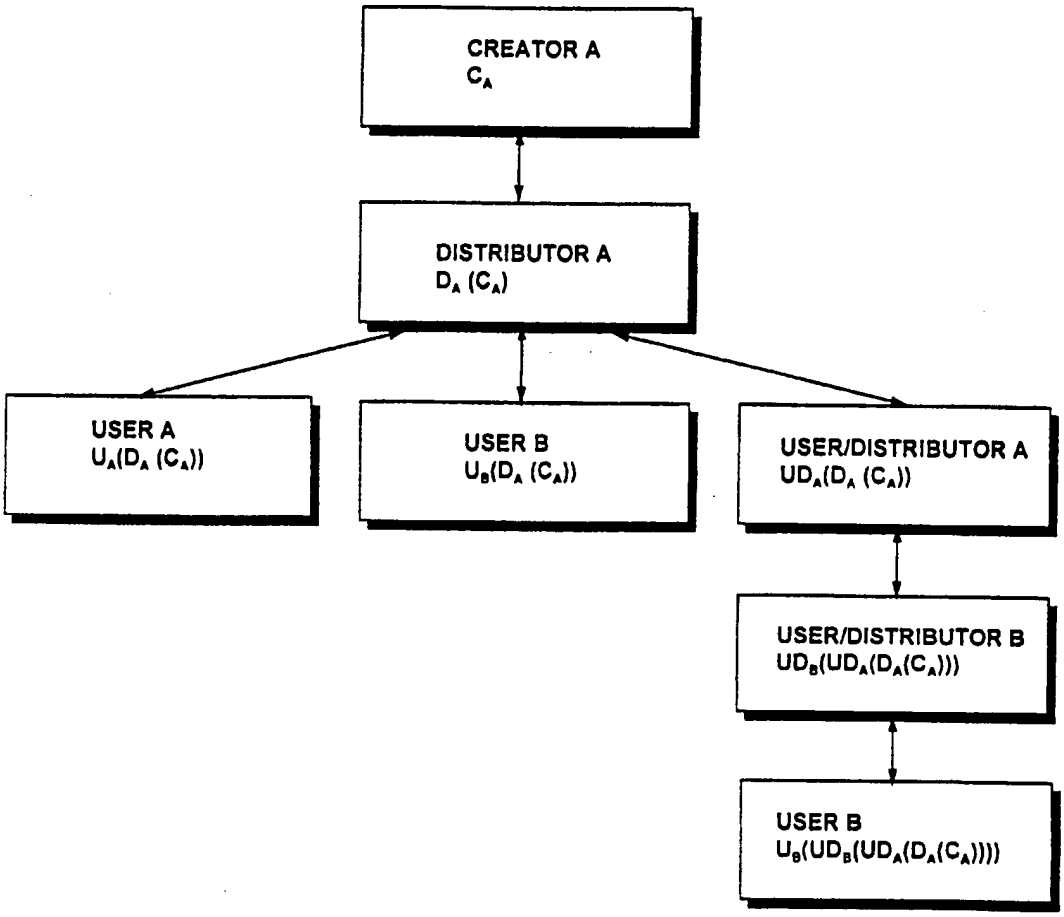


FIG. 80



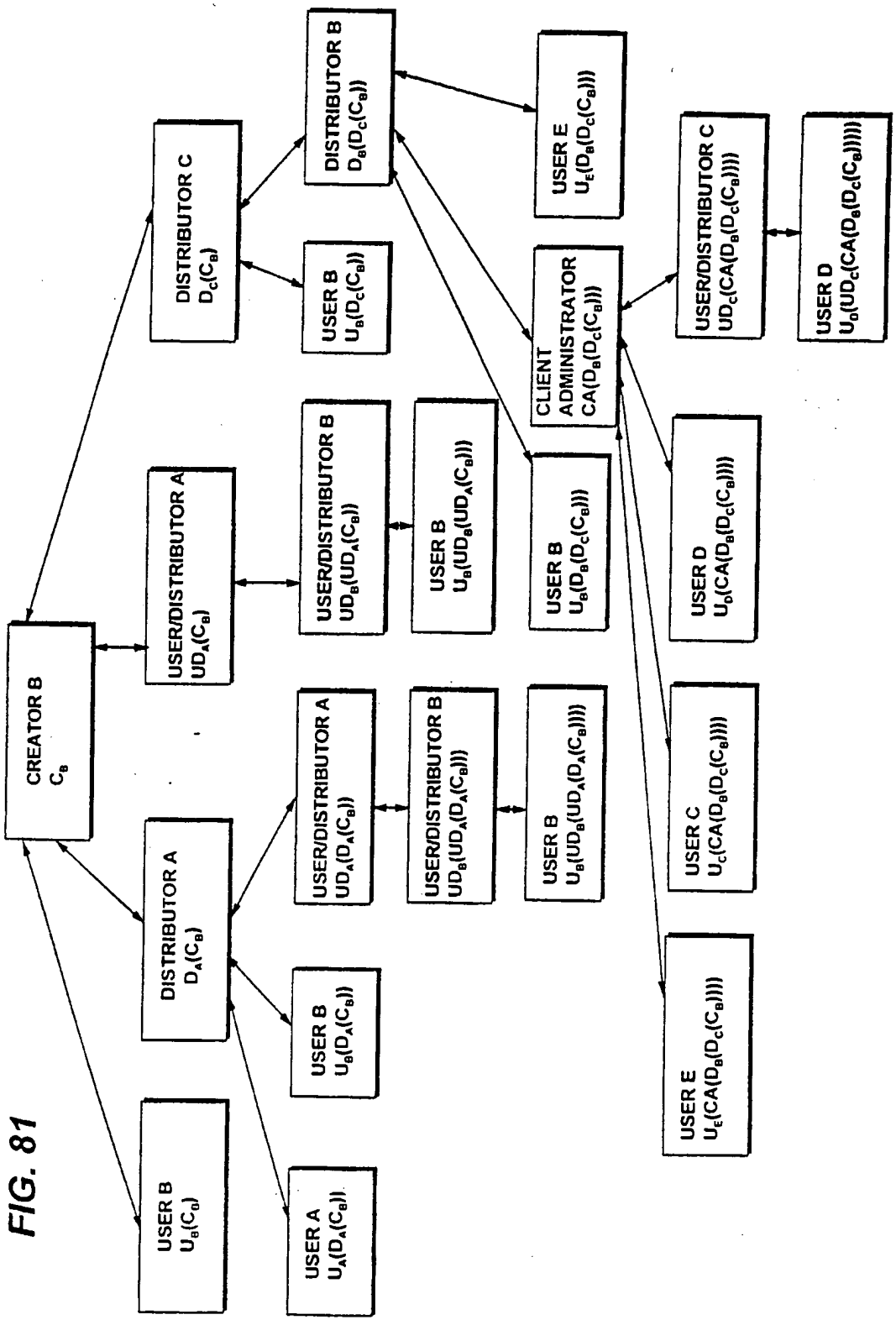

CREATOR B
C_B
DISTRIBUTOR A
$D_A(C_B)$
DISTRIBUTOR C
$D_C(C_B)$
DISTRIBUTOR B
$D_B(D_C(C_B))$
USER/DISTRIBUTOR A
$UD_A(C_B)$
USER/DISTRIBUTOR B
$UD_B(UD_A(C_B))$
USER/DISTRIBUTOR A
$UD_A(D_A(C_B))$
USER/DISTRIBUTOR B
$UD_B(UD_A(D_A(C_B)))$
USER B
$U_B(C_D)$
USER A
$U_A(D_A(C_B))$
USER B
$U_B(D_A(C_B))$
USER B
$U_B(D_C(C_B))$
USER B
$U_B(UD_A(UD_A(C_B)))$
USER B
$U_B(UD_B(UD_A(D_A(C_B))))$
USER B
$U_B(D_B(D_C(C_B)))$
CLIENT ADMINISTRATOR
$CA(D_B(D_C(C_B)))$
USER E
$U_E(D_B(D_C(C_B)))$
USER/DISTRIBUTOR C
$UD_C(CA(D_B(D_C(C_B))))$
USER D
$U_D(UD_C(CA(D_B(D_C(C_B)))))$
USER D
$U_D(CA(D_B(D_C(C_B))))$
USER C
$U_C(CA(D_B(D_C(C_B))))$
USER E
$U_E(CA(D_B(D_C(C_B))))$

FIG. 81

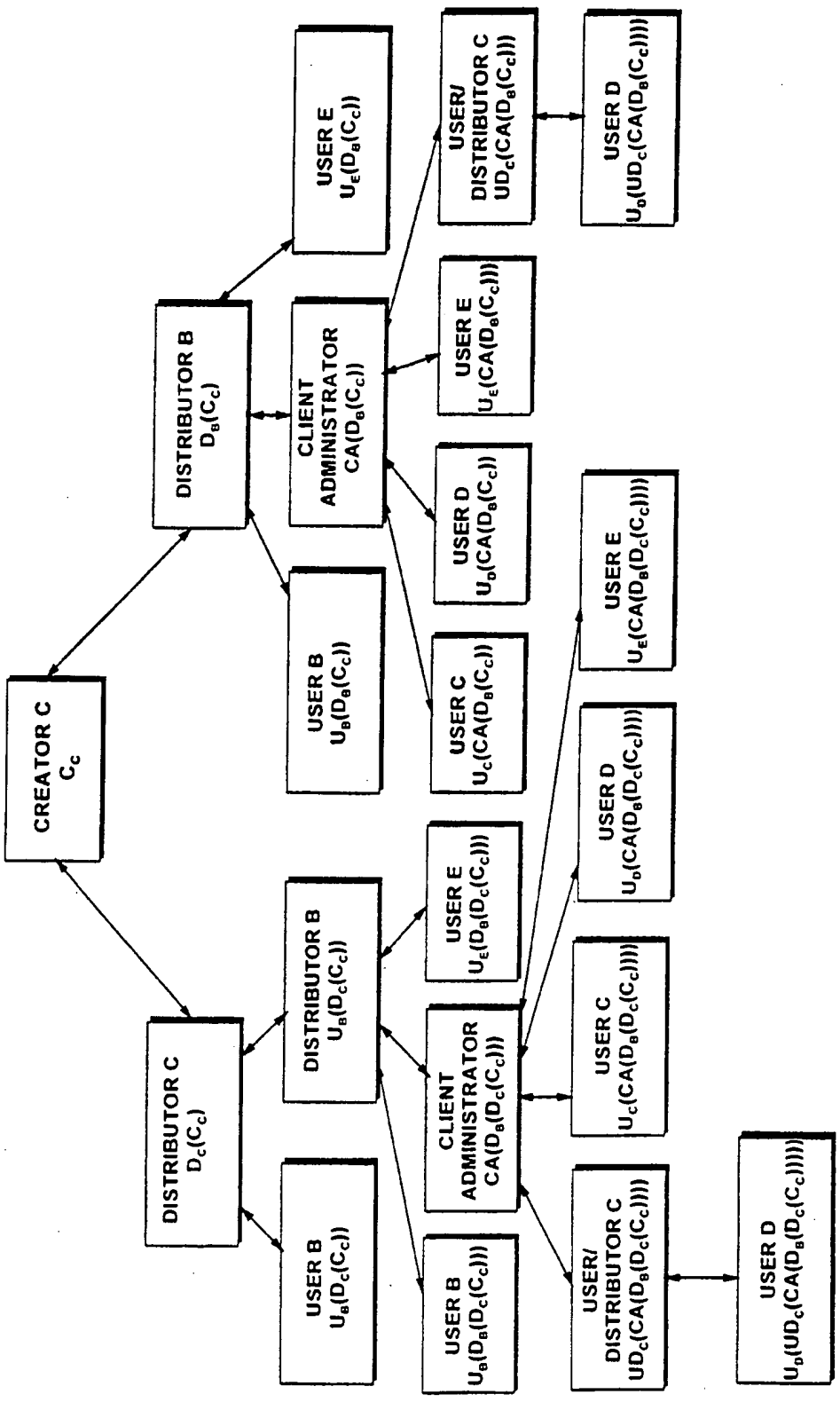


FIG. 82

FIG. 83

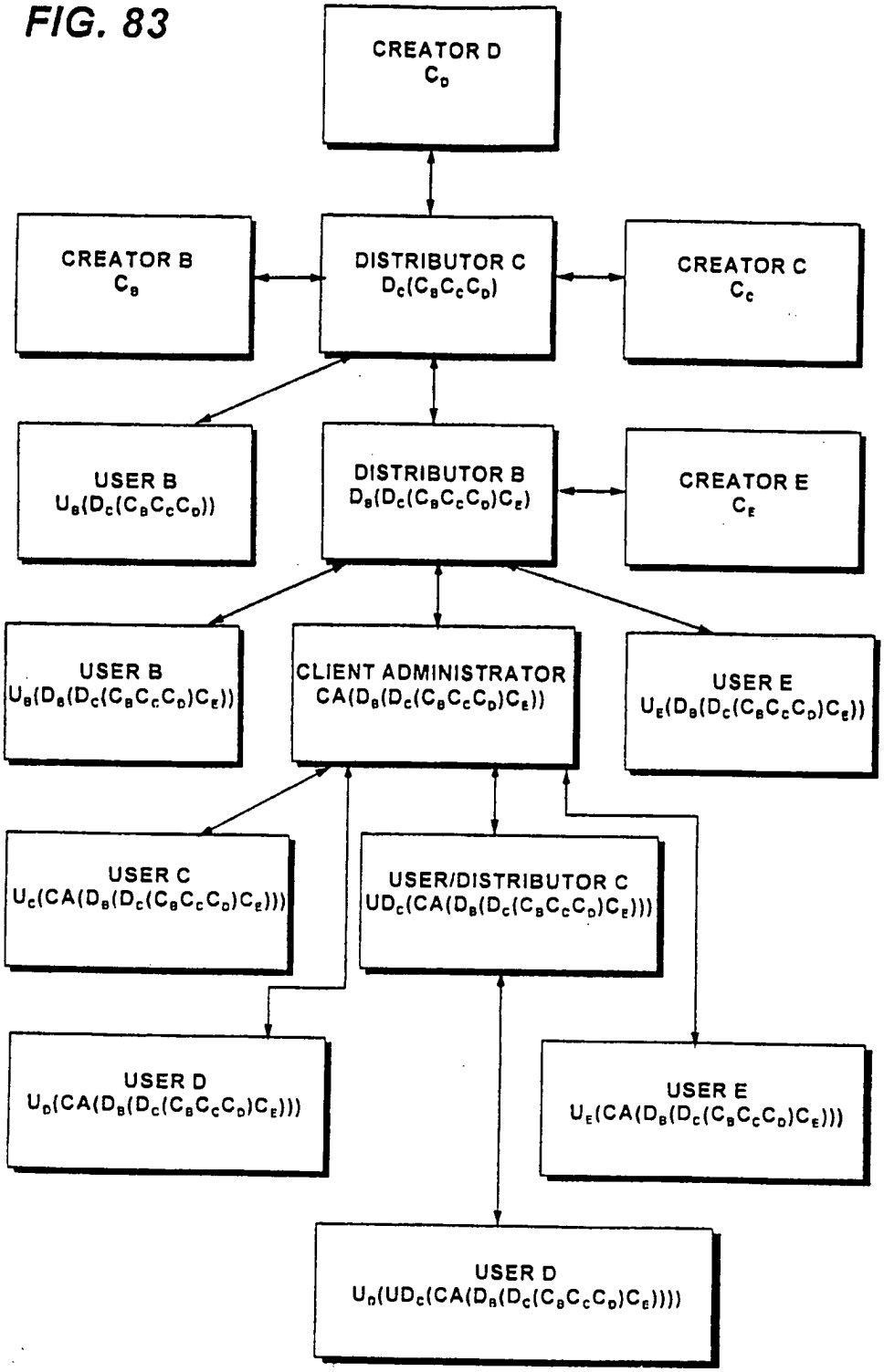


FIG. 84

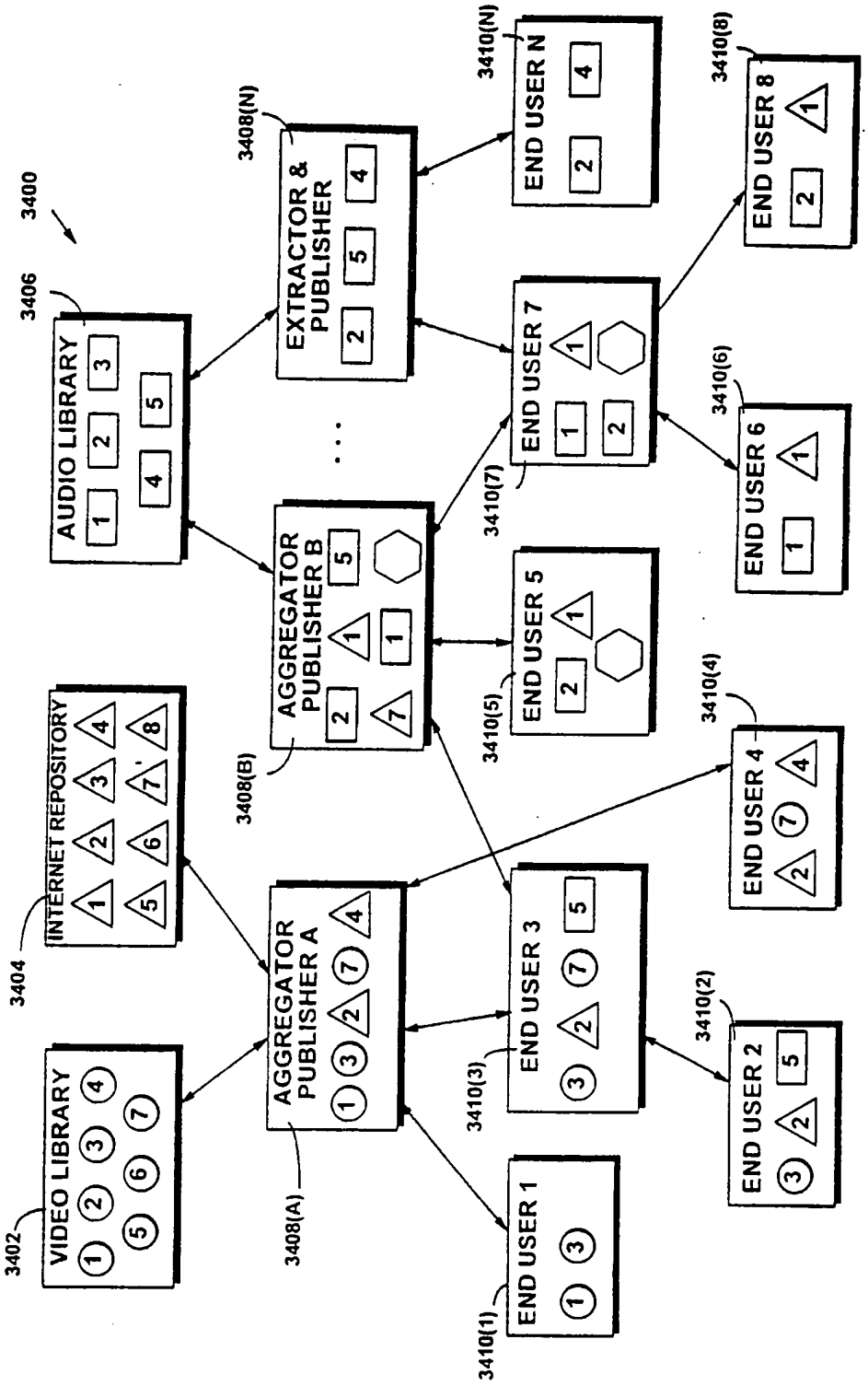
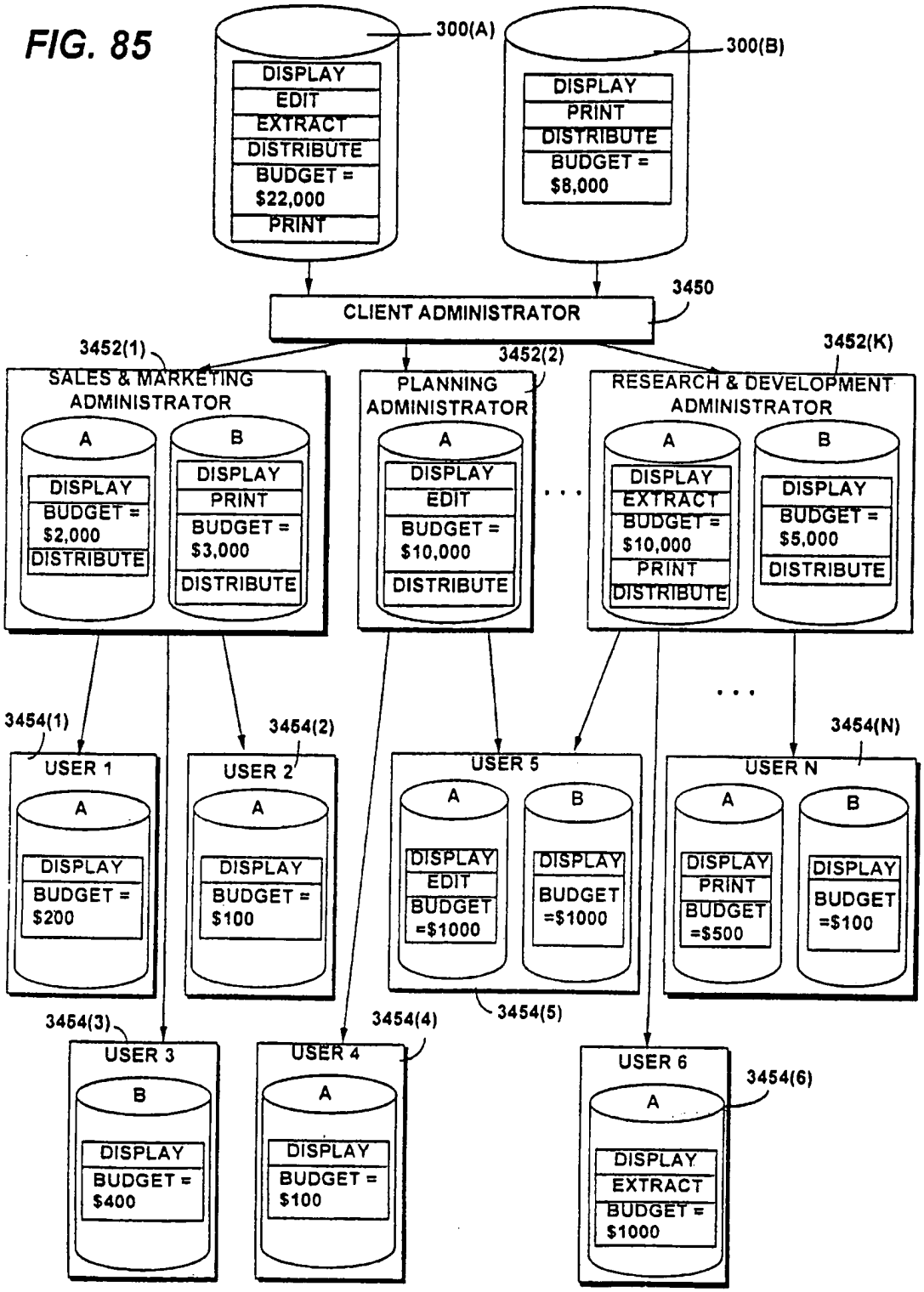


FIG. 85



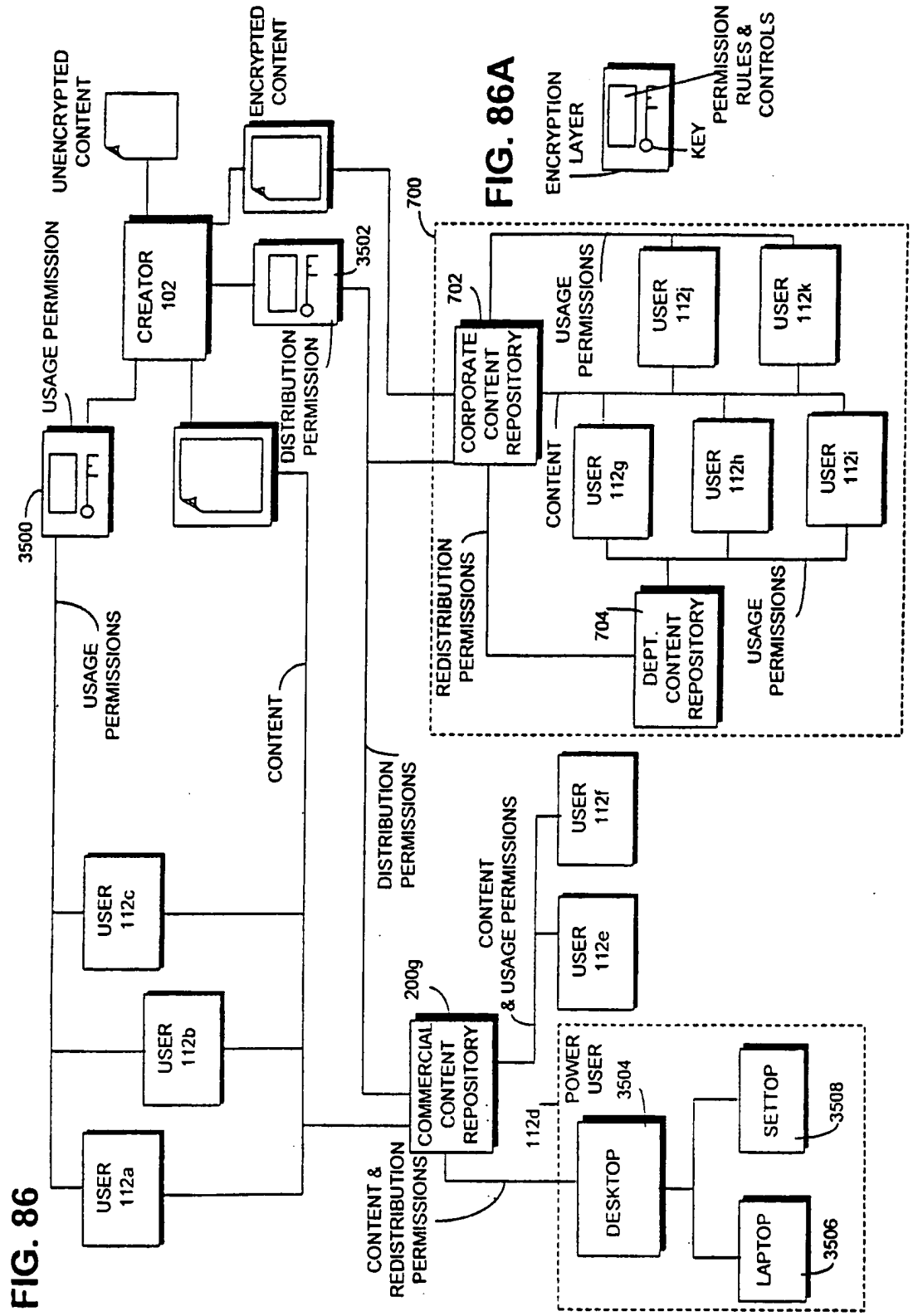


FIG. 86A

FIG. 86

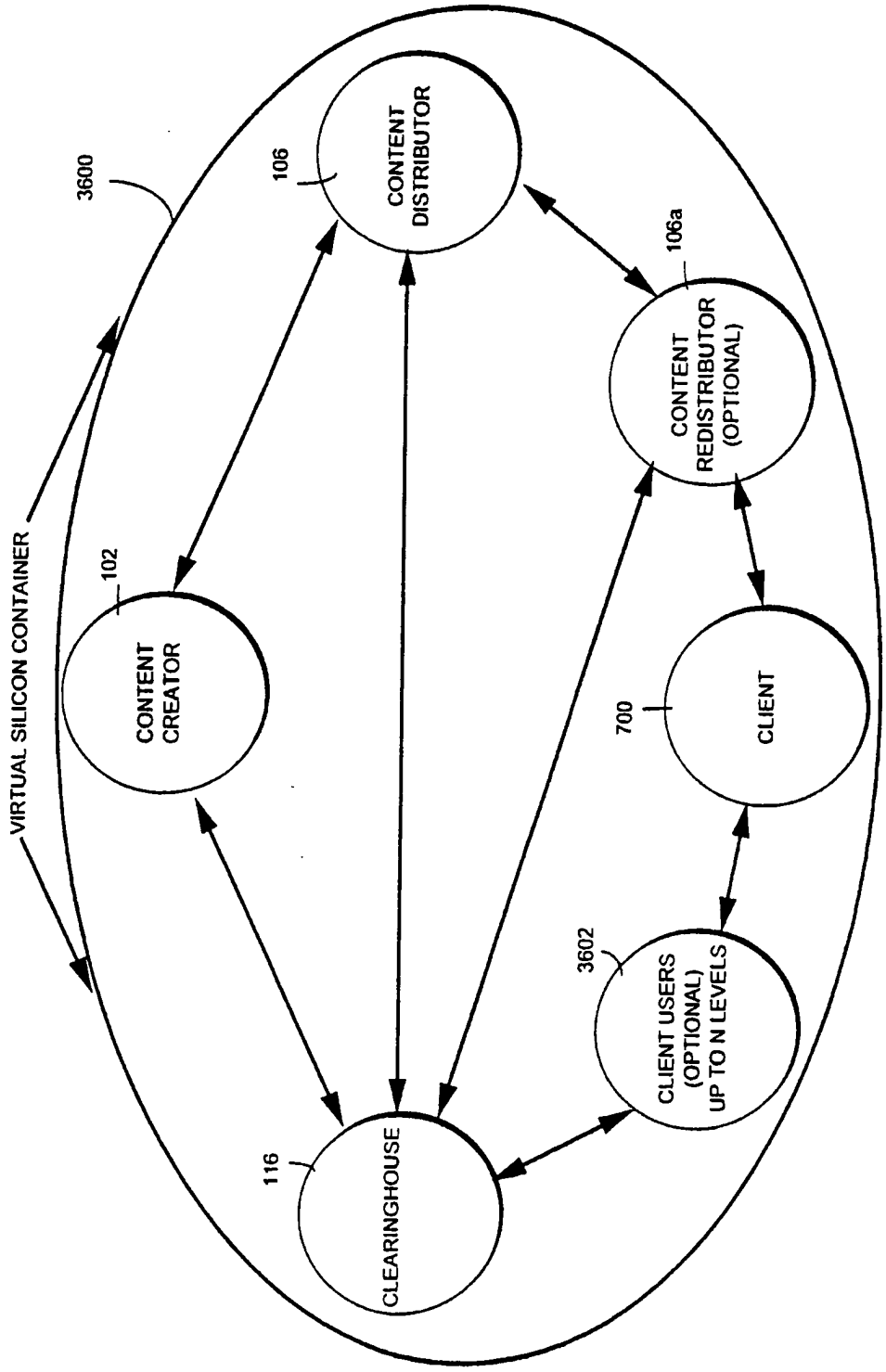


FIG. 87

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International Bureau

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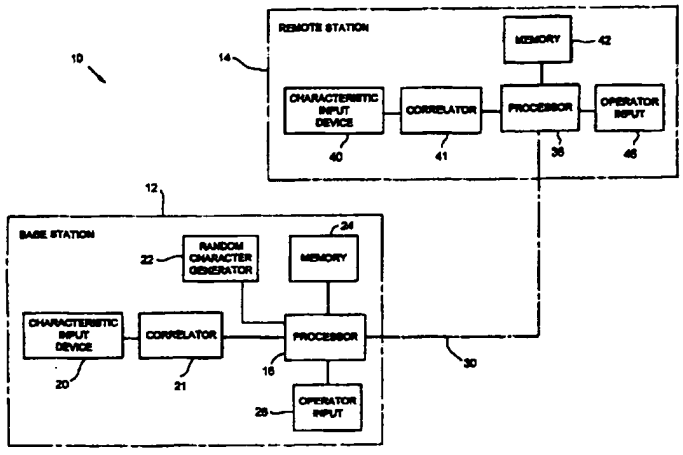
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD FOR SECURE DATA TRANSMISSION BETWEEN REMOTE STATIONS



(57) Abstract

A method for permitting the secure handling of data between two remote stations firstly involves the generation of an encrypted decryption key which is based on a fingerprint information signal from a user of a first station, a fingerprint information signal from a user of a second station, and a key representing function derived from a random key. The encrypted decryption key is of the type with the property that when it is written to a spatial light modulator (SLM) of an optical correlator, the output of the correlator is similar when input with either one of the fingerprint information signals. The encrypted key is then stored at both stations. Thereafter a message encrypted with the key may be decrypted at either station by retrieving the encrypted key, writing the encrypted key to a filter of an optical correlator, inputting one of the fingerprint information signals to the correlator in order to allow recovery of the decryption key, and applying the decryption key to the encrypted message.

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METHOD FOR SECURE DATA TRANSMISSION BETWEEN REMOTE STATIONS

Background of the Invention

1. Field of the Invention

The present invention provides a method for permitting the secure passing of data between two remote stations.

2. Background of the Invention

While use of the internet has increased rapidly, concerns for the privacy and security of data transferred over the internet have remained. The present invention seeks to provide a method for permitting the secure handling of data between remote stations, such as remote computers hooked to the internet.

Summary of the Invention

In accordance with the present invention, there is provided a method for permitting the secure passing of data between two remote stations, comprising the steps of: obtaining from a user of a first of two remote stations, a first characteristic information signal; obtaining from a user of a second of two remote stations, a second characteristic information signal; generating a sequence of random characters to obtain a random key; obtaining a key function which represents said key; obtaining a Fourier transform of said key representing function; obtaining at least one encrypted version of said key based on said Fourier transform of said key representing function, and a least one of said first characteristic information signal and said second characteristic information signal such that said key may be recovered by writing said at least one encrypted version of said encrypted key to a spatial light modulator (SLM) of an optic correlator and inputting either one of said first characteristic information signal and said second characteristic information signal

to said optic correlator; storing said at least one encrypted version of said key at each of said first station and said second station, whereby thereafter any message encrypted in such a way that it may be decrypted by said key may be decrypted at either of said two remote stations by retrieving said stored encrypted key, writing said at least one encrypted version of said encrypted key to a spatial light modulator (SLM) of an optic correlator and inputting either one of said first characteristic information signal and said second characteristic information signal to said optic correlator.

In accordance with another aspect of the present invention, there is provided a method for the secure handling of data between two remote stations, comprising the steps of: at a base station, encrypting a message such that said message may be decrypted by a decryption key; passing said message to a remote station; at said remote station, obtaining from a user of said remote station a remote station user optical characteristic information signal; retrieving from storage an encrypted version of said decryption key, said encrypted decryption key having the property that when it is written to a SLM of an optical correlator, the output of said correlator is similar when input with either one of said remote station user characteristic information signal or a base station user optical characteristic information signal; writing a remote station optical correlator with said encrypted decryption key; inputting said remote station correlator with a Fourier transform of said remote station user optical characteristic information signal; regenerating said decryption key from an output of said remote station correlator; and decrypting said message with said decryption key.

Brief Description of the Drawings

Figure 1 is a schematic view of a system for use in the secure handing of data between two remote stations made in accordance with this invention,

figure 2 is a schematic detail of a portion of figure 1, and

figure 2A is a schematic representation of an alternative embodiment for a portion of figure 2.

Detailed Description of the Preferred Embodiments

Turning to figure 1, a system indicated generally at 10 for permitting the secure passing of data between two remote stations, comprises a base station indicated generally at 12 and a remote station indicated generally at 14. The base station comprises a processor 16 linked to a correlator 21, a random character generator 22, a memory 24, and an operator input device 26. The correlator 21 is optically linked to a characteristic input device 20. The processor 16 of the base station 12 is connected for two-way communication with a processor 36 of remote station 14 on line 30. The processor 36 of the remote station is linked to a correlator 41, a memory 42, and an operator input device 46. The correlator 41 is optically linked to a characteristic input device 40.

The characteristic input device 20 and correlator 21 of base station 12 are detailed in figure 2. Turning to figure 2, input device 20 comprises a source of coherent light 222 and input prism 224 with an optical output 225 to correlator 21. The correlator 21 comprises a Fourier transform lens 228, a full-complex spatial light modulator (SLM) 230, an inverse Fourier transform lens 232, a CCD camera 234 with an A\D convertor 236 outputting to processor 16 on line 237. The processor outputs to the input of SLM 230 on line 260. The characteristic input device 40 and correlator 41 of remote station 14 may be identically constructed.

System 10 is used, firstly, to develop an encrypted version of a message decryption key at the base station which may be transmitted to the remote station without concern for privacy and, subsequently, to encrypt messages at either of the stations for transmission to other of the stations where they may be decrypted.

(i) Developing an encrypted decryption key

Assuming the user of base station 12 wishes to communicate in a secure fashion with the user of remote station 14, the user of the base station first agrees upon a temporary secret key with the user of the remote station. This secret key can, for example,

be based on a Diffie-Hellman key derivation, an exponential key derivation scheme or public key system. The user of the remote station then utilizes input device 40 to develop an information signal impressed with characteristics peculiar to the remote station user. With the input device 40 and correlator 41 configured as shown in figure 2, the remote station user activates the light source of the input device and causes the processor 36 to make the SLM of the correlator transparent so that the correlator is effectively bypassed. Next the remote station user places his finger on the input prism creating an optical signal impressed with characteristics of the fingerprint of the user. This optical characteristic signal is imaged at the camera. This characteristic information signal is then digitized and passed to the processor 36. The previously agreed upon secret key is used to encode the digitized fingerprint and this encrypted fingerprint may then be passed to the base station 12 on line 30.

At the base station 12, referencing figure 2, the base station user may activate light source 222 and cause processor 16 to make SLM 230 transparent. The base station user may then place his fingerprint 226 on the input prism so that a fingerprint (characteristic) information signal is imaged at the camera 234. The digitized version of this signal is then passed to processor 16. Returning to figure 1, the processor decrypts the fingerprint information signal from the remote station utilizing the previously agreed upon method to generate a temporary secret key, which may either be derived by processor 16 and stored in memory 24 or input directly from the operator input 26. Next the processor 16 numerically determines spatial Fourier transforms of the remote station fingerprint information signal and the base station fingerprint information signal.

The processor now prompts random character generator 22 to generate a sequence of random characters which will comprise a decryption key. The processor 16 then develops a key function which represents the key. For example, the key representing function could be developed by applying each character of the decryption key as a coefficient to a set of normalized orthogonal basis functions, preferably, delta-shaped functions. The processor then numerically calculates a Fourier transform of the key representing function.

Next, the processor obtains an encrypted version of the decryption key. In the first embodiment of the invention, this step includes developing a composite filter based on the remote station fingerprint information signal, the base station fingerprint information signal, and the key representing function. This composite filter has the property that when it is written to the SLM, the output of the correlator is similar when input with either the remote station fingerprint information signal or the base station fingerprint information signal. Preferably, this output is a set of narrow peaks, the positions of which correspond to the maxima of the delta-shaped basis functions. Methods of obtaining a composite filter with these properties are known to those skilled in the art and described in, for example, an article entitled "Tutorial Survey of Composite Filter Designs for Optical Correlators" by B.V.K. Vijaya Kumar, Applied Optics, Volume 31, No. 23, pages 4773 to 4801. Briefly, the composite filter may be constructed as a linear combination of the complex conjugate Fourier transforms of the remote station fingerprint information signal and the base station fingerprint information signal multiplied by the Fourier transform of the key representing function. The coefficients of the linear combination are determined from a set of equations derived in accordance with certain criteria.

To illustrate the process of composite filter development, let us consider a case of two fingerprints, $f_1(x)$ and $f_2(x)$, where $f_1(x)$ and $f_2(x)$ are the base and the remote station fingerprint information signals, respectively (we use a one-dimensional spatial coordinate system for simplicity). The Fourier transforms of these signals are $F_1(q)$ and $F_2(q)$ respectively, where q is a coordinate in a Fourier domain.

The key representing function may be written as

$$k(x) = \sum_{n=1}^{N} k_n \, \delta(x - x_n) \ ,$$

where $\delta()$ is a delta-function; x_n are the coordinates of the narrow peaks and N is the number of the peaks; k_n are numerical coefficients. The Fourier transform of the key representing function is

$$K(q) = \sum_{n=1}^{N} k_n \exp(- iqx_n)$$

The composite filter, H(q), may be presented in the form

$$H(q) = K(q) (C_1F_1^*(q) + C_2F_2^*(q)) ,$$

where coefficients C_1 , C_2 should be determined; " * " means complex conjugation. If this filter is put on a SLM and the SLM is illuminated with the signal $f_1(x)$, we will get a correlation function, $B_1(x)$, at the output of the correlator, and a correlation function $B_2(x)$ for the signal $f_2(x)$. For the correlation functions we have:

$$B_1(x) = (1/2\pi)C_1 \sum_{n=1}^{N} k_n \int F_1(q)F_1^*(q) \exp(iq(x-x_n)) dq +$$

$$(1/2\pi)C_2 \sum_{n=1}^{N} k_n \int F_1(q)F_2^*(q) \exp(iq(x-x_n)) dq ,$$

$$B_2(x) = (1/2\pi)C_1 \sum_{n=1}^{N} k_n \int F_2(q)F_1^*(q) \exp(iq(x-x_n)) dq +$$

$$(1/2\pi)C_2 \sum_{n=1}^{N} k_n \int F_2(q)F_2^*(q) \exp(iq(x-x_n)) dq$$

Substituting $x = x_n$, $n = 1, 2, \ldots N$ into the equations and setting, for example, the sums $\Sigma B_1(x_n)$, $\Sigma B_2(x_n)$ equal to certain values, we can obtain as many algebraic equations as necessary to find the unknown variables C_1 , C_2 , k_n and to develop the composite filter. To make sure that the number of the equations equals the number of the unknown coefficients, one can use different criteria. For example, a sum (or a sum of squares, or a product, etc.) of the heights of the output narrow peaks is set equal to a certain value. In another embodiment, the height of each peak is set equal to a certain value, but in this case both users (i.e. at the base station and at the remote station) record a few fingerprint information signals, that is, the number of the signals equals or exceeds the number of the peaks in the key representing function.

In the second embodiment of the invention, the step of obtaining an encrypted version of the decryption key includes dividing the Fourier transform of the key representing function by the Fourier transform of the base station fingerprint information signal to obtain a first filter, and dividing the Fourier transform of the key representing function by the Fourier transform of the remote station fingerprint information signal to obtain a second filter. A concatenation of the two filters can now be stored and this yields the encrypted version of the decryption key for both base and remote station fingerprint information signal.

The encrypted version of the decryption key may be stored in memory 24. Also, because the decryption key is encrypted, it may be passed to the remote station on line 30 and will remain secure even if intercepted. The remote station stores the received encrypted decryption key in its memory 42.

In a third embodiment, the decryption key generated by the base station is encrypted by the temporary secret key and transmitted to the remote station over line 30. Each station may then develop a key representing function using the techniques aforedescribed. Then each station develops a filter based on the developed key representing function and the characteristic information signal of that station, again using techniques as aforedescribed. A number of alternative approaches for generating both key representing functions and filters are described in U.S. patent application No. 08/508,978 filed July 28, 1995 and PCT/CA95/00509 filed Sept. 6, 1995, the disclosures of which are incorporated herein by reference.

(ii) Sending messages

Once an encrypted version of the decryption key is present at both the base and remote stations, encrypted messages may be sent from either station to the other and decrypted by the recipient station. For example, if the base station user wished to send an encrypted message to the remote station, he could obtain the decryption key by applying his fingerprint to the characteristic input device 20 and prompting processor 16 to write

SLM 230 with the encrypted decryption key. This will return the key representing function at camera 234 from which the key can be extracted by the processor. The base station user may then input a message by way of operator input 26 which message may be encrypted with the decryption key and the encrypted message sent on line 30 to the remote station.

In the second embodiment of the invention, the processor 16 writes to the SLM each of the previously concatenated two filters of the encrypted decryption key either in sequence or simultaneously. If the fingerprint is the same as was used at the base station during developing the encrypted decryption key, the camera 234 will register a set of narrow peaks in the case of the first filter and a random pattern in the case of the second filter. The positions of the peaks correspond to the maxima of the delta-shaped basis functions and, thus, determine the decryption key.

At the remote station, the remote user may prompt processor 36 to retrieve the encrypted decryption key from memory and write same to the filter of correlator 41. Next this user may input his fingerprint to characteristic input device 40. This will cause the correlator to return the key representing function to the processor 36 so that the processor may determine the key from this function. The decryption key may then be used to decrypt the incoming message.

In a similar fashion, the remote station user could encrypt a message by obtaining the decryption key in the manner aforedescribed and inputting a message to be encrypted at operator input 46. The encrypted message could then be decrypted by the base station in the same fashion as the remote station decrypts messages passed in the other direction.

The only difference between the base station and the remote station is the presence of random character generator 22 at the base station. The roles of these stations may be easily reversed by including a random character generator at the remote station.

As described, the subject invention is suitable for use in secure communications between two computers where the decryption key is released only by applying the fingerprint of the proper user to an input device. Of course, the characteristic input device may be modified to accept other body parts of a user so that a different biometric, such as a vein structure, or an iris pattern of a user is input.

Where the base station user is an entity such as a corporation or other organization, it may not be desirable to have access controlled by a biometric of a single individual. Figure 2a illustrates an alternative characteristic input device 300 which may be used in such instance. Turning to figure 2a, input device 300 comprises a SLM 324 held in place by holder 318 in the light path of coherent light source 222. Processor 16 writes a corporation's proprietary characteristic information (PCI) on the SLM 324 which impresses the light beam with selected characteristics such that a characteristic information signal is generated. When not in use, the PCI would be stored in a secure location in the corporation.

If the base station is sufficiently secure, it may be preferred to store an unencrypted version of the decryption key in memory 24. In such instance, correlator 21 becomes unnecessary and may be replaced with an imaging lens, CCD camera, and A/D convertor. The only use made of the base station characteristic input device would then be during generation of the encrypted decryption key.

System 10 has been described in conjunction with a decryption key which is a symmetric private key. Alternatively, the decryption key could be the private key for public key encrypted messages.

Certain parts of the subject invention have been described as using Fourier Transforms which are an expansion on a set of complex exponential orthogonal basis functions. Alternatively, other orthogonal expansions on a set of basis function can also be used such as Walsh and wavelet functions.

Other modifications will be apparent to those skilled in the art and, therefore, the invention is defined in the claims.

WHAT IS CLAIMED IS:

1. A method for permitting the secure passing of data between two remote stations, comprising the steps of:

- obtaining from a user of a first of two remote stations, a first characteristic information signal;
- obtaining from a user of a second of two remote stations, a second characteristic information signal;
- generating a sequence of random characters to obtain a random key;
- obtaining a key function which represents said key;
- obtaining a Fourier transform of said key representing function;
- obtaining at least one encrypted version of said key based on said Fourier transform of said key representing function, and a least one of said first characteristic information signal and said second characteristic information signal such that said key may be recovered by writing said at least one encrypted version of said encrypted key to a spatial light modulator (SLM) of an optic correlator and inputting either one of said first characteristic information signal and said second characteristic information signal to said optic correlator;
- storing said at least one encrypted version of said key at each of said first station and said second station, whereby thereafter any message encrypted in such a way that it may be decrypted by said key may be decrypted at either of said two remote stations by retrieving said stored encrypted key, writing said at least one encrypted version of said encrypted key to a spatial light modulator (SLM) of an optic correlator and inputting either one of said first characteristic information signal and said second characteristic information signal to said optic correlator.

2. The method of claim 1 wherein the step of obtaining a first characteristic information signal comprises obtaining an optical beam modulated with a biometric image of a first body part of said user of said first station, registering said optical beam in a two-dimensional plane and digitizing said registered optical beam.

3. The method of claim 2 wherein the step of obtaining a second characteristic information signal comprises obtaining an optical beam modulated with a biometric image of a second body part of said user of said second station, registering said optical beam in a two-dimensional plane and digitizing said registered optical beam.

4. The method of claim 3 wherein the step of obtaining said key representing function comprises obtaining normalized orthogonal basis functions and, for each basis function, applying a character of said key as a co-efficient.

5. The method of claim 4 wherein said first characteristic information signal is obtained at said first station and including the steps of:
- encrypting said digitized registered optical beam modulated with a biometric of a first body part with a pre-selected key to obtain an encrypted first biometric signal;
- sending said encrypted first biometric signal to said second station;
- utilizing said pre-selected key at said second station to decrypt said encrypted biometric of said first body part; and
- obtaining said encrypted key at said second station.

6. The method of claim 4 wherein said key representing function is obtained at said first station and including the steps of:
- encrypting said key representing function with a pre-selected key to obtain an encrypted key representing function;
- sending said encrypted key representing function to said second station;
- utilizing said pre-selected key at said second station to decrypt said encrypted key representing function; and
- obtaining said encrypted key at said second station.

7. A method for the secure handling of data between two remote stations, comprising the steps of:
- at a base station, encrypting a message such that said message may be decrypted by a decryption key;

- passing said message to a remote station;
- at said remote station,
- obtaining from a user of said remote station a remote station user optical characteristic information signal;
- retrieving from storage an encrypted version of said decryption key, said encrypted decryption key having the property that when it is written to a SLM of an optical correlator, the output of said correlator is similar when input with either one of said remote station user characteristic information signal or a base station user optical characteristic information signal;
- writing a remote station optical correlator with said encrypted decryption key;
- inputting said remote station correlator with a Fourier transform of said remote station user optical characteristic information signal;
- regenerating said decryption key from an output of said remote station correlator; and
- decrypting said message with said decryption key.

8. The method of claim 7 wherein the step of encrypting a message at said base station comprises encrypting said message utilizing said decryption key.

9. The method of claim 8 wherein the step of encrypting a message at said base station comprises the steps of:
- obtaining from a base station user said base station optical characteristic information signal, such that said base station optical characteristic signal is impressed with characteristics of a body part of said base station user;
- retrieving from storage said encrypted version of said decryption key;
- writing a base station optical correlator with said encrypted decryption key;
- inputting said base station correlator with said base station user optical characteristic information signal;
- regenerating said decryption key from an output of said base station correlator; and
- encrypting said message with said regenerated decryption key.

10. The method of claim 4 wherein said step of obtaining at least one encrypted version of said key is based on both said first characteristic information and said second characteristic information signal.

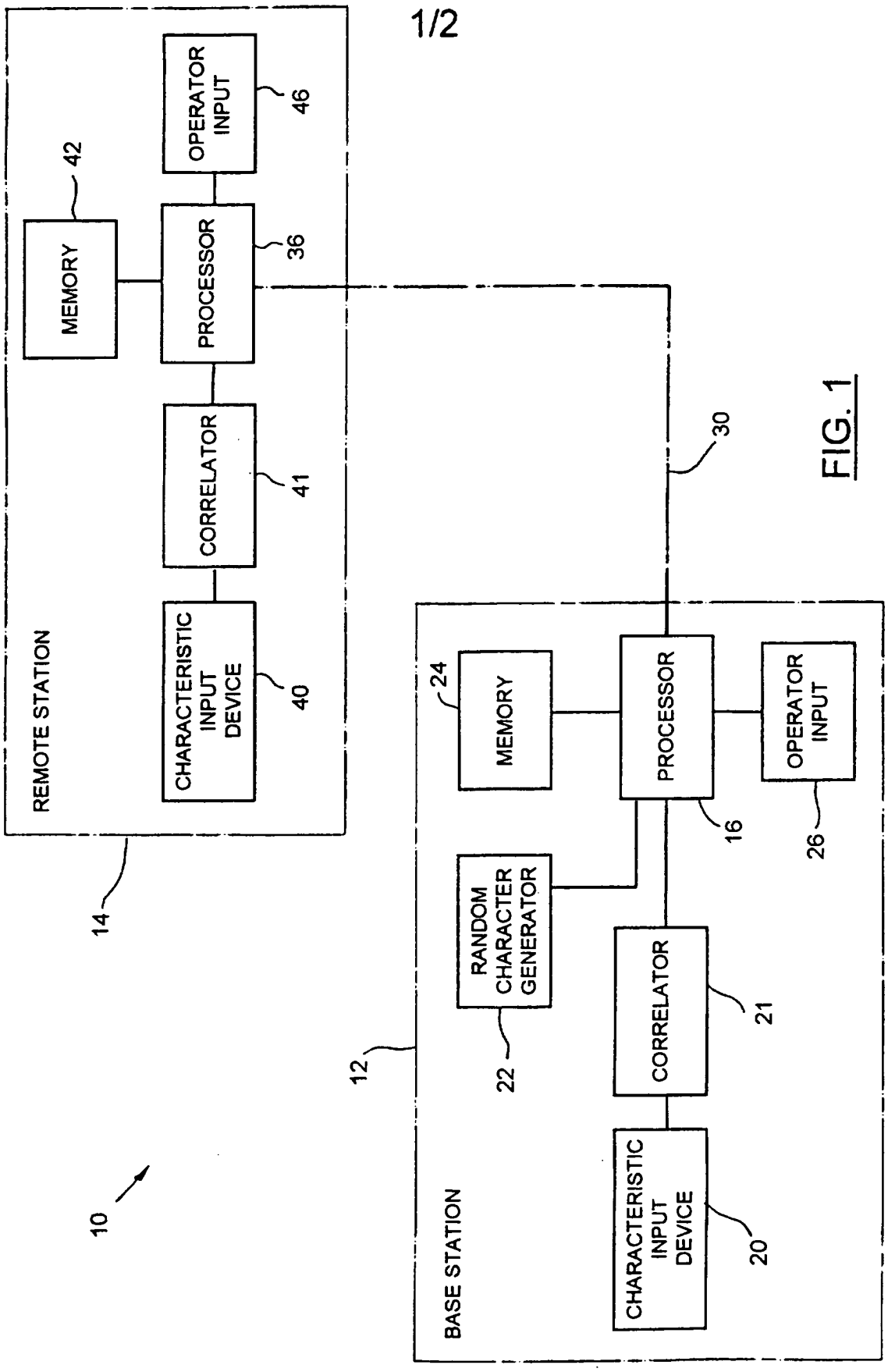

FIG. 1

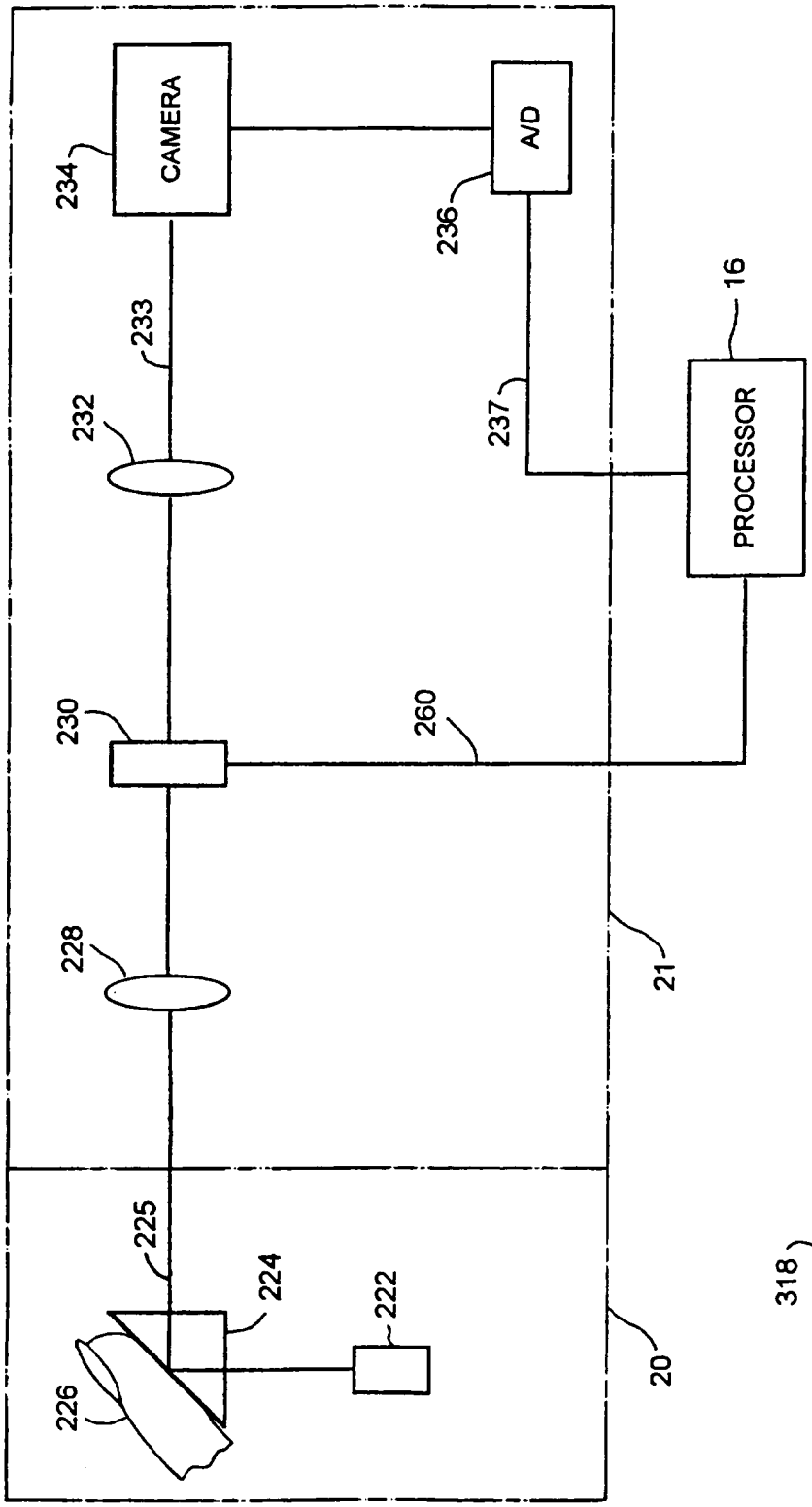

FIG. 2

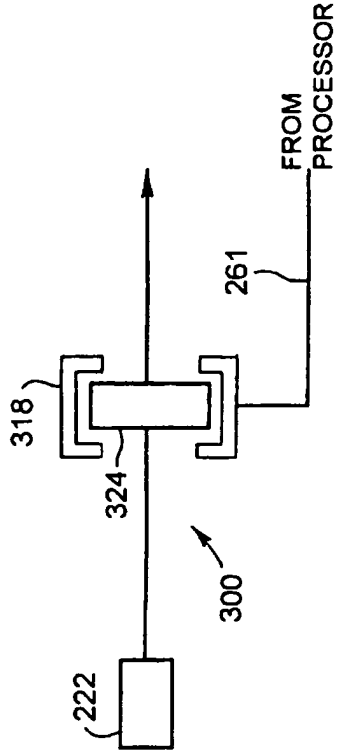

FIG. 2A

INTERNATIONAL SEARCH REPORT

Interna' d Application No
PCT/CA 96/00847

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04L9/08 G07C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04L G07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 532 508 A (RUELL) 30 July 1985 see column 1, line 57 - column 2, line 2 see column 2, line 18 - line 30 see column 3, line 44 - column 4, line 41 ---	1,2,7
A	ADVANCES IN CRYPTOLOGY, PROCEEDINGS OF CRYPTO 82, SANTA BARBARA, CA, USA, 23-25 AUG. 1982, ISBN 0-306-41366-3, 1983, NEW YORK, NY, USA, PLENUM, USA, pages 219-229, XP002029301 MUELLER-SCHLOER C ET AL: "Cryptographic protection of personal data cards" see page 226, line 2 - page 228, last line ---	1,5
A	US 5 095 194 A (BARBANELL) 10 March 1992 see column 3, line 43 - column 5, line 24 see column 6, line 28 - line 59 see column 7, line 35 - column 8, line 47 --- -/--	1,7

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 42 43 908 A (GAO) 30 June 1994 see column 2, line 32 - line 48 see column 3, line 30 - line 51 see column 4, line 18 - column 5, line 17 ---	1,7
A	US 5 050 220 A (MARSH ET AL.) 17 September 1991 see column 5, line 18 - column 6, line 24 -----	7

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INTERNATIONAL SEARCH REPORT

...rmation on patent family members

Interna... Application No
PCT/...A 96/00847

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4532508 A	30-07-85	EP 0121222 A	10-10-84
US 5095194 A	10-03-92	NONE	
DE 4243908 A	30-06-94	NONE	
US 5050220 A	17-09-91	NONE	

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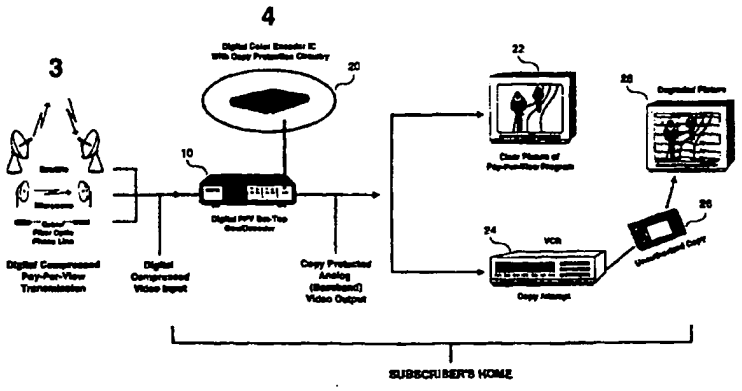

(57) Abstract

A method and system of providing copy protection of video analog and digital signals and the like, wherein the signals are transmitted via a digital delivery network, and may comprise, for example, pay-per-view (PPV) program materials protected by copyrights of respective program rights holders. The right holders authorize video service providers (3) to apply copy protection to the program material. The copy protection process is supplied to the rights holders or the service providers (3) by a copy protection process licensor. The video service providers (3) supply suitable copy protection control software via respective control and billing (tracking) centers to generate commands which activate, control and reconfigure the copy protection process being applied to the programs being transmitted. A set-top box (10) is provided to each consumer and contains a copy protection circuit which is adapted to apply selected anticopy waveforms to the video signal corresponding to the program material in response to the commands from the service providers (3). Usage data pertinent to each consumer is returned by the set-top box (10) to the service providers (3), which then report the copy protection usage to the respective rights holders and process licensor.

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A METHOD FOR CONTROLLING COPY PROTECTION IN DIGITAL VIDEO NETWORKS

BACKGROUND OF THE INVENTION

Field of the Invention

This disclosure is directed to a method of controlling copy protection in digital video networks where it is desired to copy protect an analog or digital video output signal associated with a digital video network.

Background of the Invention

Various well known copy protection schemes for video signals include that disclosed in U.S. Patent No. 4,631,603, John O. Ryan, December 23, 1986 and assigned to Macrovision Corporation, incorporated by reference, directed to modifying an analog video signal to inhibit making of acceptable video recordings therefrom. This discloses adding a plurality of pulse pairs to the otherwise unused lines of a video signal vertical blanking interval, each pulse pair being a negative-going pulse followed closely by a positive-going pulse. The effect is to confuse AGC (automatic gain control circuitry) of a VCR (video cassette recorder) recording such a signal, so that the recorded signal is unviewable due to the presence of an excessively dark picture when the recorded signal is played back.

Another analog video protection scheme is disclosed in U.S. Patent No. 4,914,694 issued April 3, 1990, to Leonard, and assigned to Eidak Corp., incorporated by reference. The Eidak system (see Abstract) increases or decreases the length of each video field from the standard length, either by changing the time duration of the respective horizontal line intervals in each field while keeping a constant, standard number of lines per frame, or by changing the number of horizontal line intervals which constitute a frame while maintaining the standard duration of each line interval.

These video protection systems modify the video signal to be recorded (for instance on tape) or to be broadcast (for instance protected pay-per-view television programs) to make copying by ordinary VCRs difficult or impossible. When a video tape on which is recorded the copy protected video signal is played back for viewing using a VCR, the copy protection process is essentially transparent, i.e., it does not interfere with viewing. However, any attempt made to copy the video signal from the tape using a second VCR to record the output of the first (playback) VCR yields a picture degraded to some extent, depending on the efficacy of the particular copy protection system. These present video copy protection systems protect only analog video signals, which are the type of video signals broadcast and recorded using current consumer video technology.

Some digital and hybrid solutions to the copy protection problem were solved by US Patent 5,315,448, issued May 24, 1994, issued to Ryan and assigned to Macrovision Corporation, incorporated by reference. This patent is directed to copy protection for use with digital signal recording where it is desired to copy protect both an analog and digital signal associated with a digital VCR, and any signal material where the original source material is not copy protectable.

A fundamental revolution is under way that will dramatically affect the delivery of home entertainment. Consumers will soon have hundreds of viewing options from which to choose because of advances in digital compression technologies and the associated reduction in costs accompanying each advance. Because of the increased number of channels more channels will be allocated for pay-per-view (PPV). The increased number of PPV channels will mean video service providers (VSP), also known as PPV providers or system operators, can provide a greater number of movies and more start times, ultimately changing the way many consumers purchase and view movies in their homes. Already, market research experts are predicting that the pay-per-view business will rival today's videocassette rental and sell-through business within 3-5 years.

Even with such a positive outlook for the future of PPV, the full benefits to the consumer of PPV programming may be delayed unless new digital video networks can protect PPV program copyrights. Rights owners are concerned that when digital programming is delivered to the home any digital set-top box will be able to produce a commercial quality video when recorded by a consumer VCR.

SUMMARY OF THE INVENTION

In this new world of direct-to-home video programming, video service providers will be called upon to protect PPV programming against unauthorized copying. They will be obligated to develop and manage the headend (cable) or uplink (satellite) systems which monitor, control, track, and report the application of copy protection on each pay-per-view video program. To this end, the present invention provides copy protection management framework which meets these needs while complementing the more technically detailed copy protection management strategy for video service providers. This framework serves to integrate all components of copy protection delivery in a digital network, and is designed to fit the diverse needs of DBS, Telco, and Cable operators while meeting the requirements of rights owners for a robust and secure environment in which to deliver copy protected PPV programming.

The value of PPV copy protection is maximized when the appropriate control and tracking systems are in place at the video service provider's control and billing centers. These control and tracking systems are best specified during the design phase of the digital signal material delivery system. At a minimum, the following system components are required:

- Copy protection-capable set-top boxes
- Capability to deliver programmable copy protection configuration
- Capability to deliver real time on/off/mode command
- Transaction/billing reporting systems/programs

A control and tracking system in accordance with the invention, for providing copy protection for a typical digital delivery system can be best understood through a short case study which begins when a consumer, that is a subscriber, receives a new set-top box. Each set-top box includes a copy protection capable digital-to-analog encoder chip. When the set-top box is initially powered on, the encoder chip is remotely programmed via a video service provider with the desired copy protection configuration. Thus the video service provider's system management software (SMS), also termed hereinafter as system control software (SCS), has the ability to store and track the designated configuration. The configuration information

applies to all copy protected programming and is updated only when a video service provider is informed of a change in the process or when a set-top box is initialized.

The copy protection status or option of each program is contained in the video service provider's system control software database. There are several potential copy protection status options. For example, a first option is for copy protection which allows for viewing only at a PPV transaction fee. A second option is for copy protection which allows for taping at a higher transaction fee. A third option is for non-protected program material for which no copy protection is required (for example, broadcast television).

When the consumer selects a viewing choice via an electronic program guide, a correct menu of options is displayed. Once a PPV program is selected by the consumer, the correct copy protection status is applied as determined by the consumer's chosen option and scheduling software of the system control software database. Either the headend/uplink facility's control software or software at the set-top box can determine and send the appropriate on/off/mode command to the copy protection capable digital-to-analog chip of previous mention.

The headend/uplink software communicates the on/off/mode command to the set-top box to correctly set the copy protection for a particular program. The system scheduling software has the capability to prevent copy protection from being applied to any type of program other than PPV programming since copy protection is licensed only for use on PPV programming. After a PPV program is viewed by a consumer, the set-top box is able to communicate to a billing subsystem of the system control software all relevant transaction data. From this data the billing subsystem is able to add this information to copy protection activity reports. These reports contain information such as the number of purchases, retail price, and copy protection usage fees owed to a licensor.

The copy protection process is applied to the analog video signal just prior to its exiting the consumer's set-top box. The application of the copy protection process is controlled and managed by system control/access software of the system control software that resides in the video service provider's operations control and billing center.

All set-top boxes in the network need to contain copy protection circuitry. If a set-top box does not have copy protection capability then the video service provider

is able to identify those set-top boxes and deny them copy protected PPV programming.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram depicting a summary of the functions of the present invention.

Fig. 2 is a block diagram depicting a typical digital set top box/decoder of the present invention.

Fig. 3 is a block diagram illustrating an example of the circuitry and architecture of the set-top box of Fig. 2 in further detail.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The basic copy protection which is controlled and tracked in accordance with the present invention, is the subject of numerous patents and co-pending applications. The PPV copy protection process works by exploiting the differences between the way television (TV) sets and VCRs respond to video signals. The two components of the anticopy process are known as the automatic gain control (AGC) and Colorstripe™ processes. The purpose of these two separate components or processes is to modify the video signal in a manner which has no effect on a TV set but which inhibits a recording VCR from making a watchable copy.

The combination of the AGC based anticopy process and the Colorstripe™ technology developed specifically for PPV applications results in an overall effectiveness rating of more than 95%. This means that over 95% of unauthorized copies will be either unwatchable or have substantially reduced entertainment value.

Security is also a major factor in the operational effectiveness of PPV copy protection. Security is a measure of the difficulty in bypassing or defeating the anticopy process. Ideally the system is completely undefeatable, but as a practical matter the copy protection system needs to be secure enough to thwart attempted breaches by typical consumers, including reasonably sophisticated consumers. The security system is successful if the vast majority of consumers are prevented from taping PPV programs in the home.

Both video service providers (VSPs), that is, PPV providers, and rights owners benefit when current movie programming is offered to consumers at the same time or shortly after these movies are available on videocassette. Subscribers benefit as well since this scenario provides them with more choices and added convenience.

As digital PPV programming generates increasing revenue for rights owners and becomes a viable viewing option to prerecorded videocassettes, video service providers will be called upon to copy protect PPV programming so that the videocassette rental and videocassette sell-through businesses are not compromised. Rights owners also will require video service providers to monitor, control, track, and report the application of copy protection on each video program for billing purposes.

Copy protection has emerged as a key element in the delivery of PPV programming via digital signal delivery networks. The aggregate system implications of copy protection are very manageable, but only when designed as a part of the overall digital delivery system architecture.

The description of the present invention is intended to apply to systems where one or more video service providers are, or will be in the future, connected to a pay-per-view (PPV) service. The PPV service can be either a video-on-demand (VOD) format, or a near video-on-demand (NVOD) format and digital delivery network, and where set-top boxes (STBs) from multiple manufacturers may be connected to the network. It is assumed that one class of technology will be deployed initially [such as Direct Broadcast Satellite (DBS), Multi-point Microwave Distribution System (MMDS), telephone line or Hybrid-Fiber Coax (HFC)] to be followed by another class of technology at some future date. Although a different technology may arise, it is intended that the invention is applicable to use with multiple platforms and technologies.

Fig. 1 illustrates a control and tracking method and system for enabling and controlling the application of copy protection of video signals and the like via digital video networks. Station 1 represents the issuance of instructions to video service providers by program rights holders who hold the copyrights, for the application by the providers of copy protection to the programs which are protected by per-per-view (PPV) or pay-to-tape (PTT) requirements.

Station 2 depicts a control and billing center of the licensed video service providers who supply copy protection control software for the respective protected programs being broadcast, to generate the commands required to activate, control and reconfigure the copy protection process for each specific PPV/PTT program offering. Although a single provider is depicted, it is understood that station 2 represents any plurality of video service providers each with their respective proprietary control and tracking (billing) software, in accordance with the present invention.

Station 3 represents the procedure of transmitting the particular copy protection command codes of the respective providers, for the PPV/PTT program offerings, via the typical broadcasting networks. Such transmissions may be made by satellite, by microwave, by phone line or by cable transmission systems as depicted.

Station 4 represents the subscriber's home, or other receiving facility, and includes a set-top box 10 for each of a multitude of subscribers. Each set-top box contains copy protection circuitry including a digital color encoder integrated chip (IC), which is adapted to apply selected anticopy waveforms to the analog or digital video signal which is supplied therefrom to a television set or monitor. The receiving facility is further described in Fig. 2.

Station 5 represents the procedure whereby data identifying each PPV or PTT transaction, including copy protection usage, is sent by the set-top box 10 back through the transmission networks of station 3, generally to the respective video service provider's control and billing (tracking) center. The center includes billing procedures which are a subset of the system control software and which process the return transaction data to provide for billing the subscriber for the PPV or PTT transaction usage.

Station 6 represents the procedure whereby each of the licensed video service providers report the copy protection usage to the program rights holder, whereby the provider pays the copy protection fees to the rights holder, i.e., the licensor.

Fig. 2 illustrates in further detail the subscriber's facility, station 4 of Fig. 1, receiving the digital, and usually compressed, pay-per-view transmissions from the broadcasting networks depicted as station 3 of Fig. 1. The compressed digital video

signal, or the like, is supplied to the respective set-top box 10 of a multitude of set-top boxes, wherein each box includes conventional circuits for converting and decoding the digital compressed video signal to an analog (baseband) video signal. The set-top box 10 also includes a digital color encoder IC 20 of previous mention which contains copy protection circuitry for applying the selected copy protection waveforms to the analog (or digital) video signal, namely, the programs which are being protected. In this example, the copy protected analog baseband video is supplied by the set-top box to a TV set 22 where the pay-per-view protected program clearly is displayed for viewing if the subscriber is authorized to view the program. If the subscriber is not authorized for a particular PPV protected program, the corresponding picture is modified so as to be un-viewable.

In the event a subscriber records the PPV protected program via a VCR 24 to obtain a taped copy 26 without authorization, the unauthorized copy will be degraded to the degree that it is un-watchable, as depicted by a TV set 28. However, if the subscriber subscribes to a pay-to-tape transaction and to the required higher PTT transaction fee, then the copy is authorized and the resulting taped copy would readily be watchable.

Referring to Fig. 3, there is illustrated in further detail an architecture of the set-top box(es) 10 of Figs. 1, 2. Upon power up of the set-top box 10 the configuration bits stored in flash memory 48 are read and written into the appropriate CP control registers 52 in the NTSC/PAL encoder 20. When the compressed digital video signal, including the copy protection control commands of previous and following discussion, are supplied by the delivery network of previous mention (satellite, HFC, MMDS, phone line) to a demodulator circuit 32, as depicted by an input lead 30. The demodulated video/audio and control signals are supplied to a demultiplexer circuit 34 where the video/audio signals are separated into respective channels and supplied to an MPEG-2 decoder and digital decompression circuit 36. The copy protection control commands are supplied from the demultiplexer 34 to a conditional access system module 38. The commands are supplied to a microprocessor in a CPU 40. The CPU processes information located in memory that is associated with the Electronic Program Guide (EPG) 46 or runs the copy protection application software 44 residing in memory 42 to deliver the activation command to the NTSC/PAL encoder 20. The EPG may also have data

which is used to determine if copy protection should be activated. There are additional methods that may be employed to activate copy protection.

In response to the control commands, the CPU 40 supplies control signals to the NTSC/PAL encoder IC 20 of previous mention, Fig. 2. The encoder IC 20 includes copy protection control registers 50, 52 for receiving the mode bits and configuration control bits respectively, of previous and following discussion. The configuration bits 52 determine the form of the copy protection (i.e., where the Pseudo Sync and AGC pulses will be located or positions of the colorstripe lines etc.) The on/off/mode byte 50 determines which components of the copy protection process will be activated. See table 1 below. The encoder IC 20 also receives decompressed video from the MPEG-2 decoder and digital decompression circuit 36. Encoder IC 20 outputs a RF signal, a composite video signal and/or an S-video signal via video leads 54. The decompressed audio signal is supplied from the circuit 36 to an audio processing circuit 56 which, in turn, outputs left and right channel stereo signals and/or an AC-3 signal on audio leads 58.

In accordance with the invention, the set-top box needs to satisfy certain requirements to insure that the copy protection process is correctly generated, controlled and tracked. Control and tracking of the copy protection process usage takes place at the VSP's control and billing center, station 2 of Fig. 1. This in turn requires that certain capabilities exist which involve the set-top box, the system control and the billing systems and programs in order to satisfy these requirements.

There follows a description of the requirements which ensure that the copy protection process or technique is correctly activated and controlled and its usage tracked. It is expected that if non-compliant set-top box hardware is attached to the digital delivery network, that each licensed service provider will be able to identify such hardware as non-compliant and will withhold copy protected programs from the respective subscriber.

Implementation of these control requirements over the network (i.e. control of the anticopy process from the program origination control and billing center) requires knowledge of the set-top box control system and process, the application program interfaces (API) present at the box and the dialog between it and the integrated circuit (IC) which incorporates the copy protection apparatus.

Copy protection control software (CPCS) is a software module or set of software modules that reside in the service provider's system control software (SCS). It provides a system operator (that is, the service provider) with an interface to manage the necessary attributes of the pay-per-view copy protection in accordance with the present invention.

For security reasons there needs to be the capability to control access to the CPCS from the system control software. This restriction is designed to limit access to the CPCS for control of the copy protection process. The operating system supporting the SCS is generally the first level of security. Every employee is required to enter a login account and password. Without these an employee is denied access. The employee's account specifies the respective privileges. A system administrator of the service provider is responsible for the assignment of the employee's privileges.

Thus, every executable file residing on the host which is capable of modifying the operational status of the copy protection process has permissions restricted to authorized personnel. Without the proper permissions, the personnel are unable to run the executable software.

The CPCS is the portion of the video service provider's software control where the decision to apply the options of pay-per-view and pay-to-tape are applied on a program-by-program basis.

There is access control to the CPCS either through password control or the assignment/denial of privileges through software. If password control is the selected method then once the correct initial password is entered, CPCS forces the selection of a new password for future access to CPCS. In this way the service provider can limit access to CPCS to those employees who carry the authority to modify the copy protection database. The password is valid for a reasonable amount of time before it expires and selection of a new password is required.

Additionally there is an access control to a subsystem within the CPCS that allows the modification of selected bits which define the configuration control and mode, and thus determine the characteristics, of the copy protection process. Any unauthorized changes to these bits can result in severe playability and effectiveness problems. In order to maximize the security of the system the video service provider needs to have a short list of personnel who are authorized to change these bits.

A mode control group controls access to the mode bits. This group has the ability to change the contents of the mode byte(s) which is sent with each PPV program to activate or deactivate the copy protection process. The membership of this group is controlled by the system administrator. The number of the service provider's personnel allowed in this group is kept to a minimum.

Similarly, a configuration control group controls access to the configuration bits. This group has the ability to change the contents of the configuration bits which define the copy protection process. These are the bits that are sent periodically to every set-top box to assure that all boxes are using the correct version of the process. The number of the service provider's personnel allowed in this group also is kept to a minimum.

Each password described below should be at least eight (8) alpha-numeric characters in length. The system administrator is responsible for defining and distributing the current password to the authorized personnel. Each password described below should have a life of no more than four months before the system administrator changes the password.

Password access to the software that applies or removes the copy protection process on a program-by-program basis is designed to query mode or configuration control group authorized personnel for an authorization password to ensure that they are a member. If the authorized personnel correctly enter the password they will be allowed to apply or remove the copy protection for a particular PPV or series of PPV events. Conversely, if authorized personnel fail to enter the password they must be denied access to that portion of the database. It is the system administrator's responsibility to ensure that only authorized personnel know the password for either the mode or configuration control. An authorized personnel will be given three attempts to login before a message is generated for the system administrator that an unauthorized request to modify the application or remove the copy protection has been made.

Alternative proposals for accessing CPCS and controlling access to the mode and configuration of the copy protection process may be developed by one skilled in the art.

The CPCS will perform the following functions: Copy protection on/off and mode control; copy protection validation; functionally unlocking copy protection

capability in a set-top box; and copy protection process configuration reprogramming.

The copy protection process which is incorporated in the set-top box is controlled by the CPCS at the licensed video service provider's control and billing central location. The need to invoke copy protection on an individual program forms part of a descriptor for each program. A default for copy protection within the descriptor needs to be turned off (i.e., no copy protection).

Steps need to be taken to prevent copy protection being applied to non-PPV program channels, since copy protection can be licensed only for PPV programming. If the system control software automatically verifies that a program is designated for PPV use, this requirement may be automated. Similarly, access to CPCS may be automatically denied for non-PPV programming. If such an automatic verification is not made, a warning notice is generated when CPCS is accessed to change the copy protection status of a program. This notice needs to be displayed until a specific keyboard entry is made to acknowledge the warning.

In the case of MPEG signals, the MPEG copyright header bits on their own are not sufficient to activate copy protection in the set-top box. The following reasons are the basis for not allowing the MPEG header bits to be used as the sole control of the copy protection process. An application routine is required in order to (a) differentiate between digital-to-digital and digital-to-analog copy protection conditions, (b) provide sufficient control capacity to set the copy protection operating mode, and (c) facilitate access to the copy protection system only by licensed video service providers.

It is preferred that the anticopy process on/off control is achieved by setting all the individual parameter on/off and mode control bits rather than a master on/off control. This requires that the N0 (N-zero) bits in the control bit listing be set as required. Depending on the individual system, this will require the control of from 5 to 8 bits.

The delivery of the mode byte to the set-top box to activate or deactivate the copy protection process may be accomplished in several ways. Each method has its positive aspects as well as its negative aspects. When selecting a mechanism to control the copy protection technology, a service provider selects one of the following means or may develop an entirely new means.

One method may be for the mode byte to be delivered via the conditional access system via the entitlement control message (ECM). Another method might be to include the mode byte in a private data field in the MPEG transport data stream.

Another method may deliver the mode byte in a user defined section of the electronic program guide (EPG) that is not identified in released documentation as controlling copy protection. This method also requires some additional security to keep the memory location of the mode byte from being accessed for unauthorized changes and the setting of a return flag that indicates the actual status of the mode byte when transmitted to the NTSC encoder.

Another method may be a combination of the conditional access ECM and EPG. The transport of the mode byte in the EPG could be combined with two bits within the ECM. To activate the copy protection technology then it would be an or operation between the ECM bits and the EPG bits. If either is set, the copy protection technology, both ECM and EPG would have to indicate that deactivation is necessary.

When a copy protected PPV program is viewed, part of the information that will need to be tracked will be the actual setting of the mode byte. In this way both the copy protection process and the service provider will have a means to discover if copy protection has been circumvented in the set-top box. The return flag may be a simple bit set to 'true' to indicate that the copy protection process was correctly activated and 'false' if it was incorrectly activated. It is required that the mode byte be sent to the NTSC encoder on a periodic basis. The frequency of the transmission is on the order of once every minute.

Setting the operating mode of the copy protection process requires independent activation of the three component parts of the copy protection process (pulses within the vertical blanking interval, pulses at end of field, colorburst phase modification) and up to 5 additional mode set parameters using N0 bits as indicated above.

Access to copy protection at the set-top box by the video service provider needs to be restricted to authorized providers. This should not to be confused with access to the CPCS as defined earlier. It follows that each system operator or video service provider is required to procure the means (i.e., keys/codes, etc.) to activate

the copy protection system control software on a program-by-program basis. When a service provider obtains the means to activate copy protection, the provider will gain access to the copy protection process at the set-top box. The copy protection process (i.e. on/off/mode or reprogramming commands) at the set-top box needs to have controlled access such that only authorized providers can issue valid commands to the box. The set-top box needs to reject commands for the copy protection process from unauthorized video service providers.

Set-top boxes such as depicted in Figs. 1, 2, may be shipped by the manufacturer with the copy protection capability installed, but functionally locked. This means that the set-top box will not respond to any copy protection control codes. However, the set-top box will be unlocked (i.e. enabled) by a message initiated via the CPCS or SCS and sent through the system by a licensed video service provider. This message may be sent as part of the log-on routine when a subscriber accesses a provider. This message need only be acted upon once by the set-top box during the lifetime of the box. Only authorized video service providers are provided with the unlocking message data.

The copy protection unlock message consists of at least 8 bytes. The set-top boxes are manufactured with an appropriate unlock message code. This code is provided by the set-top box manufacturer only to a copy protection licensor, who in turn provides the code to licensed video service providers. The copy protection unlock message is different for each set-top box manufacturer, but is the same for all boxes made by that manufacturer.

Alternative proposals on the methodology to enable the copy protection process in the set-top box will be apparent to those skilled in the art.

To ensure that over the life of the set-top box the copy protection process provides the maximum effectiveness with VCRs and compatibility with TV sets, the copy protection system needs to be upgradeable on a system-wide basis by means of commands initiated by the CPCS. This will result in new process configuration data being transmitted. In response, the set-top box processes the data to reconfigure the adjustable parameters of the copy protection process. The set-top box may be placed in a "diagnostics" mode for this feature implementation, or the configuration data may be sent and acted on by the box on a routine basis as part of the program description data or log-on routine.

However, it is recommended that the entitlement control message (ECM) be used. The ECM is embedded in the conditional access system.

In one version, configuration data of 108 bits is provided to accommodate the reconfiguration data, however, 108 bits does not fall on a byte boundary. Therefore, it is recommended that 112 be sent with a pad 0. The data is presented to the service provider in the form of hexadecimal numbers for entry into the CPCS. The 112 bits thus are entered as a string of 28 hexadecimal numbers.

In another version, configuration data of 132 bits is provided to accommodate the reconfiguration data, however, 132 bits does not fall on a byte boundary. Thus, it is recommended that 136 be sent with a pad 0. The data is presented to the provider in the form of hexadecimal numbers for entry into the CPCS. The 136 bits thus are entered as a string of 34 hexadecimal numbers.

It is possible to verify the current configuration stored by the CPCS by accessing the current contents of the configuration bits presented as the correct number hexadecimal characters. An alpha-numeric password of at least 8 bytes is required to gain access to change the programming data within CPCS. This password is separate from the password which allows access to CPCS. The service provider has the option of receiving the 'C' source code of an executable file to which to pass parameters.

The following warning notice is presented on the screen of the operational control and billing center of a provider after entering the correct password:

WARNING

Changing this copy protection configuration data without the written authorization carries the serious risk of problems with the performance of the copy protection system and degraded picture quality.

This warning notice is displayed until a specific keyboard entry is made to acknowledge the warning.

By way of example only, Table 1 illustrates a mode control bit listing which defines the corresponding bit pattern or command, which provides the routine on/off

and mode selection functions when transmitted to the set-top boxes via the delivery networks. The configuration control bit listing is generally equivalent to that of the mode control, though relatively longer since it controls considerably more control and reprogramming functions.

TABLE 1
Mode Control Bit Listing
Routine On/Off and Mode Selection

N0	**On/off and mode control; 8 bits**		
N0[7]	Reserved		CPC0[3]
N0[6]	Pay-to-tape allowed/prohibited	(Allowed=1, Default=0)	CPC0[2]
N0[5]	VBI pulses On/Off (VBIP)	(ON=1)	CPC0[1]
N0[4]	End of Field Back Porch Pulses on/off (EOFP)	(ON=1)	CPC0[0]
N0[3]	Colorstripe process On/Off (CSP)	(ON=1)	CPC1[3]
N0[2]	AGC pulse normal (amplitude cycling)/static mode select (AGCY)	(Cycling=Default=1)	CPC1[2]
N0[1]	H-sync amplitude reduction On/Off (HAMP)	(ON=1)	CPC1[1]
N0[0]	V-sync amplitude reduction On/Off (VAMP)	(ON=1)	CPC1[0]

The pay-per-view transaction information is collected by each video service provider for each subscriber so that monthly copy protection activity reports required for royalty payments and other fees may be generated. The reports include information regarding the number of subscribers accessing each copy protected program, with subtotals of the copy protection status or options selected by respective subscribers. The reports further include information sorted by PPV title, PPV program supplier, copy protection activation status requested by the subscriber, and by set-top box model code. The reports are provided by the report generating software of previous mention at the video service provider centers.

The activity report includes a manufacturer and model type descriptor code in the transaction acknowledgment between the set-top box and the control and billing system when a PPV purchase transaction is reported to the provider.

The CPCS and the set-top box are capable of applying and reporting anticopy usage according to the following conditions. The overall system allows the subscriber's copy protection to be turned off at the box only as permitted by the PPV program rights holder.

(a) PPV program rights holder permits viewing only:

The pay-to-tape mode is prohibited (off). All STBs output copy protected waveform only. I.e., the copy protection waveform unconditionally appears on the set-top box analog video output signal.

This is reported to the billing system as a "pay-per-view" copy protected transaction.

(b) PPV program rights holder permits viewing and recording:
The pay-to-tape mode bit is set for pay-to-tape permitted (on). Under this option, when the subscriber selects the "pay-to-tape" option, the copy protection process is turned "off" in the STB to allow the PPV program to be recorded (taped) for a higher transaction fee than for "viewing only." I.e., the copy protection waveform will not be present on the STB analog video output signal.

This is reported to the billing system as a "pay-to-tape" copy protected transaction.

The following Table 2 provides a summary of the control options and includes additional information.

TABLE 2
Pay-per-view and Pay-to-tape Control Options for Pay-per-view Programs

Program Descriptor of PPV Program	Consumer Request (Pay-per-view or Pay-to-tape)	Result
Copy protection NOT required	N/A	ACP off
Copy protection REQUIRED Taping NOT permitted	Pay-per-view	ACP will be ON. Pay-per-view transaction cost incurred by consumer.
Copy protection REQUIRED Taping NOT permitted	Pay-to-tape	Requested option not available. ACP will be ON. Pay-per-view transaction cost incurred by consumer.
Copy protection REQUIRED Taping permitted (at higher transaction cost)	Pay-per-view	ACP will be turned ON by STB control system. Pay-per-view transaction cost incurred by consumer.
Copy protection REQUIRED Taping permitted (at higher transaction cost)	Pay-to-tape	ACP will be turned OFF by STB control system. Pay-to-tape transaction cost incurred by consumer.

It is to be understood that various terms employed in the description herein are interchangeable. For example, a "video service provider" also is known as a pay-per-view (PPV) provider or a system operator, and the "system management software" preferably is referred to as the system control software. Likewise, the "control and billing centers" of the PPV providers represented by station 2 (and generally station 5) also may be referred to as operations control/tracking centers, program origination/termination centers, headend (cable)/uplink (satellite) control centers, etc. A licensed PPV provider facility supplies the necessary control instructions to associated software and/or circuitry in a set-top box to allow a respective subscriber access to program material to which he or she is entitled, and also receives at designated times of the week, month, etc., the usage data

automatically returned by the set-top box. A billing and license fees software subset of the system control software then enables each PPV provider to bill the subscribers and to report and pay the attendant licensing fees to the rights holders, etc.

Accordingly, the above description of the invention is illustrative and not limiting. Further modifications will be apparent to one of ordinary skill in the art in light of this disclosure. For example, although the invention is described herein relative to a video signal, and primarily an analog video signal, it is to be understood that the invention concepts may be applied to other signals with properties equivalent to a video signal where copy protection is desired. Likewise, the invention is applicable to the copy protection of digital as well as analog signal materials, such as those disclosed in the U.S. Patent No. 5,315,448 of previous mention. Further, although a specific example of a code word is disclosed herein for enabling the copy protection process via the set-top box, other combinations and numbers of bits may be employed. In addition, a selected portion of the control software for effecting the copy protection process may reside in the set-top box in the form of an insertable "smart" card, wherein for example the smart card contains the data concerning the subscriber's options and privileges.

Thus, the scope of the invention is defined by the following claims and their equivalents.

What is claimed is:

1. A method of providing copy protection of signal material transmitted via digital delivery networks, to prevent unauthorized viewing or copying of the signal material, comprising the steps of:

supplying copy protection controls indicative of desired copy protection for the signal material;

transmitting commands derived from and in response to the copy protection controls which activate the copy protection for the signal material; and

applying anticopy waveforms to the signal material in response to the commands to prevent the unauthorized viewing or copying of the signal material.

2. The method of claim 1 wherein the step of supplying includes:

establishing selected requirements for activating and controlling a process which enables said copy protection and which reports the corresponding usage thereof; and

providing copy protection control software in response to the selected requirements, which software provides said copy protection controls to activate and control the copy protection process and the usage reports.

3. The method of claim 2 wherein the step of establishing includes:

establishing requirements which differentiate between digital-to-digital and digital-to-analog copy protection conditions, which determine a copy protection process operating mode and configuration, and which ensure that there is only authorized access to the copy protection process.

4. The method of claim 2 wherein the step of providing includes:

generating the commands in the form of a bit pattern in response to the copy protection control software; and

said commands including a first bit pattern which enables real time on/off/mode control, and a second bit pattern which determines a programmable copy protection configuration.

5. The method of claim 4 including the step of:

receiving the transmitted first and second bit patterns to activate the copy protection and to control and reconfigure the copy protection process respectively in response thereto; and wherein the anticopy waveforms are applied to the signal material to provide the copy protection.

6. The method of claim 2 including the step of:

limiting access to the steps of establishing and providing to prevent unauthorized access to the application of the copy protection process or to the copy protection control software which activates and controls the process.

7. The method of claim 2 wherein the step of applying includes:

storing the copy protection controls in memory at a service provider receiving facility; and

storing control data in memory at a signal material receiving facility, which stored control data is responsive to the commands to activate, control and reconfigure the stored copy protection process.

8. The method of claim 2 including the step of:

collecting periodic copy protection activity information including copy protection activation status such pay-per-view and pay-to-tape number of signal material events watched.

9. The method of Claim 8 including the steps of generating reports which include the number of accessing receiving facilities, the rights holder of the signal material events, the number of total events watched, and corresponding billing information.

10. The method of claim 2 wherein the step of applying includes:

modifying a selected synchronizing signal in a corresponding blanking interval of a television line in response to said commands to degrade a subsequent

decoding of the synchronizing signal in the event that a recording is made of the corresponding signal material.

11. The method of claim 2 wherein the signal material is a video analog or digital signal.

12. Apparatus for controlling copy protection of proprietary signal material transmitted via digital delivery networks, wherein a service provider enables a copy protection process which prevents unauthorized copying of the signal material by consumers, the apparatus comprising:

a control/billing center for supplying copy protection control signals as directed by the service provider;

means for transmitting selected commands in response to the copy protection control signals to selectively control the copy protection process; and

means located with each consumer for applying the copy protection process to the signal material in response to the transmitted selected commands to prevent or allow viewing or copying of the signal material.

13. The apparatus of claim 12 wherein the copy protection control signals of the service provider include:

a mode command for activating the box means; and

a configuration bit pattern for determining the copy protection process's operating configuration.

14. The apparatus of claim 13 wherein the copy protection control signals include an access password for identifying that a service provider's authorized personnel have access to and control of the copy protection process.

15. The apparatus of claim 13 wherein the box means includes a set-top box having encoder means containing a copy protection circuit adapted to add anticopy signals to the signal material in response to the command signals.

16. The apparatus of claim 15 wherein the set-top box includes:

memory means for storing the copy protection configuration and/or copy protection mode; and said encoder means including means for receiving the mode command and the configuration bit pattern and for controlling the activation and configuration of the stored copy protection process in response to the command and bit pattern.

17. The apparatus of claim 15 wherein the set-top box includes software for returning usage data back to the service provider's control/billing center, said usage data being used by the service provider to bill the consumers and to provide a report of the usage and corresponding license fees.

18. The apparatus of claim 13 wherein the signal material is a pay-per-view or pay-to-tape video analog or digital signal.

19. The apparatus of claim 12 wherein the control/billing center includes:

instructional information establishing requirements for activating and controlling the copy protection process and for reporting the copy protection activity; and

wherein the service provider supplies copy protection control software commensurate with said requirements, and said copy protection control signals in response to the control software.

20. A method of providing copy protection of signal material transmitted via a digital delivery network, wherein a service provider enables a copy protection process via a set-top box located at a consumer's facility, comprising the steps of:

supplying selected control bit patterns from the service provider to the consumer's facility via the digital delivery network;

storing a copy protection configuration in the set-top box;

receiving the control bit pattern in said set-top box; and

applying the copy protection process to the transmitted signal material in response to the control bit pattern each time a selection of the material is made at the consumer's facility to prevent or allow the selected signal material to be copied.

21. The method of claim 20 wherein the step of supplying includes:

developing copy protection control software which describes selected control signals for applying the copy protection process to the signal material and for returning to the service provider usage data indicative of the signal material selected at the consumer's facility;

generating said selected control bit patterns in response to the copy protection control software; and

transmitting said selected control bit patterns to the set-top box of the consumer's facility when the consumer joins the delivery network and thereafter on a prescribed routine basis.

22. The method of claim 21 including the steps of:

storing in the set-top box copy protection application software which activates and controls the copy protection process; and

enabling the stored application software in response to the transmitted control bit pattern to selectively activate and/or modify the configuration of the copy protection process.

23. The method of claim 22 including the steps of:

modifying the configuration control bit pattern commensurate with a desired change in the copy protection process; and

transmitting the modified configuration control bit pattern to the set-top-box to effect the change in the copy protection process.

24. The method of claim 21 including the steps of:

storing consumer information in the set-top box which is indicative of viewing and/or copying options desired at the consumer's facility; and

comparing the control bit pattern to the stored consumer's information in the set-top box when a selection of the signal material is made to determine if the consumer is authorized to view only and/or to copy the material.

25. The method of claim 20 wherein:

the signal material is a pay-per-view (PPV) or pay-to-tape (PTT) signal; and

the step of supplying includes establishing selected requirements for activating and controlling the PPV and PTT copy protection process and for reporting the corresponding usage activity of the process to the service provider; and

providing copy protection control software in response to the selected requirements, which software provides said control bit pattern to activate, control and modify the PPV and PTT copy protection process.

26. The method of claim 25 including the step of:

providing limited access to the steps of establishing and providing to prevent unauthorized access to the control of the copy protection process or to the copy protection control software.

27. The method of claim 25 wherein the signal material is a pay-per-view or pay-to-tape video analog or digital signal.

28. The method of claim 27 wherein the step of applying includes:

modifying a selected synchronizing signal in a corresponding blanking interval of a television line in response to said control bit pattern to degrade any subsequent decoding of the synchronizing signal when an unauthorized attempt is made to view or copy the pay-per-view signal.

29. A method of providing copy protection of signal material transmitted via a digital delivery network, wherein a service provider enables a copy protection process via set-top boxes located at consumers' facilities, comprising the steps of:

establishing selected requirements for activating, controlling and modifying a copy protection process for the signal material and for reporting the corresponding usage thereof;

providing copy protection control software in response to the selected requirements;

generating via the control software, mode and configuration control bit patterns which enable real time on/off mode control and programmable copy protection process configuration control respectively;

transmitting the mode control and configuration control code words to the set-top boxes;

selectively applying the copy protection process to the transmitted signal material in response to the transmitted mode bit pattern each time a selection of the signal material is made via the set-top boxes to prevent or allow the selected signal material to be viewed or copied.

30. The method of claim 29 including the steps of:

storing the application software in the set-top boxes; receiving and writing the mode bit pattern in the set-top boxes; and

wherein the stored application software responds to the transmitted mode bit pattern to activate, control and modify the copy protection process as defined by the configuration control bit pattern.

31. The method of claim 30 wherein the set-top box is functionally locked including: downloading via the service provider a selected bit pattern or software adapted to functionally unlock the set top box.

32. The method of claim 30 wherein the set-top box is functionally locked including activating at the service provider's facility selected software adapted to functionally unlock the set-top box

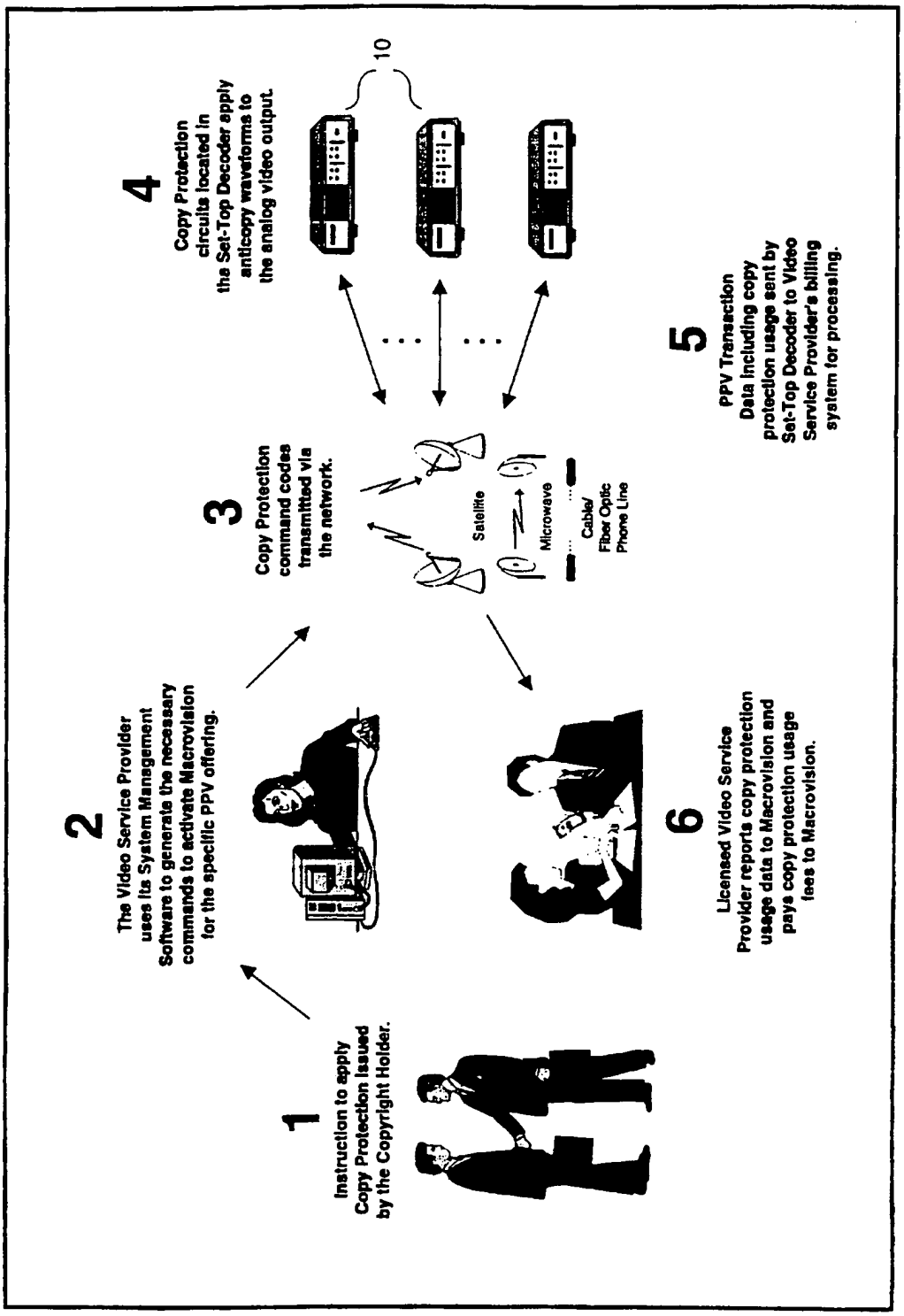
1
Instruction to apply Copy Protection issued by the Copyright Holder.
2
The Video Service Provider uses its System Management Software to generate the necessary commands to activate Macrovision for the specific PPV offering.
3
Copy Protection command codes transmitted via the network.
Satellite
Microwave
Cable/ Fiber Optic Phone Line
4
Copy Protection circuits located in the Set-Top Decoder apply anticopy waveforms to the analog video output.
10
5
PPV Transaction Data including copy protection usage sent by Set-Top Decoder to Video Service Provider's billing system for processing.
6
Licensed Video Service Provider reports copy protection usage data to Macrovision and pays copy protection usage fees to Macrovision.

FIG. 1

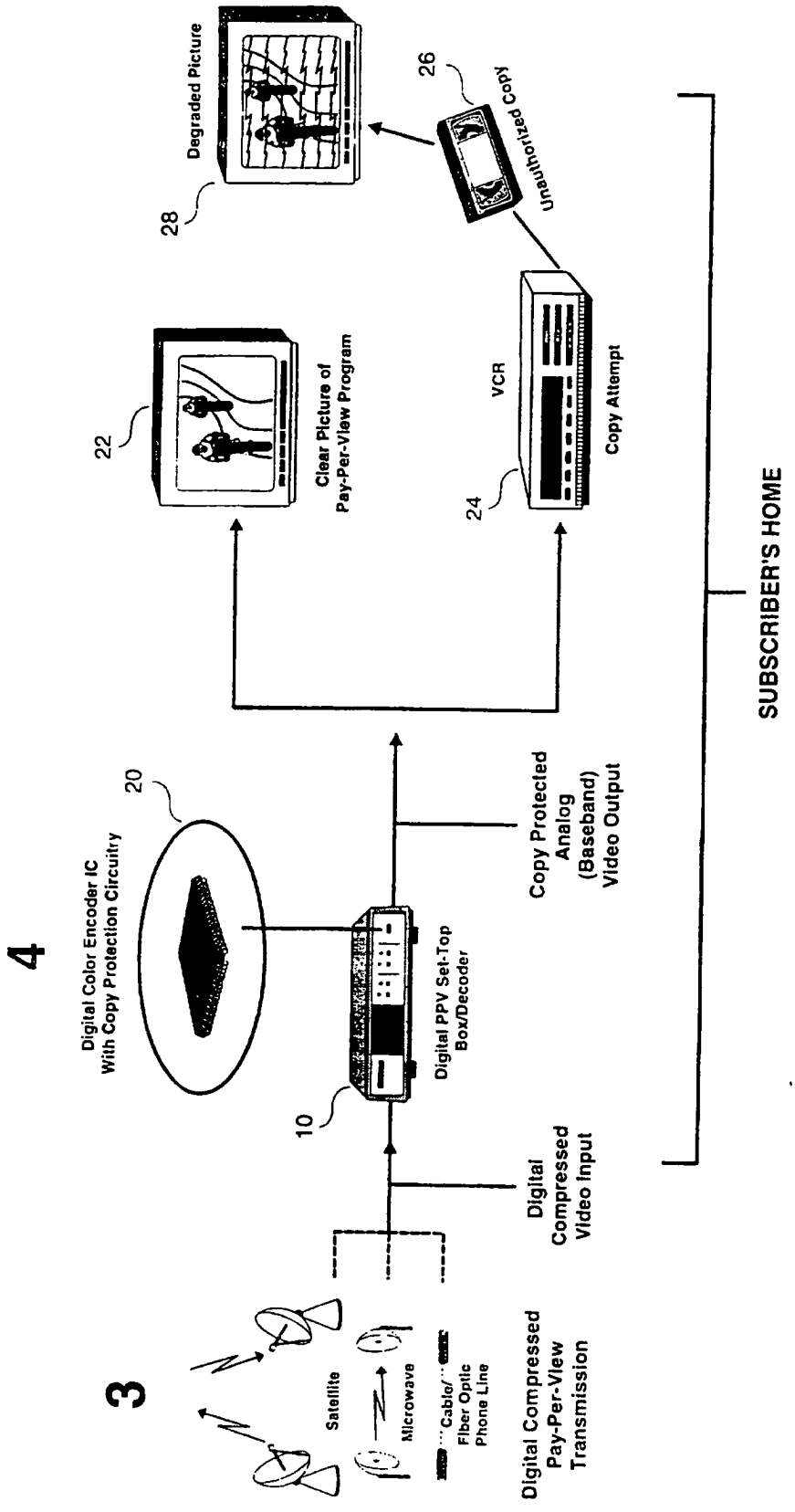
3
Satellite
Microwave
Cable/Fiber Optic Phone Line
Digital Compressed Pay-Per-View Transmission
Digital Compressed Video Input
10
Digital PPV Set-Top Box/Decoder
4
Digital Color Encoder IC With Copy Protection Circuitry
20
Copy Protected Analog (Baseband) Video Output
22
Clear Picture of Pay-Per-View Program
24
VCR
Copy Attempt
26
Unauthorized Copy
28
Degraded Picture
SUBSCRIBER'S HOME

FIG. 2

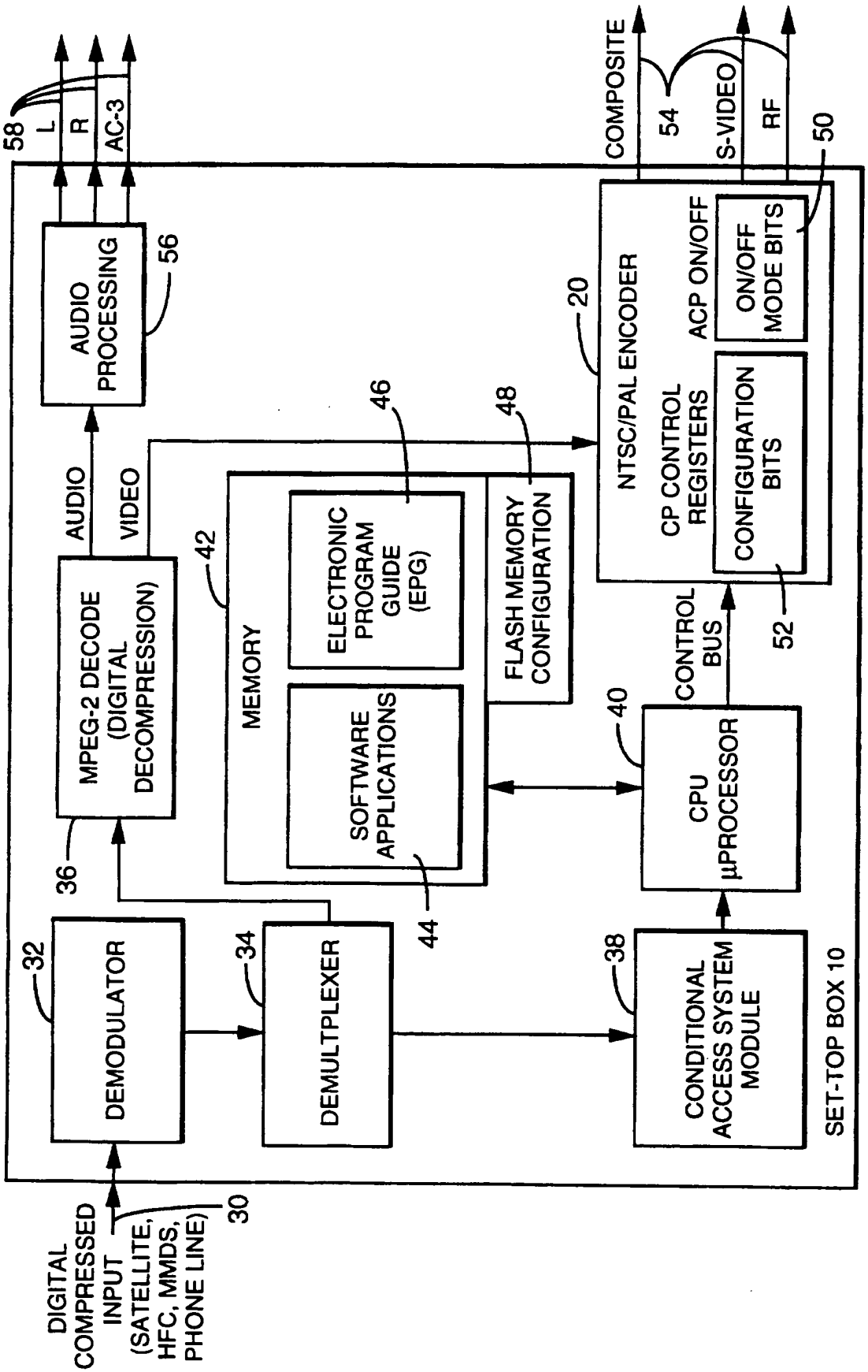
DIGITAL COMPRESSED INPUT (SATELLITE, HFC, MMDS, PHONE LINE)
30
DEMODULATOR
32
DEMULTPLEXER
34
MPEG-2 DECODE (DIGITAL DECOMPRESSION)
36
AUDIO
VIDEO
AUDIO PROCESSING
56
58
L
R
AC-3
MEMORY
42
ELECTRONIC PROGRAM GUIDE (EPG)
46
SOFTWARE APPLICATIONS
44
FLASH MEMORY CONFIGURATION
48
CPU µPROCESSOR
40
CONTROL BUS
CONDITIONAL ACCESS SYSTEM MODULE
38
NTSC/PAL ENCODER
20
CP CONTROL REGISTERS
CONFIGURATION BITS
52
ACP ON/OFF
ON/OFF MODE BITS
50
COMPOSITE
54
S-VIDEO
RF
SET-TOP BOX 10

FIG. 3

INTERNATIONAL SEARCH REPORT

Int. .onal Application No
PCT/US 97/05257

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04N5/913

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 691 787 A (SONY CORPORATION) 10 January 1996 see the whole document ---	1,2,5, 11,12, 15,18, 20,21, 27,29
A	US 5 315 448 A (RYAN) 24 May 1994 cited in the application see the whole document -----	1,4, 10-12, 18,20, 21,27-29

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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1

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 691787 A	10-01-96	CN 1115150 A	17-01-96
		JP 8077706 A	22-03-96
US 5315448 A	24-05-94	AU 677999 B	15-05-97
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		BR 9406002 A	02-01-96
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		JP 8507912 T	20-08-96
		PL 310623 A	27-12-95
		WO 9422266 A	29-09-94

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Published

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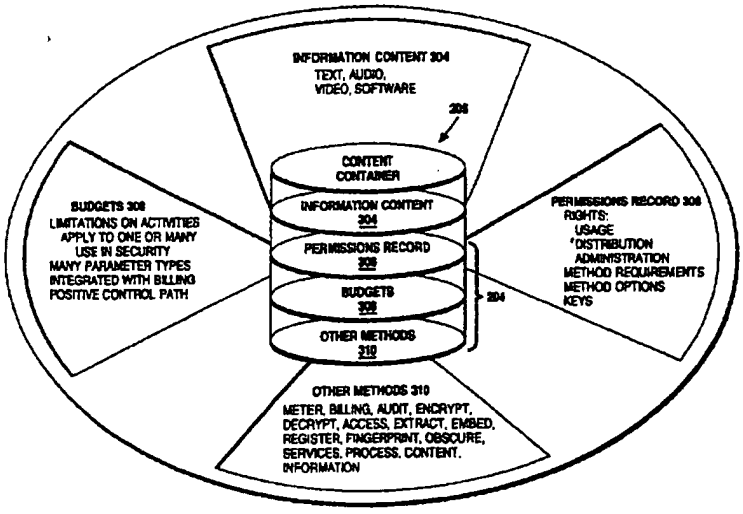
(54) Title: CRYPTOGRAPHIC METHODS, APPARATUS AND SYSTEMS FOR STORAGE MEDIAELECTRONIC RIGHTS MANAGEMENT IN CLOSED AND CONNECTED APPLIANCES

(57) Abstract

A rights management arrangement for storage media such as optical digital video disks (DVDs, also called digital versatile disks) provides adequate copy protection in a limited, inexpensive mass-produceable, low-capability platform such as a dedicated home consumer disk player and also provides enhanced, more flexible security techniques and methods when the same media are used with platforms having higher security capabilities. A control object (or set) defines plural rights management rules for instance, price for performance or rules governing redistribution. Low capability platforms may enable only a subset of the control rules such as controls on copying or marking of played material. Higher capability platforms may enable all (or different subsets) of the rules. Cryptographically strong security is provided by encrypting at least some of the information carried by the media and enabling decryption based on the control set and/or other limitations. A secure "software container" can be used to protectively encapsulate (e.g., by cryptographic techniques) various digital property content (e.g., audio, video, game, etc.) and control object (i.e., set of rules) information. A standardized container format is provided for general use on/with various mediums and platforms. In addition, a special purpose container may be provided for DVD medium and appliances (e.g., recorders, players, etc.) that contains DVD program content (digital property) and DVD medium specific rules. The techniques, systems and methods disclosed herein are capable of achieving compatibility with other protection standards, such as for example, CGMA and Matsushita data protection standards adopted for DVDs. Cooperative rights management may also be provided, where plural networked rights management arrangements collectively control a rights management event on one or more of such arrangements.



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CRYPTOGRAPHIC METHODS, APPARATUS AND SYSTEMS FOR STORAGE MEDIA ELECTRONIC RIGHTS MANAGEMENT IN CLOSED AND CONNECTED APPLIANCES

Cross-Reference to Related Applications and Patents

The specifications and drawings of the following prior, commonly assigned published patent specifications are incorporated by reference into this patent specification:

PCT Publication No. WO 96/27155 dated 6 September 1996 entitled "Systems And Methods For Secure Transaction Management And Electronic Rights Protection", which is based on PCT application no. PCT/US96/02303 filed 13 February 1996 and U.S. patent application serial no. 08/388,107 of Ginter et al. entitled filed on February 13, 1995 (hereinafter "Ginter et al");

U.S. Patent No 4,827,508 entitled "Database Usage Metering and Protection System and Method" dated May 2, 1989;

U.S. Patent No. 4,977,594 entitled "Database Usage Metering and Protection System and Method" dated December 11, 1990;

U.S. Patent No. 5,050,213 entitled "Database Usage Metering and Protection System and Method" dated September 17, 1991; and

U.S. Patent No. 5,410,598 entitled "Database Usage Metering and Protection System and Method" dated April 25, 1995; and

European Patent No.EP 329681 entitled "Database Usage Metering and Protection System and Method" dated January 17, 1996.

In addition, the specifications and drawings of the following commonly-assigned prior-filed patent specifications are incorporated by reference into this patent application:

PCT Application No. PCT/US96/14262 filed 4 September 1996 entitled "Trusted Infrastructure Support Systems, Methods And Techniques For Secure Electronic Commerce, Electronic Transactions, Commerce Process Control And Automation, Distributed Computing, And Rights Management," which corresponds to U.S. patent application serial no. 08/699,712 filed on August 12, 1996 (hereinafter "Shear et al.");

PCT Application No. _____ filed _____, 1997 entitled "Steganographic Techniques For Securely Delivering Electronic Digital Rights Management Control Information Over Insecure Communications Channels," which corresponds to U.S. patent application serial no. 08/689,606 of Van Wie and Weber filed on August 12, 1996 (hereinafter "Van Wie and Weber"); and

PCT Application No. _____ filed _____, 1997 based on U.S. Patent Application serial no.08/689,754 entitled "Systems and Methods Using Cryptography To Protect Secure Computing Environments," of Sibert and Van Wie filed on August 12, 1996 (hereinafter "Sibert and Van Wie").

FIELD OF THE INVENTION

This invention relates to information protection techniques using cryptography, and more particularly to techniques using cryptography for managing rights to information stored on portable media -- one example being optical media such as Digital Video Disks (also known as "Digital Versatile Disks" and/or "DVDs"). This invention also relates to information protection and rights management techniques having selectable applicability depending upon, for example, the resources of the device being

used by the consumer (e.g., personal computer or standalone player), other attributes of the device (such as whether the device can be and/or typically is connected to an information network ("connected" versus "unconnected")), and available rights. This invention further relates, in part, to cooperative rights management -- where plural networked rights management arrangements collectively control a rights management event on one or more of such arrangements. Further, important aspects of this invention can be employed in rights management for electronic information made available through broadcast and/or network downloads and/or use of non-portable storage media, either independent of, or in combination with portable media.

BACKGROUND OF THE INVENTION

The entertainment industry has been transformed by the pervasiveness of home consumer electronic devices that can play video and/or audio from pre-recorded media. This transformation began in the early 1900s with the invention of the phonograph—which for the first time allowed a consumer to listen to his or her favorite band, orchestra or singer in his or her home whenever he or she wishes. The availability of inexpensive video

cassette recorders/players beginning in the early 1980s brought about a profound revolution in the movie and broadcast industries, creating an entirely new home consumer market for films, documentaries, music videos, exercise videos, etc.

The entertainment industry has long searched for optimal media for distributing content to home consumers. The original phonograph cylinders distributed by Thomas Edison and other phonograph pioneers had the advantage that they were difficult to copy, but suffered from various disadvantages such as high manufacturing costs, low resistance to breakage, very limited playback time, relatively low playback quality, and susceptibility to damage from wear, scratching or melting. Later-developed wax and vinyl disks could hold more music material but suffered from many of the same disadvantages. Magnetic tapes, on the other hand, could be manufactured very inexpensively and could hold a large amount of program material (e.g., 2, 4 or even 6 hours of video and/or audio). Such magnetic tapes could reproduce program material at relatively high quality, and were not as susceptible to damage or wearing out. However, despite the many clear advantages that magnetic tape provides over other media, the

entertainment industry has never regarded it as an ideal or optimum medium because of its great susceptibility to copying.

Magnetic tape has the very flexible characteristic that it can be relatively easily recorded on. Indeed, the process for recording a magnetic tape is nearly as straightforward as that required for playing back pre-recorded content. Because of the relative ease by which magnetic tape can be recorded, home consumer magnetic tape equipment manufacturers have historically provided dual mode equipment that can both record and play back magnetic tapes. Thus, home audio and video tape players have traditionally had a "record" button that allows a consumer to record his or her own program material on a blank (un-recorded) magnetic tape. While this recording ability has given consumers additional flexibility (e.g., the ability to record a child's first words for posterity, and the ability to capture afternoon soap operas for evening viewing), it has unfortunately also been the foundation of an illegal multi-billion dollar content pirating industry that produces millions of illegal, counterfeit copies every year. This illegal pirating operation—which is international in scope—leeches huge amounts of revenue every year from the world's major

entertainment content producers. The entertainment industry must pass along these losses to honest consumers—resulting in higher box office prices, and higher video and audio tape sales and rental prices.

In the mid 1980s, the audio entertainment industry developed the optical compact disk as an answer to some of these problems. The optical compact disk—a thin, silvery plastic platter a few inches in diameter—can hold an hour or more of music or other audio programming in digital form. Such disks were later also used for computer data. The disk can be manufactured very inexpensively, and provides extremely high quality playback that is resistant to noise because of the digital techniques used to record and recover the information. Because the optical disk can be made from plastic, it is light weight, virtually unbreakable, and highly resistant to damage from normal consumer handling (unlike the prior vinyl records that were easily scratched or worn down even by properly functioning phonographs). And, because recording on an optical disk is, so far, significantly more difficult than playing back an optical disk, home consumer equipment providing both recording and playback capabilities is unlikely, in

the near future, to be as cost-effective as play-only equipment—greatly reducing the potential for illicit copying. Because of these overwhelming advantages, the music industry has rapidly embraced the new digital compact disk technology—virtually replacing older audio vinyl disk media within the space of a few short years.

Indeed, the threat of widespread and easy unauthorized copying in the absence of rights management technologies apparently has been an important contributing factor to the demise of digital audio tape (DAT) as a media for music distribution and, more importantly, home audio recording. Rightsholders in recorded music vigorously opposed the widespread commercialization of inexpensive DAT technology that lacked rights management capabilities since the quality of the digital recording was completely faithful to the digital source on, for example, music CDs. Of course, the lack of rights management was not the only factor at work, since compared with optical media, tape format made random access difficult, for example, playing songs out of sequence.

The video entertainment industry is on the verge of a revolution similar to that wrought by music CDs based on movies in digital format distributed on high capacity read-only optical media. For example, digital optical disk technology has advanced to the point where it is now possible to digitally record, among other things, a full length motion picture (plus sound) on one side of a 5" plastic optical disk. This same optical disk can accommodate multiple high-quality digital audio channels (e.g., to record multi-channel "sensurround" sound for home theaters and/or to record film dialog in multiple different languages on the same disk). This same technology makes it possible to access each individual frame or image of a movie for still image reproduction or—even more exciting—to provide an unprecedented "random access" playback capability that has never before existed in home consumer equipment. This "random access" playback could be used, for example, to delete violence, foul language or nudity at time of playback so that parents could select a "PG" playback version of an "R" rated film at the press of a button. The "random access" capability also has exciting possibilities in terms of allowing viewers to interact with the pre-recorded content (e.g.,

allowing a health enthusiast to select only those portions of an exercise video helpful to a particular day's workout). See, for example, "Applications Requirements for Innovative Video Programming," DVD Conference Proceedings (Interactive Multimedia Association, 19-20 October 1995, Sheraton Universal Hotel, Universal City, California).

Non-limiting examples of the DVD family of optical media include:

- DVD (Digital Video Disk, Digital Versatile Disk), a non-limiting example of which includes consumer appliances that play movies recorded on DVD disks;

- DVD-ROM (DVD-Read Only Memory), a non-limiting example of which includes a DVD read-only drive and disk connected to a computer or other appliance;

- DVD-RAM (DVD Random Access Memory), a non-limiting example of which includes a read/write drive and optical media in, for example, consumer appliances for home recording and in a computer or other appliance

for the broadest range of specific applications; and

- Any other high capacity optical media presently known or unknown.

"DVDs" are, of course, not limited to use with movies. Like CDs, they may also be used for other kinds of information, for example:

- sound recordings
- software
- databases
- games
- karaoke
- multimedia
- distance learning
- documentation
- policies and manuals

- any kind of digital data or other information
- any combination of kinds of digital data or other information
- any other uses presently known or unknown.

The broad range of DVD uses presents a technical challenge: how can the information content distributed on such disks, which might be any kind or combination of video, sound, or other data or information broadly speaking, be adequately protected while preserving or even maximizing consumer flexibility? One widely proposed requirement for the new technology(mainly within the context of video), is, to the extent copying is permitted at all, to either: (a) allow a consumer to make a first generation copy of the program content for their own use, but prevent the consumer from making "copies of copies", or multi-generational copies of a given property (thus keeping honest people honest); or (b) to allow unlimited copying for those properties that rightsholders do not wish to protect against copying, or which consumers have made themselves.

However, providing only such simplistic and limited copy protection in a non-extensible manner may turn out to be extremely shortsighted—since more sophisticated protection and/or rights management objectives (e.g., more robust and selective application of copy protection and other protection techniques, enablement of pay-per-view models, the ability of the consumer to make use of enhanced functionality such as extracting material or interactivity upon paying extra charges, and receiving credit for redistribution, to name a few) could be very useful now or in the future. Moreover, in optimally approaching protection and rights management objectives, it is extremely useful to take differing business opportunities and threats into account that may relate to information delivered via DVD media, for example, depending upon available resources of the device and/or whether the device is connected or unconnected.

More sophisticated rights management capabilities will also allow studios and others who have rights in movies and/or sound recordings to better manage these important assets, in one example, to allow authorized parties to repurpose pieces of digital film, video and/or audio, whether specific and/or arbitrary pieces,

to create derivative works, multimedia games, in one non-limiting example. Solutions proposed to date for protecting DVD content have generally focused solely on limited copy protection objectives and have failed to adequately address or even recognize more sophisticated rights management objectives and requirements. More specifically, one copy protection scheme for the initial generation of DVD appliances and media is based on an encryption method developed initially by Matsushita and the simple CGMA control codes that indicate permitted copying: a one-generation copy, no copies, or unlimited copying.

SUMMARY OF THE INVENTIONS

Comprehensive solutions for protecting and managing information in systems that incorporate high capacity optical media such as DVD require, among other things, methods and systems that address two broad sets of problems: (a) digital to analog conversion (and vice versa); and (b) the use of such optical media in both connected and unconnected environments. The inventions disclosed herein address these and other problems. For example, in the context of analog to digital conversion (and vice versa), it is contemplated that, in accordance with the present

inventions, at least some of the information used to protect properties and/or describe rights management and/or control information in digital form could also be carried along with the analog signal. Devices that convert from one format and/or medium to another can, for example, incorporate some or all of the control and identifying information in the new context(s), or at least not actively delete such information during the conversion process. In addition, the present inventions provide control, rights management and/or identification solutions for the digital realm generally, and also critically important technologies that can be implemented in consumer appliances, computers, and other devices. One objective of the inventions is to provide powerful rights management techniques that are useful in both the consumer electronics and computer technology markets, and that also enable future evolution of technical capabilities and business models. Another non-limiting objective is to provide a comprehensive control, rights management and/or identification solution that remains compatible, where possible, with existing industry standards for limited function copy protection and for encryption.

The present inventions provide rights management and protection techniques that fully satisfy the limited copy protection objectives currently being voiced by the entertainment industry for movies while also flexibly and extensibly accommodating a wide range of more sophisticated rights management options and capabilities.

Some important aspects of the present inventions (that are more fully discussed elsewhere in this application) include:

- Selection of control information associated with information recorded on DVD media (for example, rules and usage consequence control information, that comprise non-limiting example elements of a Virtual Distribution Environment (VDE)) that is based at least in part on class of appliance, for example, type of appliance, available resources and/or rights;

- Enabling such selected control information to be, at least in part, a subset of control information used on other appliances and/or classes of appliance, or completely different control information;

- Protecting information output from a DVD device, such as applying rights management techniques disclosed in Ginter et al. and the present application to the signals transmitted using an IEEE 1394 port (or other serial interface) on a DVD player;

- Creation of protected digital content based on an analog source;

- Reflecting differing usage rights and/or content availability in different countries and/or regions of the world;

- Securely managing information on DVD media such that certain portions may be used on one or more classes of appliance (e.g., a standalone DVD player), while other portions may be used on the same or different classes of appliance (e.g., a standalone DVD player or a PC);

- Securely storing and/or transmitting information associated with payment, auditing, controlling and/or otherwise managing content recorded on DVD media, including techniques related to those disclosed in Ginter et al. and in Shear et al.;

- Updating and/or replacing encryption keys used in the course of appliance operation to modify the scope of information that may be used by appliances and/or classes of appliances;

- Protecting information throughout the creation, distribution, and usage process, for example, by initially protecting information collected by a digital camera, and continuing protection and rights management through the editing process, production, distribution, usage, and usage reporting.

- Allowing "virtual rights machines," consisting of multiple devices and/or other systems that participate and work together in a permanently or in a temporarily connected network to share some or all of the rights management for a single and/or multiple nodes including, for example, allowing resources available in plural such devices and/or other systems, and/or rights associated with plural parties and/or groups using and/or controlling such devices and/or other systems, to be employed in concert (according to rights related rules and controls) so as to govern one or more electronic

events on any one or more of such devices and/or other systems, such event governance including, for example: viewing, editing, subsetting, anthologizing, printing, copying, titling, extracting, saving, and/or redistributing rights protected digital content.

- Allowing for the exchange of rights among peer-to-peer relating devices and/or other systems, wherein such devices and/or other systems participate in a temporary or permanently connected network, and wherein such rights are bartered, sold for currency, and/or otherwise exchanged for value and/or consideration where such value and/or consideration is exchanged between such peer-to-peer participating commercial and/or consumer devices and/or other systems.

General Purpose DVD/Cost-effective Large Capacity Digital Media Rights Protection and Management

The inventions described herein can be used with any large capacity storage arrangement where cost-effective distribution media is used for commercial and/or consumer digital information delivery and DVD, as used herein, should be read to include any such system.

Copy protection and rights management are important in practical DVD systems and will continue to be important in other large capacity storage, playback, and recording systems, presently known or unknown, in the future. Protection is needed for some or all of the information delivered (or written) on most DVD media. Such protection against copying is only one aspect of rights management. Other aspects involve allowing rightsholders and others to manage their commercial interests (and to have them enforced, potentially at a distance in time and/or space) regardless of distribution media and/or channels, and the particular nature of the receiving appliance and/or device. Such rights management solutions that incorporate DVD will become even more significant as future generations of recordable DVD media and appliances come to market. Rightsholders will want to maintain and assert their rights as, for example, video, sound recordings, and other digital properties are transmitted from one device to another and as options for recording become available in the market.

The apparent convergence between consumer appliances and computers, increasing network and modem speeds, the declining cost of computer power and bandwidth, and the

increasing capacity of optical media will combine to create a world of hybrid business models in which digital content of all kinds may be distributed on optical media played on at least occasionally connected appliances and/or computers, in which the one-time purchase models common in music CDs and initial DVD movie offerings are augmented by other models, for example, lease, pay per view, and rent to own, to name just few. Consumers may be offered a choice among these and other models from the same or different distributors and/or other providers. Payment for use may happen over a network and/or other communications channel to some payment settlement service. Consumer usage and audit information may flow back to creators, distributors, and/or other participants. The elementary copy protection technologies for DVD now being introduced cannot support these and other sophisticated models.

As writable DVD appliances and media become available, additional hybrid models are possible, including, for example, the distribution of digital movies over satellite and cable systems. Having recorded a movie, a consumer may elect a lease, rental, pay-per-view, or other model if available. As digital television

comes to market, the ability of writable DVDs to make faithful copies of on-air programming creates additional model possibilities and/or rights management requirements. Here too, simplistic copy protection mechanisms currently being deployed for the initial read-only DVD technologies will not suffice.

Encryption Is A Means, Not An End

Encryption is useful in protecting intellectual properties in digital format, whether on optical media such as DVD, on magnetic media such as disk drives, in the active memory of a digital device and/or while being transmitted across computer, cable, satellite, and other kinds of networks or transmission means. Historically, encryption was used to send secret messages. With respect to DVD, a key purpose of encryption is to require the use of a copy control and rights management system in order to ensure that only those authorized to do so by rightsholders can indeed use the content.

But encryption is more of a means, rather than an end. A central issue is how to devise methods for ensuring, to the maximal extent possible, that only authorized devices and parties can decrypt the protected content and/or otherwise use information

only to the extent permitted by the rightsholder(s) and/or other relevant parties in the protected content.

The Present Inventions

The present inventions provide powerful right management capabilities. In accordance with one aspect provided by the present invention, encrypted digital properties can be put on a DVD in a tamper-resistant software "container" such as, for example, a "DigiBox" secure container, together with rules about "no copy" and/or "copy" and/or "numbers of permitted copies" that may apply and be enforced by consumer appliances. These same rules, and/or more flexible and/or different rules, can be enforced by computer devices or other systems that may provide more and/or different capabilities (e.g., editing, excerpting, one or more payment methods, increased storage capability for more detailed audit information, etc.). In addition, the "software container" such as for example, a "DigiBox" secure container, can store certain content in the "clear" (that is, in unencrypted form). For example, movie or music titles, copyright statements, audio samples, trailers, and/or advertising can be stored in the clear and/or could be displayed by any appropriate application or

device. Such information could be protected for authenticity (integrity) when available for viewing, copying, and/or other activities. At the same time, valuable digital properties of all kinds-film, video, image, text, software, and multimedia— may be stored at least partially encrypted to be used only by authorized devices and/or applications and only under permitted, for example rightsholder-approved, circumstances.

Another aspect provided in accordance with the present invention (in combination with certain capabilities disclosed in Ginter et al.) is that multiple sets of rules could be stored in the same "container" on a DVD disk. The software then applies rules depending on whether the movie, for example, was to be played by a consumer appliance or computer, whether the particular apparatus has a backchannel (e.g., an on-line connection), the national and/or other legal or geographic region in which the player is located and/or the movie is being displayed, and/or whether the apparatus has components capable of identifying and applying such rules. For example, some usage rules may apply when information is played by a consumer device, while other rules may apply when played by a computer. The choice of rules

may be left up to the rightsholder(s) and/or other participants-- or some rules may be predetermined (e.g., based on the particular environment or application). For example, film rightsholders may wish to limit copying and ensure that excerpts are not made regardless of the context in which the property is played. This limitation might be applied only in certain legal or geographic areas. Alternatively, rightsholders of sound recordings may wish to enable excerpts of predetermined duration (e.g., no more than 20 seconds) and that these excerpts are not used to construct a new commercial work. In some cases, governments may require that only "PG" versions of movies and/or the equivalent rating for TV programs may be played on equipment deployed in their jurisdiction, and/or that the applicable taxes, fees and the like are automatically calculated and/or collected if payments related to content recorded on DVD is requested and/or performed (e.g., pay-per-use of a movie, game, database, software product, etc.; and/or orders from a catalog stored at least in part on DVD media, etc.).

In a microprocessor controlled (or augmented) digital consumer appliance, such rules contemplated by the present

inventions can be enforced, for example, without requiring more than a relatively few additions to a central, controlling microprocessor (or other CPU, a IEEE 1394 port controller, or other content handling control circuitry), and/or making available some ROM or flash memory to hold the necessary software. In addition, each ROM (or flash or other memory, which such memory may be securely connected to, or incorporated into, such control circuitry in a single, manufactured component) can, in one example, contain one or more digital documents or "certificate(s)" that uniquely identifies a particular appliance, individual identity, jurisdiction, appliance class(es), and/or other chosen parameters. An appliance can, for example, be programmed to send a copy of a digital property to another digital device only in encrypted form and only inside a new, tamper-resistant "software container." The container may also, for example, carry with it a code indicating that it is a copy rather than an original that is being sent. The device may also put a unique identifier of a receiving device and/or class of devices in the same secure container. Consequently, for example, in one particular arrangement, the copy may be playable only on the intended receiving device,

class(es) of devices, and/or devices in a particular region in one non-limiting example and rights related to use of such copy may differ according to these and/or other variables.

The receiving device, upon detecting that the digital property is indeed a copy, can, for example, be programmed not to make any additional copies that can be played on a consumer device and/or other class(es) of devices. If a device detects that a digital property is about to be played on a device and/or other class(es) of devices other than the one it was intended for, it can be programmed to refuse to play that copy (if desired).

The same restrictions applied in a consumer appliance can, for example, be enforced on a computer equipped to provide rights management protection in accordance with the present inventions. In this example, rules may specify not to play a certain film and/or other content on any device other than a consumer appliance and/or classes of appliances, for example. Alternatively, these same powerful capabilities could be used to specify different usage rules and payment schemes that would apply when played on a computer (and/or in other appliances and/or classes of appliances), as the rightsholder(s) may desire, for example,

different pricing based upon different geographic or legal locales where content is played.

In addition, if "backchannels" are present—for example, set-top boxes with bi-directional communications or computers attached to networks—the present inventions contemplate electronic, independent delivery of new rules if desired or required for a given property. These new rules may, for example, specify discounts, time-limited sales, advertising subsidies, and/or other information if desired. As noted earlier, determination of these independently delivered rules is entirely up to the rightsholder(s) and/or others in a given model.

The following are two specific examples of a few aspects of the present invention discussed above:

1. An Analog To Digital Copying Example

a) Bob has a VHS tape he bought (or rented) and wants to make a copy for his own use. The analog film has copy control codes embedded so that they do not interfere with the quality of the signal. Bob has a writable DVD appliance

that is equipped to provide rights management protection in accordance with the present invention. Bob's DVD recorder detects the control codes embedded in the analog signal (for example, such recorder may detect watermarks and/or fingerprints carrying rights related control and/or usage information), creates a new secure container to hold the content rules and describe the encoded film, and creates new control rules (and/or delivers to a secure VDE system for storage and reporting certain usage history related information such as user name, time, etc.) based on the analog control codes and/or other information it detected and that are then placed in the DigiBox and/or into a secure VDE installation data store such as a secure data base. Bob can play that copy back on his DVD appliance whenever he chooses.

b) Bob gives the DVD disk he recorded to Jennifer who wishes to play it on computer that has a DVD drive. Her computer is equipped to provide rights management protection in accordance with the present invention. Her computer opens the "DigiBox," detects that this copy is being used on a device different from the one that recorded it (an unauthorized device) and refuses to play the copy.

c) Bob gives the DVD disk to Jennifer as before, but now Jennifer contacts electronically a source of new rules and usage consequences, which might be the studio, a distributor, and/or a rights and permissions clearinghouse, (or she may have sufficient rights already on her player to play the copy). The source sends a DigiBox container to Jennifer with rules and consequences that permit playing the movie on her

computer while at the same time charging her for use, even though the movie was recorded on DVD by Bob rather than by the studio or other value chain participant.

2. A Digital To Analog Copying Example

a) Jennifer comes home from work, inserts a rented or owned DVD into a player connected to, or an integral part of her TV, and plays the disk. In a completely transparent way, the film is decrypted, the format is converted from digital to analog, and displayed on her analog TV.

b) Jennifer wishes to make a copy for her own use. She plays the film on an DVD device incorporating rights management protection in accordance with the present invention, that opens the DigiBox secure container, accesses the control information, and decrypts the film.

She records the analog version on her VCR which records a high-quality copy.

c) Jennifer gives the VCR copy to Doug who wishes to make a copy of the analog tape for his own use, but the analog control information forces the recording VCR to make a lower-quality copy, or may prevent copying. In another non-limiting example, more comprehensive rights management information may be encoded in the analog output using the methods and/or systems described in more detail in the above referenced Van Wie and Weber patent application.

In accordance with one aspect provided by this invention, the same portable storage medium, such as a DVD, can be used with a range of different, scaled protection environments providing different protection capabilities. Each of the different environments may be enabled to use the information carried by the portable storage medium based on rights management techniques and/or capabilities supported by the particular environment. For

example, a simple, inexpensive home consumer disk player may support copy protection and ignore more sophisticated and complex content rights the player is not equipped to enable. A more technically capable and/or secure platform (e.g., a personal computer incorporating a secure processing component possibly supported by a network connection, or a "smarter" appliance or device) may, for example, use the same portable storage medium and provide enhanced usage rights related to use of the content carried by the medium based on more complicated rights management techniques (e.g., requiring payment of additional compensation, providing secure extraction of selected content portions for excerpting or anthologizing, etc.). For example, a control set associated with the portable storage medium may accommodate a wide variety of different usage capabilities—with the more advanced or sophisticated uses requiring correspondingly more advanced protection and rights management enablement found on some platforms and not others. Lower-capability environments can, as another example, ignore (or not enable or attempt to use) rights in the control set that they don't understand, while higher-capability environments (having awareness of the

overall capabilities they provide), may, for example, enable the rights and corresponding protection techniques ignored by the lower-capability environments.

In accordance with another aspect provided by the invention, a media- and platform-independent security component can be scaled in terms of functionality and performance such that the elementary rights management requirements of consumer electronics devices are subsets of a richer collection of functionality that may be employed by more advanced platforms. The security component can be either a physical, hardware component, or a "software emulation" of the component. In accordance with this feature, an instance of medium (or more correctly, one version of the content irrespective of media) can be delivered to customers independently of their appliance or platform type with the assurance that the content will be protected. Platforms less advanced in terms of security and/or technical capabilities may provide only limited rights to use the content, whereas more advanced platforms may provide more expansive rights based on correspondingly appropriate security conditions and safeguards.

In accordance with a further aspect provided by the present invention, mass-produced, inexpensive home consumer DVD players (such as those constructed, for example, with minimum complexity and parts count) can be made to be compatible with the same DVDs or other portable storage media used by more powerful and/or secure platforms (such as, for example, personal computers) without degrading advanced rights management functions the storage media may provide in combination with the more powerful and/or secure platforms. The rights management and protection arrangement provided and supported in accordance with this aspect of the invention thus supports inexpensive basic copy protection and can further serve as a commercial convergence technology supporting a bridging that allows usage in accordance with rights of the same content by a limited resource consumer device while adequately protecting the content and further supporting more sophisticated security levels and capabilities by (a) devices having greater resources for secure rights management, and/or (b) devices having connectivity with other devices or systems that can supply further secure rights management resources. This aspect of the invention allows

multiple devices and/or other systems that participate and work together in a permanently or temporarily connected network to share the rights management for at least one or more electronic events (e.g., managed through the use of protected processing environments such as described in Ginter et al.) occuring at a single, or across multiple nodes and further allows the rights associated with parties and/or groups using and/or controlling such multiple devices and/or other systems to be employed according to underlying rights related rules and controls, this allowing, for example, rights available through a corporate executive's device to be combined with or substitute for, in some manner, the rights of one or more subordinate corporate employees when their computing or other devices of these parties are coupled in a temporary networking relationship and operating in the appropriate context. In general, this aspect of the invention allows distributed rights management for DVD or otherwise packaged and delivered content that is protected by a distributed, peer-to-peer rights management.Such distributed rights management can operate whether the DVD appliance or oth- electronic information usage device is participatin

permanently or temporarily connected network and whether or not the relationships among the devices and/or other systems participating in the distributed rights management arrangement are relating temporarily or have a more permanent operating relationship. In this way, the same device may have different rights available depending on the context in which that device is operating (e.g., in a corporate environment such as in collaboration with other individuals and/or with groups, in a home environment internally and/or in collaboration with external one or more specified individuals and/or other parties, in a retail environment, in a classroom setting as a student where a student's notebook might cooperate in rights management with a classroom server and/or instructor PC, in a library environment where multiple parties are collaboratively employing differing rights to use research materials, on a factory floor where a hand held device works in collaboration with control equipment to securely and appropriately perform proprietary functions, and so on).

For example, coupling a limited resource device arrangement, such as a DVD appliance, with an inexpensive network computer (NC), or a personal computer (PC), may allow

an augmenting (or replacing) of rights management capabilities and/or specific rights of parties and/or devices by permitting rights management to be a result of a combination of some or all of the rights and/or rights management capabilities of the DVD appliance and those of an Network or Personal Computer (NC or PC). Such rights may be further augmented, or otherwise modified or replaced by the availability of rights management capabilities provided by a trusted (secure) remote network rights authority.

These aspects of the present invention can allow the same device, in this example a DVD appliance, to support different arrays, e.g., degrees, of rights management capabilities, in disconnected and connected arrangements and may further allow available rights to result from the availability of rights and/or rights management capabilities resulting from the combination of rights management devices and/or other systems. This may include one or more combinations of some or all of the rights available through the use of a "less" secure and/or resource poor device or system which are augmented, replaced, or otherwise modified through connection with a device or system that is

"more" or "differently" secure and/or resource rich and/or possesses differing or different rights, wherein such connection employs rights and/or management capabilities of either and/or both devices as defined by rights related rules and controls that describe a shared rights management arrangement.

In the latter case, connectivity to a logically and/or physically remote rights management capability can expand (by, for example, increasing the available secure rights management resources) and/or change the character of the rights available to the user of the DVD appliance or a DVD appliance when such device is coupled with an NC, personal computer, local server, and/or remote rights authority. In this rights augmentation scenario, additional content portions may be available, pricing may change, redistribution rights may change (e.g., be expanded), content extraction rights may be increased, etc.

Such "networking rights management" can allow for a combination of rights management resources of plural devices and/or other systems in diverse logical and/or physical relationships, resulting in either greater or differing rights through the enhanced resources provided by connectivity with one or more

"remote" rights authorities. Further, while providing for increased and/or differing rights management capability and/or rights, such a connectivity based rights management arrangement can support multi-locational content availability, by providing for seamless integration of remotely available content, for example, content stored in remote, Internet world wide web-based, database supported content repositories, with locally available content on one or more DVD discs.

In this instance, a user may experience not only increased or differing rights but may use both local DVD content and supplementing content (i.e., content that is more current from a time standpoint, more costly, more diverse, or complementary in some other fashion, etc.). In such an instance, a DVD appliance and/or a user of a DVD appliance (or other device or system connected to such appliance) may have the same rights, differing, and/or different rights applied to locally and remotely available content, and portions of local and remotely available content may themselves be subject to differing or different rights when used by a user and/or appliance. This arrangement can support an overall, profound increase in user content opportunities that are seamlessly

integrated and efficiently available to users in a single content searching and/or usage activity by exploiting the rights management and content resources of plural, connected arrangements.

Such a rights augmenting remote authority may be directly coupled to a DVD appliance and/or other device by modem, or directly or indirectly coupled through the use of an I/O interface, such as a serial 1394 compatible controller (e.g., by communicating between a 1394 enabled DVD appliance and a local personal computer that functions as a smart synchronous or asynchronous information communications interface to such one or more remote authorities, including a local PC or NC or server that serves as a local rights management authority augmenting and/or supplying the rights management in a DVD appliance).

In accordance with yet another aspect provided by this invention, rights provided to, purchased, or otherwise acquired by a participant and/or participant DVD appliance or other system can be exchanged among such peer-to-peer relating devices and/or other systems through the use of one or more permenantly or temporarily networked arrangments. In such a case, rights may be

bartered, sold, for currency, otherwise exchanged for value, and/or loaned so long as such devices and/or other systems participate in a rights management system, for example, such as the Virtual Distribution Environment described in Ginter, et al., and employ rights transfer and other rights management capabilities described therein. For example, this aspect of the present invention allows parties to exchange games or movies in which they have purchased rights. Continuing the example, an individual might buy some of a neighbor's usage rights to watch a movie, or transfer to another party credit received from a game publisher for the successful superdistribution of the game to several acquaintances, where such credit is transferred (exchanged) to a friend to buy some of the friend's rights to play a different game a certain number of times, etc.In accordance with yet another aspect provided by this invention, content carried by a portable storage medium such as a DVD is associated with one or more encryption keys and a secure content identifier. The content itself (or information required to use the content) is at least partially cryptographically encrypted—with associated decryption keys being required to decrypt the content before the content can be

used. The decryption keys may themselves be encrypted in the form of an encrypted key block. Different key management and access techniques may be used, depending on the platform.

In accordance with still yet another aspect provided by this invention, electronic appliances that "create" digital content (or even analog content) —e.g., a digital camera/video recorder or audio recorder—can be readily equipped with appropriate hardware and/or software so as to produce content that is provided within a secure container at the outset. For example, content recorded by a digital camera could be immediately packaged in a secure container by the camera as it is recording. The camera could then output content already packaged in a secure container(s). This could preclude the need to encapsulate the content at a later point in time or at a later production stage, thus, saving at least one production-process step in the overall implementation of electronic rights management in accordance with the present invention. Moreover, it is contemplated that the very process of "reading" content for use in the rights management environment might occur at many steps along a conventional production and distribution process (such as during editing and/or

the so called "pressing" of a master DVD or audio disk, for example). Accordingly, another significant advantage of the present invention is that rights management of content essentially can be extended throughout and across each appropriate content creation, editing, distribution, and usage stages to provide a seamless content protection architecture that protects rights throughout an entire content life cycle.

In one example embodiment, the storage medium itself carries key block decryption key(s) in a hidden portion of the storage medium not normally accessible through typical access and/or copying techniques. This hidden key may be used by a drive to decrypt the encrypted key block—such decrypted key block then being used to selectively decrypt content and related information carried by the medium. The drive may be designed in a secure and tamper-resistant manner so that the hidden keys are never exposed outside of the drive to provide an additional security layer.

In accordance with another example embodiment, a video disk drive may store and maintain keys used to decrypt an encrypted key block. The key block decryption keys may be

stored in a drive key store, and may be updatable if the video disk drive may at least occasionally use a communications path provided, for example, by a set top box, network port or other communications route.

In accordance with a further example embodiment, a virtual distribution environment secure node including a protected processing environment such as a hardware-based secure processing unit may control the use of content carried by a portable storage medium such as a digital video disk in accordance with control rules and methods specified by one or more secure containers delivered to the secure node on the medium itself and/or over an independent communications path such as a network.

Certain conventional copy protection for DVD currently envisions CGMA copy protection control codes combined with certain encryption techniques first proposed apparently by Matsushita Corporation. Notwithstanding the limited benefits of this approach to digital property protection, the present invention is capable of providing a supplementary, compatible, and far more comprehensive rights management system while also providing

additional and/or different options and solutions. The following are some additional examples of advantageous features provided in accordance with the inventions:

- Strong security to fully answer content supplier needs.

- Value chain management automation and efficiencies including distributed rights protection, "piece of the tick" payment disaggregation to value chain participants, cost-effective micro-transaction management, and superdistribution, including offline micropayment and microtransaction support for at least occasionally connected devices.

- Simplified, more efficient channel management including support for the use of the same content deliverable on limited resource, greater resource, standalone, and/or connected devices.

- Can be used with any medium and application type and/or all forms of content and content models -- not just compressed video and sound as in some prior techniques and supports the use of copies of the same or materially the

same content containers across a wide variety of media delivery systems (e.g., broadcast, Internet repository, optical disc, etc) for operation on a wide variety of different electronic appliances (e.g., digital cameras, digital editing equipment, sound recorders, sound editing equipment, movie theater projectors, DVD appliances, broadcast tape players, personal computers, smart televisions, etc).

- Asset management and revenue and/or other consideration maximizing through important new content revenue and/or other consideration opportunities and the enhancement of value chain operating efficiencies.

- Is capable of providing 100% compatibility with the other protection techniques such as, for example, CGMA protection codes and/or Matsushita data scrambling approaches to DVD copy protection.

- Can be employed with a variety of existing data scrambling or protection systems to provide very high degrees of compatibility and/or level of functionality.

- Allows DVD technology to become a reusable, programmable, resource for an unlimited variety of entertainment, information commerce, and cyberspace business models.

- Enables DVD drive and/or semiconductor component manufacturers and/or distributors and/or other value adding participants to become providers of, and rights holders in, the physical infrastructure of the emerging, connected world of the Internet and Intranets where they may charge for the use of a portion (e.g., a portion they provided) of the distributed, physical infrastructure as that portion participates in commercial networks. Such manufacturers and/or distributors and/or other value adding participants can enjoy the revenue benefits resulting from participation in a "piece of the tick" by receiving a small portion of the revenue received as a result of a participating transaction.

- Provides automated internationalization, regionalization, and rights management in that:

  -- DVD content can be supplied with arrays of different rule sets for

automatic use depending on rights and identity of the user; and

-- Societal rights, including taxes, can be handled transparently.

In addition, the DVD rights management method and apparatus of the present invention provides added benefits to media recorders/publishers in that it:

- Works with a current "keep honest people honest" philosophy.
- Can provide 100% compatibility with other protection schemes such as for example, Matsushita data scrambling and/or CGMA encoded discs.
- Can work with and/or supplement other protection schemes to provide desired degree and/or functionality, or can be used in addition to or instead of other approaches to provide additional and/or different functionality and features.

- Provides powerful, extensible rights management that reaches beyond limited copy protection models to rights management for the digitally convergent world.

- Empowers recording/publishing studios to create sophisticated asset management tools.

- Creates important business opportunities through controlled use of studio properties in additional multimedia contexts.

- Uniquely ties internationalization, regionalization, superdistribution, repurposing, to content creation processes and/or usage control.

Other aspects of the present invention provide benefits to other types of rightsholders, such as for example:

- Persistent, transparent protection of digital content—globally, through value chain and process layers.

- Significant reduction in revenue loss from copying and pass-along.

- Converts "pass-along," copying, and many forms of copyright infringement from a strategic business threat to a fundamental business opportunity.

- A single standard for all digital content regardless of media and/or usage locality and other rights variables.

- Major economies of scale and/or scope across industries, distribution channels, media, and content type.

- Can support local usage governance and auditing within DVD players allowing for highly efficient micro-transaction support, including multiparty microtransactions and transparent multiparty microtransactions.

- Empowers rightsholders to employ the broadest range of pricing, business models, and market strategies—as they see fit.

Further aspects of the present invention which may prove beneficial to DVD and other digital medium appliance manufacturers are:

- Capable of providing bit for bit compatibility with existing discs.

- Content type independent.

- Media independent and programmable/reusable.

- Highly portable transition to next generation of appliances having higher density devices and/or a writable DVD and/or other optical media format(s).

- Participation in revenue flow generated using the appliance.

- Single extensible standard for all digital content appliances.

- Ready for the future "convergent" world in which many appliances are connected in the home using, as one example, IEEE 1394 interfaces or other means (e.g., some appliances will be very much like computers and some computers will be very much like appliances).

Aspects of the present inventions provide many benefits to computer and OS manufacturers such as for example:

- Implementation in computers as an extension to the operating system, via for example, at least one transparent plug-in, and does not require modifications to computer hardware and/or operating systems.

- Easy, seamless integration into operating systems and into applications.

- Extremely strong security, especially when augmented with "secure silicon" (i.e., hardware/firmware protection apparatus fabricated on chip).

- Transforms user devices into true electronic commerce appliances.

- Provides a platform for trusted, secure rights management and event processing.

- Programmable for customization to specialized requirements.

Additional features and advantages provided in accordance with the inventions include, for example:

- Information on the medium (for example, both properties and metadata) may be encrypted or not.

- Different information (for example, properties, metadata) may be encrypted using different keys. This provides greater protection against compromise, as well as supporting selective usage rights in the context of a sophisticated rights management system.

- There may be encrypted keys stored on the medium, although this is not required. These keys may be used to decrypt the protected properties and metadata. Encrypted keys are likely to be used because that allows more keying material for the information itself, while still keeping access under control of a single key.

- Multiple sets of encrypted keys may be stored on the medium, either to have different sets of keys associated with different information, or to allow multiple control regimes to use the

same information, where each control regime may use one or more different keys to decrypt the set of encrypted keys that it uses.

- To support the ability of the player to access rights managed containers and/or content, a decryption key for the encrypted keys may be hidden on the medium in one or more locations that are not normally accessible. The "not normally accessible" location(s) may be physically enabled for drives installed in players, and disabled for drives installed in computers. The enablement may be different firmware, a jumper on the drive, etc.

- The ability of the player to access rights managed containers and/or content may also be supported by one or more stored keys inside the player that decrypts certain encrypted keys on the medium.

- Keys in a player may allow some players to play different properties than others. Keys could be added to, and/or deleted from the player by a network connection (e.g., to a PC, a cable system, and/or a modem connection to a source of new and/or additional keys and/or

key revocation information) or automatically loaded by "playing" a key distribution DVD.

- Controlling computer use may be supported by some or all of the same techniques that control player use of content and/or rights managemnt information.

- Controlling computer use of content and/or rights management information may be supported by having a computer receive, through means of a trusted rights management system, one or more appropriate keys.

- A computer may receive additional keys that permit decryption of certain encrypted keys on the medium.

- A computer may receive additional keys that permit decryption of one or more portions of encrypted data directly. This may permit selective use of information on the medium without disclosing keys (e.g., a player key that decrypts any encrypted keys).

In accordance with further aspects provided by the present invention, a secure "software container" is provided that allows:

- Cryptographically protected encapsulation of content, rights rules, and usage controls.

- Persistent protection for transport, storage, and value chain management.

- Sophisticated rules interface architecture.

Elements can be delivered independently, such as new controls, for example, regarding discount pricing (e.g. sale pricing, specific customer or group discounts, pricing based on usage patterns, etc.) and/or other business model changes, can be delivered after the property has been distributed (this is especially beneficial for large properties or physical distribution media (e.g., DVD, CD-ROM) since redistribution costs may be avoided and consumers may continue to use their libraries of discs). In addition, encrypted data can be located "outside" the container. This can allow, for example, use of data stored independently from the controls and supports "streaming" content as well as "legacy" systems (e.g., CGMS).

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and advantages provided in accordance with these inventions may be better and more completely understood by referring to the following detailed description of presently preferred examples in conjunction with the drawings, of which:

Figure 1A shows example home consumer electronics equipment for using portable storage media such as digital video disks;

Figure 1B shows example secure node equipment for using the same portable storage media but providing more advanced rights management capabilities;

Figure 1C shows an example process for manufacturing protected optical disks;

Figure 2A shows an example architecture of the Figure 1A consumer electronics equipment;

Figure 2B shows an example architecture for the Figure 1B secure node equipment;

Figure 3 shows example data structures used by the Figure 1A equipment;

Figure 3A and 3B show example control set definitions;

Figures 4A and 4B show example usage techniques provided by the Figure 1A appliance;

Figure 5 shows example data structures used by the Figure 1B secure node for accessing information on the storage medium;

Figure 6 shows an example usage technique performed by the Figure 1B secure node;

Figure 7 is a block diagram illustrating an example of a special secure software container contained on a DVD;

Figure 8 is a block diagram illustrating an example of a secure container along with the video property content stored on a DVD medium;

Figure 9 is a block diagram illustrating another example of a standard container stored on a DVD medium including an additional container having a more complex rule arrangement for use, for example, with a secure node;

Figure 10 shows an example use of a DVD having a container (i.e., stored on the medium) with a DVD player provided with a secure rights management node, and also shows use of the same DVD with a DVD player that does not have a secure rights management node;

Figure 11 is a block diagram illustrating use of a DVD that does not have a container on a DVD player that is provided with rights management secure node in accordance with the present invention as compared with use of the same DVD with a DVD player that does not have a secure node;

Figures 12-14 show example network configurations; and

Figures 15A-15C show an example virtual rights process.

DETAILED DESCRIPTION OF PRESENTLY PREFERRED EXAMPLE EMBODIMENTS

Overall Example Digital Video Disk Usage System

Figure 1A shows example inexpensive mass-produced home consumer electronics equipment 50 for using information stored on a storage medium 100 such as a portable digitally-encoded optical disk (e.g., a digital video disk or "DVD").

Consumer equipment 50 includes a dedicated disk player 52, that in some embodiments, may also have the capability to write optical media (writeable DVD disks, or "DVD-RAM") for example) as well, connected to a home color television set 54. A remote control unit 56 may be used to control the disk player 52 and/or television set 54.

In one example, disk 100 may store a feature length motion picture or other video content. Someone wishing to watch the content stored on disk 100 may purchase or rent the disk, insert the disk into player 52 and use remote control 56 (and/or controls 58 that may be provided on player 52) to control the player to play back the content via home television set 54.

In some embodiments, remote control 56 (and/or controls 58 that may be provided on device 52) may be used to control the recording of a movie, for example. Player 52 reads the digitized video and audio information carried by disk 100, converts it into signals compatible with home color television set 54, and provides those signals to the home color television set.

In some embodiments, television set 54 (and/or a set top box) provide the video signals to be recorded by device 52 on writable optical media, DVD-RAM in one non-limiting example. Television set 54 produces images on screen 54a and produces sounds through loudspeakers 54b based on the signals player 52 provides to the television set.

The same disk 100 may be used by a more advanced platform 60 shown in Figure 1B. Platform 60 may include, for example, a personal computer 62 connected to a display monitor 64, a keyboard 66, a mouse pointing device 68, and a loudspeaker 70. In this example, platform 60 may be able to play back the content stored on disk 100 in the same way as dedicated disk player 52, but may also be capable of more sophisticated and/or advanced uses of the content as enabled by the presence of secure node 72 within the platform. (In some embodiments, platform 60 may also be able to record content on writable optical media, DVD-RAM, in one non-limiting example.) For example, it may be possible, using platform 60 and its secure node 72, to interactively present the motion picture or other content such that the user may input choices via keyboard 66 and/or mouse pointing device 68

that, in real time, change the presentation provided via display 64 and loudspeaker 60.

As one example, the platform 60 user selects from options displayed on display 64 that cause the content presentation sequence to change (e.g., to provide one of a number of different endings, to allow the user to interactively control the flow of the images presented, etc.). Computer 62 may also be capable of using and manipulating digital data including for example computer programs and/or other information stored on disk 100 that player 52 cannot handle.

Secure node 72 provides a secure rights management facility that may, for example, permit more invasive or extensive use of the content stored on disk. For example, dedicated player 52 may prevent any copying of content stored by disk 100, or it may allow the content to be copied only once and never again. Platform 60 including secure node 72, on the other hand, may allow multiple copies of some or all of the same content—but only if certain conditions are met (e.g., the user of equipment 60 falls within a certain class of people, compensation at an agreed on rate is securely provided for each copy made, only certain excerpts of

the content are copied, a secure audit trail is maintained and reported for each copy so made, etc.). (In some embodiments, dedicated player 52 may send protected content only to devices authenticated as able to enforce securely rights management rules and usage consequences. In some embodiments, devices may authenticate using digital certificates, one non-limiting example being certificates conforming to the X.509 standard.) Hence, platform 60 including secure node 72 can, in this example, use the content provided by disk 100 in a variety of flexible, secure ways that are not possible using dedicated player 52—or any other appliance that does not include a secure node.

Example Secure Disk Creation and Distribution Process

Figure 1C shows an example secure process for creating a master multimedia DVD disk 100 for use with players 50, 60. In this example, a digital camera 350 converts light images (i.e., pictures) into digital information 351 representing one or a sequence of images. Digital camera 350 in this example includes a secure node 72A that protects the digital information 351 before it leaves camera 350. Such protection can be accomplished, for

example, by packaging the digital information within one or more containers and/or associating controls with the digital information.

In this example, digital camera 350 provides the protected digital image information 351 to a storage device such as, for example, a digital tape recorder 352. Tape recorder 352 stores the digital image information 351 (along with any associated controls) onto a storage medium such as magnetic tape cartridge 354 for example. Tape recorder 352 may also include a secure node 72B. Secure node 72B in this example can understand and enforce the controls that the digital camera secure node 72A applies to and/or associated with the digital information 351, and/or it may apply its own controls to the stored information.

The same or different tape recorder 352 may play back protected digital information 351 to a digital mixing board 356. Digital mixing board 356 may mix, edit, enhance or otherwise process the digital information 351 to generate processed digital information 358 representing one or a sequence of images. Digital mixing board 356 may receive additional inputs from other devices such as for example other tape recorders, other digital cameras, character generators, graphics generators, animators, or

any other image-based devices. Any or all of such devices may also include secure nodes 72 to protect the information they generate. In some embodiments, some of the digital information can be derived from equipment including a secure node, and other digital information can be derived from equipment that has no secure node. In still other embodiments, some of the digital information provided to digital mixer 356 is protected and some is not protected.

Digital mixing board 356 may also include a secure node 72C in this example. The digital mixing board secure node 72C may enforce controls applied by digital camera secure node 72A and/or tape recorder secure node 72B, and/or it may add its own protections to the digital information 358 it generates.

In this example, an audio microphone 361 receives sound and converts the sound into analog audio signals. The audio signals in this example are inputted to a digital audio tape recorder 362. In the example shown, tape recorder 362 and audio mixer 364 are digital devices. However, in other embodiments, one, the other or both of these devices may operate in the analog domain. In the example shown, digital audio tape recorder 362 converts the

analog audio signals into digital information representing the sounds, and stores the digital information (and any associated controls) onto a tape 362.

In this example, audio tape recorder 362 includes a secure node 72E that may associate controls with the information stored on tape 363. Such controls may be stored with the information on the tape 363. In another embodiment, microphone 361 may include its own internal secure node 72 that associates control information with the audio information (e.g., by steganographically encoding the audio information with control information). The tape recorder 362 may enforce such controls applied by microphone 361.

Alternatively, microphone 361 may operate in the digital domain and provide digital representations of audio, perhaps including control information supplied by secure node 72 optionally incorporated in microphone 361, directly to connected devices such as audio tape recorder 362. Digital representations may optionally be substituted for analog representations of any signals between the devices in the example Figure 1C.

The same or different tape recorder 362 may play back the information recorded on tape 363, and provide the information 366 to an audio mixer 364. Audio mixer 364 may edit, mix, or otherwise process the information 366 to produce information 368 representing one or a sequence of sounds. Audio mixer 364 may also receive inputs from other devices such as for example other tape recorders, other microphones, sound generators, musical synthesizers, or any other audio-based devices. Any or all of such devices may also include secure nodes 72 to protect the information they generate. In some embodiments, some of the digital information is derived from equipment including a secure node, and other digital information is derived from equipment that has no secure node. In still other embodiments, some of the digital information provided to audio mixer 364 is protected and some is not protected.

Audio mixer 364 in this example includes a secure node 72F that enforces the controls, if any, applied by audio tape recorder secure node 72E; and/or applies its own controls.

Digital image mixer 356 may provide digital information 358 to "DVD-RAM" equipment 360 that is capable of writing to

master disks 100 and/or to disks from which master dicks may be created Similarly, audio mixer 364 may provide digital information 368 to equipment 360. Equipment 360 records the image information 358 and audio information 368 onto master disk 100. In this example, equipment 360 may include a secure node 72D that enforces controls applied by digital camera secure node 72A, tape recorder secure node 72B, digital mixer secure node 72C audio tape recorder secure node 72E and/or audio mixer secure node 72F; and/or it may add its own protections to the digital information 358 it writes onto master disks 100. A disk manufacturer can then mass-produce disks 100(1)-100(N) based on the master disk 100 using conventional disk mass-production equipment for distribution through any channels (e.g., video and music stores, websites, movie theaters, etc.). Consumer appliances 50 shown in Figures 1A and 1B may play back the disks 100 – enforcing the controls applied to the information stored on the disks 100. Secure nodes 72 thus maintain end-to-end, persistent secure control over the images generated by digital camera 350 and the sounds generated by microphone 361 during the entire process of making, distributing and using disks 100.

In the Figure 1C example shown, the various devices may communicate with one another over so-called "IEEE 1394" high-speed digital serial busses. In this context, "IEEE 1394" refers to hardware and software standards set forth in the following standards specification incorporated by reference herein: 1394-1995 IEEE Standard for a High Performance Serial Bus, No. 1-55937-583-3 (Institute of Electrical and Electronics Engineers 1995). This specification describes a high-speed memory mapped digital serial bus that is self-configuring, hot pluggable, low cost and scalable. The bus supports isochronous and asynchronous transport at 100, 200 or 400 Mbps, and flexibly supports a number of different topologies. The specification describes a physical level including two power conductors and two twisted pairs for signalling. The specification further describes physical, link and transaction layer protocols including serial bus management. Alternatively, any other suitable electronic communication means may be substituted for the "IEEE 1394" medium shown in Figure 1C, including other wired media (e.g., Ethernet, universal serial bus), and/or wireless media based on radio-frequency (RF)

transmission, infra-red signals, and/or any other means and/or types of electronic communication.

Example Dedicated Player Architecture

Figure 2A shows an example architecture for dedicated player 52. In this example, player 52 includes a video disk drive 80, a controller 82 (e.g., including a microprocessor 84, a memory device such as a read only memory 86, and a user interface 88), and a video/audio processing block 90. Video disk drive 80 optically and physically cooperates with disk 100, and reads digital information from the disk. Controller 82 controls disk drive 80 based on program instructions executed by microprocessor 84 and stored in memory 86 (and further based on user inputs provided by user interface 88 which may be coupled to controls 58 and/or remote control unit 56). Video/audio processing block 90 converts digital video and audio information read by disk drive 80 into signals compatible with home color television set 54 using standard techniques such as video and audio decompression and the like. Video/audio processing block 90 may also insert a visual marking indicating the ownership and/or protection of the video program. Block 90 may also

introduce a digital marking indicating to a standard recording device that the content should not be recorded.

Example Secure Node Architecture

Figure 2B shows an example architecture for platform 60 shown in Figure 1B—which in this example is built around a personal computer 62 but could comprise any number of different types of appliances. In this example, personal computer 62 may be connected to an electronic network 150 such as the Internet via a communications block 152. Computer equipment 62 may include a video disk drive 80' (which may be similar or identical to the disk drive 80 included within example player 52). Computer equipment 62 may further include a microprocessor 154, a memory 156 (including for example random access memory and read only memory), a magnetic disk drive 158, and a video/audio processing block 160. Additionally, computer equipment 62 may include a tamper-resistant secure processing unit 164 or other protected processing environment. Secure node 72 shown in Figure 1B may thus be provided by a secure processing unit 164, software executing on microprocessor 154, or a combination of

the two. Different embodiments may provide secure node 72 using software-only, hardware-only, or hybrid arrangements.

Secure node 72 in this example may provide and support a a general purpose Rights Operating System employing reusable kernel and rights language components. Such a commerce-enabling Rights Operating System provides capabilities and integration for advanced commerce operating systems of the future. In the evolving electronic domain, general purpose, reusable electronic commerce capabilities that all participants can rely on will become as important as any other capability of operating systems. Moreover, a rights operating system that provides, among other things, rights and auditing operating system functions can securely handle a broad range of tasks that relate to a virtual distribution environment. A secure processing unit can, for example, provide or support many of the security functions of the rights and auditing operating system functions. The other operating system functions can, for example, handle general appliance functions. The overall operating system may, for example, be designed from the beginning to include the rights and auditing operating system functions plus the other operating

system functions, or the rights and auditing operating system functions may, in another example, be an add-on to a preexisting operating system providing the other operating system functions. Any or all of these features may be used in combination with the invention disclosed herein.

Example Disk Data Structures and Associated Protections

Figure 3 shows some example data structures stored on disk 100. In this example, disk 100 may store one or more properties or other content 200 in protected or unprotected form. Generally, in this example, a property 200 is protected if it is at least in part encrypted and/or associated information needed to use the property is at least in part encrypted and/or otherwise unusable without certain conditions having being met. For example, property 200(1) may be completely or partially encrypted using conventional secure cryptographic techniques. Another property 200(2) may be completely unprotected so that it can be used freely without any restriction. Thus, in accordance with this example, disk 100 could store both a movie as a protected property 200(1) and an unprotected interview with the actors and producers or a

"trailer" as unprotected property 200(2). As shown in this example, disk 100 may store any number of different properties 200 in protected or unprotected form as limited only by the storage capacity of the disk.

In one example, the protection mechanisms provided by disk 100 may use any or all of the protection (and/or other) structures and/or techniques described in the above-referenced Shear patents. The Shear patents describe, by way of non-exhaustive example, means for solving the problem of how to protect digital content from unauthorized use. For example, the Shear patent specifications describe, among other things, means for electronically "overseeing" -- through distributed control nodes present in client computers -- the use of digital content. This includes means and methods for fulfilling the consequences of any such use.

Non-limiting examples of certain elements described in the Shear patent specifications include:

(a) decryption of encrypted information,

(b) metering,

(c) usage control in response to a combination of derived metering information and rules set by content providers,

(d) securely reporting content usage information,

(e) use of database technology for protected information storage and delivery,

(f) local secure maintenance of budgets, including, for example, credit budgets,

(g) local, secure storage of encryption key and content usage information,

(h) local secure execution of control processes, and

(i) in many non-limiting instances, the use of optical media.

Any or all of these features may be used in combination in or with the inventions disclosed herein.

Certain of the issued Shear patents' specifications also involve database content being local and remote to users.

Database information that is stored locally at the end-user's system and complemented by remote, "on-line" database information, can, for example, be used to augment the local information, which in one example, may be stored on optical media (for example, DVD and/or CD-ROM). Special purpose semiconductor hardware can, for example, be used to provide a secure execution environment to ensure a safe and reliable setting for digital commerce activities.

The Shear patents also describe, among other things, database usage control enabled through the use of security, metering, and usage administration capabilities. The specifications describe, *inter alia*, a metering and control system in which a database, at least partially encrypted, is delivered to a user (e.g., on optical media). Non-limiting examples of such optical media may, for example, include DVD and CD-ROM. Subsequent usage can, for example, be metered and controlled in any of a variety of ways, and resulting usage information can be transmitted to a responsible party (as one example).

The Shear patent specifications also describe the generation of a bill in response to the transmitted information. Other

embodiments of the Shear patents provide, for example, unique information security inventions which involve, for example, digital content usage being limited based on patterns of usage such as the quantity of particular kinds of usage. These capabilities include monitoring the "contiguousness," and/or "logical relatedness" of used information to ensure that the electronic "conduct" of an individual does not exceed his or her licensed rights. Still other aspects of the Shear patents describe, among other things, capabilities for enabling organizations to securely and locally manage electronic information usage rights. When a database or a portion of a database is delivered to a client site, some embodiments of the Shear patents provide, for example, optical storage means (non-exhaustive examples of which include DVD and CD-ROM) as the mechanism of delivery. Such storage means can store, for example, a collection of video, audio, images, software programs, games, etc., in one example, on optical media, such as DVD and/or CD-ROM, in addition to other content such as a collection of textual documents, bibliographic records, parts catalogs, and copyrighted or uncopyrighted materials of all kinds.

Any or all of these features may be used in the embodiments herein.

One specific non-limiting embodiment could, for example, involve a provider who prepares a collection of games. The provider prepares a database "index" that stores information pertaining to the games, such as for example, the name, a description, a creator identifier, the billing rates, and the maximum number of times or total elapsed time each game may be used prior to a registration or re-registration requirement. Some or all of this information could be stored in encrypted form, in one example, on optical media, non-limiting examples of which include DVD and CD-ROM. The provider may then encrypt some or all portions of the games such that a game could not be used unless one or more encrypted portions were decrypted. Typically, decryption would not occur unless provider specified conditions were satisfied, in one example, unless credit was available to compensate for use and audit information reflecting game usage was being stored. The provider could determine, for example: which user activities he or she would allow, whether to meter such activities for audit and/or control purposes, and what, if any, limits

would be set for allowed activities. This might include, for example, the number of times that a game is played, and the duration of each play. Billing rates might be discounted, for example, based on total time of game usage, total number of games currently registered for use, or whether the customer was also registered for other services available from the same provider, etc.

In the non-limiting example discussed above, a provider might, for example, assemble all of the prepared games along with other, related information, and publish the collection on optical media, non-limiting examples of which include CD-ROM and/or DVD. The provider might then distribute this DVD disk to prospective customers. The customers could then select the games they wish to play, and contact the provider. The provider, based on its business model, could then send enabling information to each authorized customer, such as for example, including, or enabling for use, decryption keys for the encrypted portion of the selected games (alternatively, authorization to use the games may have arrived with the DVD and/or CD-ROM disk, or might be automatically determined, based on provider set criteria, by the

user's secure client system, for example, based on a user's participation in a certified user class). Using the user's client decryption and metering mechanism the customer could then make use of the games. The mechanism might then record usage information, such as for example, the number of times the game was used, and, for example, the duration of each play. It could periodically transmit this information the game provider, thus substantially reducing the administration overhead requirements of the provider's central servers. The game provider could receive compensation for use of the games based upon the received audit information. This information could be used to either bill their customers or, alternatively, receive compensation from a provider of credit.

Although games provide one convenient, non-limiting example, many of these same ideas can be easily applied to all kinds of content, all kinds of properties, including, by way of non-limiting examples:

- video,
- digitized movies,

- audio,
- images,
- multimedia,
- software,
- games,
- any other kind of property
- any combination of properties.

Other non-limiting embodiments of the Shear patent specifications support, for example, securely controlling different kinds of user activities, such as displaying, printing, saving electronically, communicating, etc. Certain aspects further apply different control criteria to these different usage activities. For example, information that is being browsed may be distinguished from information that is read into a host computer for the purpose of copying, modifying, or telecommunicating, with different cost rates being applied to the different activities (so that, for example,

the cost of browsing can be much less than the cost of copying or printing).

The Shear patent specifications also, for example, describe management of information inside of organizations by both publishers and the customer. For example, an optional security system can be used to allow an organization to prevent usage of all or a portion of an information base unless the user enters his security code. Multiple levels of security codes can be supported to allow restriction of an individual's use according to his security authorization level. One embodiment can, for example, use hardware in combination with software to improve tamper resistance, and another embodiment could employ an entirely software based system. Although a dedicated hardware/software system may under certain circumstances provide assurance against tampering, techniques which may be implemented in software executing on a non-dedicated system may provide sufficient tamper resistance for some applications. Any or all of these features may be used in combination with the technology disclosed in this patent specification.

Figures 3 Disks May Also Store Metadata, Controls and Other Information

In this example, disk 100 may also store "metadata" in protected and/or unprotected form. Player 52 uses metadata 202 to assist in using one or more of the properties 200 stored by disk 100. For example, disk 100 may store one metadata block 202(1) in unprotected form and another metadata block 202(2) in protected form. Any number of metadata blocks 202 in protected and/or unprotected form may be stored by disk 100 as limited only by the disk's storage capacity. In this example, metadata 202 comprises information used to access properties 200. Such metadata 202 may comprise, for example, frame sequence or other "navigational" information that controls the playback sequence of one or more of the properties 200 stored on disk 100. As one example, an unprotected metadata block 202 may access only selected portions of a protected property 200 to generate an abbreviated "trailer" presentation, while protected metadata block 202 may contain the frame playback sequence for the entire video presentation of the property 200. As another example, different metadata blocks 202 may be provided for different "cuts" of the

same motion picture property 200 (e.g., an R-rated version, a PG-rated version, a director's cut version, etc.).

In this example, disk 100 may store additional information for security purposes. For example, disk 100 may store control rules in the form of a control set 204—which may be packaged in the form of one or more secure containers 206. Commerce model participants can securely contribute electronic rules and controls that represent their respective "electronic" interests. These rules and controls extend a "Virtual Presence™" through which the commerce participants may govern remote value chain activities according to their respective, mutually agreed to rights. This Virtual Presence may take the form of participant specified electronic conditions (e.g., rules and controls) that must be satisfied before an electronic event may occur. These rules and controls can be used to enforce the party's rights during "downstream" electronic commerce activities. Control information delivered by, and/or otherwise available for use with, VDE content containers may, for example, constitute one or more "proposed" electronic agreements which manage the use and/or consequences of the use of such content and which can enact the

terms and conditions of agreements involving multiple parties and their various rights and obligations.

The rules and controls from multiple parties can be used, in one example, to form aggregate control sets ("Cooperative Virtual Presence™") that ensure that electronic commerce activities will be consistent with the agreements amongst value chain participants. These control sets may, for example, define the conditions which govern interaction with protected digital content (disseminated digital content, appliance control information, etc.). These conditions can, for example, be used to control not only digital information use itself, but also the consequences of such use. Consequently, the individual interests of commerce participants are protected and cooperative, efficient, and flexible electronic commerce business models can be formed. These models can be used in combination with the present invention.

Disks May Store Encrypted Information

Disk 100 may also store an encrypted key block 208. In this example, disk 100 may further store one or more hidden keys 210. In this example, encrypted key block 208 provides one or more cryptographic keys for use in decrypting one or more properties

200 and/or one or more metadata blocks 202. Key block 208 may provide different cryptographic keys for decrypting different properties 200 and/or metadata blocks 202, or different portions of the same property and/or metadata block. Thus, key block 208 may comprise a large number of cryptographic keys, all of which are or may be required if all of the content stored by disk 100 is to be used. Although key block 208 is shown in Figure 3 as being separate from container 206, it may be included within or as part of the container if desired.

Cryptographic key block 208 is itself encrypted using one or more additional cryptographic keys. In order for player 52 to use any of the protected information stored on disk 100, it must first decrypt corresponding keys within the encrypted key block 208—and then use the decrypted keys from the key block to decrypt the corresponding content.

In this example, the keys required to decrypt encrypted key block 208 may come from several different (possibly alternative) sources. In the example shown in Figure 3, disk 100 stores one or more decryption keys for decrypting key block 208 on the medium itself in the form of a hidden key(s) 210. Hidden key(s) 210 may

be stored, for example, in a location on disk 100 not normally accessible. This "not normally accessible" location could, for example, be physically enabled for drives 80 installed in players 52 and disabled for drives 80' installed in personal computers 62. Enablement could be provided by different firmware, a jumper on drive 80, etc. Hidden key(s) 210 could be arranged on disk 100 so that any attempt to physically copy the disk would result in a failure to copy the hidden key(s). In one example a hidden key(s) could be hidden in the bit stream coding sequences for one or more blocks as described by J. Hogan (Josh Hogan, "DVD Copy Protection," presentation to DVD copy protect technical meeting #4, 5/30/96, Burbank, CA.)

Alternatively, and/or in addition, keys required to decrypt encrypted key block 208 could be provided by disk drive 80. In this example, disk drive 80 might include a small decryption component such as, for example, an integrated circuit decryption engine including a small secure internal key store memory 212 having keys stored therein. Disk drive 80 could use this key store 212 in order to decrypt encrypted key block 208 without exposing either keys 212 or decrypted key block 208—and then use the

decrypted key from key block 208 to decrypt protected content 200, 202.

Disks May Store and/or Use Secure Containers

In yet another example, the key(s) required to decrypt protected content 200, 202 is provided within secure container 206. Figure 3A shows a possible example of a secure container 206 including information content 304 (properties 200 and metadata 202 may be external to the container—or alternatively, most or all of the data structures stored by video disk 100 may be included as part of a logical and/or actual protected container). The control set 204 shown in Figure 3 may comprise one or more permissions record 306, one or more budgets 308 and/or one or more methods 310 as shown in Figure 3A. Figure 3B shows an example control set 204 providing one or more encryption keys 208, one or more content identifiers 220, and one or more controls 222. In this example, different controls 222 may apply to different equipment and/or classes of equipment such as player 52 and/or computer equipment 62 depending upon the capabilities of the particular platform and/or class of platform. Additionally, controls 220 may apply to different ones of properties 200 and/or

different ones of metadata blocks 202. For example, a control 222(1) may allow property 200(1) to be copied only once for archival purposes by either player 52 or computer equipment 62. A control 222(2) (which may be completely ignored by player 52 because it has insufficient technical and/or security capabilities but which may be useable by computer equipment 62 with its secure node 72) may allow the user to request and permit a public performance of the same property 200(1) (e.g., for showing in a bar or other public place) and cause the user's credit or other account to be automatically debited by a certain amount of compensation for each showing. A third control 222(3) may, for example, allow secure node 72 (but not player 52) to permit certain classes of users (e.g., certified television advertisers and journalists) to extract or excerpt certain parts of protected property 200(1) for promotional uses. A further control 222(4) may, as another example, allow both video player 52 and secure node 72 to view certain still frames within property 200(1)—but might allow only secure node 72 to make copies of the still frames based on a certain compensation level.

Example Disks and/or System May Make Use of Trusted Infrastructure

Controls 222 may contain pointers to sources of additional control sets for one or more properties, controls, metadata, and/or other content on the optical disk. In one example, these additional controls may be obtained from a trusted third party, such as a rights and permissions clearinghouse and/or from any other value chain participant authorized by at least one rightsholder to provide at least one additional control set. This kind of rights and permissions clearinghouse is one of several distributed electronic administrative and support services that may be referred to as the "Distributed Commerce Utility," which, among other things, is an integrated, modular array of administrative and support services for electronic commerce and electronic rights and transaction management. These administrative and support services can be used to supply a secure foundation for conducting financial management, rights management, certificate authority, rules clearing, usage clearing, secure directory services, and other transaction related capabilities functioning over a vast electronic network such as the Internet and/or over organization internal Intranets, or even in-home networks of electronic appliances. Non-

limiting examples of these electronic appliances include at least occasionally connected optical media appliances, examples of which include read-only and/or writable DVD players and DVD drives in computers and convergent devices, including, for example, digital televisions and settop boxes incorporating DVD drives.

These administrative and support services can, for example, be adapted to the specific needs of electronic commerce value chains in any number of vertical markets, including a wide variety of entertainment applications. Electronic commerce participants can, for example, use these administrative and support services to support their interests, and/or they can shape and reuse these services in response to competitive business realities. Non-exhaustive examples of electronic commerce participants include individual creators, film and music studios, distributors, program aggregators, broadcasters, and cable and satellite operators.

The Distributed Commerce Utility can, for example, make optimally efficient use of commerce administration resources, and can, in at least some embodiments, scale in a practical fashion to

optimally accommodate the demands of electronic commerce growth.

The Distributed Commerce Utility may, for example, comprise a number of Commerce Utility Systems. These Commerce Utility Systems can provide a web of infrastructure support available to, and reusable by, the entire electronic community and/or many or all of its participants. Different support functions can, for example, be collected together in hierarchical and/or in networked relationships to suit various business models and/or other objectives. Modular support functions can, for example, be combined in different arrays to form different Commerce Utility Systems for different design implementations and purposes. These Commerce Utility Systems can, for example, be distributed across a large number of electronic appliances with varying degrees of distribution.

The "Distributed Commerce Utility" provides numerous additional capabilities and benefits that can be used in conjunction with the particular embodiments shown in the drawings of this application, non-exhaustive examples of which include:

- Enables practical and efficient electronic commerce and rights management.

- Provides services that securely administer and support electronic interactions and consequences.

- Provides infrastructure for electronic commerce and other forms of human electronic interaction and relationships.

- Optimally applies the efficiencies of modern distributed computing and networking.

- Provides electronic automation and distributed processing.

- Supports electronic commerce and communications infrastructure that is modular, programmable, distributed and optimally computerized.

- Provides a comprehensive array of capabilities that can be combined to support services that perform various administrative and support roles.

- Maximizes benefits from electronic automation and distributed processing to produce optimal allocation and use of resources across a system or network.

- Is efficient, flexible, cost effective, configurable, reusable, modifiable, and generalizable.

- Can economically reflect users' business and privacy requirements.

- Can optimally distribute processes -- allowing commerce models to be flexible, scaled to demand and to match user requirements.

- Can efficiently handle a full range of activities and service volumes.

- Can be fashioned and operated for each business model, as a mixture of distributed and centralized processes.

- Provides a blend of local, centralized and networked capabilities that can be uniquely shaped and reshaped to meet changing conditions.

- Supports general purpose resources and is reusable for many different models; in place infrastructure can be reused by different value chains having different requirements.

- Can support any number of commerce and communications models.

- Efficiently applies local, centralized and networked resources to match each value chain's requirements.

- Sharing of common resources spreads out costs and maximizes efficiency.

- Supports mixed, distributed, peer-to-peer and centralized networked capabilities.

- Can operate locally, remotely and/or centrally.

- Can operate synchronously, asynchronously, or support both modes of operation.

- Adapts easily and flexibly to the rapidly changing sea of commercial opportunities, relationships and constraints of "Cyberspace."

Any or all of these features may be used in combination with the inventions disclosed herein.

The Distributed Commerce Utility provides, among other advantages, comprehensive, integrated administrative and support services for secure electronic commerce and other forms of electronic interaction. These electronic interactions supported by the Distributed Commerce Utility may, in at least some embodiments, entail the broadest range of appliances and distribution media, non-limiting examples of which include networks and other communications channels, consumer appliances, computers, convergent devices such as WebTV, and optical media such as CD-ROM and DVD in all their current and future forms.

Example Access Techniques

Figures 3, 4A and 4B show example access techniques provided by player 52. In this example, upon disk 100 being loaded into player disk drive 80 (Figure 4A, block 400), the player controller 82 may direct drive 80 to fetch hidden keys 210 from disk 100 and use them to decrypt some or all of the encrypted key block 208 (Figure 4A, block 402). In this example, drive 80 may

store the keys so decrypted without exposing them to player controller 82 (e.g., by storing them within key store 212 within a secure decryption component such as an integrated circuit based decryption engine) (Figure 4A, block 404). The player 52 may control drive 80 to read the control set 204 (which may or may not be encrypted) from disk 100 (Figure 4A, block 406). The player microprocessor 82 may parse control set 204, ignore or discard those controls 222 that are beyond its capability, and maintain permissions and/or rights management information corresponding to the subset of controls that it can enforce (e.g., the "copy once" control 222(1)).

Player 52 may then wait for the user to provide a request via control inputs 58 and/or remote control unit 56. If the control input is a copy request ("yes" exit to Figure 4A, decision block 408), then player microprocessor 84 may query control 222(1) to determine whether copying is allowed, and if so, under what conditions (Figure 4A, decision block 410). Player 52 may refuse to copy the disk 100 if the corresponding control 222(1) forbids copying ("no" exit to Figure 4A, decision block 410), and may allow copying (e.g., by controlling drive 80 to sequentially access

all of the information on disk 100 and provide it to an output port not shown) if corresponding control 222(1) permits copying ("yes" exit to Figure 4A, decision block 410; block 412). In this example, player 52 may, upon making a copy, store an identifier associated with disk 100 within an internal, non-volatile memory (e.g., controller memory 86) or elsewhere if control 222(1) so requires. This stored disk identifier can be used by player 52 to enforce a "copy once" restriction (i.e., if the user tries to use the same player to copy the same disk more than once or otherwise as forbidden by control 222(1), the player can deny the request).

If the user requests one of properties 200 to be played or read ("yes" exit to Figure 4A, decision block 414), player controller 82 may control drive 80 to read the corresponding information from the selected property 200 (e.g., in a sequence as specified by metadata 202) and decrypt the read information as needed using the keys initially obtained from key block 208 and now stored within drive key storage 212 (Figure 4A, block 416).

Figure 4B is a variation on the Figure 4A process to accommodate a situation in which player 52 itself provides decryption keys for decrypting encrypted key block 208. In this

example, controller 82 may supply one or more decryption keys to drive 80 using a secure protocol such a Diffie-Hellman key agreement, or through use of a shared key known to both the drive and some other system or component to which the player 52 is or once was coupled (Figure 4B, block 403). The drive 80 may use these supplied keys to decrypt encrypted key block 208 as shown in Figure 4A, block 404, or it may use the supplied keys to directly decrypt content such as protected property 200 and/or protected metadata 202(2).

As a further example, the player 52 can be programmed to place a copy it makes of a digital property such as a film in encrypted form inside a tamper-resistant software container. The software container may carry with it a code indicating that the digital property is a copy rather than an original. The sending player 52 may also put its own unique identifier (or the unique identifier of an intended receiving device such as another player 52, a video cassette player or equipment 50) in the same secure container to enforce a requirement that the copy can be played only on the intended receiving device. Player 52 (or other receiving device) can be programmed to make no copies (or no

additional copies) upon detecting that the digital property is a copy rather than an original. If desired, a player 52 can be programmed to refuse to play a digital property that is not packaged with the player's unique ID.

Example Use of Analog Encoding Techniques

In another example, more comprehensive rights management information may be encoded by player 52 in the analog output using methods for watermarking and/or fingerprinting.Today, a substantial portion of the "real world" is analog rather than digital. Despite the pervasiveness of analog signals, existing methods for managing rights and protecting copyright in the analog realm are primitive or non-existent. For example:

- Quality degradation inherent in multigenerational analog copying has not prevented a multi-billion dollar pirating industry from flourishing.

- Some methods for video tape copy and pay per view protection attempt to prevent any copying at all of commercially released content, or allow only one

generation of copying. These methods can generally be easily circumvented.

- Not all existing devices respond appropriately to copy protection signals.

- Existing schemes are limited for example to "copy/no copy" controls.

- Copy protection for sound recordings has not been commercially implemented.

A related problem relates to the conversion of information between the analog and digital domains. Even if information is effectively protected and controlled initially using strong digital rights management techniques, an analog copy of the same information may no longer be securely protected.

For example, it is generally possible for someone to make an analog recording of program material initially delivered in digital form. Some analog recordings based on digital originals are of quite good quality. For example, a Digital Versatile Disk

("DVD") player may convert a movie from digital to analog format and provide the analog signal to a high quality analog home VCR. The home VCR records the analog signal. A consumer now has a high quality analog copy of the original digital property. A person could re-record the analog signal on a DVD-RAM. This recording will in many circumstances have substantial quality – and would no longer be subject to "pay per view" or other digital rights management controls associated with the digital form of the same content.

Since analog formats will be with us for a long time to come, rightsholders such as film studios, video rental and distribution companies, music studios and distributors, and other value chain participants would very much like to have significantly better rights management capabilities for analog film, video, sound recordings and other content. Solving this problem generally requires a way to securely associate rights management information with the content being protected.

In combination with other rights management capabilities, watermarking and/or fingerprinting, may provide "end to end"

secure rights management protection that allows content providers and rights holders to be sure their content will be adequately protected -- irrespective of the types of devices, signaling formats and nature of signal processing within the content distribution chain. This "end to end" protection also allows authorized analog appliances to be easily, seamlessly and cost-effectively integrated into a modern digital rights management architecture.

Watermarking and/or fingerprinting may carry, for example, control information that can be a basis for a Virtual Distribution Environment ("VDE") in which electronic rights management control information may be delivered over insecure (e.g., analog) communications channels. This Virtual Distribution Environment is highly flexible and convenient, accommodating existing and new business models while also providing an unprecedented degree of flexibility in facilitating ad hoc creation of new arrangements and relationships between electronic commerce and value chain participants -- regardless of whether content is distributed in digital and/or analog formats.

Watermarking together with distributed, peer-to-peer rights management technologies providers numerous advantages, including, but not limited to:

- An indelible and invisible, secure technique for providing rights management information.

- An indelible method of associating electronic commerce and/or rights management controls with analog content such as film, video, and sound recordings.

- Persistent association of the commerce and/or rights management controls with content from one end of a distribution system to the other -- regardless of the number and types of transformations between signaling formats (for example, analog to digital, and digital to analog).

- The ability to specify "no copy/ one copy/ many copies" rights management rules, and also more

complex rights and transaction pricing models (such as, for example, "pay per view" and others).

- The ability to fully and seamlessly integrate with comprehensive, general electronic rights management solutions.

- Secure control information delivery in conjunction with authorized analog and other non-digital and/or non-secure information signal delivery mechanisms.

- The ability to provide more complex and/or more flexible commerce and/or rights management rules as content moves from the analog to the digital realm and back.

- The flexible ability to communicate commerce and/or rights management rules implementing new, updated, or additional business models to authorized analog and/or digital devices.

Any or all of these features may be used in combination in and/or with the inventions disclosed in the present specification.

Briefly, watermarking and/or fingerprinting methods may, using "steganographical" techniques, substantially indelibly and substantially invisibly encode rights management and/or electronic commerce rules and controls within an information signal such as, for example, an analog signal or a digitized (for example, sampled) version of an analog signal, non-limiting examples of which may include video and/or audio data, that is then decoded and utilized by the local appliance. The analog information and stenographically encoded rights management information may be transmitted via many means, non-limiting examples of which may include broadcast, cable TV, and/or physical media, VCR tapes, to mention one non-limiting example. Any or all of these techniques may be used in combination in accordance with the inventions disclosed herein.

Watermarking and/or fingerprinting methods enable at least some rights management information to survive transformation of the video and/or other information from analog to digital and from

digital to analog format. Thus in one example, two or more analog and/or digital appliances may participate in an end-to-end fabric of trusted, secure rights management processes and/or events.

Example, More Capable Embodiments

As discussed above, the example control set shown in Figure 3B provides a comprehensive, flexible and extensible set of controls for use by both player 52 and computer equipment 62 (or other platform) depending upon the particular technical, security and other capabilities of the platform. In this example, player 52 has only limited technical and security capabilities in order to keep cost and complexity down in a mass-produced consumer item, and therefore may essentially ignore or fail to enable some or all of the controls 222 provided within control set 204. In another example, the cost of memory and/or processors may continue to decline and manufacturers may choose to expand the technical and security capabilities of player 52. A more capable player 52 will provide more powerful, robust, and flexible rights management capabilities.

Figure 5 shows an example arrangement permitting platform 60 including secure node 72 to have enhanced and/or different capabilities to use information and/or rights management information on disk 100, and Figure 6 shows an example access technique provided by the secure node. Referring to Figure 5, secure node 72 may be coupled to a network 150 whereas player 52 may not be—giving the secure node great additional flexibility in terms of communicating security related information such as audit trails, compensation related information such as payment requests or orders, etc. This connection of secure node 72 to network 150 (which may be replaced in any given application by some other communications technique such as insertion of a replaceable memory cartridge) allows secure node 72 to receive and securely maintain rights management control information such as an additional container 206' containing an additional control set 204'. Secure node 72 may use control set 204' in addition or in lieu of a control set 204 stored on disk 100. Secure node 72 may also maintain a secure cryptographic key store 212 that may provide cryptographic keys to be used in lieu of or in addition to any keys 208, 210 that may be stored on disk 100.

Because of its increased security and/or technical capabilities, secure node 72 may be able to use controls 222 within control set 204 that player 52 ignores or cannot use—and may be provided with further and/or enhanced rights and/or rights management capabilities based on control set 204' (which the user may, for example, order specially and which may apply to particular properties 200 stored on disk 100 and/or particular sets of disks).

Example Secure Node Access Techniques

The Figure 6 example access technique (which may be performed by platform 60 employing secure node 72, for example) involves, in this particular example, the secure node 72 fetching property identification information 220 from disk 100 (Figure 6, block 502), and then locating applicable control sets and/or rules 204 (which may be stored on disk 100, within secure node 72, within one or more repositories the secure node 72 accesses via network 150, and/or a combination of any or all of these techniques) (Figure 6, block 504). Secure node 72 then loads the necessary decryption keys and uses them to decrypt information as required (Figure 6, block 506). In one example, secure node 72 obtains the necessary keys from secure containers 206 and/or 206'

and maintains them within a protected processing environment such as SPU 164 or a software-emulated protected processing environment without exposing them externally of that environment. In another example, the secure node 72 may load the necessary keys (or a subset of them) into disk drive 82' using a secure key exchange protocol for use by the disk drive in decrypting information much in the same manner as would occur within player 52 in order to maintain complete compatibility in drive hardware.

Secure node 72 may monitor user inputs and perform requested actions based on the particular control set 204, 204'. For example, upon receiving a user request, secure node 72 may query the control set 204, 204' to determine whether it (they) permits the action the user has requested (Figure 6, block 508) and, if permitted, whether conditions for performing the requested operation have been satisfied (Figure 6, block 510). In this example, secure node 72 may effect the operations necessary to satisfy any such required conditions such as by, for example, debiting a user's locally-stored electronic cash wallet, securely requesting an account debit via network 150, obtaining and/or

checking user certificates to ensure that the user is within an appropriate class or is who he or she says he is, etc.—using network 150 as required (Figure 6, block 510). Upon all necessary conditions being satisfied, secure node 72 may perform the requested operation (and/or enable microprocessor 154 to perform the operation) (e.g., to release content) and may then generate secure audit records which can be maintained by the secure node and/or reported at the time or later via network 150 (Figure 6, block 512).

If the requested operation is to release content (e.g., make a copy of the content), platform 60 (or player 52 in the example above) may perform the requested operation based at least in part on the particular controls that enforce rights over the content. For example, the controls may prevent platform 60 from releasing content except to certain types of output devices that cannot be used to copy the content, or they may release the content in a way that discourages copying (e.g., by "fingerprinting" the copy with an embedded designation of who created the copy, by intentionally degrading the released content so that any copies made from it will be inferior, etc.). As one specific example, a

video cassette recorder (not shown) connected to platform 60 may be the output device used to make the copy. Because present generations of analog devices such as video cassette recorders are incapable of making multigenerational copies without significant loss in quality, the content provider may provide controls that permit content to be copied by such analog devices but not by digital devices (which can make an unlimited number of copies without quality loss). For example, platform 60 may, under control of digital controls maintained by secure node 72, release content to the video cassette recorder only after the video cassette recorder supplies the platform a digital ID that designates the output device as a video cassette recorder -- and may refuse to provide any output at all unless such a digital ID identifying the output device as a lower quality analog device is provided. Additionally or in the alternative, platform 60 may intentionally degrade the content it supplies to the video cassette recorder to ensure that no acceptable second -generation copies will be made. In another example, more comprehensive rights management information may be encoded by platform 60 in the analog output using watermarking and/or fingerprinting.

Additional Examples of Secure Container Usage

Figure 7 shows a basic example of a DVD medium 700 containing a kind of secure container 701 for use in DVDs in accordance with the present invention. As shown in this example, container 701 ("DigiBox for DVDs") could be a specialized version of a "standard" container tailored especially for use with DVD and/or other media, or it could, alternatively (in an arrangement shown later in Figure 8), be a fully "standard" container. As shown in this example, the specialized container 701 incorporates features that permit it to be used in conjunction with content information, metadata, and cryptographic and/or protection information that is stored on the DVD medium 700 in the same manner as would have been used had container 701 not been present. Thus, specialized container 701 provides compatibility with existing data formats and organizations used on DVDs and/or other media. In addition, a specialized container 701 can be tailored to support only those features necessary for use in support of DVD and/or other media, so that it can be processed and/or manipulated using less powerful or less expensive computing resources than would be required for complete support of a "standard" container object.

In this example, specialized "DVD only" container 701 includes a content object (a property) 703 which includes an "external reference" 705 to video title content 707, which may be stored on the DVD and/or other medium in the same manner as would have been used for a medium not including container 701. The video title content 707 may include MPEG-2 and/or AC-3 content 708, as well as scrambling (protection) information 710 and header, structure and/or meta data 711. External reference 705 contains information that "designates" (points to, identifies, and/or describes) specific external processes to be applied/executed in order to usecontent and other information not stored in container 701. In this example, external reference 705 designates video title content 707 and its components 708, 710, and 711. Alternatively, container 701 could store some or all of the video title content in the container itself, using a format and organization that is specific to container 701, rather than the standard format for the DVD and/or other medium 700.

In this example, container 701 also includes a control object (control set) 705 that specifies the rules that apply to use of video title content 707. As indicates by solid arrow 702, control object

705 "applies to" content object (property) 703. As shown in this example, rule 704 can specify that protection processes, for example CGMA or the Matsushita data scrambling process, be applied, and can designate, by external reference 709 contained in rule 704, data scrambling information 710 to be used in carrying out the protection scheme. The shorthand "do CGMA" description in rule 704 indicates that the rule requires that the standard CGMA protection scheme used for content on DVD media is to be used in conjunction with video title content 707, but a different example could specify arbitrary other rules in control object 705 in addition to or instead of the "do CGMA" rule, including other standard DVD protection mechanisms such as the Matsushita data scrambling scheme and/or other rights management mechanisms. External reference 709 permits rule 704 to be based on protection information 710 that is stored and manipulated in the same format and manner as for a DVD medium that does not incorporate container 701 and/or protection information that is meaningful only in the context of processing container 701.

Figure 8 shows a example of a DVD medium 800 containing a "standard" secure container 801. In this example, the

"standard" container provides all of the functionality (if desired) of the Figure 7 container, but may offer additional and/or more extensive rights management and/or content use capabilities than available on the "DVD only" container (e.g., the capacity to operate with various different platforms that use secure nodes).

Figure 9 shows a more complex example of DVD medium 800 having a standard container 901 that provides all of the functionality (if desired) of the Figure 7 container, and that can function in concert with other standard containers 902 located either on the same DVD medium or imported from another remote secure node or network. In this example, standard container 902 may include a supplementary control object 904 which applies to content object 903 of standard container 901. Also in this example, container 902 may provide an additional rule(s) such as, for example, a rule permitting/extending rights to allow up to a certain number (e.g., five) copies of the content available on DVD 900. This arrangement, for example, provides added flexibility in controlling rights management of DVD content between multiple platforms via access through "backchannels" such as via a set-top

box or other hardware having bi-directional communications capabilities with other networks or computers.

Additional Use of A DVD Disk With A Secure Container

Figure 10 illustrates the use of a "new" DVD disk—i.e., one that includes a special DVD secure container in the medium. This container may, in one example, be used or two possible use scenarios: a first situation in which the disk is used on an "old" player (DVD appliance, i.e., a DVD appliance that is not equipped with a secure node to provide rights management in accordance with the present invention; and a second situation in which the disk is used on a "new" player—i.e., a DVD appliance which is equipped with a secure node to provide rights management in accordance with the present invention. In this example, a secure node within the "new" player is configured with the necessary capabilities to process other copy protection information such as, for example, CGMA control codes and data scrambling formats developed and proposed principally by Matsushita.

For example, in the situation shown in Figure 10, the "new" player (which incorporates a secure node in accordance with the

present invention) can recognize the presence of a secure container on the disk. The player may then load the special DVD secure container from the disk into the resident secure node. The secure node opens the container, and implements and/or enforces appropriate rules and usage consequences associated with the content by applying rules from the control object. These rules are extremely flexible. In one example, the rules may, for example, call for use of other protection mechanisms (such as, for example, CGMA protection codes and Matsushita data scrambling) which can be found in the content (or property) portion of the container.

In another example shown in Figure 10, the special DVD container on the disk still allows the "old" player to use to a predetermined limited amount content material which may be used in accordance with conventional practices.

Example Use of A DVD Disk With No Secure Container

Referring now to Figure 11, a further scenario is discussed. Figure 11 illustrates use of an "old" DVD disk with two possible use examples: a first example in which the disk is used on an "old" player—i.e., a DVD appliance that is not equipped with a secure

node for providing rights management in accordance with the present invention—and a second example in which the disk is used on a "new" player (i.e., equipped with a secure node).

In the first case, the "old" player will play the DVD content in a conventional manner. In the second scenario, the "new" player will recognize that the disk does not have a container stored in the medium. It therefore constructs a "virtual" container in resident memory of the appliance. To do this, it constructs a container content object, and also constructs a control object containing the appropriate rules. In one particular example, the only applicable rule it need apply is to "do CGMA" -- but in other examples, additional and/or different rules could be employed. The virtual container is then provided to the secure node within the "new" player for implementing management of use rights in accordance with the present invention. Although not shown in Figures 10 and 11, use of "external references" may also be provided in both virtual and non-virtual containers used in the DVD context.

Example Illustrative Arrangements for Sharing, Brokering and Combining Rights When Operating in At Least Occasionally Connected Scenarios

As described above, the rights management resources of several different devices and/or other systems can be flexibly combined in diverse logical and/or physical relationships, resulting for example in greater and/or differing rights. Such rights management resource combinations can be effected through connection to one or more remote rights authorities. Figures 12-14 show some non-limiting examples of how rights authorities can be used in various contexts.

For example, Figure 12 shows a rights authority broker 1000 connected to a local area network (LAN) 1002. LAN 1002 may connect to wide area network if desired. LAN 1002 provides connectivity between rights authority broker 1000 and any number of appliances such as for example a player 50, a personal computer 60, a CD "tower" type server 1004. In the example shown, LAN 1002 includes a modem pool (and/or network

protocol server, not shown)1006 that allows a laptop computer 1008 to connect to the rights authority broker 1000 via dial-up lines 1010. Alternatively, laptop 1008 could communicate with rights authority broker 1000 using other network and/or communication means, such as the Internet and/or other Wide Area Networks (WANs). A disk player 50A may be coupled to laptop 1008 at the laptop location. In accordance with the teachings above, any or all of devices shown in Figure 12 may include one or more secure nodes 72.

Rights authority broker 1000 may act as an arbiter and/or negotiator of rights. For example, laptop 1008 and associated player 50A may have only limited usage rights when operating in a stand-alone configuration. However, when laptop 1008 connects to rights authority broker 1000 via modem pool 1006 and LAN 1002 and/or by other communication means, the laptop may acquire different and/or expanded rights to use disks 100 (e.g., availability of different content portions, different pricing, different extraction and/or redistribution rights, etc.) Similarly, player 50, equipment 60 and equipment 1004 may be provided with an enhanced and/or different set of disk usage rights through

communication with rights authority broker 1000 over LAN 1002. Communication to and from rights authority broker 1000 is preferably secured through use of containers of the type disclosed in the above-referenced Ginter et al. patent specification.

Figure 13 shows another example use of a rights authority broker 1000 within a home environment. In this example, the laptop computer 1008 may be connected to a home-based rights authority broker 1000 via a high speed serial IEEE 1394 bus and/or by other electronic communication means. In addition, rights authority broker 1000 can connect with any or all of:

- a high definition television 1100,
- one or more loudspeakers 1102 or other audio transducers,
- one or more personal computers 60,
- one or more set-top boxes 1030,
- one or more disk players 50,
- one or more other rights authority brokers 1000A-1000N and

- any other home or consumer equipment or appliances.

Any or all of the equipment listed above may include a secure node 72.

Figure 14 shows another example use of a rights authority broker 1000. In this example, rights authority broker 1000 is connected to a network 1020 such as a LAN, a WAN, the Internet, etc. Network 1020 may provide connectivity between rights authority broker 1000 and any or all of the following equipment:

- one or more connected or occasionally connected disk players 50A, 50B;
- one more networked computers 1022;
- one or more disk reader towers/servers 1004;
- one or more laptop computers 1008;
- one or more Commerce Utility Systems such as a rights and permissions clearinghouse 1024 (see Shear et al., "Trusted Infrastructure..." specification referenced above);

- one or more satellite or other communications uplinks 1026;
- one or more cable television head-ends 1028;
- one or more set-top boxes 1030 (which may be connected to satellite downlinks 1032 and/or disk players 50C);
- one or more personal computer equipment 60;
- one or more portable disk players 1034 (which may be connected through other equipment, directly, and/or occasionally unconnected;
- one or more other rights authority brokers 1000A-1000N; and
- any other desired equipment.

Any or all of the above-mentioned equipment may include one or more secure nodes 72. Rights authority broker 1000 can distribute and/or combine rights for use by any or all of the other components shown in Figure 14. For example, rights authority broker 100 can supply further

secure rights management resources to equipment connected to the broker via network 1020. Multiple equipment shown in Figure 14 can participate and work together in a permanently or temporarily connected network 1020 to share the rights management for a single node. Rights associated with parties and/or groups using and/or controlling such multiple devices and/or other systems can be employed according to underlying rights related rules and controls. As one example, rights available through a corporate executive's laptop computer 1008 might be combined with or substituted for, in some manner, the rights of one or more subordinate corporate employees when their computing or other devices 60 are coupled to network 1020 in a temporary networking relationship. In general, this aspect of the invention allows distributed rights management for DVD or otherwise packaged and delivered content that is protected by a distributed, peer-to-peer rights management. Such a distributed rights management can operate whether the DVD appliance or other content usage device is participating in a permanently or temporarily

connected network 1020, and whether or not the relationships among the devices and/or other systems participating in the distributed rights management arrangement are relating temporarily or have a more permanent operating relationship.

For example, laptop computer 1008 may have different rights available depending on the context in which that device is operating. For example, in a general corporate environment such as shown in Figure 12, the laptop 1008 may have one set of rights. However, the same laptop 1008 may be given a different set of rights when connected to a more general network 1020 in collaboration with specified individuals and/or groups in a corporation. The same laptop 1008 may be given a still different set of rights when connected in a general home environment such as shown by example in Figure 13. The same laptop 1008 could be given still different rights when connected in still other environments such as, by way of non-limiting example:

- a home environment in collaboration with specified individuals and/or groups,

- a retail environment,
- a classroom setting as a student,
- a classroom setting in collaboration with an instructor, in a library environment,
- on a factory floor,
- on a factory floor in collaboration with equipment enabled to perform proprietary functions, and so on.

As one more particular example, coupling a limited resource device arrangement such as a DVD appliance 50 shown in Figure 14 with an inexpensive network computer (NC) 1022 may allow an augmenting (or replacing) of rights management capabilities and/or specific rights of parties and/or devices by permitting rights management to be a result of a combination of some or all of the rights and/or rights management capabilities of the DVD appliance and those of an Network or Personal Computer (NC or PC). Such rights may be further augmented, or otherwise modified or replaced by the availability of rights management capabilities provided by a trusted (secure) remote network rights authority 1000.

The same device, in this example a DVD appliance 50, can thus support different arrays, e.g., degrees, of rights management capabilities, in disconnected and connected arrangements and may further allow available rights to result from the availability of rights and/or rights management capabilities resulting from the combination of rights management devices and/or other systems. This may include one or more combinations of some or all of the rights available through the use of a "less" secure and/or resource poor device or system which are augmented, replaced, or otherwise modified through connection with a device or system that is "more" or "differently" secure and/or resource rich and/or possesses differing or different rights, wherein such connection employs rights and/or management capabilities of either and/or both devices as defined by rights related rules and controls that describe a shared rights management arrangement.

In the latter case, connectivity to a logically and/or physically remote rights management capability can expand (by, for example, increasing the available secure rights management resources) and/or change the character of the rights available to the user of the DVD appliance 50 or a DVD appliance when such

device is coupled with an NC 1022, personal computer 60, and/or remote rights authority 1000. In this rights augmentation scenario, additional content portions may be available, pricing may change, redistribution rights may change (e.g., be expanded), content extraction rights may be increased, etc.

Such "networking rights management" can allow for a combination of rights management resources of plural devices and/or other systems in diverse logical and/or physical relationships, resulting in either greater or differing rights through the enhanced resources provided by connectivity with one or more "remote" rights authorities. Further, while providing for increased and/or differing rights management capability and/or rights, such a connectivity based rights management arrangement can support multi-locational content availability, by providing for seamless integration of remotely available content, for example, content stored in remote, Internet world wide web-based, database supported content repositories, with locally available content on one or more DVD discs 100.

In this instance, a user may experience not only increased or differing rights but may be able to use to both local DVD content

and supplementing content (i.e., content that is more current from a time standpoint, more costly, more diverse, or complementary in some other fashion, etc.). In such an instance, a DVD appliance 50 and/or a user of a DVD appliance (or other device or system connected to such appliance) may have the same rights, differing, and/or different rights applied to locally and remotely available content, and portions of local and remotely available content may themselves be subject to differing or different rights when used by a user and/or appliance. This arrangement can support an overall, profound increase in user content opportunities that are seamlessly integrated and efficiently available to users in a single content searching and/or usage activity.

Such a rights augmenting remote authority 1000 may be directly coupled to a DVD appliance 50 and/or other device by modem (see item 1006 in Figure 12) and/or directly or indirectly coupled through the use of an I/O interface, such as a serial 1394 compatible controller (e.g., by communicating between a 1394 enabled DVD appliance and a local personal computer that functions as a smart synchronous or asynchronous information communications interface to such one or more remote authorities,

including a local PC 60 or NC 1022 that serves as a local rights management authority augmenting and/or supplying the rights management in a DVD appliance) and/or by other digital communication means such as wired and/or wireless network connections.

Rights provided to, purchased, or otherwise acquired by a participant and/or participant DVD appliance 50 or other system can be exchanged among such peer-to-peer relating devices and/or other systems so long as they participate in a permanently or temporarily connected network. 1020. In such a case, rights may be bartered, sold, for currency, otherwise exchanged for value, and/or loaned so long as such devices and/or other systems participate in a rights management system, for example, such as the Virtual Distribution Environment described in Ginter, et al., and employ rights transfer and other rights management capabilities described therein. For example, this aspect of the present invention allows parties to exchange games or movies in which they have purchased rights. Continuing the example, an individual might buy some of a neighbor's usage rights to watch a movie, or transfer to another party credit received from a game

publisher for the successful superdistribution of the game to several acquaintances, where such credit is transferred (exchanged) to a friend to buy some of the friend's rights to play a different game a certain number of times, etc.

Example Virtual Rights Process

Figures 15A-15C shows an example of a process in which rights management components of two or more appliances or other devices establish a virtual rights machine environment associated with an event, operation and/or other action. The process may be initiated in a number of ways. In one example, an appliance user (and/or computer software acting on behalf of a user, group of users, and/or automated system for performing actions) performs an action with a first appliance (e.g., requesting the appliance to display the contents of a secure container, extract a portion of a content element, run a protected computer program, authorize a work flow process step, initiate an operation on a machine tool, play a song, etc.) that results in the activation of a rights management component associated with such first appliance (Figure 15A, block 1500). In other examples, the process may get started in response to an automatically generated event (e.g., based

on a time of day or the like), a random or pseudo-random event, and/or a combination of such events with a user-initiated event.

Once the process begins, a rights management component such as a secure node 72 (for example, an SPE and/or HPE as disclosed in Ginter et al.) determines which rights associated with such first appliance, if any, the user has available with respect to such an action (Figure 15A, block 1502). The rights management component also determines the coordinating and/or cooperating rights associated with such an action available to the user located in whole or in part on other appliances (Figure 15A, block 1502).

In one example, these steps may be performed by securely delivering a request to a rights authority server 1000 that identifies the first appliance, the nature of the proposed action, and other information required or desired by such a rights authority server. Such other information may include, for example:

- the date and time of the request,
- the identity of the user,
- the nature of the network connection,

- the acceptable latency of a response, etc.), and/or
- any other information.

In response to such a request, the rights authority server 1000 may return a list (or other appropriate structure) to the first appliance. This list may, for example, contain the identities of other appliances that do, or may, have rights and/or rights related information relevant to such a proposed action.

In another embodiment, the first appliance may communicate (e.g., poll) a network with requests to other appliances that do, or may, have rights and/or rights related information relevant to such proposed action. Polling may be desirable in cases where the number of appliances is relatively small and/or changes infrequently. Polling may also be useful, for example, in cases where functions of a rights authority server 1000 are distributed across several appliances.

The rights management component associated with the first appliance may then, in this example, check the security level(s) (and/or types) of devices and/or users of other appliances that do, or may, have rights and/or rights related information relevant to

such an action (Figure 15A, block 1506). This step may, for example, be performed in accordance with the security level(s) and/or device type management techniques disclosed in Sibert and Van Wie, and the user rights, secure name services and secure communications techniques disclosed in Ginter et al. Device and/or user security level determination may be based, for example, in whole or in part on device and/or user class.

The rights management component may then make a decision as to whether each of the other appliance devices and/or users have a sufficient security level to cooperate in forming the set of rights and/or rights related information associated with such an action (Figure 15A, block 1508). As each appliance is evaluated, some devices and/or users may have sufficient security levels, and others may not. In this example, if a sufficient security level is not available ("No" exit to decision block 1508), the rights management component may create an audit record (for example, an audit record of the form disclosed in Ginter et al.) (Figure 15A, block 1510), and may end the process (Figure 15A, block 1512). Such audit record may be for either immediate transmission to a responsible authority and/or for local storage and later

transmission, for example. The audit recording step may include, as one example, incrementing a counter that records security level failures (such as the counters associated with summary services in Ginter et al.)

If the devices and/or users provide the requisite security level ("Yes" exit to block 1508), the rights management component in this example may make a further determination based on the device and/or user class(es) and/or other configuration and/or characteristics (Figure 15B, block 1514). Such determination may be based on any number of factors such as for example:

- the device is accessible only through a network interface that has insufficient throughput;
- devices in such a class typically have insufficient resources to perform the action, or relevant portion of the action, at all or with acceptable performance, quality, or other characteristics;

- the user class is inappropriate due to various conditions (e.g., age, security clearance, citizenship, jurisdiction, or any other class-based or other user characteristic); and/or
- other factors.

In one example, decision block 1514 may be performed in part by presenting a choice to the user that the user declines.

If processes within the rights management component determines that such device and/or user class(es) are inappropriate("No" exit to block 1514), the rights management component may write an audit record if required or desired (Figure 15B, block 1516) and the process may end (Figure 15B, block 1518).

If, on the other hand, the rights management component determines that the device and/or user classes are appropriate to proceed ("Yes" exit to block 1514), the rights management component may determine the rights and resources available for performing the action on the first appliance and the other appliances acting together (Figure 15B, block 1520). This step may be performed, for example, using any or all of the method

processing techniques disclosed in Ginter et al. For example, method functions may include event processing capabilities that formulate a request to each relevant appliance that describes, in whole or in part, information related to the action, or portion of the action, potentially suitable for processing, in whole or in part, by such appliance. In this example, such requests, and associated responses, may be managed using the reciprocal method techniques disclosed in Ginter et al. If such interaction requires additional information, or results in ambiguity, the rights management component may, for example, communicate with the user and allow them to make a choice, such as making a choice among various available, functionally different options, and/or the rights management component may engage in a negotiation (for example, using the negotiation techniques disclosed in Ginter et al.) concerning resources, rights and/or rights related information.

The rights management component next determines whether there are sufficient rights and/or resources available to perform the requested action (Figure 15B, decision block 1522). If there are insufficient rights and/or resources available to perform the action ("No" exit to block 1522), the rights management component may

write an audit record (Figure 15B, block 1524), and end the process (Figure 15B, block 1526).

In this example, if sufficient rights and/or resources are available ("Yes" exit to block 1522), the rights management component may make a decision regarding whether additional events should be processed in order to complete the overall action (Figure 15B, block 1528). For example, it may not be desirable to perform only part of the overall action if the necessary rights and/or resources are not available to complete the action. If more events are necessary and/or desired ("Yes" exit to block 1528), the rights management component may repeat blocks 1520, 1522 (and potentially perform blocks 1524, 1526) for each such event.

If sufficient rights and/or resources are available for each of the events ("No" exit to block 1528), the rights management component may, if desired or required, present a user with a choice concerning the available alternatives for rights and/or resources for performing the action (Figure 15B, block 1530). Alternatively and/or in addition, the rights management component may rely on user preference information (and/or defaults) to "automatically" make such a determination on behalf

of the user (for example, based on the overall cost, performance, quality, etc.). In another embodiment, the user's class, or classes, may be used to filter or otherwise aid in selecting among available options. In still another embodiment, artificial intelligence (including, for example, expert systems techniques) may be used to aid in the selection among alternatives. In another embodiment, a mixture of any or all of the foregoing (and/or other) techniques may be used in the selection process.

If there are no acceptable alternatives for rights and/or resources, or because of other negative aspects of the selection process (e.g., a user presses a "Cancel" button in a graphical user interface, a user interaction process exceeds the available time to make such a selection, etc.), ("No" exit to block 1530) the rights management component may write an audit record (Figure 15B, block 1532), and end the process (Figure 15B, block 1534).

On the other hand, if a selection process identifies one or more acceptable sets of rights and/or resources for performing the action and the decision to proceed is affirmative ("Yes" exit to block 1530), the rights management component may perform the proposed action using the first appliance alone or in combination

with any additional appliances (e.g., a rights authority 1000, or any other connected appliance) based on the selected rights and/or resources (Figure 15C, block 1536). Such cooperative implementation of the proposed actions may include for example:

- performing some or all of the action with the first appliance;
- performing some or all of the action with one or more appliances other than the first appliance (e.g., a rights authority 1000 and/or some other appliance);
- performing part of the action with the first appliance and part of the action with one or more other appliances; or
- any combination of these.

For example, this step may be performed using the event processing techniques disclosed in Ginter et al.

As one illustrative example, the first appliance may have all of the resources necessary to perform a particular task (e.g., read certain information from an optical disk), but may lack the rights necessary to do so. In such an instance, the first appliance may

obtain the additional rights it requires to perform the task through the steps described above. In another illustrative example, the first appliance may have all of the rights required to perform a particular task, but it may not have the resources to do so. For example, the first appliance may not have sufficient hardware and/or software resources available to it for accessing, processing or otherwise using information in certain ways. In this example, step 1536 may be performed in whole or in part by some other appliance or appliances based in whole or in part on rights supplied by the first appliance. In still another example, the first appliance may lack both rights and resources necessary to perform a certain action, and may rely on one or more additional appliances to supply such resources and rights.

In this example, the rights management component may, upon completion of the action, write one or more audit records (Figure 15C, block 1538), and the process may end (Figure 15C, block 1540).

* * * * * *

An arrangement has been described which adequately satisfies current entertainment industry requirements for a low cost, mass-produceable digital video disk or other high capacity disc copy protection scheme but which also provides enhanced, extensible rights management capabilities for more advanced and/or secure platforms and for cooperative rights management between devices of lessor, greater, and/or differing rights resources. While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiment, it is to be understood that the invention is not to be limited to the disclosed embodiment, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the invention.

We Claim:

1. An electronic appliance including:

a disk use arrangement for at least one of (a) reading information from, and (b) writing information to, a digital versatile disk optical storage medium; and

a secure node coupled to the disk use arrangement, the secure node providing at least one rights management process.

2. An electronic appliance including:

a disk use arrangement for at least one of (a) reading information from, and (b) writing information to, a digital versatile disk optical storage medium; and

at least one processing arrangement coupled to the disk use arrangement, the processing arrangement selecting at least some control information associated with information recorded on the storage medium based at least in part on the class of the appliance and/or the user of the appliance.

3. A system as in claim 2 wherein the processing arrangement selects a subset of control information used on another appliance and/or class of appliance.

4. A system as in claim 2 wherein the processing arrangement selects different control information from the information selected by another appliance and/or class of appliance.

5. A system as in claim 2 wherein at least some of the control information comprises an analog signal.

6. A system as in claim 2 wherein at least some of the control information comprises digitally encoded information.

7. In an appliance capable of using digital versatile disks, a method including the following steps:

at least one of (a) reading information from, and (b) writing information to, a digital versatile disk optical storage medium; and

selecting at least some control information associated with information recorded on the storage medium based at least in part on the class of the appliance and/or the user of the appliance.

8. A method as in claim 7 wherein the selecting step includes the step of selecting a subset of control information used on another appliance and/or class of appliance.

9. A method as in claim 7 wherein the selecting step includes the step of selecting, from control information stored on the storage medium, a different set of control information than the control information selected by another appliance and/or class of appliance.

10. An electronic appliance including:

a disk use arrangement for reading information from a digital versatile disk optical storage medium; and

at least one processing arrangement coupled to the disk use arrangement, the processing arrangement protecting information read from the storage medium.

11. An appliance as in claim 10 wherein the processing arrangement includes a rights management arrangement that applies at least one rights management technique to the read information.

12. An appliance as in claim 10 wherein the appliance further includes at least one port compliant at least in part with the IEEE 1394-1995 high speed serial bus standard, and the processing arrangement couples the protected information to the port.

13. In an electronic appliance, a method including the following steps:

reading information from a digital versatile disk optical storage medium; and

protecting the information read from the optical storage medium.

14. A method as in claim 13 wherein the protecting step includes the step of applying at least one rights management technique to the read information.

15. A method as in claim 13 further including the step of sending the protected information to an IEEE 1394 port.

16. An electronic appliance including:

a disk use arrangement for using information stored, or to be stored, on a digital versatile disk optical storage medium; and

at least one protecting arrangement coupled to the disk use arrangement and also coupled to receive at least one analog signal, the protecting arrangement creating protected digital information based at least in part on the analog signal.

17. In an electronic appliance, a method including the following steps:

receiving at least one analog signal; and

creating protected digital content based at least in part on the analog signal for storage on a digital versatile disk.

18. In an electronic appliance, a method including the following steps:

reading at least one analog signal from a digital versatile disk;

creating protected digital content based at least in part on the analog signal; and

outputting the protected digital content.

19. An electronic appliance including:

a disk use arrangement for using information stored, or to be stored, on a digital versatile disk optical storage medium; and

at least one rights management arrangement coupled to the disk use arrangement, the rights management arrangement treating the storage medium and/or information obtained from the storage medium differently depending on the geographical and/or jurisdictional context of the appliance.

20. In an electronic appliance, a method including the steps of:

reading information from at least one digital versatile disk; and

performing at least one rights management operation based at least in part on the geographical and/or jurisdictional context of the appliance.

21. An electronic appliance including:

a disk use arrangement for using at least one secure container stored on a digital versatile disk optical storage medium; and

at least one rights management arrangement coupled to the disk use arrangement, the rights management arrangement processing the secure container.

22. In an electronic appliance, a method including the following steps:

reading at least one secure container from at least one digital versatile disk; and

performing at least one rights management operation on the secure container.

23. An electronic appliance including:

at least one rights management arrangement for generating and/or modifying at least one secure container for storage onto a digital versatile disk optical storage medium.

24. In an electronic appliance, a method including the step of performing at least one rights management operation on at least one secure container for storage onto a digital versatile disk optical storage medium.

25. A digital versatile disk use system and/or method characterized in that the system and/or method uses at least one secure container.

26. A digital versatile disk use system and/or method characterized in that the system and/or method uses at least one

secure container of the type disclosed in PCT Publication No. WO 96/27155.

27. An electronic appliance including:

a disk use arrangement for writing information onto and/or reading information from a digital versatile disk optical storage medium; and

a secure arrangement that securely manages information on the storage medium such that at least a first portion of the information may be used on at least a first class of appliance while at least a second portion of the information may be used on at least a second class of appliance

28. In an electronic appliance, a method including the following steps:

reading information from and/or writing information to at least one digital versatile disk optical storage medium;

using at least a first portion of the information on at least a first class of appliance; and

using at least a second portion of the information on at least a second class of appliance.

29. A system including first and second classes of electronic appliances each including a secure processing arrangement, the first appliance class secure arrangement securely managing and/or using at least a first portion of the information, the second appliance class secure arrangement securely managing and/or using at least a second portion of the information.

30. A system as in claim 29 wherein the first and second information portions are different, and the second appliance class secure arrangement does not use the first information portion.

31. A system as in claim 29 wherein the first appliance class does not use the second information portion.

32. In a system including first and second classes of electronic appliances each including a secure arrangement, a method comprising:

(a) securely managing and/or using at least a first portion of the information with the first appliance class secure arrangement, and

(b) securely managing and/or using at least a second portion of the information with the second appliance class secure arrangement.

33. A method as in claim 32 wherein the first and second information portions are different, and step (b) does not use the first information portion.

34. A method as in claim 32 wherein step (a) does not use the second information portion.

35. An electronic appliance including:

a disk use arrangement for writing information onto and/or reading information from a digital versatile disk optical storage medium; and

a secure arrangement that securely stores and/or transmits information associated with at least one of payment, auditing, controlling and/or otherwise managing content recorded on the storage medium.

36. In an electronic appliance, a method including the following steps:

reading information from and/or writing information to at least one digital versatile disk optical storage medium; and

securely storing and/or transmitting information associated with at least one of payment, auditing, controlling and/or otherwise managing content recorded on the storage medium.

37. An electronic appliance including:

a disk use arrangement for writing information onto and/or reading information from a digital versatile disk optical storage medium;

a cryptographic engine coupled to the disk use arrangement, the engine using at least one cryptographic key; and

a secure arrangement that securely updates and/or replaces at least one cryptographic key used by the cryptographic engine to at least in part modify the scope of information usable by the appliance.

38. A method of operating an electronic appliance including:

writing information onto and/or reading information from a digital versatile disk optical storage medium;

using at least one cryptographic key in conjunction with said information; and

securely updating and/or replacing at least one cryptographic key used by the cryptographic engine to at least in part modify the scope of information useable by the appliance.

39. A digital versatile disk appliance characterized in that at least one cryptographic key used by the appliance is securely updated and/or replaced to at least in part modify the scope of information that can be used by the appliance.

40. An appliance as in claim 39 further characterized in that the key updating and/or replacing is based on class of appliance.

41. An electronic appliance having a class associated therewith, characterized in that at least one cryptographic key set used by the appliance class is selected to help ensure security of information released from at least one digital versatile disk.

42. A digital camera for generating at least one image to be written onto a digital versatile disk optical storage medium, characterized in that the camera includes at least one information protecting arrangement that at least in part protects the image so that the information is persistently protected through subsequent processes such as editing, production, writing onto a digital versatile disk, and/or reading from a digital versatile disk.

43. A digital camera for generating image information that can be written onto a digital versatile disk optical storage medium, a method comprising:

capturing at least one image with a digital camera; and

protecting information provided by the digital camera so that the information is selectively persistently protected through subsequent processes such as distribution, editing and/or production, writing onto the digital versatile disk optical storage medium, and/or reading from the digital versatile disk optical storage medium.

44. In an electronic appliance including a disk use arrangement, a method comprising:

reading information from at least one digital versatile disk optical storage medium; and

persistently protecting at least some of the read information through at least one subsequent editing and/or production process.

45. In an electronic appliance, a method including the following steps:

reading information from and/or writing information to at least one digital versatile disk optical storage medium; and

securely managing information on the storage medium, including the step of using at least a first portion of the information on at least a first class of appliance, and using at least a second portion of the information on at least a second class of appliance.

46. A method of providing copy protection and/or use rights management of at least one digital property content and/or secure container to be stored and/or distributed on a digital versatile disk medium, comprising the step(s) of:

providing a set of use control(s) within a cryptographically encapsulated data structure having a predetermined format, the data structure format defining at least one secure software container for providing use rights information for digital property content to be stored on the digital versatile disk medium.

47. A method as in claim 46 further including the step of using at least one digital property content stored on an optical disk in accordance with the use controls, including the step of using a prescribed secure cryptographic key or set of cryptographic keys for using rights information.

48. A method as in claim 46 further including the step of decrypting control rules and/or other selected encrypted

information content encapsulated in the software container using at least one set of cryptographic keys.

49. A method as in claim 46 further including the step of applying decrypted control rules to regulate use in accordance with control information contained within said control rules, so as to facilitate management of a diverse set of use and distribution rights which may be specific to different users and/or optical disk appliances.

50. A method of providing rights management of digital property stored on digital versatile disk according to claim 46 wherein said secure container data structure comprises:

one or more content objects comprising digital property content; and

one or more control objects comprising a set of control rules defining copy protection, use and distribution rights to digital property content stored on the optical disk.

51. A method of providing rights management of digital property stored on a digital versatile disk according to claim 46, wherein a content object further comprises one or more reference pointers to digital property content stored elsewhere on the digital versatile disk.

52. A method of providing rights management of digital property stored on a digital versatile disk according to claim 46, wherein a control object further comprises one or more reference pointers to control information stored elsewhere on the digital versatile disk.

53. A method of providing rights management of digital property stored on digital versatile disk according to claim 46, wherein digital information stored on said optical disk includes one or more metadata blocks comprising further information used in conjunction with the control rules to use digital property content stored elsewhere on the optical disk.

54. A method of providing rights management of digital property stored on digital versatile disk according to claim 46, wherein a metablock may be either of a protected type or of an unprotected type.

55. An arrangement for implementing a rights management system for controlling copy protection, use and/or distribution rights to multi-media digital property content stored or otherwise contained on a digital versatile disk, comprising:

an encrypted data structure defining a secure information container stored on an optical disk medium, the encrypted data structure including and/or referencing at least one content object and at least one control object associated with the content object, said content object comprising digital property content and said control object comprising rules defining use rights to the digital property content.

56. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a content object further comprises one or more reference pointers to digital property content stored elsewhere on the digital versatile disk.

57. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a control object further comprises one or more reference pointers to control information stored elsewhere on the digital versatile disk.

58. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein an control object further comprises information for controlling various operations of an optical disk appliance or computer.

59. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a control object further comprises information for controlling various operations of an optical disk appliance or computer.

60. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a control object further comprises a rule specifying decoding and/or enforcement of CGMA encoded copy protection rules associated with the digital content property.

61. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a control object further comprises a rule specifying at least one content scrambling system compatible encoding/decoding of digital property content.

62. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein said optical disk contains a block of stored information comprising encrypted keys used for decryption of said encrypted data structure.

63. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein said optical disk contains a block of stored information comprising hidden keys used for decryption of said encrypted keys.

64. An arrangement for implementing a rights management system for digital versatile disks according to claim 55, wherein a content object further comprises one or more reference pointers to digital property content stored on a separate storage medium.

65. A rights management system for providing copy protection, use and/or distribution rights management for multi-media digital property content stored or otherwise contained on a digital versatile disk for access by an optical disk player device that uses digital property content stored on said optical disk medium, wherein said appliance includes a microprocessor controller for decrypting and using control rules and other selected encrypted information content encapsulated in the secure container by using a prescribed cryptographic key and applying said decrypted control rules to regulate use in accordance with control information contained within said control rules, so as to facilitate management of a diverse set of use and/or distribution rights which may be specific to different users and/or optical disk appliances, the system including:

an optical disk medium having stored thereon an encrypted data structure defining a secure information container, the encrypted data structure comprising and/or referencing at least one content object and at least one control object, said content object comprising digital property content, said control object

comprising rules defining use rights associated with the digital property.

66. A method for providing copy protection, use and distribution rights management of multi-media digital property stored on and/or distributed via digital versatile disk, said optical disk medium having stored thereon an encrypted data structure defining a secure container for housing rights and/or copy protection information pertaining to digital property content stored on the optical disk, wherein an optical disk player appliance for using digital property content stored on an optical disk must utilize a prescribed secure cryptographic key or set of keys to use the secure container, said data structure comprising one or more content objects comprising digital property content and one or more control objects comprising a set of rules defining use rights to digital property, comprising the steps of:

(a) decrypting control rules and other selected encrypted information content encapsulated in the secure container using one or more cryptographic keys; and

(b) applying decrypted control rules to regulate use and/or distribution of digital property content stored on the optical disk in accordance with control information contained within the control rules, so as to provide customized use and/or distribution rights that are specific to different optical disk user platforms and/or optical disk appliances.

67. A rights management system for providing copy protection, use and/or distribution rights management of digital property stored or otherwise contained on a digital versatile disk, comprising:

a secure container means provided on an optical disk medium for cryptographically encapsulating digital property content stored on the optical disk, said container means comprising a content object means for containing digital property content and a control object means for containing control rules for regulating use and/or distribution of said digital property content stored on the optical disk.

68. The rights management system of claim 67 wherein an optical disk player appliance for using information stored on an optical disk comprises a secure node means for using said secure container means provided on an optical disk and implementing said control rules to control operation of said player appliance to regulate use of said digital property content.

69. In a system including plural electronic appliances at least temporarily connected to one another, a rights authority broker that determines what appliances are connected and specifies at least one rights management context depending on said determination.

70. An electronic appliance at least temporarily connected to a rights authority broker, the electronic appliance receiving at least one rights context from the rights authority broker when the device is connected to the rights authority broker.

71. A first electronic appliance at least temporarily connected to a second electronic appliance, the first

electronic appliance selecting between at least first and second rights management contexts depending at least in part on whether the first appliance is connected to the second electronic appliance.

72. In a system including first and second electronic appliances that may be selectively coupled to communicate with one another, an arrangement for defining at least one different rights management control based at least in part on whether the first and second electronic appliances are connected.

73. A method of defining at least one rights management context comprising:

(a) determining whether a first electronic appliance is present; and

(b) defining at least one rights management control set based at least in part on the determining step (a).

74. A method of defining at least one rights management context including:

(a) coupling an optical disk storing information to an electronic appliance that can be selectively connected to a rights management broker;

(b) determining whether the electronic appliance is currently coupled to a rights management broker; and

(c) conditioning at least one aspect of use of at least some of the information stored on the optical disk based on whether the electronic appliance is coupled to the rights management broker.

75. A method as in claim 74 wherein step (c) includes the step of obtaining at least one rights management context from the rights management broker.

76. A method as in claim 74 wherein step (c) includes the step of obtaining at least one combined control set from the rights management broker.

77. A method of defining at least one rights management context including:

(a) coupling an optical disk storing information to an electronic appliance;

(b) using at least some of the information stored on the optical disk based on a first rights management context;

(c) coupling the electronic appliance to a rights management broker; and

(d) concurrently with step (c), using at least some of the information stored on the optical disk based on a second rights management context different from the first rights management context

78. An electronic appliance include a secure node and an optical disk reader, the electronic appliance applying different rights management contexts to protected information stored on an optical disk coupled to the optical disk reader depending at least in part on whether the electronic appliance is coupled to at least one additional secure node.

79. An electronic appliance including:

an optical disk reading and/or writing arrangement;

a secure node coupled to the optical disk reading and/or writing arrangement, the secure node performing at least one rights management related function with respect to at least some information read by the optical disk reading and/or writing arrangement; and

at least one serial bus port coupled to the secure node, the serial bus port for providing any or all of the functions, structures, protocols and/or methods of IEEE 1394-1995.

80. A digital versatile disk appliance including:

means for watermarking content; and

serial bus means for communicating the watermarked content,

wherein the serial bus means complies with IEEE 1394-1995.

81. An optical disk reading and/or writing device including:

at least one secure node capable of watermarking content and/or processing watermarked content; and

an IEEE 1394-1995 serial bus port.

82. An optical disk using device comprising:

a secure processing unit; and

an IEEE 1394-1995 serial bus port.

83. A device as in claim 82 wherein the secure processing unit includes a channel manager.

84. A device as in claim 82 wherein the secure processing unit executes a rights operating system in whole or in part.

85. A device as in claim 82 wherein the secure processing unit includes a tamper-resistant barrier.

86. A device as in claim 82 wherein the secure processing unit includes an encryption/decryption engine.

87. A rights cooperation method comprising:

(a) connecting an appliance to at least one further appliance;

(b) determining whether the first and/or further appliance and/or user(s) of said first and/or further appliance have appropriate rights and/or resources for performing an action; and

(c) selectively performing the action based at least in part on the determination.

88. A rights cooperation method comprising:

(a) connecting an appliance to at least one further appliance;

(b) determining whether the first and/or further appliance and/or user(s) of said first and/or further appliance have appropriate security for performing an action; and

(c) cooperating between the first and further appliance to selectively perform the action.

89. A cooperative rights management arrangement comprising:

a communications arrangement that allows at least first and second appliances to communicate; and

an arrangement that processes at least one event based at least in part on assessing and/or pooling rights and/or resources between the first and second appliances.

90. An optical disk using system and/or method including at least some of the elements shown in Figure 1A.

91. An optical disk using system and/or method including at least some of the elements shown in Figure 1B.

92. An optical disk using system and/or method including at least some of the elements shown in Figure 1C.

93. An optical disk using system and/or method including at least some of the elements shown in Figure 2A.

94. An optical disk using system and/or method including at least some of the elements shown in Figure 2B.

95. An optical disk using system and/or method including at least some of the elements shown in Figure 3.

96. An optical disk using system and/or method using at least some of the elements shown in Figure 3A.

97. An optical disk using system and/or method using at least some of the control set elements shown in Figure 3B.

98. An optical disk using system and/or method using at least some of the elements shown in Figure 4A.

99. An optical disk using system and/or method using at least some of the elements shown in Figure 4B.

100. An optical disk using system and/or method using at least some of the elements shown in Figure 5.

101. An optical disk using system and/or method using at least some of the elements shown in Figure 6.

102. An optical disk using system and/or method using at least some of the elements shown in Figure 7.

103. An optical disk using system and/or method using at least some of the elements shown in Figure 8.

104. An optical disk using system and/or method using at least some of the elements shown in Figure 9.

105. An optical disk using system and/or method using at least some of the elements shown in Figure 10.

106. An optical disk using system and/or method using at least some of the elements shown in Figure 11.

107. An optical disk using system and/or method including at least some of the elements shown in Figure 12.

108. An optical disk using system and/or method including at least some of the elements shown in Figure 13.

109. An optical disk using system and/or method including at least some of the elements shown in Figure 14.

110. A system and/or method including some or all of the elements shown in Figures 15A-15C.

111. A system and/or method as in any one of the preceding claims, further including, in combination, any element described in any one of the following prior patent specifications:

PCT Publication No. WO 96/27155;

European Patent No. EP 329681;

PCT Application No. PCT/US96/14262;

U.S. Patent Application Serial No. 08/689,606; and/or

U.S. Patent Application Serial No. 08/689,754.

112. A system or process as in any of the preceding claims wherein the phrase "high capacity optical disk" is substituted for "digital versatile disk."

113. A method of clearing or otherwise processing information resulting at least in part from one or more digital versatile disk appliances and/or methods as defined in any of the preceding claims.

114. A system and/or method for defining rules for use in one or more digital versatile disk appliances and/or methods as defined in any of the preceding claims.

115. A system and/or method for defining rules and associated content for use in one or more digital versatile disk appliances and/or methods as defined in any of the preceding claims.

116. A system and/or method for producing an optical disk for use with one or more digital versatile disk appliances and/or methods as defined in any of the preceding claims.

117. A system and/or method for clearing audit information from one or more appliances and/or methods as defined in any of the preceding claims.

118. In an network including at least one electronic appliance that reads information from and/or writes information to at least one digital versatile disk optical storage medium, and securely communicates information associated with at least one of

payment, auditing, usage, access, controlling and/or otherwise managing content recorded on the storage medium, a method of processing said communicated information including the step of generating at least one payment request and/or order based at least in part on the information.

119. A method of defining at least one control set for storage on a high capacity optical disk that can storage images, audio, text and/or other information, the high capacity optical disk for use by any of plural different electronic appliance types, the method including the step of specifying at least one control that provides different conditions and/or consequences depending upon at least one of the following:

electronic appliance class;

electronic appliance security;

electronic appliance user class;

electronic appliance connectivity;

electronic appliance resources;

electronic appliance access to resources; and

rights management cooperation between plural electronic appliances.

Fig.1B

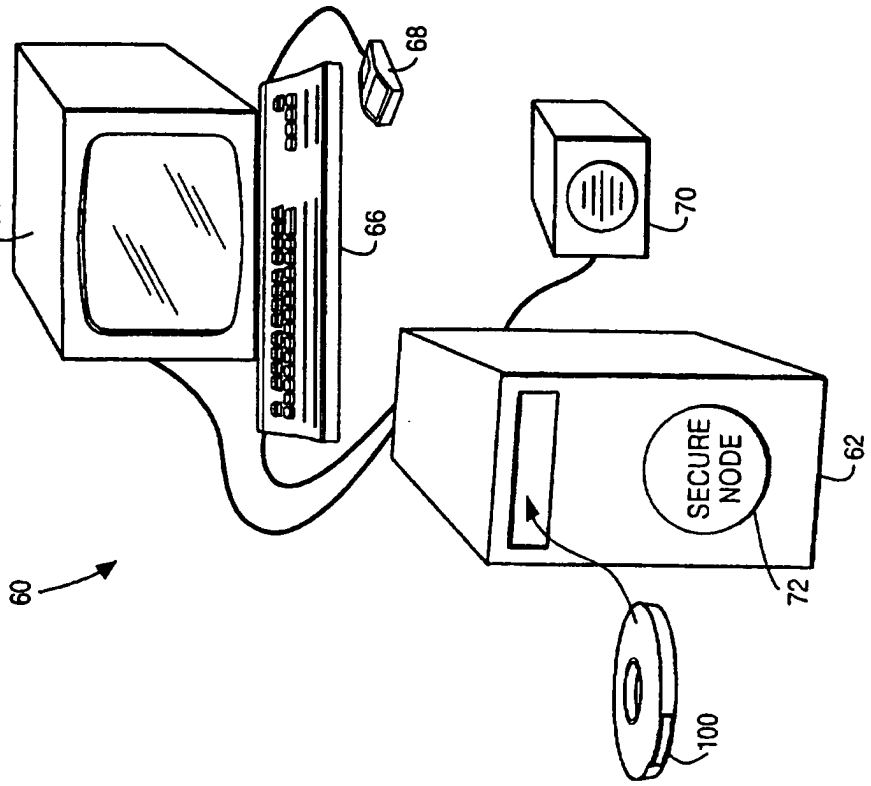
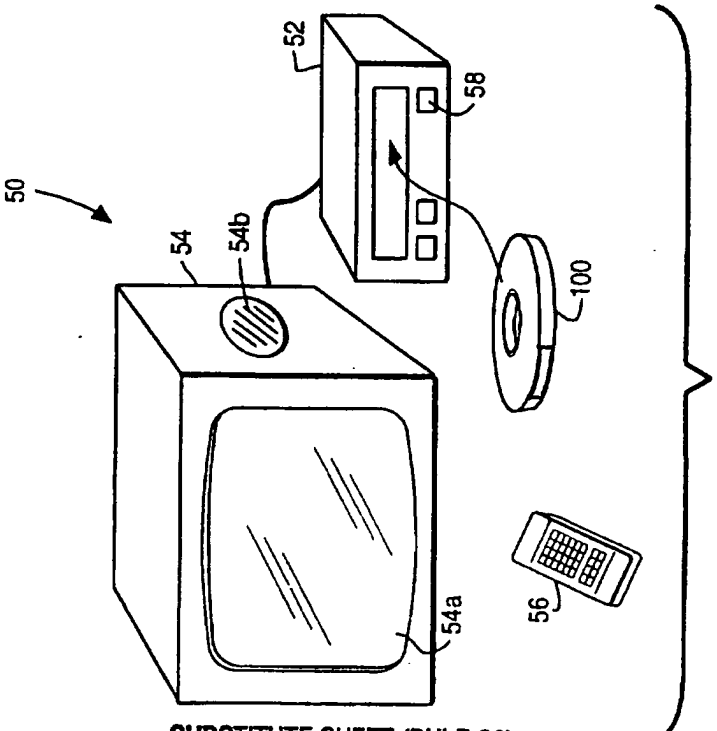


Fig.1A



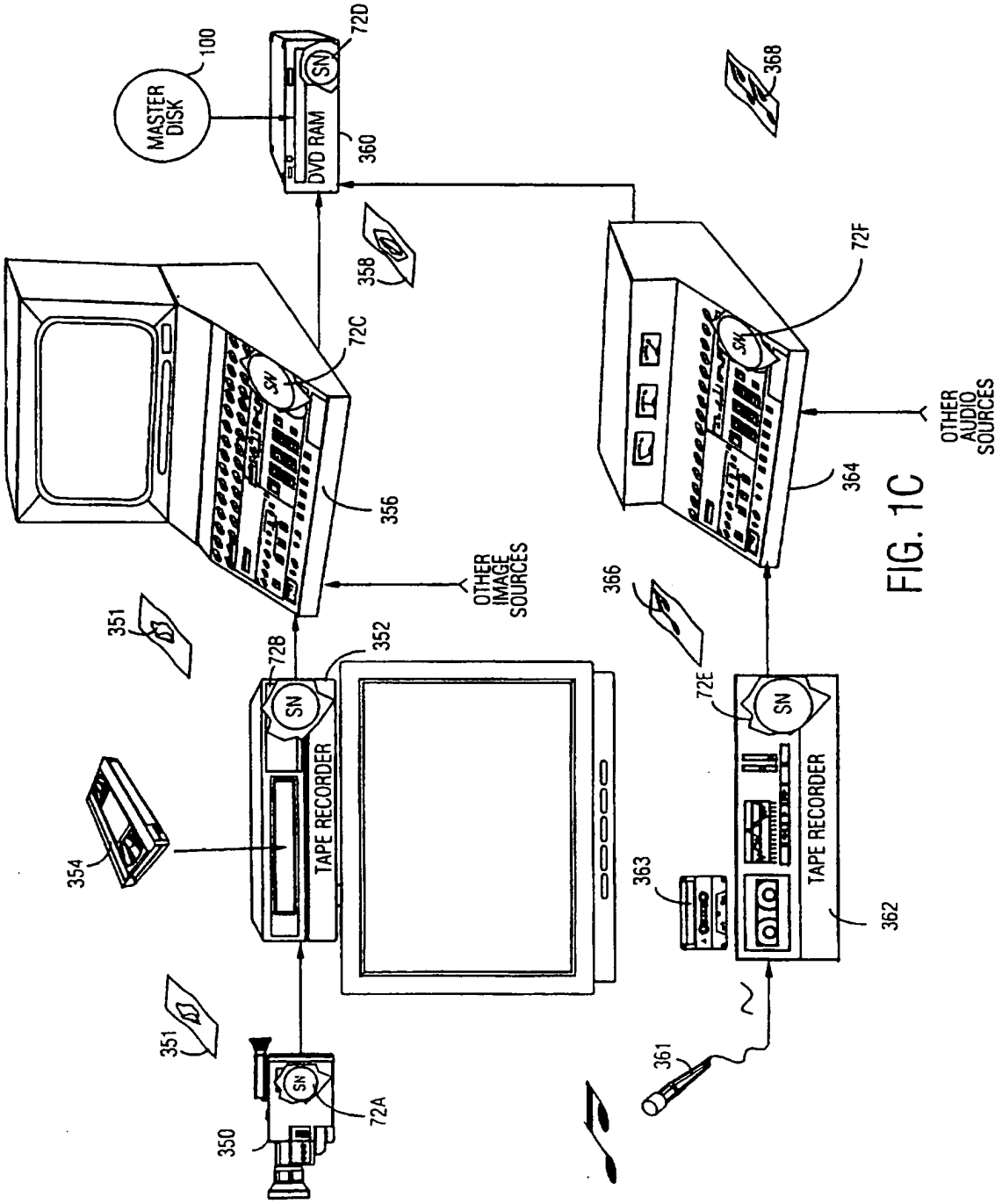


FIG. 1C

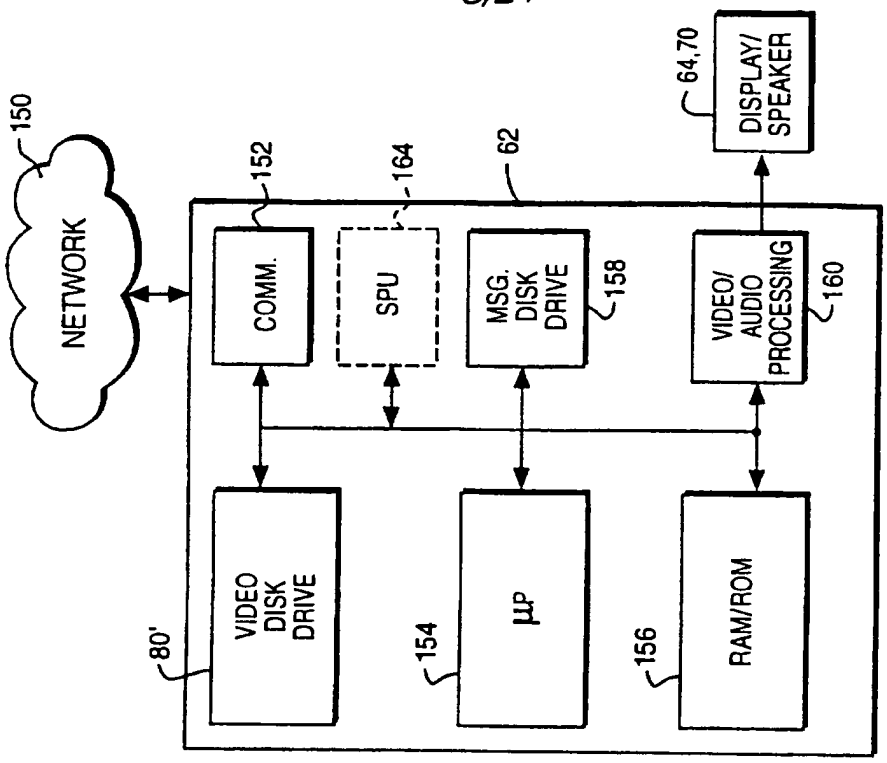


Fig.2B

EXAMPLE SECURE NODE ARCHITECTURE

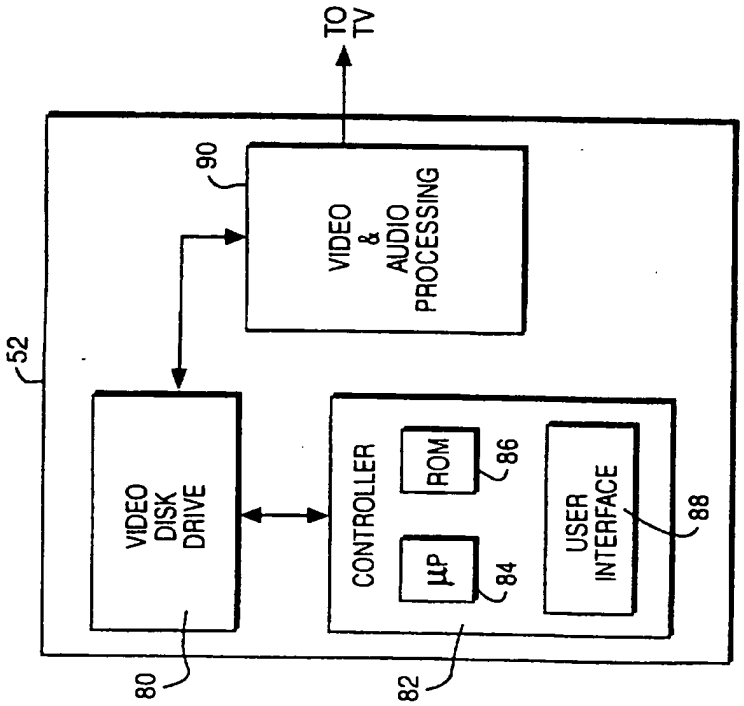


Fig.2A

EXAMPLE PLAYER ARCHITECTURE

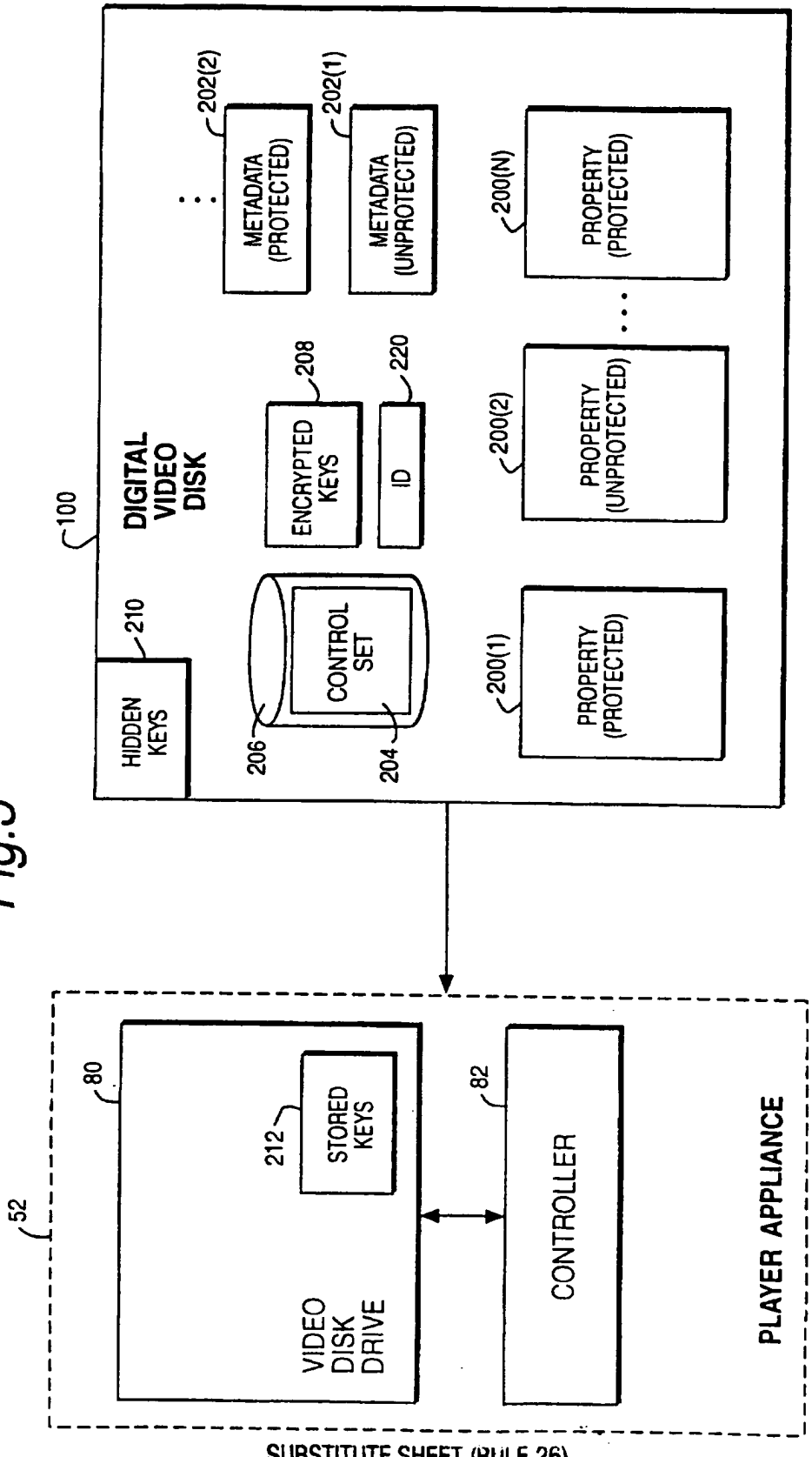


Fig.3

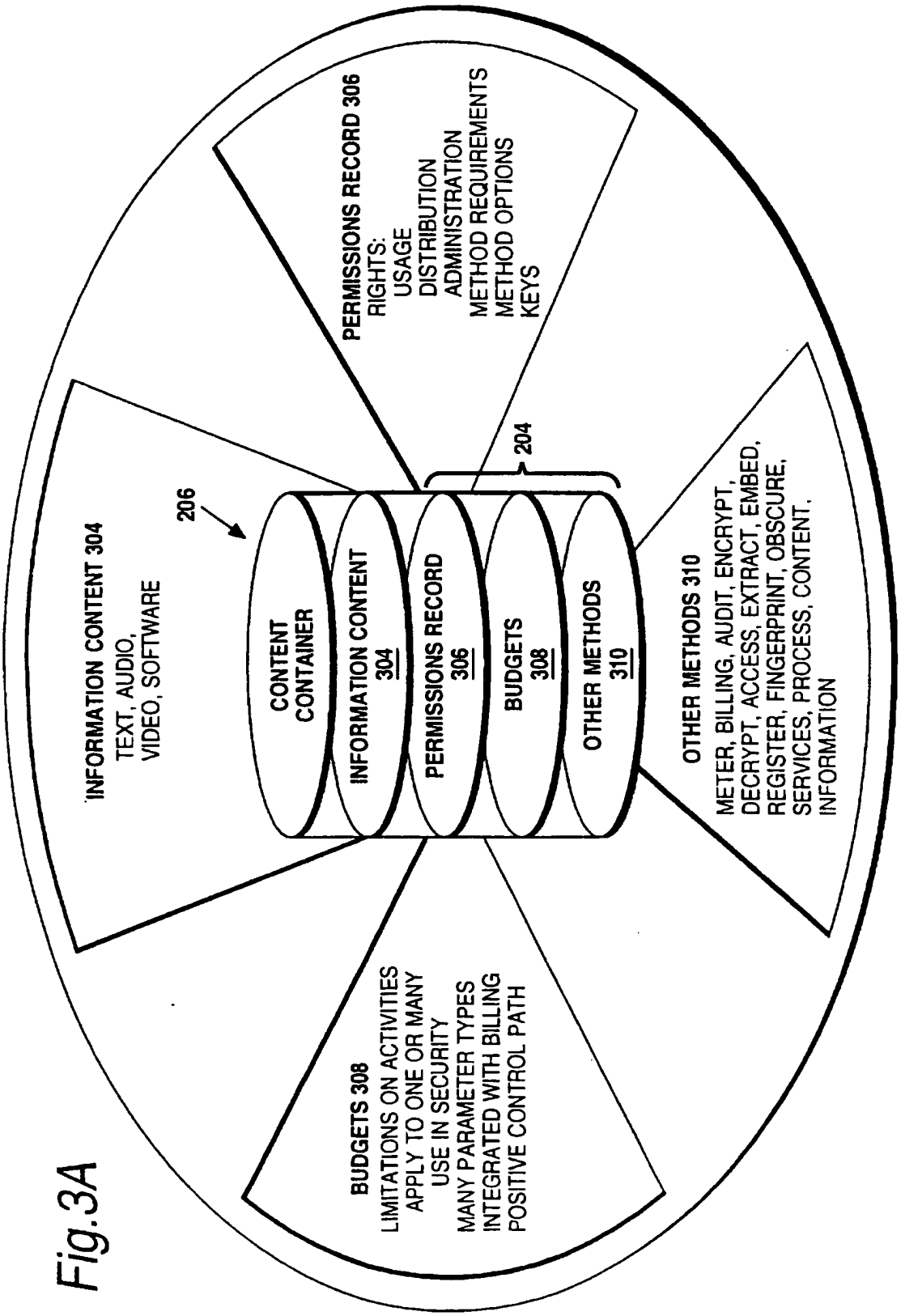


Fig.3A

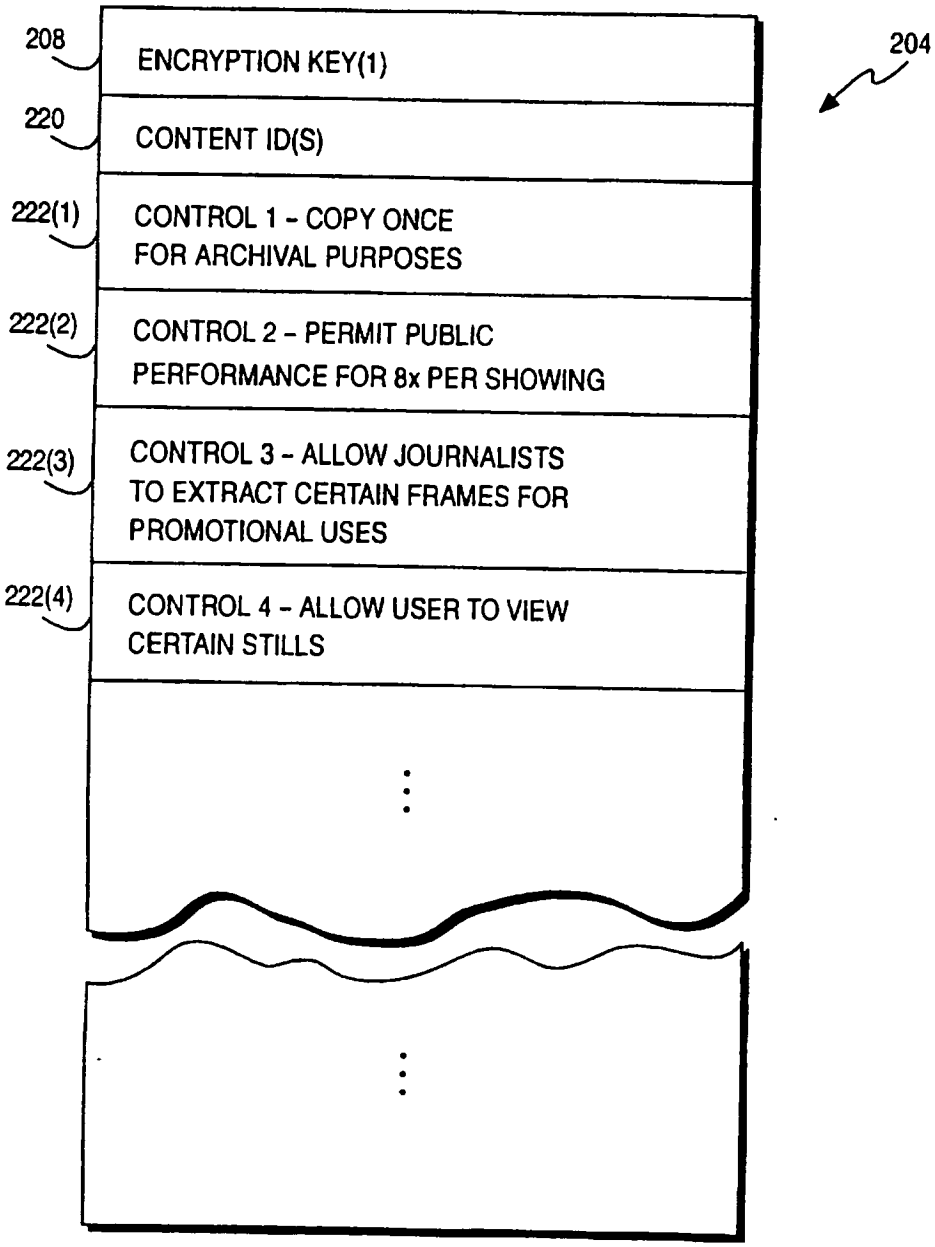


Fig.3B

EXAMPLE CONTROL SET

Fig.4A
EXAMPLE PLAYER STEPS

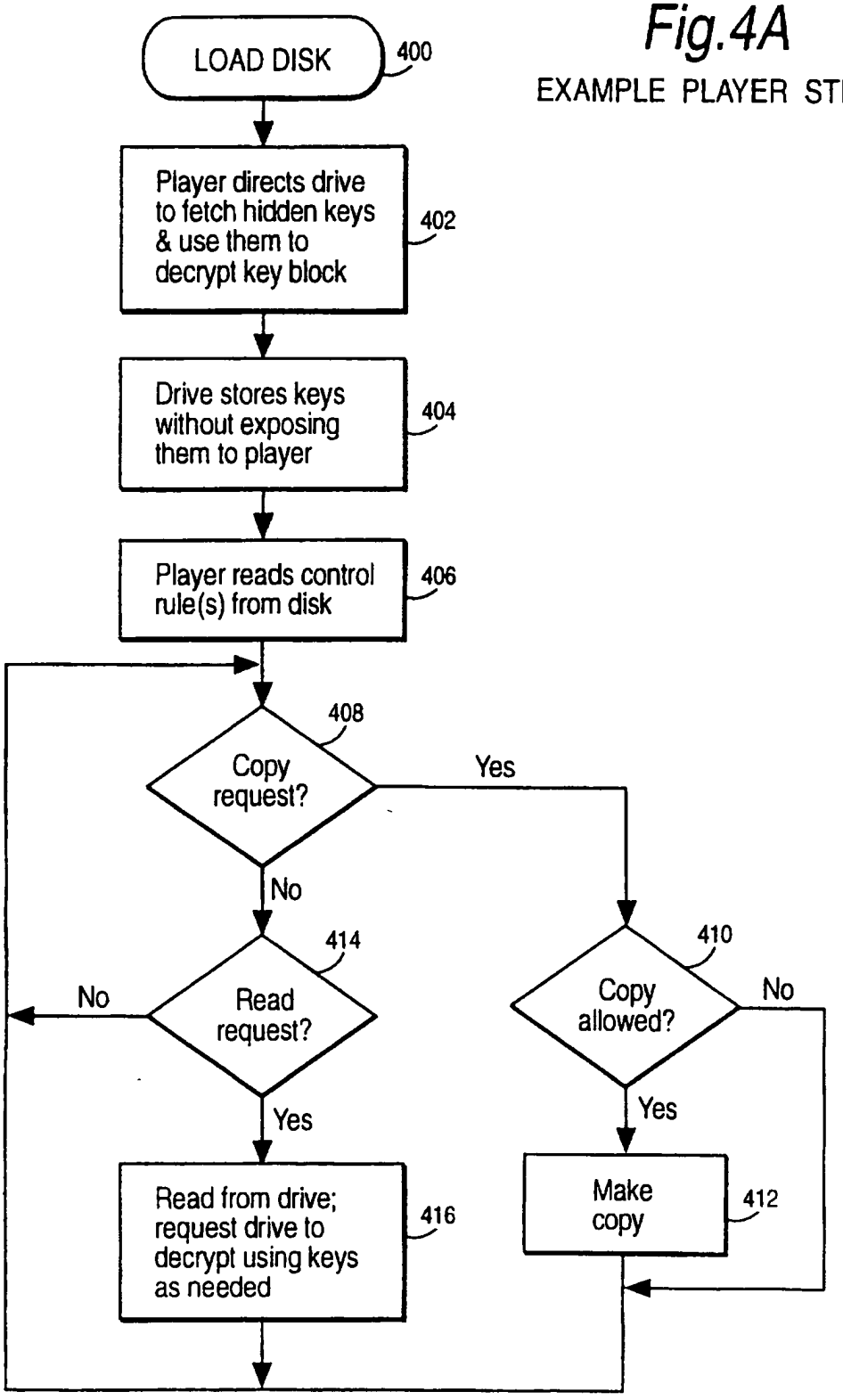
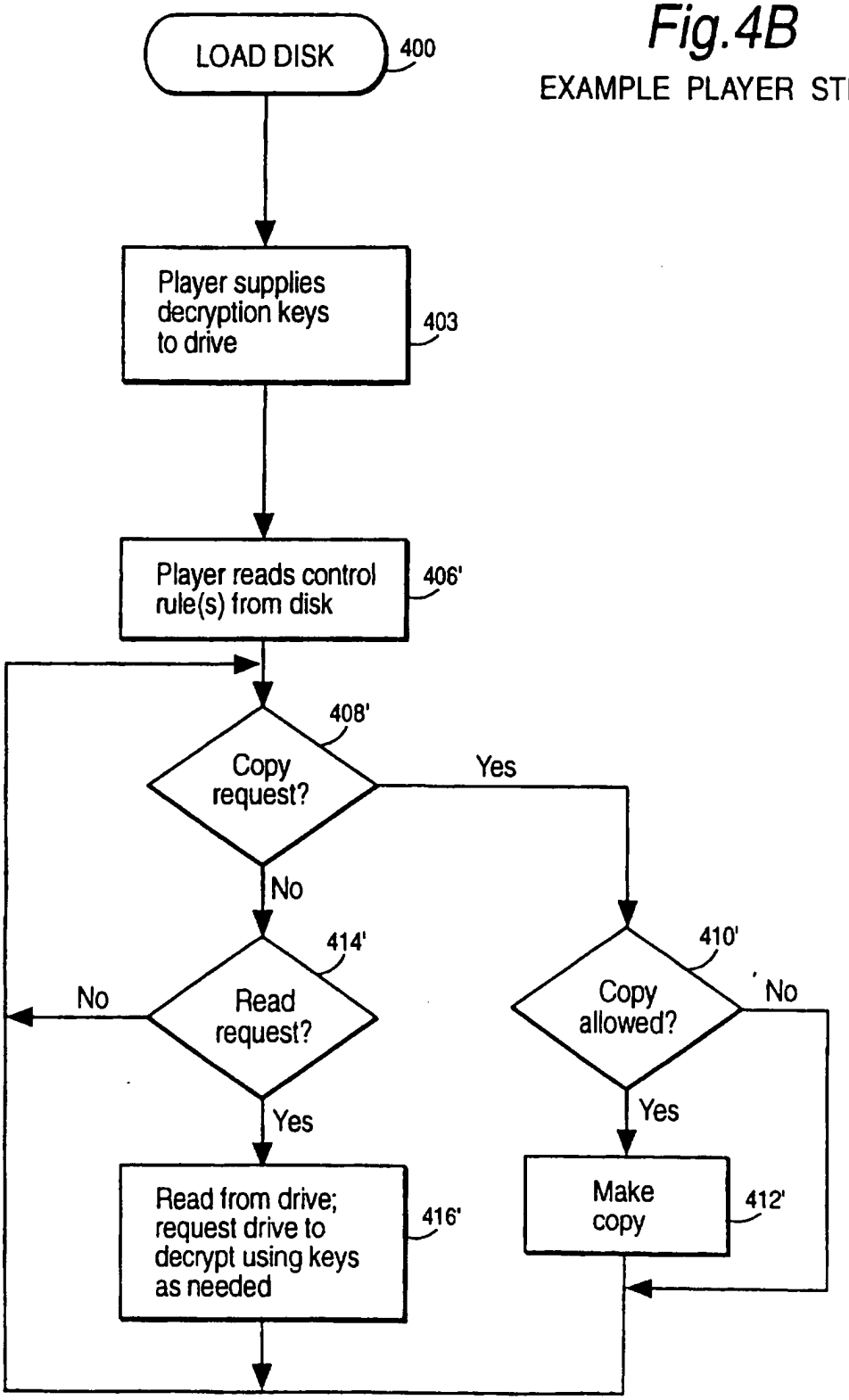


Fig.4B
EXAMPLE PLAYER STEPS



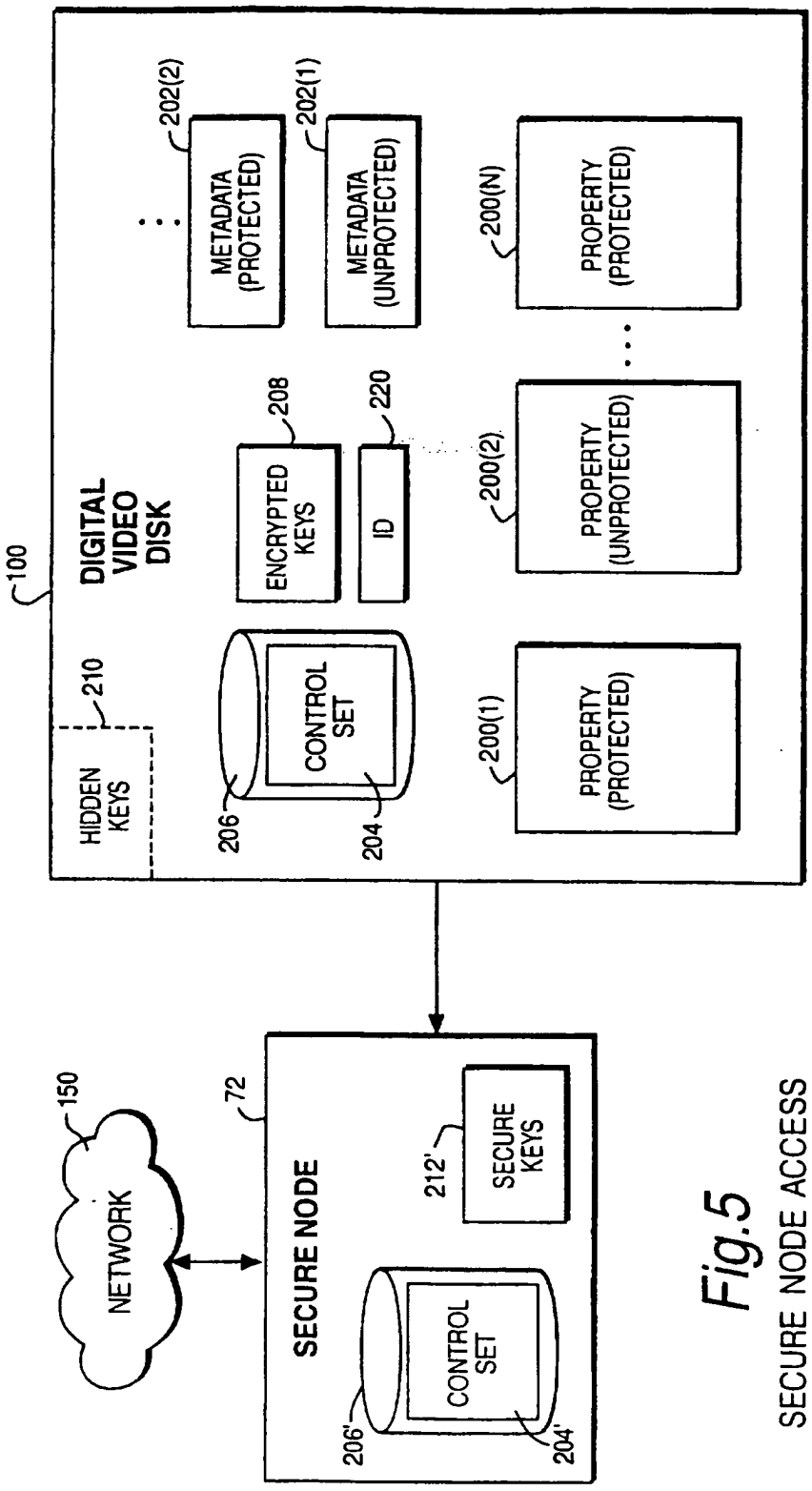


Fig.5
SECURE NODE ACCESS

Fig.6

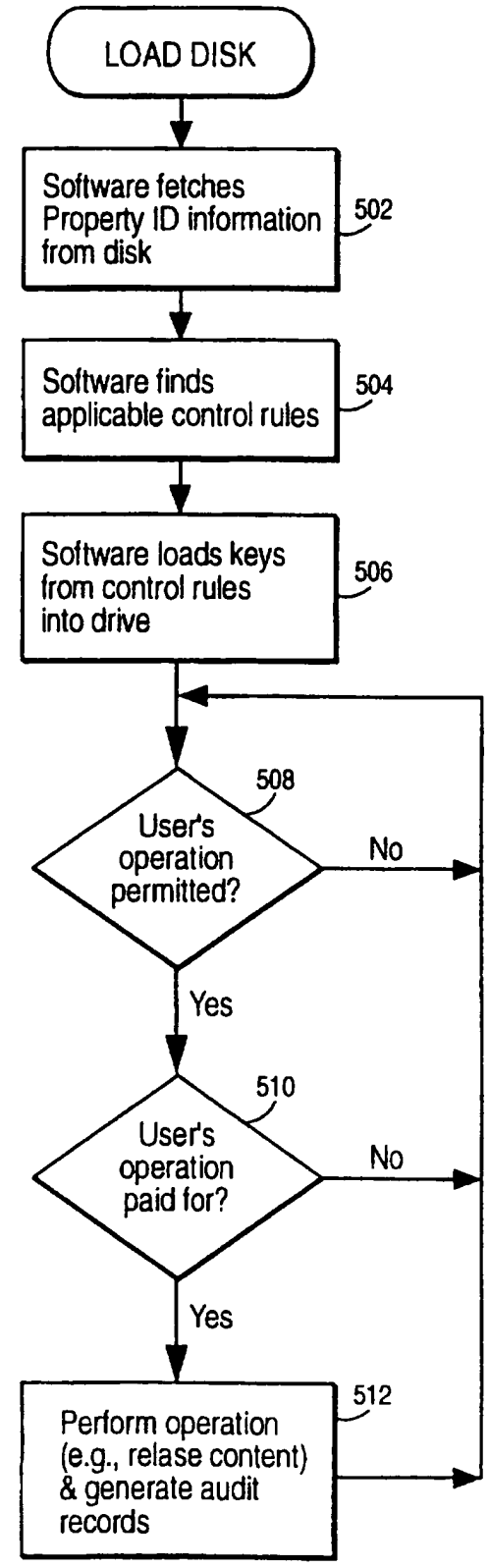


FIG. 7

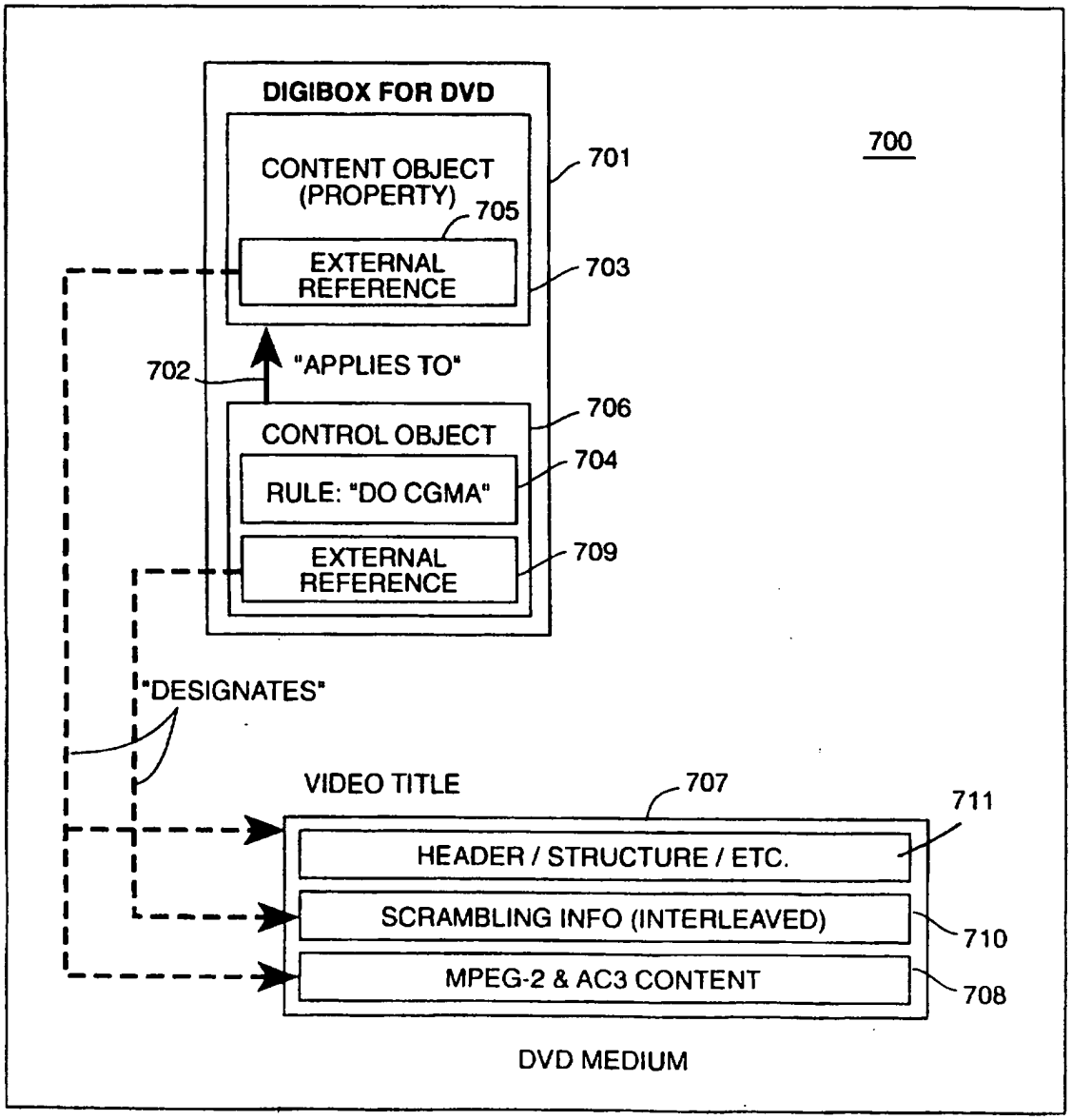


FIG. 8

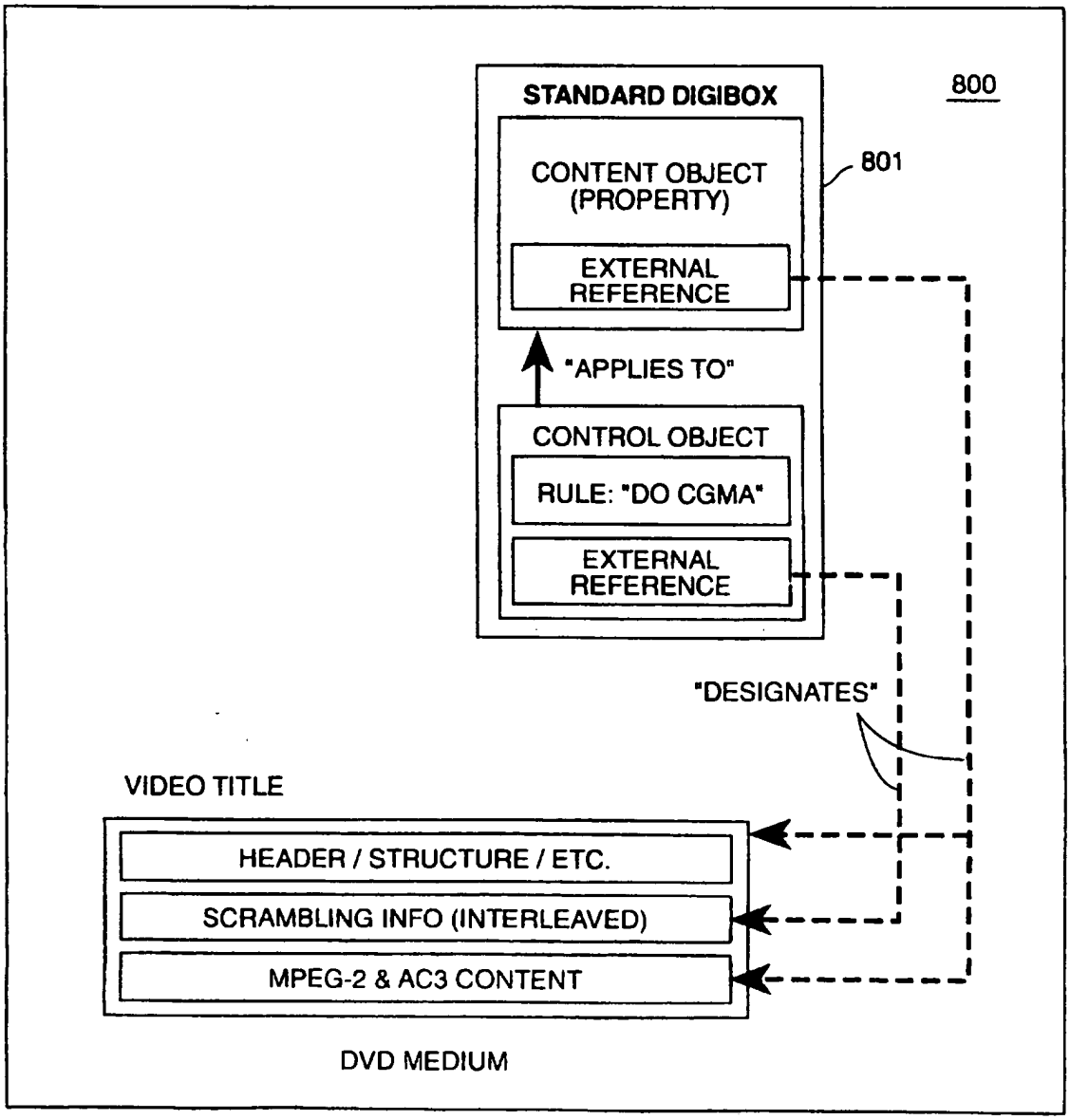


FIG. 9

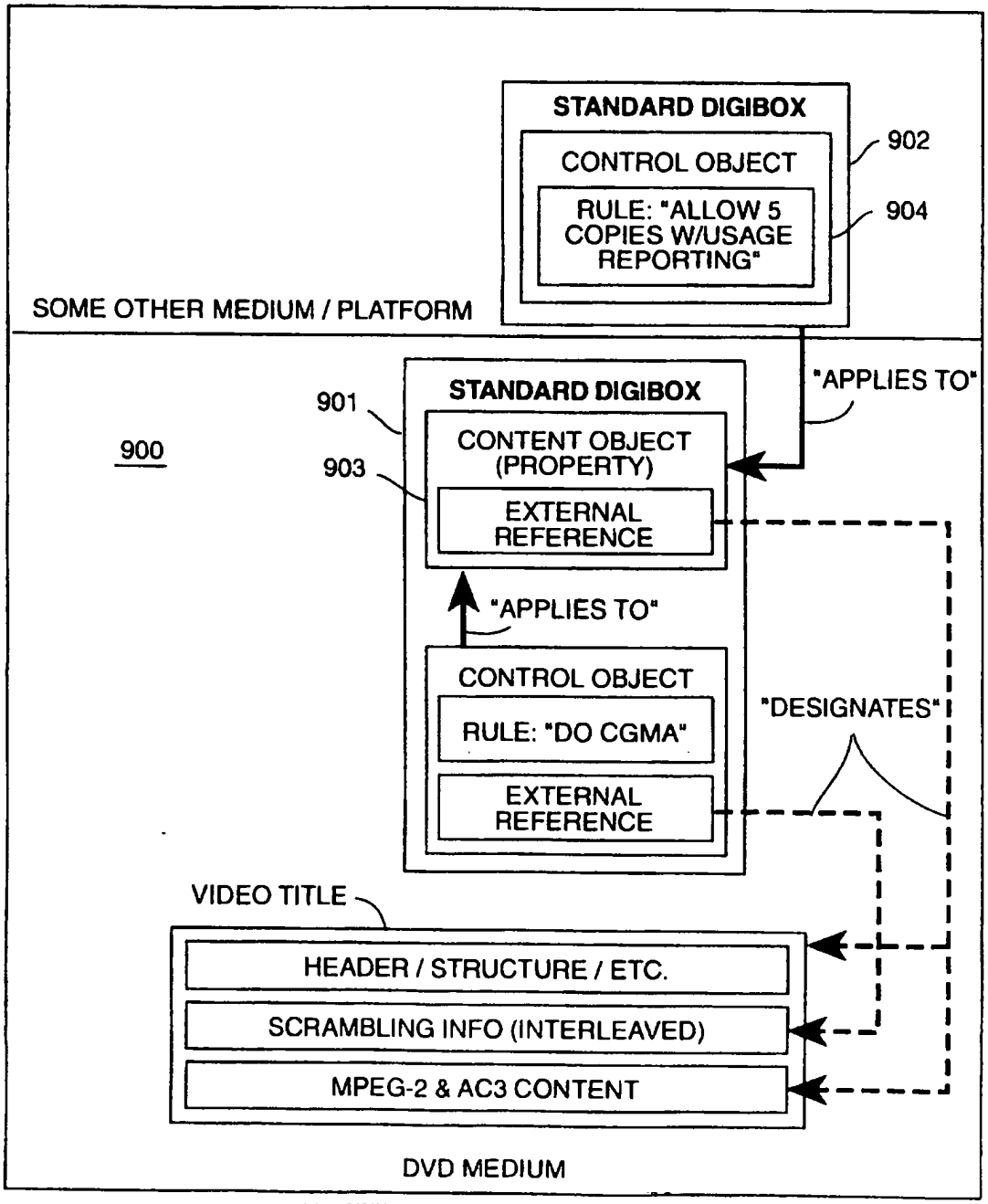


FIG. 10

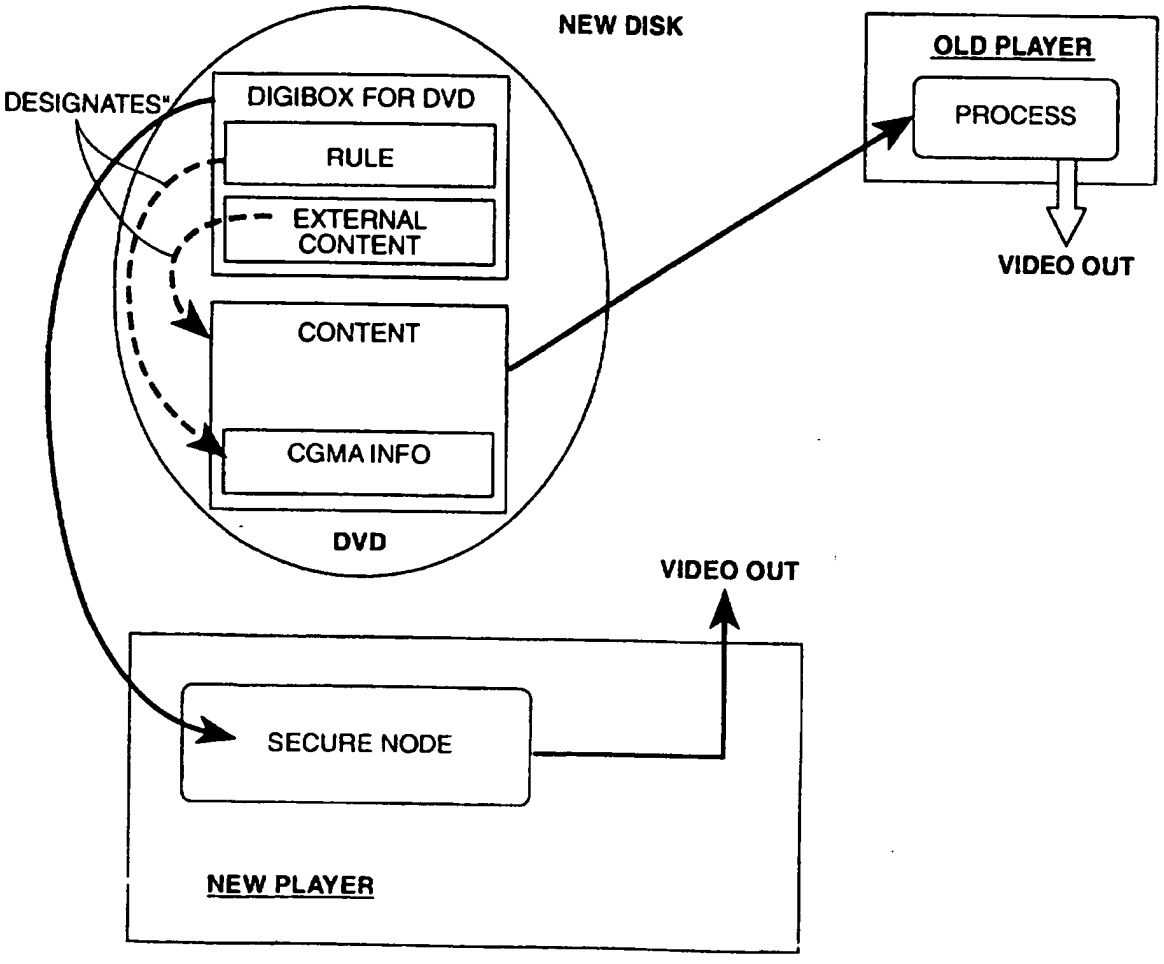
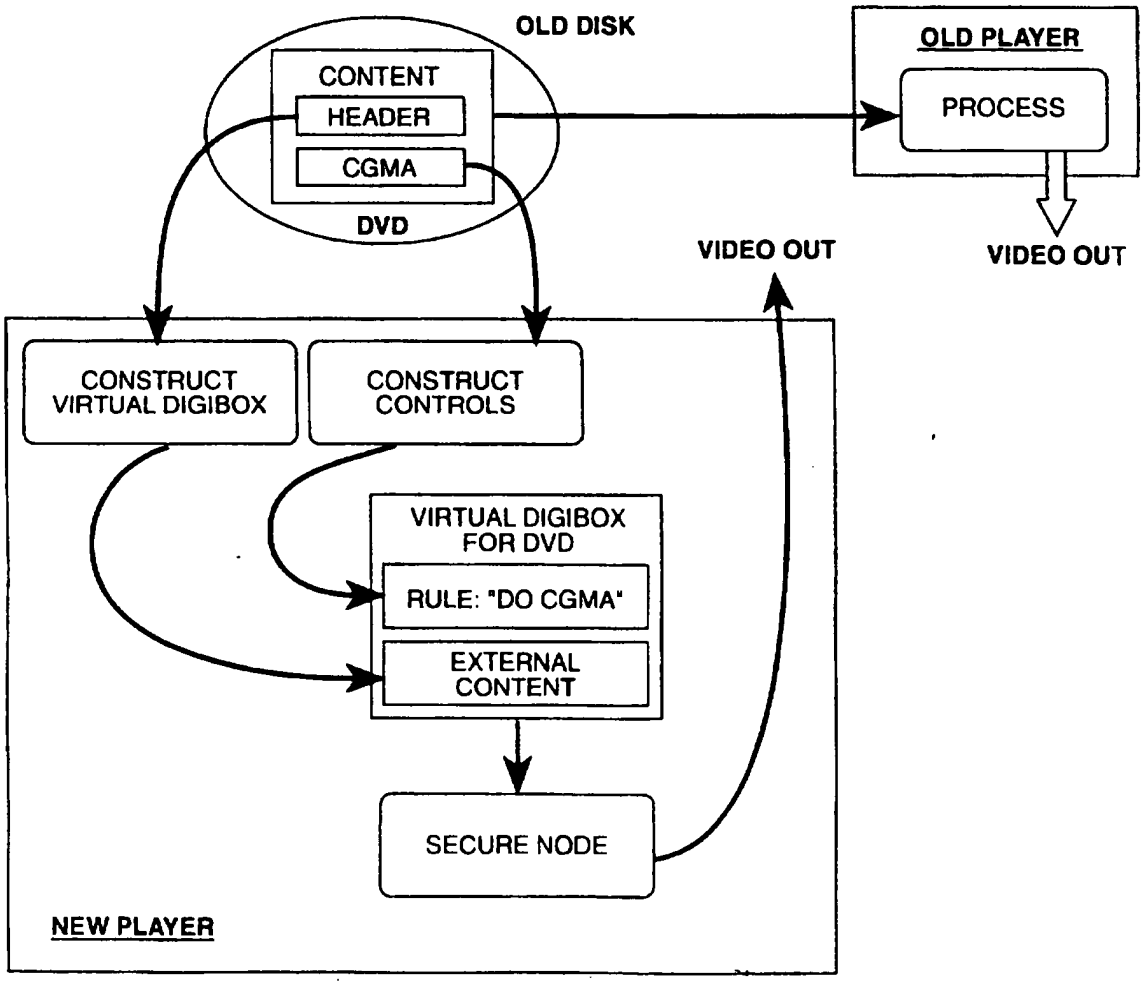


FIG. 11



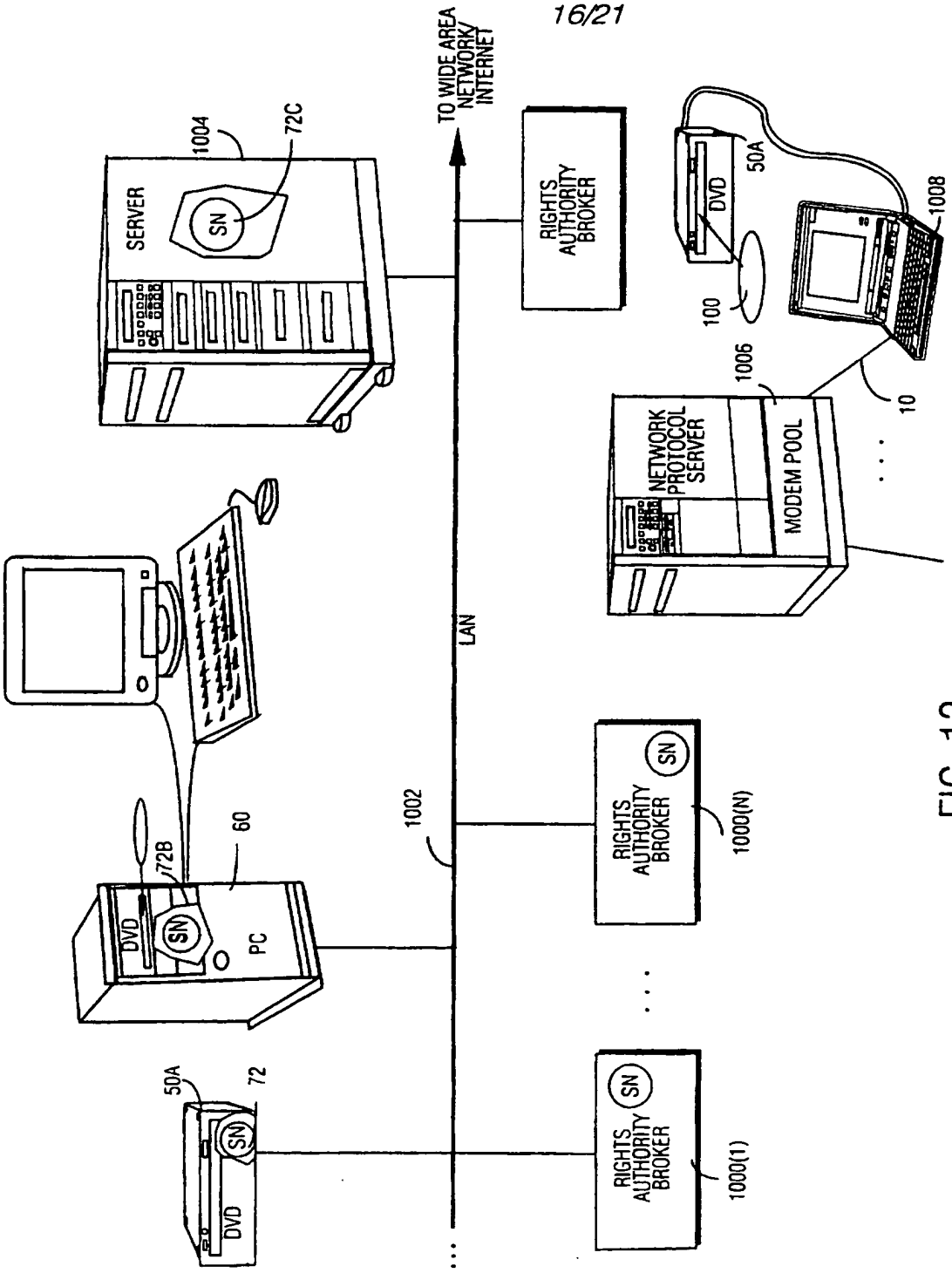


FIG. 12

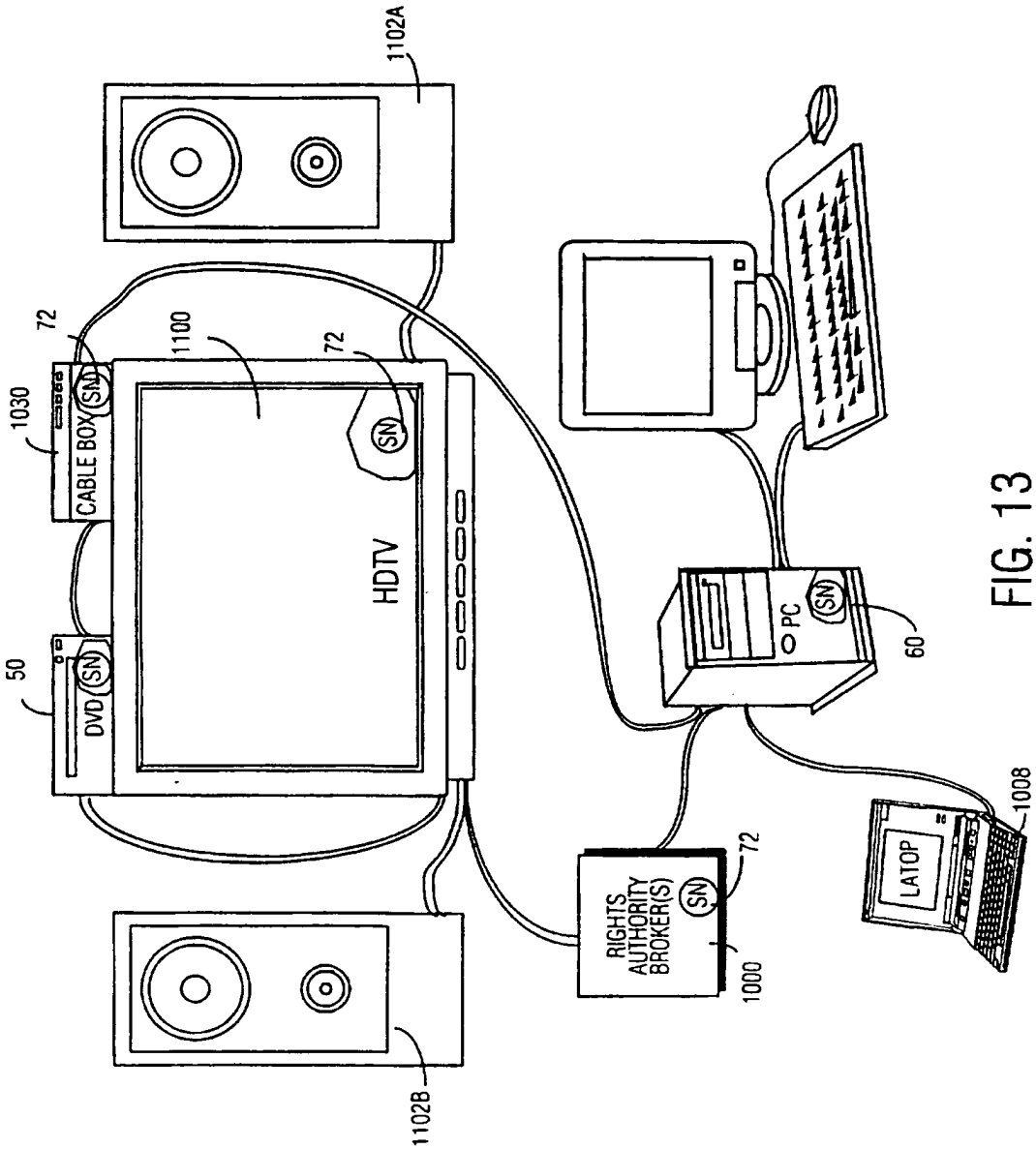


FIG. 13

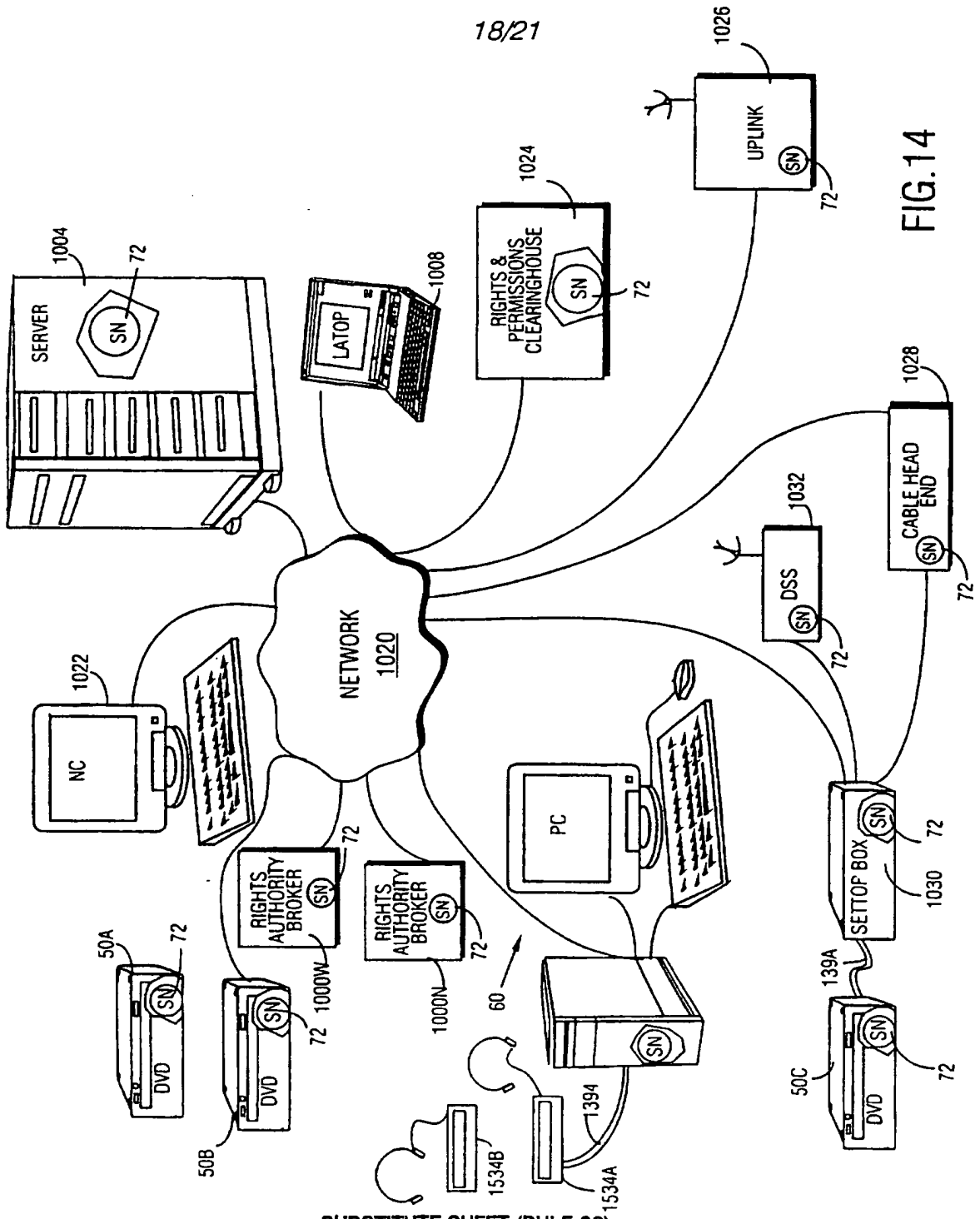


FIG.14

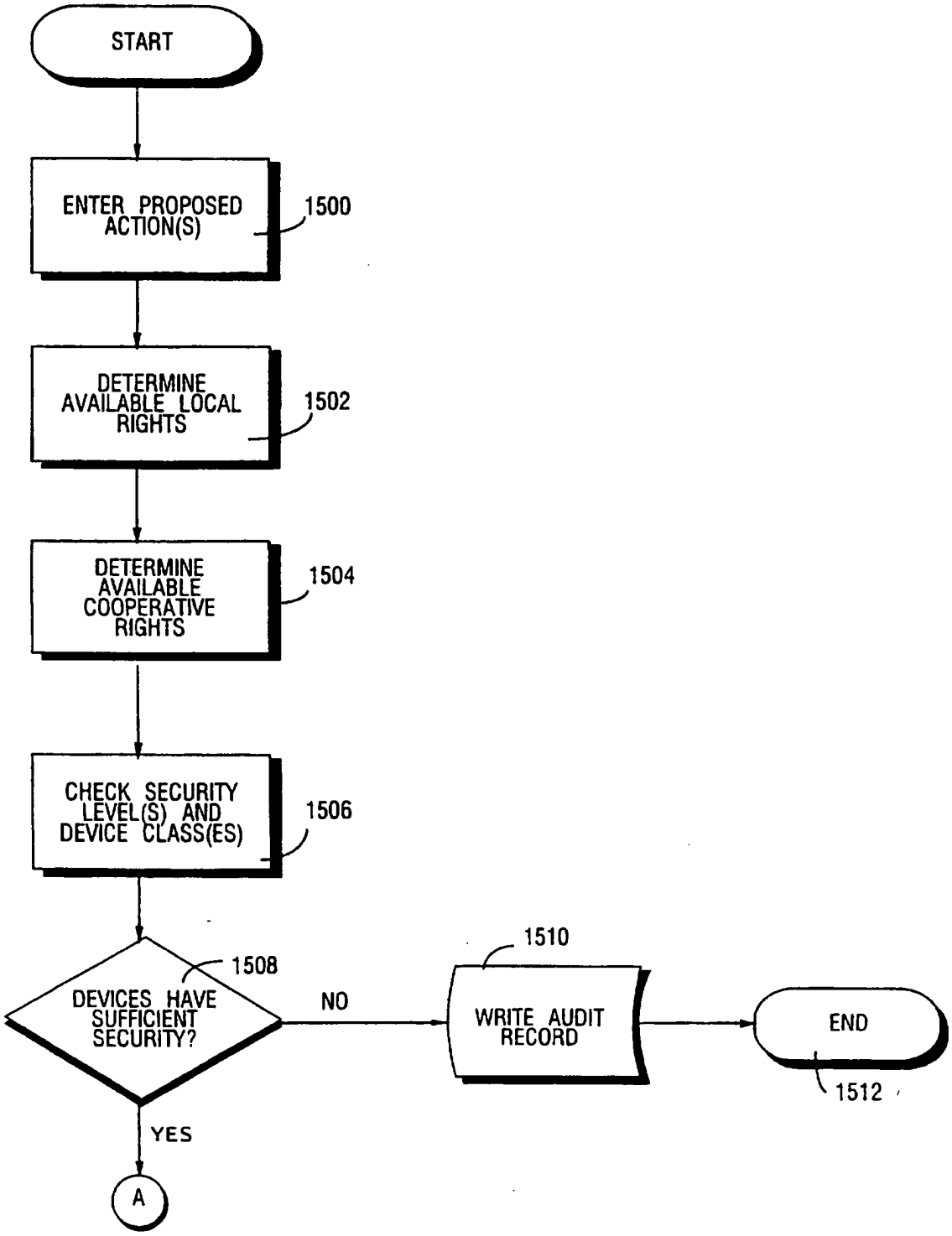


FIG.15A

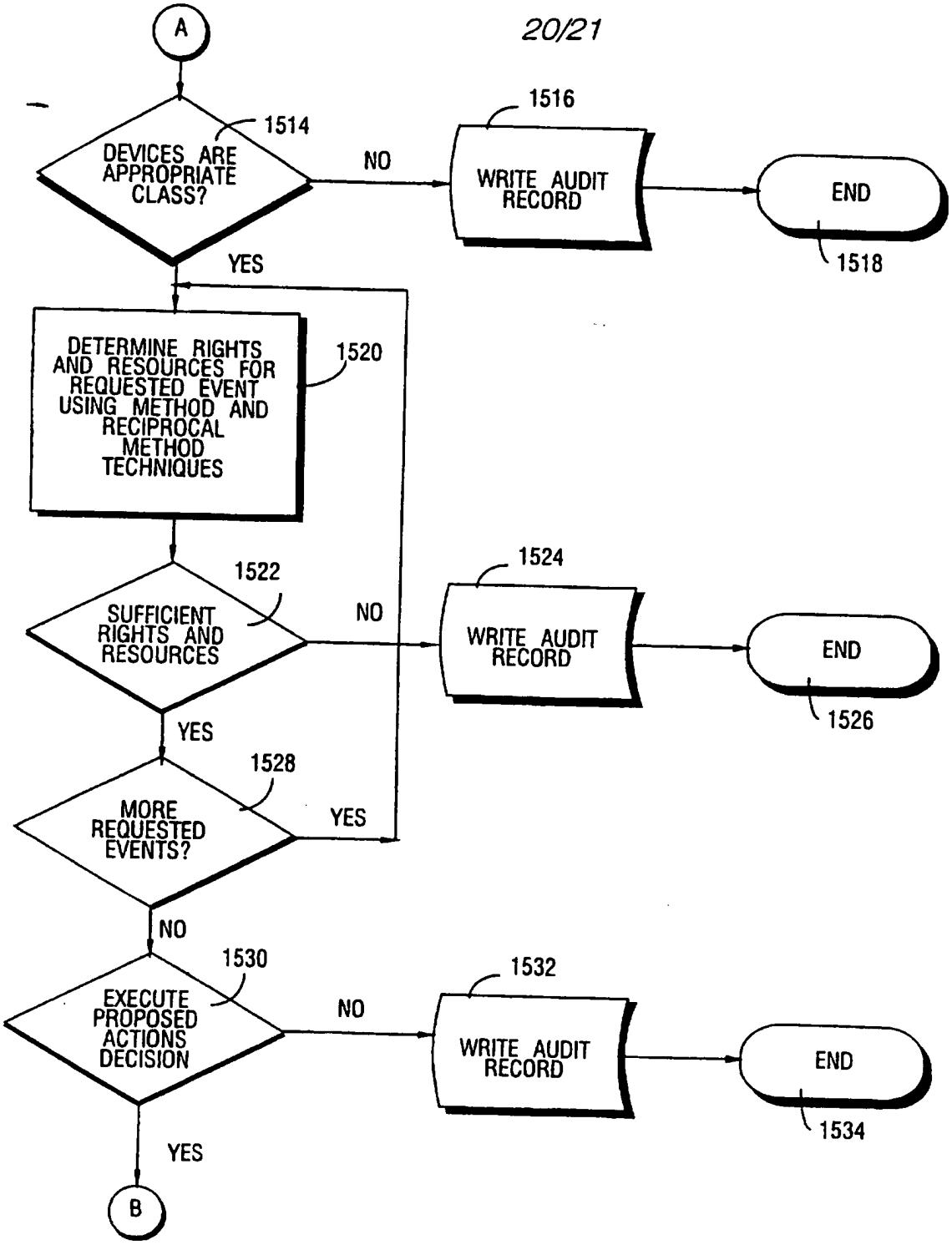
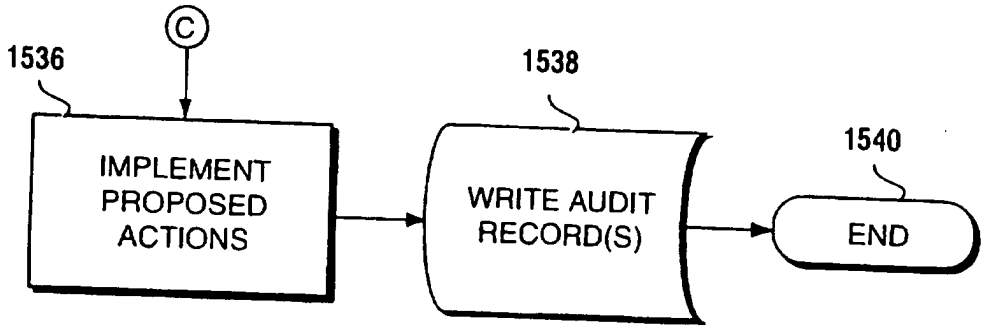


FIG.15B

FIG. 15C



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E36         1   PN=BR 9811001
E37         1   PN=BR 9811002
E38         1   PN=BR 9811004
E39         1   PN=BR 9811005
E40         1   PN=BR 9811006
E41         1   PN=BR 9811007
E42         1   PN=BR 9811008
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E44         1   PN=BR 9811010
E45         1   PN=BR 9811011
E46         1   PN=BR 9811012
E47         1   PN=BR 9811013
E48         1   PN=BR 9811014
E49         1   PN=BR 9811015
E50         1   PN=BR 9811016

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? t 1/7/1

1/7/1
DIALOG(R)File 351: Derwent WPI

0009253575 *Drawing available*
WPI Acc no: 1999-181268/199915
Related WPI Acc No: 1996-465320; 1997-363998; 1998-363180; 1999-154174; 1999-154175; 1999-154176; 1999-154177; 1999-154178; 1999-154179; 1999-243551; 2002-060946; 2002-499082; 2002-705909; 2002-722051; 2002-722052; 2003-677663; 2003-898213; 2004-155029; 2004-478232; 2004-579235; 2004-623798; 2005-809338; 2007-015228
XRPX Acc No: N1999-133079
method for decrypting an instance of service that has been decrypted with short-term key
Patent Assignee: SCIENTIFIC-ATLANTA INC (SCAT)
Inventor: AKINS G L; PALGON M S; PINDER H G; WASILEWSKI A J; AKINS G

Patent Family (8 patents, 79 countries)

Patent Number	Kind	Date	Application Number	Kind	Date	Update	Type
WO 1999009743	A2	19990225	WO 1998US16079	A	19980731	199915	B

AU 199915816	A	19990308	AU 199915816	A	19980731	199929	E
EP 1000511	A2	20000517	EP 1998960147	A	19980731	200028	E
			WO 1998US16079	A	19980731		
BR 199810967	A	20011030	BR 199810967	A	19980731	200173	E
			WO 1998US16079	A	19980731		
EP 1000511	B1	20011114	EP 1998960147	A	19980731	200175	E
			WO 1998US16079	A	19980731		
DE 69802540	E	20011220	DE 69802540	A	19980731	200207	E
			EP 1998960147	A	19980731		
			WO 1998US16079	A	19980731		
JP 2003521820	W	20030715	WO 1998US16079	A	19980731	200347	E
			JP 2000510276	A	19980731		
JP 2005253109	A	20050915	JP 2000510276	A	19980731	200560	E
			JP 2005120425	A	20050418		

Priority Applications (no., kind, date): US 199754575 P 19970801; US 1998126921 A 19980731

Patent Details

Patent Number	Kind	Lan	Pgs	Draw	Filing Notes	
WO 1999009743	A2	EN	113	29		
National Designated States,Original	AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE GH GM HR HU ID IL IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG UZ VN YU ZW					
Regional Designated States,Original	AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL OA PT SD SE SZ UG ZW					
AU 199915816	A	EN			Based on OPI patent	WO 1999009743
EP 1000511	A2	EN			PCT Application	WO 1998US16079
					Based on OPI patent	WO 1999009743
Regional Designated States,Original	DE FR GB IT NL					
BR 199810967	A	PT			PCT Application	WO 1998US16079
					Based on OPI patent	WO 1999009743
EP 1000511	B1	EN			PCT Application	WO 1998US16079
					Based on OPI patent	WO 1999009743
Regional Designated States,Original	DE FR GB IT NL					
DE 69802540	E	DE			Application	EP 1998960147
					PCT Application	WO 1998US16079
					Based on OPI patent	EP 1000511

				Based on OPI patent	WO 1999009743
JP 2003521820	W	JA	136	PCT Application	WO 1998US16079
				Based on OPI patent	WO 1999009743
JP 2005253109	A	JA	59	Division of application	JP 2000510276

Alerting Abstract WO A2

NOVELTY - The method involves receiving a second message in a receiver together with the instance of the service. The second message includes a key derivation value that is used with a long-term key to obtain the short-term key to decrypt the instance of the service.

DESCRIPTION - A control word is combined into an encrypted coded message (ECM) (107) with other service-related information. The ECM (107) is authenticated by Control Word Encrypt & Message Authenticate function (204) which produces a message authentication code using a keyed-hash value derived from the message content combined with a secret which can be shared with the receiving set-top box (113). This secret is preferably part or all of a multisession key (MSS) (208). The message authentication code is appended to the rest of the ECM (107). The CAW (202) is always encrypted before being sent along with the other parts of the ECM to MX (200). This encryption is preferably a symmetric cipher such as the Triple-DES algorithm using two distinct 56-bit keys (which taken together comprise MSS (208).

USE - The invention concerns systems for protecting information and more particularly concerns systems for protecting information that is transmitted by a wired or wireless medium against unauthorized access.

ADVANTAGE - The service distribution organizations require access restrictions which are both more secure and more flexible than those in conventional systems

DESCRIPTION OF DRAWINGS - The drawing is a block diagram of service instance encryption techniques.

107 encrypted coded message

204 Control Word Encrypt & Message Authenticate function

200 MX

Title Terms /Index Terms/Additional Words: METHOD; INSTANCE; SERVICE; SHORT; TERM; KEY

Class Codes

International Patent Classification

IPC	Class Level	Scope	Position	Status	Version Date
H04L-009/08			Main		"Version 7"
H04H-001/00; H04N-007/167; H04N-007/173			Secondary		"Version 7"
H04H-0001/00	A	I	L	R	20060101
H04L-0009/08	A	I	L	R	20060101
H04N-0005/00	A	I		R	20060101
H04N-0007/16	A	I		R	20060101
H04N-0007/167	A	I		R	20060101
H04N-0007/173	A	I	F	R	20060101

H04H-0001/00	C	I	L	R	20060101
H04L-0009/08	C	I	F	R	20060101
H04N-0005/00	C	I		R	20060101
H04N-0007/16	C	I		R	20060101
H04N-0007/167	C	I		R	20060101
H04N-0007/173	C	I	L	R	20060101

File Segment: EPI;
DWPI Class: W02; W03
Manual Codes (EPI/S-X): W02-F05A1B; W03-A16C3A

Original Publication Data by Authority

Australia

Publication No. AU 199915816 A (Update 199929 E)
Publication Date: 19990308
Assignee: SCIENTIFIC-ATLANTA INC; US (SCAT)
Language: EN
Application: AU 199915816 A 19980731 (Local application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: WO 1999009743 A (Based on OPI patent)
Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00 (R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08 (R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00 (R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16 (R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167 (R,I,M,EP,20060101,20051008,C) H04N-7/173(R,I,M,JP,20060101,20051220,A,F) H04N-7/173 (R,I,M,JP,20060101,20051220,C,L)

Brazil

Publication No. BR 199810967 A (Update 200173 E)
Publication Date: 20011030
Assignee: SCIENTIFIC-ATLANTA INC (SCAT)
Inventor: WASILEWSKI A J
AKINS G L
PALGON M S
PINDER H G
Language: PT
Application: BR 199810967 A 19980731 (Local application)
WO 1998US16079 A 19980731 (PCT Application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: WO 1999009743 A (Based on OPI patent)

Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00
(R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08
(R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00
(R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16
(R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167
(R,I,M,EP,20060101,20051008,C) H04N-7/173(R,I,M,JP,20060101,20051220,A,F) H04N-7/173
(R,I,M,JP,20060101,20051220,C,L)

Germany

Publication No. DE 69802540 E (Update 200207 E)
Publication Date: 20011220
Assignee: SCIENTIFIC-ATLANTA INC; US (SCAT)
Language: DE
Application: DE 69802540 A 19980731 (Local application)
EP 1998960147 A 19980731 (Application)
WO 1998US16079 A 19980731 (PCT Application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: EP 1000511 A (Based on OPI patent)
WO 1999009743 A (Based on OPI patent)

EPO

Publication No. EP 1000511 A2 (Update 200028 E)
Publication Date: 20000517
Assignee: SCIENTIFIC-ATLANTA, INC., One Technology Parkway South, Norcross, Georgia 30092, US
Inventor: AKINS, Glendon, L., III, 2510 Windward Lane N.E., Gainesville, GA 30501, US
PALGON, Michael, S., 1196 Poplar Grove Drive, Atlanta, GA 30306, US
PINDER, Howard, G., 4317 Stilson Circle, Norcross, GA 30092, US
WASILEWSKI, Anthony, J., 10680 Wren Ridge Road, Alpharetta, GA 30022, US
Agent: Kugele, Bernhard, NOVAPAT INTERNATIONAL SA, 9, Rue du Valais, 1202 Geneve, CH
Language: EN
Application: EP 1998960147 A 19980731 (Local application)
WO 1998US16079 A 19980731 (PCT Application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: WO 1999009743 A (Based on OPI patent)
Designated States: (Regional Original) DE FR GB IT NL
Original IPC: H04N-7/167(A)
Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00
(R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08
(R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00
(R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16
(R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167
(R,I,M,EP,20060101,20051008,C) H04N-7/173(R,I,M,JP,20060101,20051220,A,F) H04N-7/173
(R,I,M,JP,20060101,20051220,C,L)
Original Abstract:

A cable television system provides conditional access to services. The cable television system includes a headend from which service "instances", or programs, are broadcast and a plurality of set top units for receiving the instances and selectively decrypting the instances for display to system subscribers. The service instances are encrypted using public and/or private keys provided by service providers or central authorization agents. Keys used by the set tops for selective decryption may also be public or private in nature, and such keys may be reassigned at different times to provide a cable television system in which piracy concerns are minimized.

Publication No. EP 1000511 B1 (Update 200175 E)
Publication Date: 20011114
Assignee: Scientific-Atlanta, Inc., 5030 Sugarloaf Parkway, Lawrenceville, GA 30044, US
Inventor: AKINS, Glendon, L., III, 2510 Windward Lane N.E., Gainesville, GA 30501, US
PALGON, Michael, S., 1196 Poplar Grove Drive, Atlanta, GA 30306, US
PINDER, Howard, G., 4317 Stilson Circle, Norcross, GA 30092, US
WASILEWSKI, Anthony, J., 10680 Wren Ridge Road, Alpharetta, GA 30022, US
Agent: Kugele, Bernhard, NOVAPAT INTERNATIONAL SA, 9, Rue du Valais, 1202 Geneve, CH
Language: EN
Application: EP 1998960147 A 19980731 (Local application)
WO 1998US16079 A 19980731 (PCT Application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: WO 1999009743 A (Based on OPI patent)
Designated States: (Regional Original) DE FR GB IT NL
Original IPC: H04N-7/167(A)
Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00 (R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08 (R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00 (R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16 (R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167 (R,I,M,EP,20060101,20051008,C) H04N-7/ 173(R,I,M,JP,20060101,20051220,A,F) H04N-7/173 (R,I,M,JP,20060101,20051220,C,L)
Claim:

1. Verfahren der Entschlusselung einer Diensteeinheit (325), die mit einem gegebenen Kurzzeitschlussel (319) verschlusselt wurde, wobei das Verfahren in einem Empfanger (333) ausgefuhrt wird, der ein Offentlich/Privat-Schlusselpaar besitzt, und das Verfahren durch die folgenden Schritte **gekennzeichnet** ist:
   - im Empfanger eine erste Nachricht (315) zu empfangen, deren Inhalt einen ersten Langzeitschlussel (309) einschliesst und unter Verwendung des offentlichen Schlussels (312) fiir den Empfanger (333) verschlusselt wurde;
   - den privaten Schlussel (337) zur Entschlusselung des Inhalts zu verwenden;
   - den ersten Schlussel (309) zu speichern;
   - im Empfanger (333) zusammen mit der verschlusselten Diensteeinheit (329) eine zweite Nachricht (323) zu empfangen, wobei die zweite Nachricht (323) einen Indikator fur einen zweiten Kurzzeitschlussel (319) einschliesst;
   - den Indikator und den ersten Schlussel (309) zu benutzen, um den zweiten Schlussel zu erhalten; worin der zweite Schlussel dem gegebenen Schlussel (319), mit dem der Dienst verschlusselt wurde, gleichwertig ist, und
   - den zweiten Schlussel zur Entschlusselung der empfangenen Diensteeinheit zu

verwenden.

1. A method of decrypting an instance of a service (325) that has been encrypted with a given short-term key (319), the method being carried out in a receiver (333) that has a public key-private key pair and the method being **characterised by** the following steps:
   - o receiving a first message (315) in the receiver whose contents include a first long-term key (309), the contents having been encrypted using the public key (312) for the receiver (333);
   - o using the private key (337) to decrypt the contents;
   - o storing the first key (309);
   - o receiving a second message (323) in the receiver (333) together with the encrypted instance of the service (329), the second message (323) including an indicator for a second short-term key (319);
   - o using the indicator an the first key (309) to obtain the second key; wherein the second key is equivalent to the given key (319) that encrypted the service, and
   - o using the second key to decrypt the received instance of the service.

1. Procede de decryptage d'une instance d'un service (326) qui etait cryptee avec une cle a court terme donnee (319), le procede etant execute dans un recepteur (333) qui comporte une paire de cle publique-cle privee et le procede etant **caracterise par** les etapes suivantes:
   - o recevoir un premier message (315) dans le recepteur dont le contenu comprend une premiere cle a long terme (309), le contenu ayant ete crypte en utilisant la cle publique (312) pour le recepteur (333),
   - o utiliser la cle privee (337) pour decrypter le contenu,
   - o memoriser la premiere cle (309),
   - o recevoir un second message (323) dans le recepteur (333) en meme temps que l'instance cryptee du service (329), le second message (323) comprenant un indicateur pour une seconde cle a court terme (319),
   - o utiliser l'indicateur et la premiere cle (309) pour obtenir la seconde cle, dans lequel
   - o la seconde cle est equivalente a la cle donnee (319) qui a crypte le service, et
   - o utiliser la seconde cle pour decrypter l'instance recue du service.

Japan

Publication No. JP 2003521820 W (Update 200347 E)
Publication Date: 20030715
Language: JA (136 pages)
Application: WO 1998US16079 A 19980731 (PCT Application)
JP 2000510276 A 19980731 (Local application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Related Publication: WO 1999009743 A (Based on OPI patent)

Original IPC: H04L-9/08(A) H04H-1/00(B) H04N-7/167(B) H04N-7/173(B)
Current IPC: H04L-9/08(A) H04H-1/00(B) H04N-7/167(B) H04N-7/173(B)

Publication No. JP 2005253109 A (Update 200560 E)
Publication Date: 20050915
CONDITIONAL ACCESS SYSTEM
Assignee: SCIENTIFIC-ATLANTA INC (SCAT)
Inventor: AKINS GLENDON L III
PALGON MICHAEL S
PINDER HOWARD G
WASILEWSKI ANTHONY J
Language: JA (59 pages)
Application: JP 2000510276 A 19980731 (Division of application)
JP 2005120425 A 20050418 (Local application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Original IPC: H04L-9/08(A)
Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00 (R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08 (R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00 (R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16 (R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167 (R,I,M,EP,20060101,20051008,C) H04N-7/173(R,I,M,JP,20060101,20051220,A,F) H04N-7/173 (R,I,M,JP,20060101,20051220,C,L)

WIPO

Publication No. WO 1999009743 A2 (Update 199915 B)
Publication Date: 19990225
CONDITIONAL ACCESS SYSTEM
RESEAU D'ACCES CONDITIONNEL
Assignee: SCIENTIFIC-ATLANTA, INC., Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092, US Residence: US Nationality: US (SCAT)
Inventor: AKINS, Glendon, L., III, 2510 Windward Lane N.E., Gainesville, GA 30501, US
PALGON, Michael, S., 1196 Poplar Grove Drive, Atlanta, GA 30306, US
PINDER, Howard, G., 4317 Stilson Circle, Norcross, GA 30092, US
WASILEWSKI, Anthony, J., 10680 Wren Ridge Road, Alpharetta, GA 30022, US
Agent: GARDNER, Kelly, A., Scientific-Atlantic, Inc., Intellectual Property Dept., One Technology Parkway South, Norcross, GA 30092, US
Language: EN (113 pages, 29 drawings)
Application: WO 1998US16079 A 19980731 (Local application)
Priority: US 199754575 P 19970801
US 1998126921 A 19980731
Designated States: (National Original) AL AM AT AU AZ BA BB BG BR BY CA CH CN CU CZ DE DK EE ES FI GB GE GH GM HR HU ID IL IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT UA UG UZ VN YU ZW
(Regional Original) AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL OA PT SD SE SZ UG ZW
Original IPC: H04N-7/167(A)
Current IPC: H04H-1/00(R,I,M,JP,20060101,20051220,A,L) H04H-1/00

(R,I,M,JP,20060101,20051220,C,L) H04L-9/08(R,I,M,JP,20060101,20051220,A,L) H04L-9/08 (R,I,M,JP,20060101,20060310,C,F) H04N-5/00(R,I,M,EP,20060101,20051008,A) H04N-5/00 (R,I,M,EP,20060101,20051008,C) H04N-7/16(R,I,M,EP,20060101,20051008,A) H04N-7/16 (R,I,M,EP,20060101,20051008,C) H04N-7/167(R,I,M,EP,20060101,20051008,A) H04N-7/167 (R,I,M,EP,20060101,20051008,C) H04N-7/173(R,I,M,JP,20060101,20051220, A,F) H04N-7/173 (R,I,M,JP,20060101,20051220,C,L)

Original Abstract:

A cable television system provides conditional access to services. The cable television system includes a headend from which service "instances", or programs, are broadcast and a plurality of set top units for receiving the instances and selectively decrypting the instances for display to system subscribers. The service instances are encrypted using public and/or private keys provided by service providers or central authorization agents. Keys used by the set tops for selective decryption may also be public or private in nature, and such keys may be reassigned at different times to provide a cable television system in which piracy concerns are minimized.

Un reseau de television par cable assure un acces conditionnel a des services. Le reseau de television par cable comprend une tete de reseau a partir de laquelle on diffuse les "instances" de service ou programmes. Ce reseau comprend aussi une pluralite d'unites decodeurs concues pour recevoir les instances et dechiffrer selectivement les instances qui vont s'afficher pour les abonnes du reseau. Les instances de service sont chiffrees par des cles publiques et/ou privees fournies par des fournisseurs de service ou des agents d'autorisation centraux.Les cles utilisees par les decodeurs permettant un dechiffrement selectif peuvent aussi etre publiques ou privees et de telles cles peuvent etre reaffectees a differents moments pour assurer un reseau de television par cable dans lequel les risques de piratage sont minimises.

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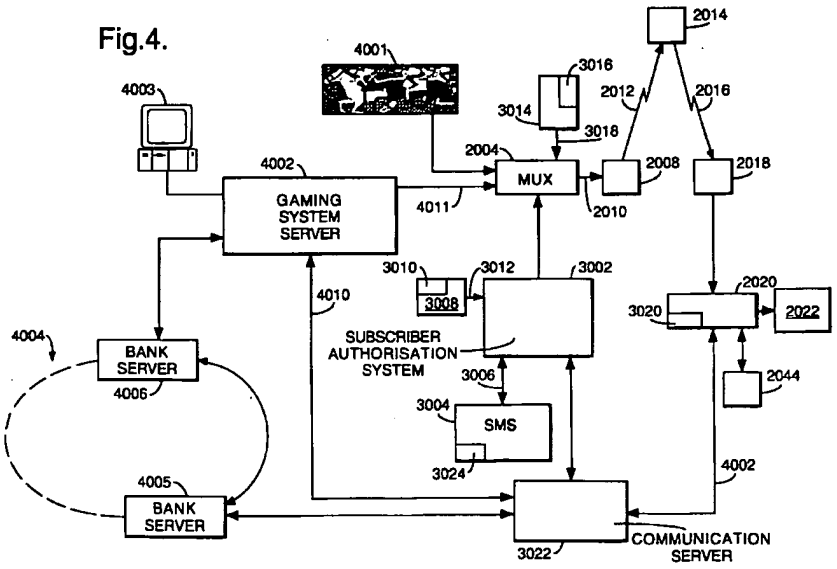
(54) Interactive gaming system

(57) An interactive gaming and audiovisual transmission system comprising a central gaming computer 4002 for processing gaming data, a decoder 2020 adapted to receive gaming data from the central gaming computer 4002 together with transmitted audiovisual data, the decoder further including a card reading device for interacting with a user's bank card in order to credit a gaming account held by the central gaming computer means in response to a transfer of credit from the user's bank account.

Fig.4.



EP 0 934 765 A1

Description

[0001] The present invention relates to an interactive gaming and digital audiovisual transmission system, in particular a gaming and digital television transmission system.

[0002] Broadcast transmission of digital data is well-known in the field of pay TV systems, where scrambled audiovisual information is sent, usually by a satellite or satellite/cable link, to a number of subscribers, each possessing a decoder capable of descrambling the transmitted program for subsequent viewing. Terrestrial digital broadcast systems are also known. Recent systems have also used the broadcast link to transmit other data, in addition to or as well as audiovisual data, such as computer programs or interactive applications to the decoder or to a connected PC.

[0003] The increasing sophistication of such technology, in particular in relation to the receiver/decoder devices used in the systems, has led to an increase in the possible services that may be provided thereby. In particular, a number of systems have been proposed using interactive technology to enable a viewer to, for example, participate in a quiz show, or to select further information regarding a product currently being displayed on a shopping channel.

[0004] In the case of gaming applications, a number of largely theoretical systems have been proposed to enable a viewer to gamble a sum of money on the outcome of a sporting event or casino-type game broadcast over a television network. In most of these systems, a viewer is usually obliged to open an initial account with the controlling gaming authority by phoning or mailing a money transfer to the gaming authority before any gambling can be carried out. The disadvantages of this sort of procedure will be apparent.

[0005] Alternative systems are also known, in which the viewer buys credits to be gambled in the form of an electronic purse, i.e. a smart card or the like, the credits in the purse being available for subsequent gaming operations. The card is inserted in the decoder and the credits used thereafter in the subsequent gaming operations. When the contents of the purse are exhausted, the viewer buys a new card or re-charges the card at a suitable sales point. This system again implies a certain infra-structure to be put in place to enable a user to obtain the necessary credits to be gambled.

[0006] The present invention seeks to overcome some or all of the disadvantages of these prior art systems.

[0007] According to the present invention, there is provided an interactive gaming and audiovisual transmission system comprising a central gaming computer means for processing gaming data, a decoder adapted to receive gaming data from the central gaming computer together with transmitted audiovisual data, the decoder further including a card reading device for interacting with a user's bank card in order to credit a gaming account held by the central gaming computer means in response to a transfer of credit from the user's bank account.

[0008] In this way, the present invention enables a user to simply and quickly open and credit a gaming account from the comfort of his home, avoiding the more elaborate payment methods of the known systems.

[0009] The type of bank card used in this transaction may be of the debit or credit type. The card reading device may in particular comprise a smart card reader adapted to interact with a bank card in the form of a smart card.

[0010] Advantageously, the decoder is further equipped with a second card reading device. For example, in the case where the decoder forms part of a television subscription service, the subscriber may be provided with a subscription card in the form of a smart card or the like. The provision of two card reader devices in the decoder permits the decoder to carry out credit transactions on a bank card inserted in one reader whilst the subscription card is held in the second reader.

[0011] In one realisation, the decoder may be adapted to obtain transfer of credit information in the form of an electronic certificate generated by the bank card in response to transaction data submitted by the decoder. This transaction information may include, for example, the details of the bank account of the gaming authority to be credited in the operation, the sum of money to be transferred etc.

[0012] Typically, data is entered by the user into the decoder using a handheld remote control. In the case where a credit transaction is to be carried out, it may be necessary to enter the bank card PIN number using the remote control. In one embodiment, the decoder is provided with a handheld remote control, some or all of the data sent to the decoder being encrypted by the handheld remote control and subsequently decrypted by the decoder. In this way, interception by third parties of sensitive data emitted by the remote control may be avoided.

[0013] Preferably, the decoder is adapted to transmit transfer of credit information from the decoder to a bank server via a network communication link, for example, using an modem integrated in the decoder.

[0014] The decoder may be adapted to directly communicate transfer of credit information to a bank computer. However, preferably, the system further comprises an intermediate communications server, adapted to receive transfer of credit information communicated from the decoder and to forward this information on to a bank server.

[0015] The intermediate communications server may further be adapted to communicate with the central gaming computer means, for example, to inform the central communication means of a transfer of credit instruction being forwarded from the intermediate communication means to a bank computer, so as to permit

the gaming computer means to set up an account without having to verify the transaction carried out at an associated bank server.

[0016] The central gaming computer means may equally be adapted to receive and transmit credit information to or from a bank server via a network communication link. This may be necessary, for example, in the case of a win or in order to verify the transfer of funds from the bank account of a user to the gaming authorities bank account before opening a gaming account.

[0017] Preferably, the decoder is adapted to communicate gaming information to the central gaming computer during gaming operation via a network communication link. This may be the same link as used to communicate transfer of credit information to a bank computer, for example, using a modem device integrated in the decoder.

[0018] Some or all of the gaming information communicated from the decoder to the central gaming computer during gaming operation may be encrypted by the decoder. For example, the decoder may be adapted to transmit in encrypted form a code word entered by the user associated with the gaming account of the user held by the central gaming computer.

[0019] The decoder may be adapted to directly communicate information to the central gaming computer during gaming operation. However, preferably, the system further comprises an intermediate communications server, adapted to receive information communicated from the decoder during gaming operation and to forward this information on to the central gaming computer. This may be the same intermediate server as used for the transfer of credit information between the decoder and a bank.

[0020] In the case where gaming information is encrypted by the decoder, the intermediate communications server may be adapted to simply pass this information "as is" to the central gaming computer. However, in one embodiment, the intermediate communications server is adapted to decrypt information received from the decoder and to re-crypt this information for subsequent communication to the central gaming computer. This may be required, for example, in the case where different encryption algorithms are used by the decoder and central gaming computer.

[0021] The intermediate communications server may further be adapted to communicate information to and from other computer devices, for example, computer databases holding TV subscriber information. In this way, the intermediate communications server may obtain directly information regarding the user of the system (name, address etc) to be used in setting up a gaming account, without the user having to re-enter the same information.

[0022] The communication means used to transmit gaming data from the central gaming computer to the decoder may be defined in a number of different ways and by a number of different communication elements. For example, some or all of the gaming data sent from the gaming computer to the decoder may be transmitted via a transmitter means used to transmit audiovisual data to the decoder.

[0023] In addition, or alternatively, some or all of the gaming data sent from the central gaming computer to the decoder may be sent via a network communication link, for example, the same network used to communicate information from the decoder to the central gaming computer during gaming operation.

[0024] In practice, a mixture of these two communication paths may prove optimal, the network path being used for rapid dialogue between the decoder and the gaming computer during real-time operation and the transmission path being used for relatively fixed data, such as screen format display data or the like.

[0025] The present invention also extends to a gaming system for processing gaming data, comprising:

means for transmitting gaming data to a user's decoder;
means for receiving data from the user's decoder; and
means for connection to a bank server holding the user's bank account in order to transfer credit to or from the account.

[0026] The gaming system may include a gaming account held by the gaming system which can be credited in response to the transfer of credit.

[0027] The gaming system may be adapted to communicate with the decoder and the bank server via a communications server. If so, the gaming system may be adapted to receive encrypted information from the communications server.

[0028] The present invention also provides a interactive gaming and audiovisual transmission system comprising a gaming system as aforementioned, said user's decoder, and said bank server.

[0029] As mentioned above the system may be used to permit gaming in relation to various events. For example, the central gaming computer may be adapted to generate a computer game (computer blackjack or the like), the computer generated images being transmitted via the audiovisual link to the decoder.

[0030] However, as will be appreciated, the combination of gaming and audiovisual systems makes the present invention particularly adapted to permit gaming in relation to televised sports, such as horse racing or the like. In one embodiment, the present invention comprises a central gaming computer adapted to provide gaming data related to a real-time sporting event, the decoder being adapted to receive both gaming data and associated audiovisual data of the event.

[0031] In the context of the present application the term ((audiovisual transmission system)) refers to all transmission systems for transmitting or broadcasting primarily audiovisual or multimedia digital data. The

present invention is particularly, but not exclusively, applicable to a broadcast digital television system.

[0032] In this application the term ((smart card)) is used to mean any conventional chip-based card device possessing, for example, microprocessor and/or memory storage. Also included in this term are chip devices having alternative physical forms, for example key-shaped devices such as are often used in TV decoder systems.

[0033] In the present application, the term "decoder" is used to apply to an integrated receiver/decoder for receiving and decrypting an encrypted transmission, the receiver and decoder elements of such a system as considered separately, as well as to a receiver capable of receiving non-encrypted broadcasts. The term equally covers decoders including additional functions, such as web browsers, together with decoder systems integrated with other devices, for example, integrated VHS/decoder devices or the like.

Figure 1 shows the overall architecture of a digital television system, as may be incorporated in the gaming system of the present invention;

Figure 2 shows the conditional access system of the television system of Figure 1;

Figure 3 shows the structure of the decoder of Figures 1 and 2;

Figure 4 shows a gaming system incorporating the television system of Figures 1 and 2; and

Figure 5 shows a flow diagram of the logical steps involved in a gaming transaction

Digital Television System

[0034] An overview of a digital television broadcast and reception system 1000 adaptable to the present invention is shown in Figure 1. The system includes a mostly conventional digital television system 2000, which uses the known MPEG-2 compression system to transmit compressed digital signals. In more detail, the MPEG-2 compressor 2002 in a broadcast centre receives a digital signal stream (typically a stream of video signals). The compressor 2002 is connected to a multiplexer and scrambler 2004 by linkage 2006. The multiplexer 2004 receives a plurality of further input signals, assembles one or more transport streams and transmits compressed digital signals to a transmitter 2008 of the broadcast centre via linkage 2010, which can of course take a wide variety of forms including telecom links.

[0035] The transmitter 2008 transmits electromagnetic signals via uplink 2012 towards a satellite transponder 2014, where they are electronically processed and broadcast via notional downlink 2016 to earth receiver 2018, conventionally in the form of a dish owned or rented by the end user. The signals received by receiver 2018 are transmitted to an integrated receiver/decoder 2020 owned or rented by the end user and connected to the end user's television 2022. The receiver/decoder 2020 decodes the compressed MPEG-2 signal into a television signal for the television set 2022.

[0036] A conditional access system 3000 is connected to the multiplexer 2004 and the receiver/decoder 2020, and is located partly in the broadcast centre and partly in the decoder. It enables the end user to access digital television broadcasts from one or more broadcast suppliers. A smart card, capable of decrypting messages relating to commercial offers (that is, on or several television programmes sold by the broadcast supplier), can be inserted into the receiver/decoder 2020. Using the decoder 2020 and smart card, the end user may purchase events in either a subscription mode or a pay-per-view-mode.

[0037] An interactive system 4000, also connected to the multiplexer 2004 and the receiver/decoder 2020 and again located partly in the broadcast and partly in the decoder, enables the end user to interact with various applications via a modemmed back channel 4002. Such interactive applications may include an interactive shopping service, a quiz application, an interactive programme guide etc.

[0038] In point of fact, whilst the interactive system 4000 has been represented as a discrete logical block, the physical elements of this system, such as the server or servers used to handle communications between the receiver/decoder and central servers, may be elements shared with the conditional access system 3000. This will become clear in the description of the gaming system of Figure 4.

Conditional Access System

[0039] With reference to Figure 2, the conditional access system 3000 includes a Subscriber Authorization System (SAS) 3002. The SAS 3002 is connected to one or more Subscriber Management Systems (SMS) 3004, one SMS for each broadcast supplier, by a respective TCP-IP link 3006 (although other types of linkage could alternatively be used). Alternatively, one SMS could be shared between two broadcast suppliers, or one supplier could use two SMSs, and so on.

[0040] First encrypting units in the form of ciphering units 3008 utilising ((mother)) smart cards 3010 are connected to the SAS by linkage 3012. Second encrypting units again in the form of ciphering units 3014 utilising mother smart cards 3016 are connected to the multiplexer 2004 by linkage 3018. The receiver/decoder 2020 receives a ((daughter)) smart card 3020. It is connected directly to the SAS 3002 by Communications Servers 3022 via the modemmed back channel 4002. The SAS sends amongst other things subscription

rights to the daughter smart card on request.

[0041] The smart cards contain the secrets of one or more commercial operators. The ((mother)) smart card encrypts different kinds of messages and the ((daughter)) smart cards decrypt the messages, if they have the rights to do so.

[0042] The first and second ciphering units 3008 and 3014 comprise a rack, an electronic VME card with software stored on an EEPROM, up to 20 electronic cards and one smart card 3010 and 3016 respectively, for each electronic card, one (card 3016) for encrypting the ECMs and one (card 3010) for encrypting the EMMS.

[0043] Also shown in Figure 2 is a handheld remote control used by the viewer to control and program functions of the receiver/decoder 2020.

Multiplexer and Scrambler

[0044] With reference to Figures 1 and 2, in the broadcast centre, the digital video signal is first compressed (or bit rate reduced), using the MPEG-2 compressor 2002. This compressed signal is then transmitted to the multiplexer and scrambler 2004 via the linkage 2006 in order to be multiplexed with other data, such as other compressed data.

[0045] The scrambler generates a control word CW used in the scrambling process and included in the MPEG-2 stream in the multiplexer 2004. The control word CW is generated internally and enables the end user's integrated receiver/decoder 2020 to descramble the programme. Access criteria, indicating how the programme is commercialised, are also added to the MPEG-2 stream. The programme may be commercialised in either one of a number of ((subscription)) modes and/or one of a number of ((Pay Per View)) (PPV) modes or events.

[0046] In the subscription mode, the end user subscribes to one or more commercial offers, of ((bouquets)), thus getting the rights to watch every channel inside those bouquets. In the preferred embodiment, up to 960 commercial offers may be selected from a bouquet of channels. In the Pay Per View mode, the end user is provided with the capability to purchase events as he wishes. This can be achieved by either pre-booking the event in advance (((pre-book mode))), or by purchasing the event as soon as it is broadcast (((impulse mode))).

[0047] Both the control word CW and the access criteria are used to build an Entitlement Control Message (ECM); this is a message sent in relation with a scrambled program. The message contains a control word (which allows for the descrambling of the program) and the access criteria of the broadcast program. The access criteria and control word are transmitted to the second encrypting unit 3014 via the linkage 3018. In this unit an ECM is generated, encrypted with an exploitation key Cex and transmitted on to the multiplexer and scrambler 2004.

Programme Transmission

[0048] The multiplexer 2004 receives encrypted EMMs from the SAS 3002, encrypted ECMs from the second encrypting unit 3014 and compressed programmes from the compressor 2002. The multiplexer 2004 scrambles the programmes and communicates the scrambled programmes, the encrypted EMM (if present) and the encrypted ECMs to a transmitter 2008 of the broadcast centre via linkage 2010. The transmitter 2008 transmits electromagnetic signals towards the satellite transponder 2014 via uplink 2012.

Programme Reception

[0049] The satellite transponder 2014 receives and processes the electromagnetic signals transmitted by the transmitter 2008 and transmits the signals on to the earth receiver 2018, conventionally in the form of a dish owned or rented by the end user, via downlink 2016. The signals received by receiver 2018 are transmitted to the integrated receiver/decoder 2020 owned or rented by the end user and connected to the end user's television set 2022. The receiver/decoder 2020 demultiplexes the signals to obtain scrambled programmes with encrypted EMMs and encrypted ECMs.

[0050] If the programme is not scrambled the receiver/decoder 2020 decompresses the data and transforms the signal into a video signal for transmission to television set 2022.

[0051] If the programme is scrambled, the receiver/decoder 2020 extracts the corresponding ECM from the MPEG-2 stream and passes the ECM to the ((daughter)) smart card 3020 of the end user. This slots into a housing in the receiver/decoder 2020. The daughter smart card 3020 controls whether the end user has the right to decrypt the ECM and to access the programme. If not, a negative status is passed to the receiver/decoder 2020 to indicate that the programme cannot be descrambled. If the end user does have the rights, the ECM is decrypted and the control word extracted. The decoder 2020 can then descramble the programme using this control word. The MPEG-2 stream is decompressed and translated into a video signal onward transmission to television set 2022.

Subscriber Management System (SMS)

[0052] A Subscriber Management System (SMS) 3004 includes a database 3024 which manages, amongst others, all of the end user files, commercial offers (such as tariffs and promotions), subscriptions, PPV details, and data regarding end user consumption and authorization. The SMS may be physically remote from the SAS

[0053] Each SMS 3004 transmits messages to the SAS 3002 via respective linkage 3006 to enable modifications to or creations of Entitlement Management Mes-

sages (EMMs) to be transmitted to end users.

[0054] The SMS 3004 also transmits messages to the SAS 3002 which imply no modifications or creations of EMMs but imply only a change in an end user's state (relating to the authorization granted to the end user when ordering products or to the amount that the end user will be charged).

Entitlement Management Messages and Entitlement Control Messages

[0055] ECMs or Entitlement Control Messages are encrypted messages embedded in the data stream of a transmitted program and which contain the control word necessary for descrambling of part or all of a program. Authorisation of a given receiver/decoder is controlled by EMMs or Entitlement Management Messages, transmitted on a less frequent basis and which supply an authorised receiver/decoder with the exploitation key necessary to decode the ECM.

[0056] An EMM is a message dedicated to an individual end user (subscriber), or a group of end users. A group may contain a given number of end users. This organisation as a group aims at optimising the bandwidth; that is, access to one group can permit the reaching of a great number of end users.

[0057] Various specific types of EMM may be used. Individual EMMs are dedicated to individual subscribers, and are typically used in the provision of Pay Per View services. So-called ((Group)) subscription EMMs are dedicated to groups, of say, 256 individual users, and are typically used in the administration of some subscription services. This EMM has a group identifier and a subscribers' group bitmap

[0058] For security reasons, the control word CW embedded in an encrypted ECM changes on average every 10 seconds or so. In contrast, the exploitation key Cex used by the receiver to decode the ECM is changed every month or so by means of an EMM. The exploitation key Cex is encrypted using a personalised key corresponding to the identity of the subscriber or group of subscribers recorded on the smart card. If the subscriber is one of those chosen to receive an updated exploitation key Cex, the card will decrypt the message using its personalised key to obtain that month's exploitation key Cex.

[0059] The operation of EMMs and ECMs will be well-known to one skilled in the art and will not be described here in any more detail.

Receiver/Decoder Structure

[0060] Referring to Figure 3, the elements of a receiver/decoder 2020 or set-top box for use in a digital broadcast system and adapted to be used in the present invention will now be described. As will be understood, the elements of this decoder are largely conventional and their implementation will be within the capabilities of one skilled in the art.

[0061] As shown, the decoder 2020 is equipped with several interfaces for receiving and transmitting data, in particular an MPEG tuner and demultiplexer 2040 for receiving broadcast MPEG transmissions, a serial interface 2041, a parallel interface 2042, and a modem 2028 for sending and receiving data via the telephone network. In this embodiment, the decoder also includes a first and second smart card reader 2030 and 2031, the first reader 2030 for accepting a subscription smart card containing decryption keys associated with the system and the second reader 2031 for accepting bank and other cards. As will be described, the use of a two-slot decoder, adapted to read bank cards, is an important aspect in the implementation of the gaming system of Figure 4.

[0062] The decoder also includes a receiver 2043 for receiving infra-red control signals from the handset remote control 2044 and a Peritel output for sending audiovisual signals to a television 2022 connected to the decoder. In certain cases it may be desired that the infra-red signals transmitted from the handset 2044 to receiver 2043 are subject to a simple scrambling/descrambling process to ensure that no useful information may be obtained by any third party monitoring the transmission.

[0063] Such algorithms will not be described in any detail, but may comprise, for example a symmetric algorithmic key known to both handset 2044 and receiver/decoder 2020. This may be varied from time to time, for example, by means of a modulating random number chosen by the receiver/decoder 2020 and displayed by the television 2022, the user then programming the handset 2044 with this number to ensure that the handset scrambles entered data using an encryption algorithm key equivalent to that used the receiver/decoder to decrypt the received infra-red signals.

[0064] Processing of digital signals received via the interfaces and generation of digital output signals is handled by a central control unit 2045. The software architecture of the control unit within the decoder may correspond to that used in a known decoder and will not be described here in any detail. It may be based, for example, on a virtual machine interacting via an interface layer with a lower level operating system implemented in the hardware components of the decoder. In terms of the hardware architecture, the decoder will be equipped with a processor, memory elements such as ROM, RAM, FLASH memory etc. as in known decoders.

[0065] Applications processed by the control unit 2045 may be resident applications stored in the ROM or FLASH of the decoder or applications broadcast and downloaded via the MPEG interface 2 of the decoder. Applications can include program guide applications, games, interactive services, teleshopping applications, as well as initiating applications to enable the decoder

to be immediately operational upon start-up and applications for configuring the decoder. Applications are stored in memory locations in the decoder and represented as resource files comprising graphic object description files, unit files, variables block files, instruction sequence files, application files, data files etc.

[0066] Conventionally, applications downloaded into the decoder via the broadcast link are divided into modules, each module corresponding to one or more MPEG tables. Each MPEG table may be divided into a number of sections. For data transfer via the serial and parallel ports, modules are also split into tables and sections, the size of the section depending on the channel used.

[0067] In the case of broadcast transmission, modules are transported in the form of data packets within respective types of data stream, for example, the video data stream, the audio data stream, a text data stream. In accordance with MPEG standards each packet is preceded by a Packet Identifier (PID) of 13 bits, one PID for every packet transported in the MPEG stream. A programme map table (PMT) contains a list of the different streams and defines the content of each stream according to the respective PID. A PID may alert the device to the presence of applications in the data stream, the PID being identified by the PMT table.

Gaming System Architecture

[0068] Referring now to Figure 4, there will now be described the elements and functioning of a gaming system according to an embodiment of the present invention. The gaming system includes the elements of the digital television system described and shown in Figures 1 and 2, which have been assigned the same reference numerals . Some elements, such as the digital compressor 2002 shown in Figure 1, have been omitted in order to focus on those aspects of the system which are pertinent to the present invention.

[0069] As shown, the gaming system additionally comprises a source of audiovisual information 4001 regarding the event which will form the subject of betting etc within the system. In the present case, the event has been represented as a horse race, and the present system is indeed particular adapted to gaming activities centred around televised live action sporting events. However, as will be understood, the present system may equally used to permit gambling in relation to other events, such as casino-type games, as well as computer generated games, pre-recorded events etc.

[0070] The system further comprises a central gaming computer means in the form of a gaming system server 4002, together with associated operating terminal or terminals 4003, adapted to generate odds, calculate winnings etc in relation to the gaming event. The gaming server 4002 is adapted to communicate with a receiver/decoder 2020 via the intermediate communication server or servers 3022. The connection between the gaming server 4002 and communication server 3022 may be implemented by an X25 Transpac link or via a dedicated line. The network link for the server is indicated broadly at 4010.

[0071] As described above, the communication server 3022 communicates with the receiver/decoder 2020 by means of a telephone link using the in-built modem of the receiver/decoder.

[0072] The gaming server may be equally adapted to send information to the receiver/decoder 2020 via a satellite link, indicated broadly at 4011, by injection of information into the multiplexer 2004 for subsequent integration in the transmitted MPEG stream.

[0073] As will be understood, all communications from the receiver/decoder 2020 to the gaming server 4002 are via the receiver/decoder modem and communication server 3022. In the case of communications from the gaming server 4002 to the receiver/decoder 2020, the choice of communication channel and communication means (MPEG satellite transmission or communication server/modem connection) may depend on the nature of the information to be transmitted.

[0074] Typically, the satellite link 4011 will be used to send data or information that may be updated on a daily basis or which may be received by any number of receiver/decoders in the park (odds for tomorrow's races etc). In particular, the satellite link may be used to download the application that needs to be installed in the receiver/decoder to enable the receiver/decoder to function in the gaming system.

[0075] In contrast, the modem link 4010 may be preferred for data that changes on a minute-by-minute basis or that is specific to a particular user (results of last race, current state of the account of the user etc).

[0076] In addition to handling gaming activities resulting from bets placed via the receiver/decoder 2020, for example as programmed in using the remote control 2044, the gaming server 4002 may also be adapted to manage bets to be placed by other input means, for example as placed by a phone service or as received by a "Minitel" type system, as used in France and other countries.

[0077] The gaming system server 4002 is additionally connected to a bank server network 4003 comprising one or more bank servers 4005, 4006. The bank server network may correspond to an existing network used to handle electronic payment transactions. The level of security and encryption in the communications between each of the elements of the gaming system will be described in more detail below in relation to the operation of the system.

Gaming System Operation

[0078] As mentioned in the introduction of the present application, gaming systems used in interactive television systems proposed to date have tended to use relatively laborious methods for settling accounts between the viewer and the central gaming authority, requiring

the viewer either to pay by a conventional method (cheque, telephone credit transfer etc) or to physically purchase an "electronic purse" in the form of a smart card or key containing a number of pre-paid credits that may be gambled.

[0079] The present embodiment differs from such systems in proposing a system architecture that enables a viewer to pay by means of a credit or debit card inserted in the decoder and by entering data into the system by means of the hand-held remote control. As mentioned above, the provision of a decoder provided with two distinct card readers 2030, 2031 enables the decoder to simultaneously hold a subscription card containing the viewers access rights (eg to the gaming channel) as well as interacting with a credit/debit card inserted in the decoder.

[0080] In order to comply with regulations concerning the use of credit/debit cards in gambling transactions, two different types of transactions need to be distinguished: (i) opening or re-crediting an account managed by the gaming system server and (ii) gambling the sums in this account.

Opening an account

[0081] In the present case, the card reader 2031 functions in a similar manner to a standard card reader used in banking terminals and the like to read and write data on a smart card presented in the reader. As with all card readers used in the banking field, communication between the terminal (in this case the decoder) and external servers is prohibited during the time that the card is being accessed by the terminal, i.e. for the time that the memory zones on the card are "open".

[0082] In order to open and credit an account with the gaming system server, the following steps are carried out during a first phase:

a) Using the handheld remote control, and as guided by the application loaded in the receiver/decoder, the user selects the option "open an account" and enters the sum of money that he wishes to transfer to this account.

b) After having introduced his credit card into the card reader slot 2031, the viewer is invited to enter his personal PIN code. The user has a maximum of two opportunities to enter the code, after which the receiver/decoder will refuse to accept any further entries and the transaction will be abandoned.

Note that in the case of sensitive information communicated to the receiver/decoder by the handset (in particular the PIN code) the data entered by the user on the key pad of the handset may be scrambled before transmission between the handset and decoder so as to prevent interception of this information by any third party. See above.

c) Assuming the code is correct, the smart card downloads certain information in response to a request from the receiver/decoder, including details of the last transactions, to enable the decoder to verify that the sum of transactions during a certain period is within, for example, the transaction limit of the card holder for that period.

d) The receiver/decoder then passes to the smart card information regarding the current transaction including the amount of the transaction, the date and time of the transaction, the details of the bank account to be credited in the transaction and so on. (The details of the account to be credited can be obtained by the decoder prior to the interrogation of the card from the gaming system server or the intermediate communications system server).

e) In the conventional manner, the smart card then calculates a first numeric certificate using this information, which is communicated to the receiver/decoder. The receiver/decoder writes the present transaction in the card and a second numeric certificate is calculated and communicated to the receiver/decoder. The memory zones of the smart card are then closed off.

The generation of a pair of numeric certificates is a specific security measure associated with the use of a receiver/decoder as transaction terminal.

Once the above steps have been carried out, the system then moves to a second phase involving communication between the receiver/decoder 2020, the intermediate communication server 3022 and the bank server 4005.

f) Before transferring any information, the receiver/decoder 2020 verifies the identity of the communication server 3022 by means of a public/private key system (eg using the RSA algorithm). In particular, the receiver/decoder generates a random number, which is transmitted to the server for encryption by a private key and returned to the receiver/decoder, which checks the encrypted value using the equivalent public key.

A simple handshake signal may also be provided by the decoder 2020 to identify itself to the server 3022.

g) Assuming the identity of the communication server is verified, the receiver/decoder 2020 sends to the communication server 3022 the details of the transaction to be carried out, including the first and second numeric certificate generated by the smart card.

h) The communication server 3022 then sends the transaction details to the first bank server 4005, which verifies the account of the user, and author-

ises (or not) the transaction and sends an acknowledgement of the transaction to the communication server. The transfer of money between the user's account and that of the central gaming authority will then be handled within the bank network 4004.

i) Once the communication server 3022 has received acknowledgement of the acceptation of the monetary transfer, a message will be sent to the receiver/decoder 2020 of the completion of the transfer and the operation will proceed to the next phase.

Note that the same steps a) to i) as used in the first two phases will also be carried out in the event that the user wishes to increase the credit in an existing gaming account.

The next phase in the opening of a gaming account involves communication between the receiver/decoder 2020, the communication server 3022 (and the SAS and SMS servers 3002, 3004) and the gaming server 4002. The information communicated between these servers is largely non-sensitive and may be communicated in clear, with the exception of the code word chosen by the user to obtain access to his gaming account.

j) Using the information (name, address etc) on the user held in the SAS and SMS servers 3002, 3004, the communication server prepares a request for opening of an account with the gaming system server 4002. This information has been gathered in the SMS server during the original procedure carried out when the user originally subscribed to the television service. The user is thus spared the inconvenience of repeating all this information when subscribing to the gaming service.

Note that in the event that SMS database reveals, for example, that the subscriber is in debt with the television service, the communication server may abort the opening of an account with the gaming service. This extra verification step may be carried out earlier, for example, at step g).

k) In one embodiment, the communication server 3022 may send the subscriber information to the receiver/decoder 2020 where it is displayed on the television 2022 for verification by the user. Once verified, the information is sent to the gaming system server 4002 where a gambling account is created by the server 4002.

l) The account information (account number etc) is then sent from the gaming server 4002, via the communication server 3022, to the receiver/decoder 2022. The user is then invited to choose a suitable code word for the account which will be demanded by the system at every opening of a gaming session. As for the PIN number, the infrared signal containing this information and sent between the remote control and the decoder may be scrambled by the remote to avoid interception and descrambled by decoder.

m) The code word is then encrypted by a public key of a public/private key pair held in the receiver/decoder 2020 and sent to the communication server 3022, where it is decrypted by the corresponding private key. In this case, for example, the same RSA key pair as used for the verification of the communication server may be used.

n) The code word is then re-encrypted by the communication server 3022 and sent to the gaming system server 4002 where it is decrypted and assigned to the user's account. In this case, a symmetric key algorithm, such as DES, may be advantageously used, for example, to permit two-way encrypted communication between the communication server 3022 and gaming server 4002.

Gambling with an existing gaming account

[0083] Once the user has set up and credited a gaming account with the gaming server 4002, all future gambling transactions will be handled between the receiver/decoder 2020 and the gaming system server 4002. At the start of every gaming session, the system server 4002 will demand the user's assigned code word, which will be communicated between the receiver/decoder and the gaming server, via the communications server, as described above.

[0084] For simplicity, and in order to permit a relatively rapid dialogue, all questions and responses between the user and the gaming system in order to place a bet and receive the results are preferably passed via the telephone/modem link and the communication server 3022. Certain data, such as the format of the screens displayed by the receiver/decoder in gaming mode and/or slowly changing or universal data (details of that day's races, the horses taking part etc) may be passed via the satellite uplink in order to take advantage of the bandwidth of this channel.

[0085] Other embodiments, in which data is shared between the two communication channels in alternative ways may nevertheless be envisaged, for example, where all communication from the receiver/decoder to the gaming system server passes via the modem link, whilst all communications from the server to the receiver/decoder pass via the satellite link.

[0086] As mentioned above, the present system may be used with a number of interactive gaming applications, for example, with computer games such as blackjack, poker or the like, in which the user places a bet on the outcome of a game managed by the gaming server. However, in view of the use of television broadcast technology, the system is particularly adapted to permit

gaming in relation to live action sporting events, such as televised horse, dog or camel racing.

[0087] Figure 5 is a flow diagram of the steps involved in the placing of a bet in relation to one or more broadcast horse races. In the present case, the bet is to be placed in respect of the present day's races, i.e. in "real time", and the odds quoted for the horses may depend on the time at which the bet is taken. In alternative embodiments, bets may be placed the day or week before the race or races in question.

[0088] Firstly, at step 5000, the user enters his code word and opens a betting session. At steps 5001 and 5002, he chooses the racecourse he is interested in and one of the races running at that racecourse, respectively. Depending on which race is running, the user may be offered a number of different standard types of bet, from a simple bet to more complex bets, including main and side bets.

[0089] As will be appreciated, the bet types offered may be determined according to the wishes of the gaming authority and may be based on any of the usual types of bet offered for an event of this type.

[0090] At step 5003, the user chooses the type of bet he wishes to place. In the case of a simple bet on one horse, the next step will be step 5004 where the user chooses the formula of the bet, ie whether the horse will win or be placed in the first three or four positions. At step 5005, the user chooses the horse he wishes to bet on.

[0091] In the case of a complex bet, the user then chooses from a combination of win, place or win/place at step 5007 and from one of a number of types of bet (single, combined, reduced field, full field) at step 5007. The user may decide, for example to choose one horse to win and/or one horse to be placed in the top three or four. Other combinations may be made presented to reflect the choice of bet normally available. At step 5008 the user chooses the horses he wishes to bet on.

[0092] At step 5009 the user chooses his stake, i.e. the sum to be extracted from the money deposited in his gaming account. At step 5010 confirmation of the stake to be gambled is demanded. At this time, the system may also indicate the overall odds for the bet or bets placed and the sum of money to be won. Assuming that the user confirms the bet, the bet is registered at step 5011.

[0093] Following the results of the race, the gaming system server calculates the winnings or losses for the user. These will be subtracted or added automatically to his gaming account. The user may demand at any time the position of his account.

[0094] In the event that the user eventually wishes to close the account or to transfer some of his winnings to his bank account, a message to this end may be sent by the user from the receiver/decoder 2020 to the gaming system server 4002 (Figure 4). At that time, the server 4002 will communicate with the bank server 4006 to organise a credit transfer to the user's bank account. Since the identity and bank details of the owner of the receiver/decoder are already known, the server will only transfer money from the gaming account of the user to the bank account originally used in the setting up of the gaming account.

[0095] It will be understood that the present invention has been described above purely by way of example, and modifications of detail can be made within the scope of the invention.

[0096] Each feature disclosed in the description, and (where appropriate) the claims and drawings may be provided independently or in any appropriate combination.

[0097] In the aforementioned preferred embodiments, certain features of the present invention have been implemented using computer software. However, it will of course be clear to the skilled man that any of these features may be implemented using hardware. Furthermore, it will be readily understood that the functions performed by the hardware, the computer software, and such like are performed on or using electrical and like signals.

Claims

1. An interactive gaming and audiovisual transmission system comprising a central gaming computer means for processing gaming data, a decoder adapted to receive gaming data from the central gaming computer together with transmitted audiovisual data, the decoder further including a card reading device for interacting with a user's bank card in order to credit a gaming account held by the central gaming computer means in response to a transfer of credit from the user's bank account.

2. An interactive gaming and audiovisual transmission system as claimed in claim 1, in which the decoder is equipped with a card reading device in the form of a smart card reader.

3. An interactive gaming and audiovisual transmission system as claimed in claim 1 or 2, in which the decoder is further equipped with a second card reading device

4. An interactive gaming and audiovisual transmission system as claimed in any preceding claim in which the decoder is adapted to obtain transfer of credit information in the form of an electronic certificate generated by the bank card in response to transaction data submitted by the decoder.

5. An interactive gaming and audiovisual transmission system as claimed in any preceding claim in which the decoder is provided with a handheld remote control, some or all of the data sent to the decoder being encrypted by the handheld remote

control and subsequently decrypted by the decoder.

6. An interactive gaming and audiovisual transmission system as claimed in any preceding claim in which the decoder is adapted to transmit transfer of credit information from the decoder to a bank server via a network communication link.

21. A gaming system as claimed in Claim 19 or 20, adapted to communicate with the decoder and the bank server via a communications server.

22. A gaming system as claimed in Claim 21, adapted to receive encrypted information from the communications server.

23. A gaming system as claimed in any of Claims 19 to 22, adapted to transmit gaming data related to a real-time sporting event.

24. An interactive gaming and audiovisual transmission system comprising a gaming system as claimed in any of Claims 19 to 23, said user's decoder, and said bank server.

Fig.1.

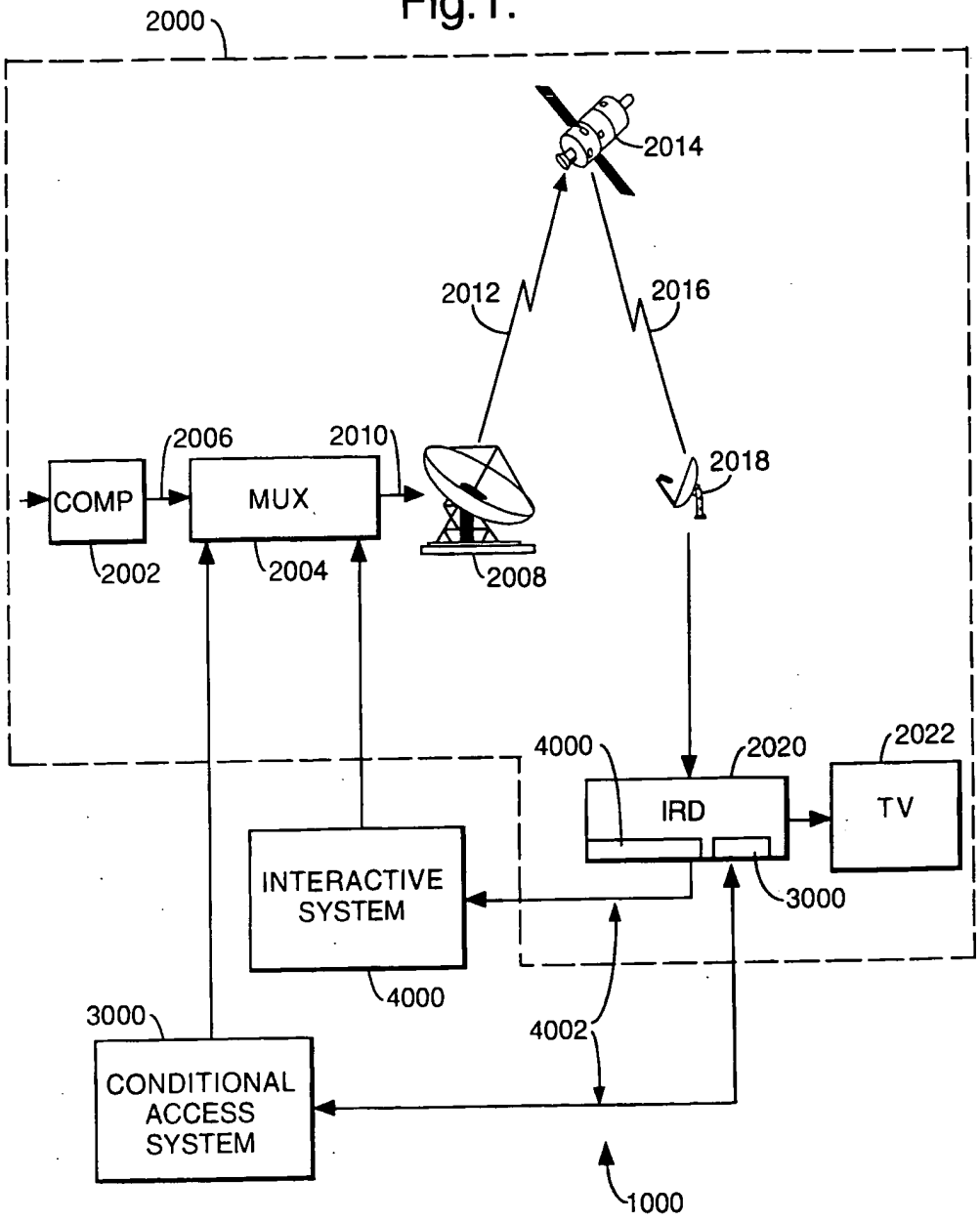


Fig.2.

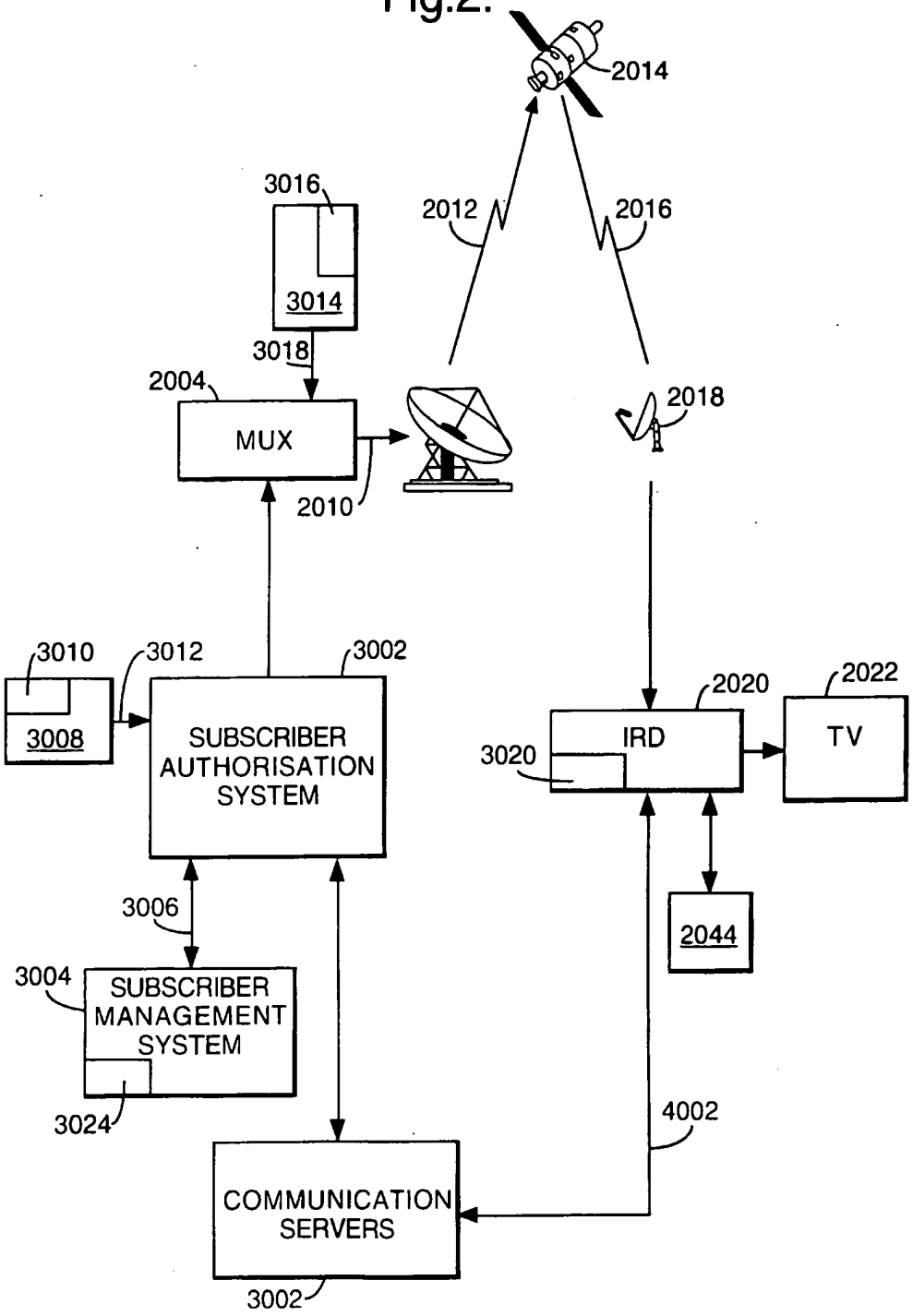
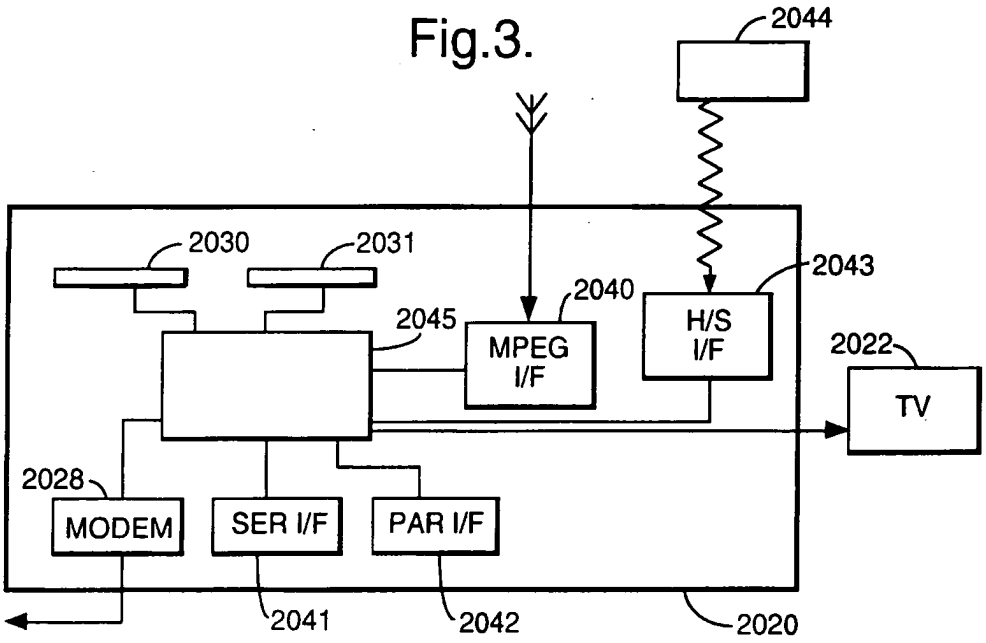


Fig.3.



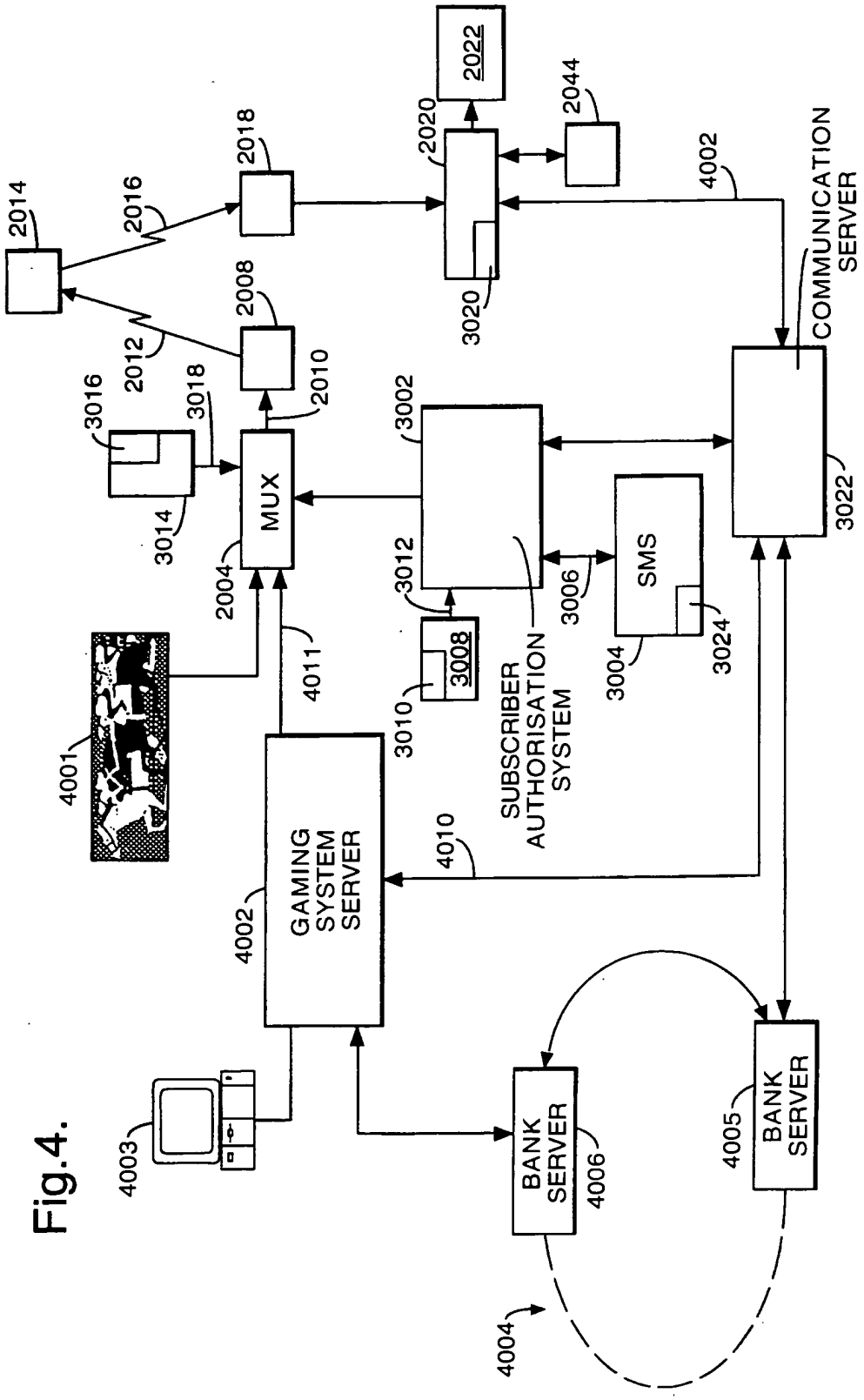


Fig.4.

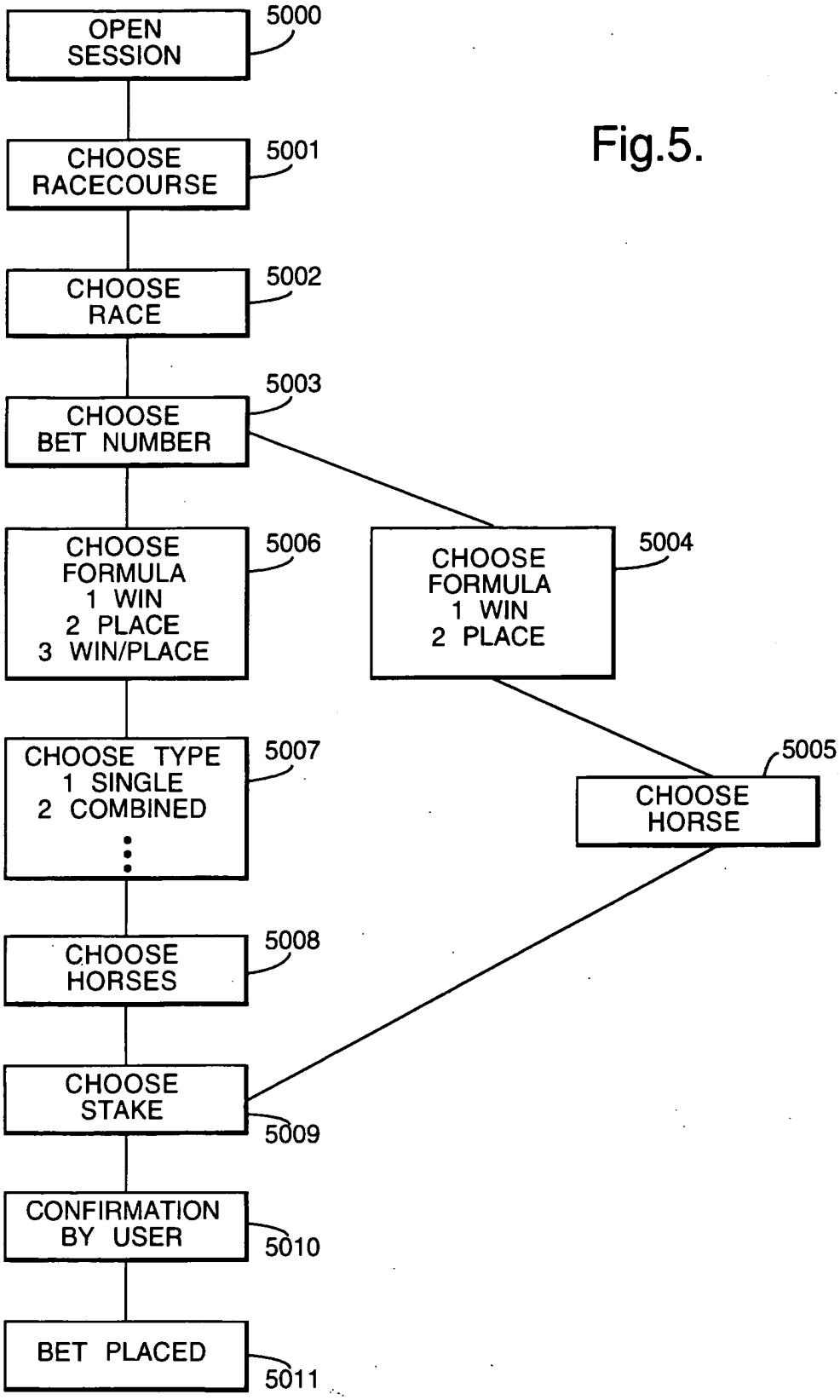


Fig.5.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 40 0285

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y A	US 5 539 822 A (LETT DAVID B) 23 July 1996 * column 7, line 13 - line 33 * * column 9, line 58 - column 10, line 11 * * column 11, line 22 - line 42 * * column 15, line 11 - line 44 * * column 18, line 44 - column 20, line 33 * * figures 3E,3I *	1-3,10, 12, 15-19,23 4-9,11, 14,20, 21,24 5	A63F9/22
X	US 4 815 741 A (SMALL MAYNARD E) 28 March 1989 * column 4, line 41 - column 5, line 5 * * column 5, line 27 - line 38 *	1,19	
Y A	US 5 634 848 A (TSUDA YOICHIRO ET AL) 3 June 1997 * column 1, line 42 - line 64 * * column 3, line 6 - column 4, line 2 * * column 8, line 44 - column 9, line 21 *	6-9,14, 20,21,24 1,19	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A63F H04N G07F G06F
Y	WO 95 01060 A (LINCOLN MINT HONG KONG LTD) 5 January 1995 * page 1, line 19 - line 29 * * page 3, line 17 - page 4, line 35 * * page 12, line 36 - page 13, line 35 * * page 14, line 31 - page 15, line 2 * * page 18, line 22 - line 27 * * page 20, line 8 - line 17 * * page 27, line 21 - page 28, line 6 * * page 29, line 4 - line 23 * * page 40, line 13 - page 42, line 2 *	4,5,11	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 August 1998	Sindic, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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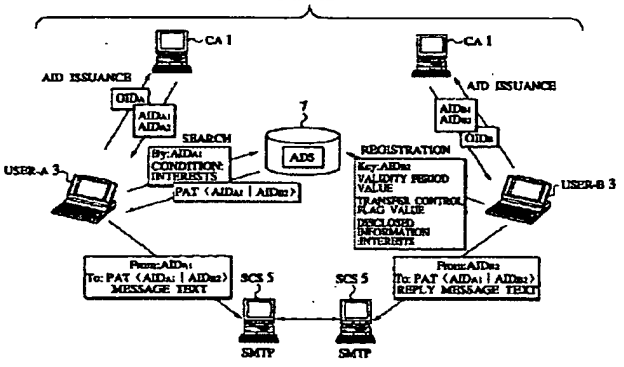
(54) Email access control scheme for communication network using identification concealment mechanism

(57) An email access control scheme capable of resolving problems of the real email address and enabling a unique identification of the identity of the user while concealing the user identification is disclosed. A personalized access ticket containing a sender's identification and a recipient's identification in correspondence is to be presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email. Then, accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket at a secure communication service. Also, an official identification of each user by which each user is uniquely identifiable by a certification authority, and an anonymous identification of each user containing at least one fragment of the official identification are defined, and each user is identified by the anonymous identification of each user in communications for emails on a communication network.

FIG.1



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to an email access control scheme for controlling transmission and reception of emails by controlling accesses for communications from other users whose identifications on the communication network are concealed while concealing an identification of a recipient on the communication network.

DESCRIPTION OF THE BACKGROUND ART

[0002] In conjunction with the spread of the Internet, the SPAM and the harassment using emails are drastically increasing. The SPAM is a generic name for emails or news that are unilaterally sent without any consideration to the recipient's time consumption, economical and mental burdens. The SPAM using emails are also known as UBE (Unsolicited Bulk Emails) or UCE (Unsolicited Commercial Emails).

[0003] The SPAM is sent indiscriminately regardless of the recipient's age, sex, interests, etc., so that the SPAM often contains an uninteresting or unpleasant content for the recipient. Moreover, the time consumption load and the economical load required for receiving the SPAM is not so small. For the business user, the SPAM can cause the lowering of the working efficiency as it becomes hard to find important mails that are buried among the SPAM. Also, as the SPAM is sent to a huge number of users, the SPAM wastes the network resources and in the worst case the SPAM can cause the overloading. As a result, there case be cases where mails that are important for the user may be lost. Also, the SPAM is sent either anonymously or by pretending someone else so that there is a need to provide some human resources to handle complaints.

[0004] On the other hand, the harassment is an act for keep sending mails with unpleasant contents for the user continually on the purpose of causing mental agony or exerting economical and time consumption burdens to the specific user. Similarly as the SPAM, the harassment mails are sent by pretending an actual or virtual third person, so that the identification of the sender is quite difficult. Also, there are cases where a large capacity mail is sent or a large amount of mails are sent in short period of time so that there is a danger of causing the system breakdown.

[0005] In order to deal with the SPAM and the harassment, the mail system is required to satisfy the following requirements.

* Security

  It is necessary to detect the pretending by the sender and refuse the delivery from the pretending sender.

* Strength

  It is necessary to limit the mail capacity in order to circumvent the system breakdown due to the large capacity mail. It is also necessary to limit the number of transmissions in order to circumvent the system breakdown due to the large amount transmission.

* Compatibility

  It is necessary not to require a considerable change to the implementation of the existing mail system.

* Handling

  It is necessary not to require a considerable change to the handling of the existing mail system.

The MTA (message Transfer Agent) such as sendmail and qmail detects the forgery of the envelope information and the header information and refuses the delivery. The MTA also refuses mail receiving from a mail server which is a source of the SPAM by referring to the so called black list such as MAPS RBL. The MTA also detects the transmission using someone else's real email address and refuses the delivery by carrying out the signature verification using PGP, S/MIME, TLS, etc. The MTA also limits the message length by partial deletion of the message text.

One of the causes of the SPAM and the harassment is the real email address, and the real email address is associated with the following problems.

* User's identity can be guessed from real email address:

  The real email address contains an information useful in guessing the identity so that it can be used in selecting the harassment target. For example, the place of employment can be identified from the real domain. Also, the name and the sex can be guessed from the user name.

* Real email address can be guessed from user's identity:

  The real email address has a universal format of [user name]@[domain name] so that the real email address can be guessed if the user's identity is known, without an explicit knowledge of the real email address itself. For example, if the user's real name is known, the candidates for the user name can be enumerated. Also, if the user's affiliation is known, the candidates for the domain name can be enumerated. Even in the case where the user name is given by a character string which is totally unrelated to the real name, if the naming rule for the user name is known, the user name can be guessed by trial and error transmissions.

* Real email address is transferrable:

  The real email address can be transferred from one person to another, so that mails can be transmitted even if the real email address is not taught by the holder himself. The transfer of real email

address through mails includes the following cases. By specifying the other's real email address in the cc: line of the mail, that real email address can be transferred to all the recipients specified in the To: line of the mail. Also, by forwarding the mail that contains the real email address of the recipient specified in the To: line in the message text to a third person, that real email address can be transferred to the third person.

- Real email address is hard to cancel:

  It is difficult to cancel the real email address because if the real email address is cancelled it becomes impossible to read not only the SPAM and the harassment mails but also the important mails as well.

[0006] Cypherpunk remailers and Mixmaster remailers which are collectively known as Anonymous remailers use a scheme for delivering mails after encrypting the real email address and the real domain of the sender. This scheme is called the reply block. The encryption and decryption of the reply block uses a public key and a secret key of the Anonymous remailer so that it is difficult to identify the real email address and the real domain of the sender for any users other than the sender.

[0007] The Anonymous remailers also make it difficult to transfer the real email address because it is difficult to identify the real email address. However, the reply block is transferrable, so that reply mails can be returned to the sender from users other than the recipient.

[0008] AS-Node and nym.alias.net which are collectively known as Pseudonymous servers use mail transmission and reception using a pseudonym account uniquely corresponding to the real email address of the user. The pseudonym account can be arbitrarily created at the user side so that the user can have a pseudonym account from which the real email address is hard to guess. In addition, by the use of the reply block, it is also possible to conceal the real email address and the real domain of the user to the Pseudonymous server. By combining these means, it can be made difficult to identify the real email address and the real domain of the sender for any users other than the sender. Also, the pseudonym account is cancellable so that there is no need to cancel the real email address.

[0009] The Pseudonymous servers also make it difficult to transfer the real email address because it is difficult to identify the real email address. However, the pseudonym account is transferrable so that reply mails can be returned to the sender from users other than the recipient.

[0010] In addition, in order to protect a recipient from the SPAM and the harrassment, it is also necessary to reject a connection request from a sender who are exercising such action. For this reason, it is necessary for the communication system to be capable of uniquely identifying the identity of the sender.

[0011] In view of these factors, the communication system is required to be capable of uniquely identifying the identity of the user while concealing the real email address of the user (that is while guaranteeing the anonymity of the user), but in the conventional communication system, it has been difficult to meet both of these requirements simultaneously.

[0012] In order to identify the identity of the user in the mail system, the real email address of that user is necessary. On the other hand, the Anonymous remailers deliver a mail after either encrypting or deleting the real email address of the sender in order to guarantee the anonymity of the sender. In order to identify the identity of the sender under this condition, it is necessary to trace the delivery route of the mail using the traffic analysis. However, the Anonymous remailers may delay the mail delivery or interchange the delivery orders of mails. Also, The Mixmaster remailers deliver the mail by dividing it into plural blocks. For this reason, it is difficult to trace the delivery route by the traffic analysis, and therefore the identification of the identity of the sender is also difficult.

[0013] The Pseudonymous servers also utilize the Anonymous remailers for the mail delivery, so that it is possible to guarantee the anonymity of the sender but it is also difficult to uniquely identify the identity of the sender.

[0014] On the other hand, the German Digital Signature Law allows entry of a pseudonym instead of a real name into a digital certificate for generating the digital signature to be used in communication services. The digital certificate is uniquely assigned to the user so that the identity of the user can be uniquely identified even if the pseudonym is entered. Also, the right for naming the pseudonym is given to the user side so that it is possible to enter the pseudonym from which it is difficult to guess the real name.

SUMMARY OF THE INVENTION

[0015] It is therefore an object of the present invention to provide an email access control scheme in a communication network which is capable of resolving the above described problems of the real email address which is one of the causes of the SPAM and the harassment.

[0016] It is another object of the present invention to provide an email access control scheme in a communication network which is capable of enabling a unique identification of the identity of the user while concealing the user identification.

[0017] In order to resolve the problems associated with the transfer and the cancellation of the real email address, the present invention employs the email access control scheme using a personalized access ticket (PAT). In order to resolve the problem associated with the transfer of the real email address, the destination is specified by the PAT which contains both the real email address of the sender and a real email address of

the recipient. Also, in order to resolve the problem associated with the cancellation of the real email address, a validity period is set in the PAT by a Trusted Third Party. Then, the mail delivery from the sender who presented the PAT with the expired validity period will be refused. Also, instead of cancelling the real email address, the PAT is registered at a secure storage device managed by a secure communication service.

[0018] In other words, the present invention controls accesses in units in which the real email address of the sender and the real email address of the recipient is paired. For this reason, even when the real email address is transferred, it is possible to avoid receiving mails from users to which the real email address has been transferred as long as the PAT is not acquired by these users.

[0019] Also, in the present invention, it is possible to refuse receiving mails without cancelling the real email address because the mail delivery from the sender who presented the PAT with the expired validity period or the PAT that is registered in a database by the recipient will be refused.

[0020] Also, in the present invention, the mail receiving can be resumed without re-acquiring the real email address because the mail receiving can be resumed by deleting the PAT from the above described storage device.

[0021] Also, in the present invention, the time consumption and economical loads required for the mail receiving or downloading at the user side can be reduced because the transmission of mails are refused at the server side.

[0022] In addition, the present invention employs the email access control scheme using an official identification (OID) and an anonymous identification (AID) in order to make it possible to identify the identity of the user while guaranteeing the anonymity of the user.

[0023] Namely, in the present invention, a certificate in which the personal information is signed by a secret key of the Trusted Third Party is assigned to each user in order to uniquely identify each user. This certificate will be referred to as OID. Also, a certificate which contains fragments of the OID information is assigned to each user as a user identifier on a communication network in order to make it possible to identify the identity while guaranteeing the anonymity of the user. This certificate will be referred to as AID.

[0024] Also, in the present invention, the OID is reconstructed by judging the identity of a plurality of AIDs in order to identify the identity of the user. Also, the AID is contained in the PAT and the PAT is authenticated at a secure communication service (SCS) in order to resolve the problems associated with the transfer and the cancellation of the AID.

[0025] Also, in the present invention, the AID is managed in a directory which is accessible for search by unspecified many and which outputs the PAT containing the AID as a destination, in order to meet the user side demand for being able to admit accesses from unspecified many without revealing the own identity.

[0026] In this way, in the present invention, the identity of the user can be concealed in the mail transmission and reception because the AID only contains fragments of the OID. Also, the identity of the user can be concealed from unspecified many even when the AID is registered at the directory service which is accessible from unspecified many.

[0027] Also, in the present invention, the identity of the user can be identified probabilistically by reconstructing the OID by judging the identity of a plurality of AIDs. For this reason, it is possible to provide a measure against the SPAM and the harassment without revealing the identity.

[0028] Also, in the present invention, it is possible to admit accesses from unspecified many without revealing the identity, by managing the AID rather than the real email address at the directory and outputting the PAT containing the AID as a destination at the directory.

[0029] More specifically, according to one aspect of the present invention there is provided a method of email access control, comprising the steps of: receiving a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, at a secure communication service for connecting communications between the sender and the receiver; and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket at the secure communication service.

[0030] Also, in this aspect of the present invention, at the controlling step the secure communication service authenticates the personalized access ticket presented by the sender, and refuses a delivery of the email when the personalized access ticket presented by the sender has been altered.

[0031] Also, in this aspect of the present invention, the personalized access ticket is signed by a secret key of a secure processing device which issued the personalized access ticket, and at the controlling step the secure communication service authenticates the personalized access ticket by verifying a signature of the secure processing device in the personalized access ticket using a public key of the secure processing device.

[0032] Also, in this aspect of the present invention, at the receiving step the secure communication service also receives the sender's identification presented by the sender along with the personalized access ticket, and at the controlling step the secure communication service checks whether the sender's identification presented by the sender is contained in the personalized access ticket presented by the sender, and refuses a delivery of the email when the sender's identification presented by the sender is not contained in the person-

alized access ticket presented by the sender.

[0033] Also, in this aspect of the present invention, the personalized access ticket also contains a validity period indicating a period for which the personalized access ticket is valid, and at the controlling step the secure communication service checks the validity period contained in the personalized access ticket presented by the sender and refuses a delivery of the email when the personalized access ticket presented by the sender contains the validity period that has already been expired.

[0034] Also, in this aspect of the present invention, the validity period of the personalized access ticket is set by a trusted third party.

[0035] Also, in this aspect of the present invention, the method can further comprise the step of: issuing the personalized access ticket to the sender at a directory service for managing an identification of each registrant and a disclosed information of each registrant which has a lower secrecy than a personal information, in a state which is accessible for search by unspecified many, in response to search conditions specified by the sender, by using an identification of a registrant whose disclosed information matches the search conditions as the recipient's identification and the sender's identification specified by the sender along with the search conditions.

[0036] Also, in this aspect of the present invention, the method can further comprise the step of: registering in advance the personalized access ticket containing an identification of a specific user from which a delivery of emails to a specific registrant is to be refused as the sender's identification and an identification of the specific registrant as the recipient's identification, at the secure communication service; wherein the controlling step the secure communication service refuses a delivery of the email from the sender when the personalized access ticket presented by the sender is registered therein in advance at the registering step.

[0037] Also, in this aspect of the present invention, the method can further comprise the step of: deleting the personalized access ticket registered at the secure communication service upon request from the specific registrant who registered the personalized access ticket at the registering step.

[0038] Also, in this aspect of the present invention, the personalized access ticket also contains a transfer control flag indicating whether or not the sender should be authenticated by the secure communication service, and at the controlling step, when the transfer control flag contained in the personalized access ticket indicates that the sender should be authenticated, the secure communication service authenticates the sender's identification presented by the sender and refuses a delivery of the email when an authentication of the sender's identification fails.

[0039] Also, in this aspect of the present invention, the authentication of the sender's identification is realized by a challenge/response procedure between the sender and the secure communication service.

[0040] Also, in this aspect of the present invention, the transfer control flag of the personalized access ticket is set by a trusted third party.

[0041] Also, in this aspect of the present invention, the sender's identification and the recipient's identification in the personalized access ticket can be given by real email addresses of the sender and the recipient.

[0042] Also, in this aspect of the present invention, the sender's identification and the recipient's identification in the personalized access ticket can be given by anonymous identifications of the sender and the recipient, where an anonymous identification of each user contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority.

[0043] Also, in this aspect of the present invention, the anonymous identification of each user is an information containing the at least one fragment of the official identification of each user which is signed by the certification authority using a secret key of the certification authority.

[0044] Also, in this aspect of the present invention, the official identification of each user is a character string uniquely assigned to each user by the certification authority and a public key of each user which are signed by a secret key of the certification authority.

[0045] Also, in this aspect of the present invention, the method can further comprise the step of: probabilistically identifying an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0046] Also, in this aspect of the present invention, an anonymous identification of each user that contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority and a link information of each anonymous identification by which each anonymous identification can be uniquely identified can be defined, and the sender's identification and the recipient's identification in the personalized access ticket can be given by a link information of the anonymous identification of the sender and a link information of the anonymous identification of the recipient.

[0047] Also, in this aspect of the present invention, the link information of each anonymous identification is an identifier uniquely assigned to each anonymous identification by the certification authority.

[0048] Also, in this aspect of the present invention, the method can further comprise the step of: probabilistically identifying an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender corresponding to the link information contained in a plurality of personalized access tickets used by the sender.

[0049] Also, in this aspect of the present invention, the personalized access ticket can contain a single sender's identification and a single recipient's identification in 1-to-1 correspondence.

[0050] Also, in this aspect of the present invention, the personalized access ticket can contain a single sender's identification and a plurality of recipient's identifications in 1-to-N correspondence, where N is an integer greater than 1.

[0051] Also, in this aspect of the present invention, one identification among the single sender's identification and the plurality of recipient's identifications is a holder identification for identifying a holder of the personalized access ticket while other identifications among the single sender's identification and the plurality of recipient's identifications are member identifications for identifying members of a group to which the holder belongs.

[0052] Also, in this aspect of the present invention, the method can further comprise the step of: issuing an identification of each user and an enabler of the identification of each user indicating a right to change the personalized access ticket containing the identification of each user as the holder identification, to each user at a certification authority, such that prescribed processing on the personalized access ticket can be carried out at a secure processing device only by a user who presented both the holder identification contained in the personalized access ticket and the enabler corresponding to the holder identification to the secure processing device.

[0053] Also, in this aspect of the present invention, the certification authority issues the enabler of the identification of each user as an information indicating that it is the enabler and the identification of each user itself which are signed by a secret key of the certification authority.

[0054] Also, in this aspect of the present invention, the prescribed processing includes a generation of a new personalized access ticket, a merging of a plurality of personalized access tickets, a splitting of one personalized access ticket into a plurality of personalized access tickets, a changing of the holder of the personalized access ticket, changing of a validity period of the personalized access ticket, and a changing of a transfer control flag of the personalized access ticket.

[0055] Also, in this aspect of the present invention, a special identification and a special enabler corresponding to the special identification which are known to all users can be defined such that the generation of a new personalized access ticket and the changing of the holder of the personalized access ticket can be carried out by the holder of the personalized access ticket by using the special identification and the special enabler without using an enabler of a member identification.

[0056] Also, in this aspect of the present invention, the special identification is defined to be capable of being used only as the holder identification of the personalized access ticket.

[0057] Also, in this aspect of the present invention, a special identification which is known to all users can be defined such that a read only attribute can be set to the personalized access ticket by using the special identification.

[0058] Also, in this aspect of the present invention, at the controlling step, when the access right of the sender with respect to the recipient is verified according to the personalized access ticket, the secure communication service takes out the recipient's identification from the personalized access ticket by using the sender's identification presented by the sender, converts the mail by using a taken out recipient's identification into a format that can be interpreted by a mail transfer function for actually carrying out a mail delivery processing, and gives the mail after conversion to the mail transfer function by attaching the personalized access ticket.

[0059] According to another aspect of the present invention there is provided a method of email access control, comprising the steps of: defining an official identification of each user by which each user is uniquely identifiable by a certification authority, and an anonymous identification of each user containing at least one fragment of the official identification; and identifying each user by the anonymous identification of each user in communications for emails on a communication network.

[0060] Also, in this aspect of the present invention, the anonymous identification of each user is an information containing the at least one fragment of the official identification of each user which is signed by the certification authority using a secret key of the certification authority.

[0061] Also, in this aspect of the present invention, the official identification of each user is a character string uniquely assigned to each user by the certification authority and a public key of each user which are signed by a secret key of the certification authority.

[0062] Also, in this aspect of the present invention, the method can further comprise the steps of: receiving a personalized access ticket containing a sender's anonymous identification and a recipient's anonymous identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, at a secure communication service for connecting communications between the sender and the receiver; and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket at the secure communication service.

[0063] Also, in this aspect of the present invention, the method can further comprises the step of: probabilistically identifying an identity of the sender at the secure communication service by reconstructing the official identification of the sender while judging identity of a plurality of anonymous identifications of the sender con-

tained in a plurality of personalized access tickets used by the sender.

[0064] Also, in this aspect of the present invention, the defining step can also define a link information of each anonymous identification by which each anonymous identification can be uniquely identified, and each anonymous identification can also contain the link information of each anonymous identification.

[0065] Also, in this aspect of the present invention, the link information of each anonymous identification is an identifier uniquely assigned to each anonymous identification by the certification authority.

[0066] Also, in this aspect of the present invention, the method can further comprises the steps of: receiving a personalized access ticket containing a link information of a sender's anonymous identification and a link information of a recipient's anonymous identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, at a secure communication service for connecting communications between the sender and the receiver; and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket at the secure communication service.

[0067] Also, in this aspect of the present invention, the method can further comprises the step of: probabilistically identifying an identity of the sender by reconstructing the official identification of the sender while judging identity of a plurality of anonymous identifications of the sender corresponding to the link information contained in a plurality of personalized access tickets used by the sender.

[0068] According to another aspect of the present invention there is provided a communication system realizing email access control, comprising: a communication network to which a plurality of user terminals are connected; and a secure communication service device for connecting communications between the sender and the receiver on the communication network, by receiving a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket.

[0069] Also, in this aspect of the present invention, the secure communication service device authenticates the personalized access ticket presented by the sender, and refuses a delivery of the email when the personalized access ticket presented by the sender has been altered.

[0070] Also, in this aspect of the present invention, the system further comprises: a secure processing device for issuing the personalized access ticket which is signed by a secret key of the secure processing device; wherein the secure communication service device authenticates the personalized access ticket by verifying a signature of the secure processing device in the personalized access ticket using a public key of the secure processing device.

[0071] Also, in this aspect of the present invention, the secure communication service device also receives the sender's identification presented by the sender along with the personalized access ticket, checks whether the sender's identification presented by the sender is contained in the personalized access ticket presented by the sender, and refuses a delivery of the email when the sender's identification presented by the sender is not contained in the personalized access ticket presented by the sender.

[0072] Also, in this aspect of the present invention, the personalized access ticket also contains a validity period indicating a period for which the personalized access ticket is valid, and the secure communication service device checks the validity period contained in the personalized access ticket presented by the sender and refuses a delivery of the email when the personalized access ticket presented by the sender contains the validity period that has already been expired.

[0073] Also, in this aspect of the present invention, the system further comprises: a trusted third party for setting the validity period of the personalized access ticket.

[0074] Also, in this aspect of the present invention, the system can further comprise: a directory service device for managing an identification of each registrant and and a disclosed information of each registrant which has a lower secrecy than a personal information, in a state which is accessible for search by unspecified many, and issuing the personalized access ticket to the sender in response to search conditions specified by the sender, by using an identification of a registrant whose disclosed information matches the search conditions as the recipient's identification and the sender's identification specified by the sender along with the search conditions.

[0075] Also, in this aspect of the present invention, the secure communication service device can register in advance the personalized access ticket containing an identification of a specific user from which a delivery of emails to a specific registrant is to be refused as the sender's identification and an identification of the specific registrant as the recipient's identification, and refuse a delivery of the email from the sender when the personalized access ticket presented by the sender is registered therein in advance.

[0076] Also, in this aspect of the present invention, the secure communication service device can delete the personalized access ticket registered therein upon request from the specific registrant who registered the personalized access ticket.

[0077] Also, in this aspect of the present invention, the

personalized access ticket also contains a transfer control flag indicating whether or not the sender should be authenticated by the secure communication service, and when the transfer control flag contained in the personalized access ticket indicates that the sender should be authenticated, the secure communication service device authenticates the sender's identification presented by the sender and refuses a delivery of the email when an authentication of the sender's identification fails.

[0078] Also, in this aspect of the present invention, the authentication of the sender's identification is realized by a challenge/response procedure between the sender and the secure communication service device.

[0079] Also, in this aspect of the present invention, the system further comprises a trusted third party for setting the transfer control flag of the personalized access ticket.

[0080] Also, in this aspect of the present invention, the sender's identification and the recipient's identification in the personalized access ticket can be given by real email addresses of the sender and the recipient.

[0081] Also, in this aspect of the present invention, the system can further comprise: a certification authority device for issuing an anonymous identification of each user which contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by the certification authority device; wherein the sender's identification and the recipient's identification in the personalized access ticket can be given by anonymous identifications of the sender and the recipient.

[0082] Also, in this aspect of the present invention, the anonymous identification of each user is an information containing the at least one fragment of the official identification of each user which is signed by the certification authority device using a secret key of the certification authority device.

[0083] Also, in this aspect of the present invention, the official identification of each user is a character string uniquely assigned to each user by the certification authority device and a public key of each user which are signed by a secret key of the certification authority device.

[0084] Also, in this aspect of the present invention, the secure communication service device can probabilistically identify an identity of the sender by reconstructing the official identification of the sender while judging identity of a plurality of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0085] Also, in this aspect of the present invention, the system can further comprise: a certification authority device for issuing an anonymous identification of each user which contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by the certification authority device and a link information of each anonymous identification by which each anonymous identification can be uniquely identified; wherein the sender's identification and the recipient's identification in the personalized access ticket can be given by a link information of the anonymous identification of the sender and a link information of the anonymous identification of the recipient.

[0086] Also, in this aspect of the present invention, the link information of each anonymous identification is an identifier uniquely assigned to each anonymous identification by the certification authority device.

[0087] Also, in this aspect of the present invention, the secure communication service device can probabilistically identify an identity of the sender by reconstructing the official identification of the sender while judging identity of a plurality of anonymous identifications of the sender corresponding to the link information contained in a plurality of personalized access tickets used by the sender.

[0088] Also, in this aspect of the present invention, the personalized access ticket can contain a single sender's identification and a single recipient's identification in 1-to-1 correspondence.

[0089] Also, in this aspect of the present invention, the personalized access ticket can contain a single sender's identification and a plurality of recipient's identifications in 1-to-N correspondence, where N is an integer greater than 1.

[0090] Also, in this aspect of the present invention, one identification among the single sender's identification and the plurality of recipient's identifications is a holder identification for identifying a holder of the personalized access ticket while other identifications among the single sender's identification and the plurality of recipient's identifications are member identifications for identifying members of a group to which the holder belongs.

[0091] Also, in this aspect of the present invention, the system can further comprises: a certification authority device for issuing to each user an identification of each user and an enabler of the identification of each user indicating a right to change the personalized access ticket containing the identification of each user as the holder identification; and a secure processing device at which prescribed processing on the personalized access ticket can be carried out only by a user who presented both the holder identification contained in the personalized access ticket and the enabler corresponding to the holder identification to the secure processing device.

[0092] Also, in this aspect of the present invention, the certification authority device issues the enabler of the identification of each user as an information indicating that it is the enabler and the identification of each user itself which are signed by a secret key of the certification authority device.

[0093] Also, in this aspect of the present invention, the prescribed processing includes a generation of a new personalized access ticket, a merging of a plurality of

personalized access tickets, a splitting of one personalized access ticket into a plurality of personalized access tickets, a changing of the holder of the personalized access ticket, changing of a validity period of the personalized access ticket, and a changing of a transfer control flag of the personalized access ticket.

[0094] Also, in this aspect of the present invention, a special identification and a special enabler corresponding to the special identification which are known to all users can be defined such that the generation of a new personalized access ticket and the changing of the holder of the personalized access ticket can be carried out by the holder of the personalized access ticket by using the special identification and the special enabler without using an enabler of a member identification.

[0095] Also, in this aspect of the present invention, the special identification is defined to be capable of being used only as the holder identification of the personalized access ticket.

[0096] Also, in this aspect of the present invention, a special identification which is known to all users can be defined such that a read only attribute can be set to the personalized access ticket by using the special identification.

[0097] Also, in this aspect of the present invention, when the access right of the sender with respect to the recipient is verified according to the personalized access ticket, the secure communication service device takes out the recipient's identification from the personalized access ticket by using the sender's identification presented by the sender, converts the mail by using a taken out recipient's identification into a format that can be interpreted by a mail transfer function for actually carrying out a mail delivery processing, and gives the mail after conversion to the mail transfer function by attaching the personalized access ticket.

[0098] According to another aspect of the present invention there is provided a communication system realizing email access control, comprising: a certification authority device for defining an official identification of each user by which each user is uniquely identifiable by the certification authority device, and an anonymous identification of each user which contains at least one fragment of the official identification; and a communication network on which each user is identified by the anonymous identification of each user in communications for emails on the communication network.

[0099] Also, in this aspect of the present invention, the anonymous identification of each user is an information containing the at least one fragment of the official identification of each user which is signed by the certification authority device using a secret key of the certification authority device.

[0100] Also, in this aspect of the present invention, the official identification of each user is a character string uniquely assigned to each user by the certification authority device and a public key of each user which are signed by a secret key of the certification authority device.

[0101] Also, in this aspect of the present invention, the system can further comprises: a secure communication service device for connecting communications between the sender and the receiver on the communication network, by receiving a personalized access ticket containing a sender's anonymous identification and a recipient's anonymous identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket.

[0102] Also, in this aspect of the present invention, the secure communication service device can probabilistically identify an identity of the sender by reconstructing the official identification of the sender while judging identity of a plurality of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0103] Also, in this aspect of the present invention, the certification authority device can also define a link information of each anonymous identification by which each anonymous identification can be uniquely identified, and each anonymous identification can also contain the link information of each anonymous identification.

[0104] Also, in this aspect of the present invention, the link information of each anonymous identification is an identifier uniquely assigned to each anonymous identification by the certification authority device.

[0105] Also, in this aspect of the present invention, the system can further comprise: a secure communication service device for connecting communications between the sender and the receiver on the communication network, by receiving a personalized access ticket containing a link information of a sender's anonymous identification and a link information of a recipient's anonymous identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket.

[0106] Also, in this aspect of the present invention, the secure communication service device can probabilistically identify an identity of the sender by reconstructing the official identification of the sender while judging identity of a plurality of link informations of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0107] According to another aspect of the present invention there is provided a secure communication service device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to connect communications

between the sender and the receiver, by receiving a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email, and controlling accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket.

[0108] Also, in this aspect of the present invention, the computer software causes the computer hardware to authenticate the personalized access ticket presented by the sender, and refuse a delivery of the email when the personalized access ticket presented by the sender has been altered.

[0109] Also, in this aspect of the present invention, the personalized access ticket is signed by a secret key of a secure processing device which issued the personalized access ticket, and the computer software causes the computer hardware to authenticate the personalized access ticket by verifying a signature of the secure processing device in the personalized access ticket using a public key of the secure processing device.

[0110] Also, in this aspect of the present invention, the computer software causes the computer hardware to also receive the sender's identification presented by the sender along with the personalized access ticket, check whether the sender's identification presented by the sender is contained in the personalized access ticket presented by the sender, and refuse a delivery of the email when the sender's identification presented by the sender is not contained in the personalized access ticket presented by the sender.

[0111] Also, in this aspect of the present invention, the personalized access ticket also contains a validity period indicating a period for which the personalized access ticket is valid, and the computer software causes the computer hardware to check the validity period contained in the personalized access ticket presented by the sender and refuse a delivery of the email when the personalized access ticket presented by the sender contains the validity period that has already been expired.

[0112] Also, in this aspect of the present invention, the computer software can cause the computer hardware to register in advance the personalized access ticket containing an identification of a specific user from which a delivery of emails to a specific registrant is to be refused as the sender's identification and an identification of the specific registrant as the recipient's identification, at the secure communication service device, and refuse a delivery of the email from the sender when the personalized access ticket presented by the sender is registered at the secure communication service device in advance.

[0113] Also, in this aspect of the present invention, the computer software can cause the computer hardware to delete the personalized access ticket registered at the secure communication service device upon request from the specific registrant who registered the personalized access ticket.

[0114] Also, in this aspect of the present invention, the personalized access ticket also contains a transfer control flag indicating whether or not the sender should be authenticated by the secure communication service device, and when the transfer control flag contained in the personalized access ticket indicates that the sender should be authenticated, the computer software causes the computer hardware to authenticate the sender's identification presented by the sender and refuse a delivery of the email when an authentication of the sender's identification fails.

[0115] Also, in this aspect of the present invention, the computer software causes the computer hardware to realize the authentication of the sender's identification by a challenge/response procedure between the sender and the secure communication service device.

[0116] Also, in this aspect of the present invention, the sender's identification and the recipient's identification in the personalized access ticket can be given by anonymous identifications of the sender and the recipient, where an anonymous identification of each user contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority, and the computer software can also cause the computer hardware to probabilistically identify an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0117] Also, in this aspect of the present invention, an anonymous identification of each user that contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority and a link information of each anonymous identification by which each anonymous identification can be uniquely identified can be defined, the sender's identification and the recipient's identification in the personalized access ticket can be given by a link information of the anonymous identification of the sender and a link information of the anonymous identification of the recipient, and the computer software can also cause the computer hardware to probabilistically identify an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender corresponding to the link information contained in a plurality of personalized access tickets used by the sender.

[0118] Also, in this aspect of the present invention, when the access right of the sender with respect to the recipient is verified according to the personalized access ticket, the computer software causes the computer hardware to take out the recipient's identification from the personalized access ticket by using the sender's identification presented by the sender, convert

the mail by using a taken out recipient's identification into a format that can be interpreted by a mail transfer function for actually carrying out a mail delivery processing, and give the mail after conversion to the mail transfer function by attaching the personalized access ticket.

[0119] According to another aspect of the present invention there is provided a secure processing device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to receive a request for a personalized access ticket from a user, and issue a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is signed by a secret key of the secure processing device.

[0120] According to another aspect of the present invention there is provided a directory service device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to manage an identification of each registrant and a disclosed information of each registrant which has a lower secrecy than a personal information, in a state which is accessible for search by unspecified many, and issue a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, to the sender in response to search conditions specified by the sender, by using an identification of a registrant whose disclosed information matches the search conditions as the recipient's identification and the sender's identification specified by the sender along with the search conditions.

[0121] According to another aspect of the present invention there is provided a certification authority device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to issue to each user an official identification of each user by which each user is uniquely identifiable by the certification authority device, and an anonymous identification of each user which contains at least one fragment of the official identification.

[0122] According to another aspect of the present invention there is provided a certification authority device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to issue to each user an identification of each user and an enabler of the identification of each user indicating a right to change any personalized access ticket that contains the identification of each user as a holder identification, where the personalized access ticket generally contains a sender's identification and a plurality of recipient's identifications in correspondence, and one of the sender's identification and the recipient's identifications is a holder identification.

[0123] According to another aspect of the present invention there is provided a secure processing device for use in a communication system realizing email access control, comprising: a computer hardware; and a computer software for causing the computer hardware to receive from a user a request for prescribed processing on a personalized access ticket containing a sender's identification and a plurality of recipient's identifications in correspondence, where one of the sender's identification and the recipient's identifications is a holder identification, and execute the prescribed processing on the personalized access ticket when the user presented both the holder identification contained in the personalized access ticket and an enabler corresponding to the holder identification which indicates a right to change the personalized access ticket containing the identification of the user as the holder identification.

[0124] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as a secure communication service device for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to receive a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is presented by a sender who wishes to send an email to a recipient so as to specify the recipient as an intended destination of the email; and second computer readable program code means for causing said computer to control accesses between the sender and the recipient by verifying an access right of the sender with respect to the recipient according to the personalized access ticket, so as to connect communications between the sender and the receiver on the communication network.

[0125] Also, in this aspect of the present invention, the second computer readable program code means causes said computer to authenticate the personalized access ticket presented by the sender, and refuse a delivery of the email when the personalized access ticket presented by the sender has been altered.

[0126] Also, in this aspect of the present invention, the personalized access ticket is signed by a secret key of a secure processing device which issued the personalized access ticket, and the second computer readable program code means causes said computer to authenticate the personalized access ticket by verifying a signature of the secure processing device in the personalized access ticket using a public key of the secure processing device.

[0127] Also, in this aspect of the present invention, the first computer readable program code means causes said computer to also receive the sender's identification presented by the sender along with the personalized access ticket, and the second computer readable program code means causes said computer to check

whether the sender's identification presented by the sender is contained in the personalized access ticket presented by the sender and refuse a delivery of the email when the sender's identification presented by the sender is not contained in the personalized access ticket presented by the sender.

[0128] Also, in this aspect of the present invention, the personalized access ticket also contains a validity period indicating a period for which the personalized access ticket is valid, and the second computer readable program code means causes said computer to check the validity period contained in the personalized access ticket presented by the sender and refuse a delivery of the email when the personalized access ticket presented by the sender contains the validity period that has already been expired.

[0129] Also, in this aspect of the present invention, the second computer readable program code means can cause said computer to register in advance the personalized access ticket containing an identification of a specific user from which a delivery of emails to a specific registrant is to be refused as the sender's identification and an identification of the specific registrant as the recipient's identification, at the secure communication service device, and refuse a delivery of the email from the sender when the personalized access ticket presented by the sender is registered at the secure communication service device in advance.

[0130] Also, in this aspect of the present invention, the second computer readable program code means can cause said computer to delete the personalized access ticket registered at the secure communication service device upon request from the specific registrant who registered the personalized access ticket.

[0131] Also, in this aspect of the present invention, the personalized access ticket also contains a transfer control flag indicating whether or not the sender should be authenticated by the secure communication service device, and when the transfer control flag contained in the personalized access ticket indicates that the sender should be authenticated, the second computer readable program code means causes said computer to authenticate the sender's identification presented by the sender and refuse a delivery of the email when an authentication of the sender's identification fails.

[0132] Also, in this aspect of the present invention, the second computer readable program code means causes said computer to realize the authentication of the sender's identification by a challenge/response procedure between the sender and the secure communication service device.

[0133] Also, in this aspect of the present invention, the sender's identification and the recipient's identification in the personalized access ticket can be given by anonymous identifications of the sender and the recipient, where an anonymous identification of each user contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority, and the second computer readable program code means can also cause said computer to probabilistically identify an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender contained in a plurality of personalized access tickets used by the sender.

[0134] Also, in this aspect of the present invention, an anonymous identification of each user that contains at least one fragment of an official identification of each user by which each user is uniquely identifiable by a certification authority and a link information of each anonymous identification by which each anonymous identification can be uniquely identified can be defined, the sender's identification and the recipient's identification in the personalized access ticket can be given by a link information of the anonymous identification of the sender and a link information of the anonymous identification of the recipient, and the second computer readable program code means can also cause said computer to probabilistically identify an identity of the sender by reconstructing the official identification of the sender by judging identity of a plurality of anonymous identifications of the sender corresponding to the link information contained in a plurality of personalized access tickets used by the sender.

[0135] Also, in this aspect of the present invention, when the access right of the sender with respect to the recipient is verified according to the personalized access ticket, the second computer readable program code means causes said computer to take out the recipient's identification from the personalized access ticket by using the sender's identification presented by the sender, convert the mail by using a taken out recipient's identification into a format that can be interpreted by a mail transfer function for actually carrying out a mail delivery processing, and give the mail after conversion to the mail transfer function by attaching the personalized access ticket.

[0136] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as a secure processing device for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to receive a request for a personalized access ticket from a user; and second computer readable program code means for causing said computer to issue the personalized access ticket containing a sender's identification and a recipient's identification in correspondence, which is signed by a secret key of the secure processing device.

[0137] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as

a directory service devicer for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to manage an identification of each registrant and a disclosed information of each registrant which has a lower secrecy than a personal information, in a state which is accessible for search by unspecified many, and second computer readable program code means for causing said computer to issue a personalized access ticket containing a sender's identification and a recipient's identification in correspondence, to the sender in response to search conditions specified by the sender, by using an identification of a registrant whose disclosed information matches the search conditions as the recipient's identification and the sender's identification specified by the sender along with the search conditions.

[0138] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as a certification authority device for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to issue to each user an official identification of each user by which each user is uniquely identifiable by the certification authority device; and second computer readable program code means for causing said computer to issue to each user an anonymous identification of each user which contains at least one fragment of the official identification.

[0139] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as a certification authority device for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to issue to each user an identification of each user; and second computer readable program code means for causing said computer to issue to each user an enabler of the identification of each user indicating a right to change any personalized access ticket that contains the identification of each user as a holder identification, where the persnalized access ticket generally contains a sender's identification and a plurality of recipient's identifications in correspondence, and one of the sender's identification and the recipient's identifications is a holder identification.

[0140] According to another aspect of the present invention there is provided a computer usable medium having computer readable program code means embodied therein for causing a computer to function as a secure processing device for use in a communication system realizing email access control, the computer readable program code means includes: first computer readable program code means for causing said computer to receive from a user a request for prescribed processing on a personalized access ticket containing a sender's identification and a plurality of recipient's identifications in correspondence, where one of the sender's identification and the recipient's identifications is a holder identification; and second computer readable program code means for causing said computer to execute the prescribed processing on the personalized access ticket when the user presented both the holder identification contained in the personalized access ticket and an enabler corresponding to the holder identification which indicates a right to change the personalized access ticket containing the identification of the user as the holder identification.

[0141] Other features and advantages of the present invention will become apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0142]

Fig. 1 is a diagram showing an overall configuration of a communication system according to the first embodiment of the present invention.

Fig. 2 is a diagram showing exemplary data structures of an official identification, an anonymous identification, and a 1-to-1 personalized access ticket according to the first embodiment of the present invention.

Fig. 3 is a flow chart for an anonymous identification generation processing at a certification authority according to the first embodiment of the present invention.

Fig. 4 is a flow chart for a personalized access ticket generation processing at an anonymous directory service according to the first embodiment of the present invention.

Fig. 5 is a flow chart for a mail access control processing at a secure communication service according to the first embodiment of the present invention.

Fig. 6 is a flow chart for an anonymous identification identity judgement processing at a secure communication service according to the first embodiment of the present invention.

Fig. 7 is a diagram showing exemplary data structures of data used in the anonymous identification identity judgement processing of Fig. 6.

Fig. 8 is a diagram showing exemplary data structures of an official identification, an anonymous identification, and a 1-to-N personalized access ticket according to the second embodiment of the present invention.

Fig. 9 is a diagram showing exemplary data struc-

tures of an anonymous identification and an enabler according to the second embodiment of the present invention.

Fig. 10 is a diagram showing a definition of a processing rule (MakePAT) used in the second embodiment of the present invention.

Fig. 11 is a diagram showing a definition of a processing rule (MergePAT) used in the second embodiment of the present invention.

Fig. 12 is a diagram showing a definition of a processing rule (SplitPAT) used in the second embodiment of the present invention.

Fig. 13 is a diagram showing a definition of a processing rule (TransPAT) used in the second embodiment of the present invention.

Fig. 14 is a first exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 15 is a second exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 16 is a third exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 17 is a fourth exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 18 is a fifth exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 19 is a sixth exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 20 is a seventh exemplary system configuration that can be used in the second embodiment of the present invention.

Fig. 21 is a flow chart showing an overall processing flow of MakePAT, MergePAT or TransPAT processing according to the second embodiment of the present invention.

Fig. 22 is a flow chart showing an overall processing flow of SplitPAT processing according to the second embodiment of the present invention.

Fig. 23 is a flow chart for an anonymous identification list generation processing (for MakePAT, MergePAT, SplitPAT and TransPAT) according to the second embodiment of the present invention.

Fig. 24 is an enabler authenticity verification processing (for MakePAT, MergePAT, SplitPAT and TransPAT) according to the second embodiment of the present invention.

Fig. 25 is a diagram showing an exemplary data structure of Null-AID used in the third embodiment of the present invention.

Fig. 26 is a diagram showing an exemplary data structure of Enabler of Null-AID used in the third embodiment of the present invention.

Fig. 27 is a diagram showing a first exemplary application of the third embodiment of the present invention.

Fig. 28 is a diagram showing a second exemplary application of the third embodiment of the present invention.

Fig. 29 is a diagram showing an exemplary data structure of God-AID used in the fourth embodiment of the present invention.

Fig. 30 is a diagram showing a first exemplary application of the fourth embodiment of the present invention.

Fig. 31 is a diagram showing a second exemplary application of the fourth embodiment of the present invention.

Fig. 32 is a flow chart for a member anonymous identification checking processing according to the fifth embodiment of the present invention.

Fig. 33 is a diagram showing an overall configuration of a communication system according to the sixth embodiment of the present invention.

Fig. 34 is a diagram showing exemplary data structures of an official identification, a link information attached anonymous identification, and a link specifying 1-to-1 personalized access ticket according to the sixth embodiment of the present invention.

Fig. 35 is a flow chart for a link information attached anonymous identification generation processing at a certification authority according to the sixth embodiment of the present invention.

Fig. 36 is a flow chart for a link specifying 1-to-1 personalized access ticket generation processing at an anonymous directory service according to the sixth embodiment of the present invention.

Fig. 37 is a flow chart for a mail access control processing at a secure communication service according to the sixth embodiment of the present invention.

Fig. 38 is a flow chart for an anonymous identification identity judgement processing at a secure communication service according to the sixth embodiment of the present invention.

Fig. 39 is a diagram showing exemplary data structures of data used in the anonymous identification identity judgement processing of Fig. 38.

Fig. 40 is a diagram showing exemplary data structures of an official identification, a link information attached anonymous identification, and a link specifying 1-to-N personalized access ticket according to the seventh embodiment of the present invention.

Fig. 41 is a diagram showing exemplary data structures of a link information attached anonymous identification and an enabler according to the seventh embodiment of the present invention.

Fig. 42 is a first exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 43 is a second exemplary system configuration

that can be used in the seventh embodiment of the present invention.

Fig. 44 is a third exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 45 is a fourth exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 46 is a fifth exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 47 is a sixth exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 48 is a seventh exemplary system configuration that can be used in the seventh embodiment of the present invention.

Fig. 49 is a flow chart for a link specifying anonymous identification list generation processing (for MakePAT, MergePAT, SplitPAT and TransPAT) according to the seventh embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0143] Referring now to Fig. 1 to Fig. 7, the first embodiment of the email access control scheme according to the present invention will be described in detail.

[0144] The email access control scheme of the present invention enables bidirectional communications between a sender and a recipient appropriately while maintaining anonymity of a sender and a recipient on a communication network. Basically, this is realized by disclosing only information indicative of characteristics of recipients in a state of concealing true identifiers of the recipients, and assigning limited access rights with respect to those who wish to carry out communications while maintaining the anonymity according to the disclosed information.

[0145] More specifically, an Anonymous Identification (abbreviated hereafter as AID) that functions as a role identifier in which a personal information is concealed is assigned to a user, and this AID is disclosed on the network in combination with an information indicative of characteristics of the user such as his/her interests, age, job, etc., which cannot be used in identifying the user on the network but which can be useful for a sender in judging whether or not it is worth communicating with that user.

[0146] Also, the sender can search out a recipient with whom he/she wishes to communicate by reading or searching through the disclosed information. Namely, in the case where the sender wishes to communicate with a recipient while maintaining his/her own anonymity, the sender specifies the AID of that recipient and acquires a Personalized Access Ticket (abbreviated hereafter as PAT). The PAT contains the AIDs of the sender and the recipient as well as information regarding a transfer control flag and a validity period. The transfer control flag is used in order to determine whether a Secure Communication Service (abbreviated hereafter as SCS) to be described below carries out the authentication with respect to the sender. Namely, when the transfer control flag is set ON, the SCS will carry out the authentication such as signature verification for example, with respect to the sender at a time of the connection request. On the other hand, when the transfer control flag is set OFF, the SCS will give the connection request to a physical communication network to which the SCS is connected, without carrying out the authentication. In other words, the transfer control is used in order to verify whether or not the AID is properly utilized by the user to whom it is allocated by a Certification Authority (abbreviated hereafter as CA).

[0147] In the communication network realizing the email access control scheme of the present invention, the assignment of AIDs with respect to users, the maintenance of information disclosed in combination with AIDs, the issuance of PATs, and the email access control based on PATs are realized by separate organizations. This is because it is more convenient to realize them by separate organizations from a perspective of maintaining the security of the entire network, since security levels to be maintained in relation to respective actions are different. Note however that the maintenance of the disclosed information and the issuance of PATs may be realized by the same organization.

[0148] Fig. 1 shows an overall configuration of a communication system in this first embodiment, which is directed to the email service on Internet or Intranet.

[0149] In Fig. 1, the CA (Certification Authority) 1 has a right to authenticate an Official Identification (abbreviated hereafter as OID) that identifies each individual and a right to issue AIDs, and functions to generate AIDs from OIDs and allocate AIDs to users 3.

[0150] The SCS (Secure Communication Service) 5 judges whether or not to admit a connection in response to a connection request by an email from a user 3, according to the PAT (Personalized Access Ticket) presented from a user 3. The SCS 5 also rejects a connection request by an email according to a request from a user 3. The SCS 5 also judges the identity of OIDs according to a request from a user 3.

[0151] An Anonymous Directory Service (abbreviated hereafter as ADS) 7 is a database for managing the AID, the transfer control flag value, the validity period value, and the disclosed information (such as interests, which can be regarded as requiring a lower secrecy compared with a personal information such as name, telephone number, and real email address) of each user 3. The ADS 7 has a function to generate the PAT from the AID of a user 3 who presented search conditions, the AID of a user 3 who has been registering the disclosed information that matches the search conditions

in the ADS 7, the transfer control flag value given from a user 3 or administrators of the ADS, and the validity period value given from a user 3 or administrators of the ADS, and then allocate the PAT to a user 3 who presented the search conditions.

[0152] First, a series of processing from generating the AID from the OID according to a request from a user until allocating the AID to that user will be described.

[0153] Fig. 2 shows exemplary formats of the OID, the AID, and the PAT. As shown in a part (a) of Fig. 2, the OID is an information comprising an arbitrary character string according to a rule by which the CA 1 can uniquely identify the user and a public key, which is signed by the CA 1 using a secret key of the CA 1.

[0154] Also, as shown in a part (b) of Fig. 2, the AID is an information comprising fragments of the OID and their position information, redundant character strings, and an SCS information given by an arbitrary character string (host name, real domain name, etc.) by which a host or a domain that is operating the SCS 5 can be uniquely identified on the network, which is signed by the CA 1 using the secret key of the CA 1.

[0155] Also, as shown in a part (c) of Fig. 2, the PAT is an information comprising the transfer control flag, AID_{ϕ}, AID_1, and the validity period, which is signed by the ADS 7 using a secret key of the ADS 7. Here, the transfer control flag value is defined to take either 0 or 1. Also, the validity period is defined by any one or combination of the number of times for which the PAT is available, the absolute time (UTC) by which the PAT becomes unavailable, the absolute time (UTC) by which the PAT becomes available, and the relative time (lifetime) since the PAT becomes available until it becomes unavailable.

[0156] Note that, as will be explained in the subsequent embodiments described below, in addition to the 1-to-1 PAT which sets one sender and one recipient in correspondence as described above, the present invention can also use a 1-to-N PAT which sets one sender and N recipients, as well as a link specifying PAT which specifies the AID by a link information that is capable of specifying the AID instead of specifying the AID itself in the PAT. The link specifying PAT can be either a link specifying 1-to-1 PAT or a link specifying 1-to-N PAT depending on the correspondence relationship between the sender and the recipients as described above. Namely, the PAT of the present invention can be given in four types: 1-to-1 PAT, 1-to-N PAT, link specifying 1-to-1 PAT, and link specifying 1-to-N PAT.

[0157] Next, a procedure by which the user 3 requests the AID to the CA 1 will be described. The user 3 generates a pair of a secret key and a public key. Then, the user 3 and the CA 1 carries out the bidirectional authentication using the OID of the user 3 and the certificate of the CA 1, and the user 3 transmits the public key to the CA 1 by arbitrary means. Here, there can be cases where communications between the user 3 and the CA 1 are to be encrypted.

[0158] Next, a procedure by which the CA 1 issues the AID to the user 3 in response to a request for the AID as described above will be described. Upon receiving the public key from the user 3, the CA 1 generates the AID. Then, the CA 1 transmits the AID to the user 3 by arbitrary means. Upon receiving the AID from the CA 1, the user 3 stores the received AID into its storage device. Here, there can be cases where communications between the user 3 and the CA 1 are to be encrypted.

[0159] Next, the AID generation processing at the CA will be described with reference to Fig. 3.

[0160] In the procedure of Fig. 3, the CA 1 generates an information of a length equal to the total length L of the OID, and sets this information as a tentative AID (step S911). Then, in order to carry out the partial copying of the OID, values of parameters p_i and ℓ_i for specifying a copying region are determined using arbitrary means such as random number generation respectively (step S913). Here, L is equal to the total length L of the OID, and ℓ_i is an arbitrarily defined value within a range in which a relationship of $0 \leq \ell_i \leq L$ holds. Then, an information in a range between a position p_i to a position $p_i + \ell_i$ from the top of the OID is copied to the same positions in the tentative AID (step S915). In other words, this OID fragment will be copies to a range between a position p_i and a position $p_i + \ell_i$ from the top of the tentative AID. Then, the values of p_i and ℓ_i are written into a prescribed range in the tentative AID into which the OID has been partially copied, in a form encrypted by an arbitrary means (step S917). Then, an SCS information given by an arbitrary character string (host name, real domain, etc.) that can uniquely identify a host or a domain that is operating the SCS 5 on the network is written into a prescribed range in the tentative AID into which these values are written (step S919). Then, the tentative AID into which the above character string is written is signed using a secret key of the CA 1 (step S921).

[0161] Next, a procedure for registering the AID of a user-B 3 and the disclosed information into the ADS 7 will be described. First, the bidirectional authentication by arbitrary means using the AID of the user-B 3 and the certificate of the ADS 7 is carried out between the user-B 3 who is a registrant and the ADS 7. Then, the user-B 3 transmits the transfer control flag value, the validity period value, and the disclosed information such as interests to the ADS 7. Then, the ADS 7 stores the transfer control flag value, the validity period value, and the entire disclosed information in relation to the AID of the user-B 3 in its storage device. Here, there can be cases where communications between the user-B 3 who is the registrant and the ADS 7 are to be encrypted.

[0162] Next, a procedure by which a user-A 3 searches through the disclosed information that is registered in the ADS 7 will be described. First, the bidirectional authentication by arbitrary means using the AID of the user-A 3 and the certificate of the ADS 7 is carried out between the user-A 3 who is a searcher and the

ADS 7. Then, the user-A 3 transmits arbitrary search conditions to the ADS 7. Then, the ADS 7 presents all the received search conditions to its storage device, and extracts the AID of a registrant which satisfies these search conditions. Then, the ADS 7 generates the PAT from the AID of the user-A 3, the AID of the registrant who satisfied all the search conditions, the transfer control flag value, and the validity period value. Then, the ADS 7 transmits the generated PAT to the user-A 3. Here, there can be cases where communications between the user-A 3 who is a searcher and the ADS 7 are to be encrypted. Note that the 1-to-1 PAT is generated as a search result of the ADS 7.

[0163] Next, the 1-to-1 PAT generation processing at the ADS 7 will be described with reference to Fig. 4.

[0164] First, an information of a prescribed length is generated, and this information is set as a tentative PAT (step S1210). Then, the AID of the user-A 3 who is a searcher and the AID of the user-B 3 who is a registrant are copied into a prescribed region of the tentative PAT (step S1215). Then, the transfer control flag value and the validity period value are written into respective prescribed regions of the tentative PAT into which the AIDs are copied (step S1217). Then, the tentative PAT into which these values are written is signed using a secret key of the ADS 7 (step S1219).

[0165] Next, the transfer control using the 1-to-1 PAT will be described. The transfer control is a function for limiting accesses to a user who has a proper access right from a third person to whom the PAT has been transferred or who has eavesdropped the PAT (a user who originally does not have the access right).

[0166] The ADS 7 and the user-B 3 of the registrant AID can prohibit a connection to the user-B 3 from a third person who does not have the access right, by setting a certain value in to the transfer control flag of the PAT.

[0167] When the transfer control flag value is set to be 1, the sender's AID is authenticated between the SCS 5 and the sender according to an arbitrary challenge/response process, so that even if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will not be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0168] On the other hand, when the transfer control flag value is set to be 0, no challenge/response process will be carried out between the SCS 5 and the sender, so that if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will also be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0169] Next, the email access control method at the SCS 5 will be described with reference to Fig. 5.

[0170] The sender specifies "[sender's AID]@[real domain of SCS of sender]" in From: line, and "[PAT]@[real domain of SCS of sender]" in To: line.

[0171] The SCS 5 acquires a mail received by an MTA (Message Transfer Agent) such as SMTP (Simple Mail Transfer Protocol), and executes the processing of Fig. 5 as follows.

(1) The signature of the PAT is verified using a public key of the ADS 7 (step S1413).

When the PAT is found to have been altered (step S1415 YES), the mail is discarded and the processing is terminated (step S1416).

When the PAT is found to have been not altered (step S1415 NO), the following processing (2) is executed.

(2) The search is carried out by presenting the sender's AID to the PAT (steps S1417, S1419, S1421).

When an AID that completely matches with the sender's AID is not contained in the PAT (step S1423 NO), the mail is discarded and the processing is terminated (step S1416).

When an AID that completely matches with the sender's AID is contained in the PAT (step S1423 YES), the following processing (3) is executed.

(3) The validity period value of the PAT is evaluated (steps S1425, S1427).

When the PAT is outside the validity period (step S1427 NO), the mail is discarded and the processing is terminated (step S1416).

When the PAT is within the validity period (step S1427 YES), the following processing (4) is executed.

(4) Whether or not to authenticate the sender is determined by referring to the transfer control flag value of the PAT (steps S1431, S1433).

When the value is 1 (step S1433 YES), the challenge/response authentication between the SCS 5 and the sender is carried out, and the signature of the sender is verified (step S1435). When the signature is valid, the recipient is specified and the PAT is attached (step S1437). When the signature is invalid, the mail is discarded and the processing is terminated (step S1416).

When the value is 0 (step S1433 NO), the recipient is specified and the PAT is attached without executing the challenge/response authentication (step S1437).

[0172] Next, an exemplary challenge/response authentication between the SCS 5 and the sender will be described.

[0173] First, the SCS 5 generates an arbitrary information such as a timestamp, for example, and transmits the generated information to the sender.

[0174] Then, the sender signs the received information using a secret key of the sender's AID and transmits it along with a public key of the sender's AID.

[0175] The SCS 5 then verifies the signature of the received information using the public key of the sender's AID. When the signature is valid, the recipient is speci-

fied and the PAT is attached. When the signature is invalid, the mail is discarded and the processing is terminated.

[0176] Next, a method for specifying the recipient at the SCS 5 will be described. First, the SCS 5 carries out the search by presenting the sender's AID to the PAT, so as to acquire all the AIDs which do not completely match the sender's AID. All these acquired AIDs will be defined as recipient's AIDs hereafter. Then, for every recipient's AID, the real domain of SCS of recipient is taken out from the recipient's AID. Then, the recipient is specified in a format of "[recipient's AID]@[real domain of SCS of recipient]". Finally, the SCS 5 changes the sender from a format of "[sender's AID]@[real domain of SCS of sender]" to a format of "sender's AID".

[0177] Next, a method for attaching the PAT at the SCS 5 will be described. The SCS 5 attaches the PAT to an arbitrary position in the mail. The SCS 5 gives the mail to the MTA after specifying the sender and the recipient and attaching the PAT.

[0178] Note that all the processings described above are the same in the case of the 1-to-N PAT.

[0179] Next, a method of receiving refusal with respect to the PAT at the SCS 5 will be described.

[0180] Receiving refusal setting: The bidirectional authentication is carried out by an arbitrary means between the user and the SCS 5. Then, the user transmits a registration command, his/her own AID, and arbitrary PATs to the SCS 5. Then, the SCS 5 verifies the signature of the received AID. If the signature is invalid, the processing of the SCS 5 is terminated. If the signature is valid, the SCS 5 next verifies the signature of each received PAT using a public key of the ADS. Those PATs with the invalid signature are discarded by the SCS 5. When the signature is valid, the SCS 5 carries out the search by presenting the received AID to each PAT. For each of those PATs which contain the AID that completely matches with the received AID, the SCS 5 presents the registration command and the PAT to the storage device such that the PAT is registered into the storage device. Those PATs which do not contain the AID that completely matches with the received AID are discarded by the SCS 5 without storing them into the storage device. Here, there can be cases where communications between the user and the SCS 5 are to be encrypted.

[0181] Receiving refusal execution: The SCS 5 carries out the search by presenting the PAT to the storage device. When a PAT that completely matches the presented PAT is registered in the storage device, the mail is discarded. When a PAT that completely matches the present PAT is not registered in the storage device, the mail is not discarded.

[0182] Receiving refusal cancellation: The bidirectional authentication is carried out by an arbitrary means between the user and the SCS 5. Then, the user presents his/her own AID to the SCS 5. Then, the SCS 5 verifies the signature of the received AID. If the signature is invalid, the processing of the SCS 5 is terminated. If the signature is valid, the SCS 5 next presents the presented AID as a search condition to the storage device and acquire all the PATs that contain the presented AID, and then presents all the acquired PATs to the user. Then, the user selects all the PATs for which the receiving refusal is to be cancelled by referring to all the PATs presented from the SCS 5, and transmits all the selected PATs along with a deletion command to the SCS 5. Upon receiving the deletion command and all the PATs for which the receiving refusal is to be cancelled, the SCS 5 presents the deletion command and all the PATs received from the user to the storage device, such that all the received PATs are deleted from the storage device.

[0183] Note that the method of receiving refusal with respect to the 1-to-N PAT at the SCS 5 is the same as the method of receiving refusal with respect to the 1-to-1 PAT described above.

[0184] Note also the the case of returning of a mail from the user-B to the user-A is the same as in the case of transmitting a mail from the user-A to the user-B.

[0185] Next, the judgement of identity will be described with reference to Fig. 6 and Fig. 7.

(1) An initial value of a variable OID_M is defined as a bit sequence with a length equal to the total length L of the OID and all values equal to "0". Also, an initial value of a variable OID_V is defined as a bit sequence with a length equal to the total length of the OID and all values equal to "0" (step S2511).

(2) One AID is selected from a set of processing target AIDs, and the following bit processing is carried out (step S2513).

(a) Values of variables AID_M and AID_V are determined according to the position information contained in the AID (step S2515). Here, AID_M is defined as a bit sequence with a length equal to the total length L of the OID and a value of a position at which the OID information is defined is "1" while a value of a position at which the OID information is not defined is "0" (see Fig. 7). Also, AID_V is defined as a bit sequence with a length equal to the total length L of the OID and a value of a position at which the OID information is defined is an actual value of the OID information while a value of a position at which the OID information is not defined is 0 (see Fig. 7).

(b) AND processing of OID_M and AID_M is carried out and its result is substituted into a variable OVR_M (step S2517).

(c) AND processing of OVR_M and AID_M as well as AND processing of OVR_M and OID_M are carried out and their results are compared (step S2519). When they coincide, OR processing of OID_M and AID_M is carried out

and its result is substituted into OID_M (step S2521), while OR processing of OID_V and AID_V is also carried out and its result is substituted into OID_M (step S2523). On the other hand, when they do not coincide, the processing proceeds to the step S2525.

(d) An AID to be processed next is selected from a set of processing target AIDs. When at least one another AID is contained in the set, the steps S2513 to S2523 are executed for that another AID. When no other AID is contained in the set, the processing proceeds to the step S2527.

(e) Values of OID_M and OID_V are outputted (step S2527).

[0186] The value of OID_M that is eventually obtained indicates all positions of the OID information that can be recovered from the set of processing target AIDs. Also, the value of OID_V that is eventually obtained indicates all the OID information that can be recovered from the set of processing target AID. In other words, by using the values of OID_M and OID_V it is possible to obtain the OID albeit probabilistically when the value of OID_V is used as a search condition, and it is possible to quantitatively evaluate a precision of the above search by a ratio OID_M/L with respect to the total length L of the OID.

[0187] As described above, in this first embodiment, the CA 1 which is a Trusted Third Party with high secrecy and credibility generates the AID in which the personal information is concealed, from the OID that contains the highly secret personal information such as name, telephone number, real email address, etc., according to a user request, and issues the AID to the user. By identifying the user by this AID on the communication network as well as in various services provided on the communication network, it becomes possible to provide both the anonymity guarantee and the identity guarantee for the user. In other words, it becomes possible for the user to communicate with another user without revealing the own real name, telephone number, email address, etc., to that another user, and it also becomes possible to disclose the disclosed information to unspecified many through the ADS 7 as will be described below.

[0188] The user registers the disclosed information, that is an information which is supposed to have a low secrecy compared with the personal information at the ADS 7. In the case of searching the disclosed information and the registrant AID, the searcher presents the AID of the searcher and arbitrary search conditions to the ADS 7. The ADS 7 then extracts the registrant AID that satisfies these search conditions, and generates the PAT from the AID of the searcher and the AID of the registrant who satisfied the search conditions, the transfer control flag value, and the validity period value.

[0189] In this 1-to-1 PAT, the transfer control flag value and the validity period value are set as shown a part (c) of Fig. 2, and by setting up this validity period in advance, it is possible to limit connections from the sender.

[0190] It is also possible to prohibit connections from a third person who does not have the access right, by using the transfer control flag value. Namely, when the transfer control flag value is set to be 1, the sender's AID is authenticated between the SCS 5 and the sender according to an arbitrary challenge/response process, so that even if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will not be able to make a connection to the registrant of the ADS 7 through the SCS 5. On the other hand, when the transfer control flag value is set to be 0, no challenge/response process will be carried out between the SCS 5 and the sender, so that if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will also be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0191] It is also possible to make a connection request to the communication network such that a call for which the recipient is specified by the 1-to-1 PAT will be received by the recipient's AID or the sender's AID defined within the PAT. In addition, it is also possible to refuse receiving calls with the 1-to-1 PAT selected by the recipient among calls which are specified by the 1-to-1 PAT. It is also possible to cancel the receiving refusal of the calls with the 1-to-1 PAT selected by the recipient. In addition, as a measure against the sender who repeats the personal attach using a plurality of sender's AIDs by taking an advantage of the anonymity, it is possible to judge the identity of the OID from these plurality of sender's AIDs and it is possible to extract that OID at some probability.

[0192] Next, with references to Fig. 8 to Fig. 24, the second embodiment of the email access control scheme according to the present invention will be described in detail.

[0193] In contrast to the first embodiment described above which is directed to the case where a sender and a recipient are set in 1-to-1 correspondence, this second embodiment is directed to the case where a sender and recipients are set in 1-to-N correspondence and a generation of a new PAT and a content change of the existing PAT can be made by the initiative of a user. Here, the sender is either a holder of the PAT or a member of the PAT. Similarly, the recipient is either a holder of the PAT or a member of the PAT.

[0194] In general, a membership of a group communication (mailing list, etc.) is changing dynamically so that it is necessary for a host of the group communication to manage information on a point of contact such as telephone number, email address, etc., of each member. In contrast, in the case where it is only possible to newly generate a 1-to-1 PAT as in the first embodiment, the management of a point of contact is difficult. For example, it is difficult to manage the group collectively, and

even if it is given to the others for the purpose of the transfer control, it does not function as an address of the group communication such as mailing list.

[0195] In this second embodiment, in order to resolve such a problem, it is made possible to carry out a generation of a new 1-to-N PAT and a content change of the existing 1-to-N PAT by the initiative of a user.

[0196] First, the definition of various identifications used in this second embodiment will be described with references to Fig. 8 and Fig. 9.

[0197] As shown in a part (a) of Fig. 8, the OID is an information comprising an arbitrary character string (telephone number, email address, etc.) according to a rule by which the CA 1 can uniquely identify the user and a public key, which is signed by the CA 1.

[0198] Also, as shown in a part (b) of Fig. 8, the AID is an information comprising fragments of the OID and their position information, redundant character strings, and an SCS information given by an arbitrary character string (host name, real domain name, etc.) by which a host or a domain that is operating the SCS 5 can be uniquely identified on the network, which is signed by the CA 1.

[0199] Also, as shown in a part (c) of Fig. 8, the 1-to-N PAT is an information comprising two or more AIDs, a holder index, the validity period, the transfer control flag, and a PAT processing device identifier, which is signed using a secret key of the PAT processing device.

[0200] Here, one of the AIDs is a holder AID of this PAT, where the change of the information contained in the PAT such as an addition of AID to the PAT, a deletion of AID from the PAT, a change of the validity period in the PAT, a change of the transfer control flag value in the PAT, etc., can be made by presenting the holder AID and a corresponding Enabler to the PAT processing device.

[0201] On the other hand, the AIDs other than the holder AID that are contained in the PAT are all member AIDs, where a change of the information contained in the PAT cannot be made even when the member AID and a corresponding Enabler are presented to the PAT processing device.

[0202] The holder index is a numerical data for identifying the holder AID, which is defined to take a value 1 when the holder AID is a top AID in the AID list formed from the holder AID and the member AIDs, a value 2 when the holder AID is a second AID from the top of the AID list, or a value n when the holder AID is an n-th AID from the top of the AID list.

[0203] The transfer control flag value is defined to take either 0 or 1 similarly as in the case of the 1-to-1 PAT.

[0204] The holder AID is defined to be an AID which is written at a position of the holder index value in the AID list. The member AIDs are defined to be all the AIDs other than the holder AID.

[0205] The validity period is defined by any one or combination of the number of times for which the PAT is available, the absolute time (UTC) by which the PAT becomes unavailable, the absolute time (UTC) by which the PAT becomes available, and the relative time (lifetime) since the PAT becomes available until it becomes unavailable.

[0206] The identifier of a PAT processing device (or a PAT processing object on the network) is defined as a serial number of the PAT processing device (or an distinguished name of the PAT processing object on the network). The secret key of the PAT processing device (or the PAT processing object on the network) is defined to be uniquely corresponding to the identifier.

[0207] Also, in this second embodiment, an Enabler is introduced as an identifier corresponding to the AID. As shown in Fig. 9, the Enabler is an information comprising a character string uniquely indicating that it is an Enabler and an AID itself, which is signed by the CA 1.

[0208] Next, the operations for a generation of a new PAT and a content change of the existing PAT will be described. Here, the following operations are defined at a secure PAT processing device on the communication terminal or a PAT processing object on the CA or on a network which is properly requested from the CA (which will also be referred to as a PAT processing device hereafter).

1. Editing of AID list:
   A list of AIDs (referred hereafter as an AID list) contained in the PAT is edited using AIDs and Enabler. Else, the AID list is newly generated.
2. Setting of the validity period and the transfer control flag:
   The validity period value and the transfer control flag value contained in the PAT are changed using an AID and Enabler. Also, a new validity period value and a new transfer control flag value are set in the newly generated AID list.

[0209] A user who presented the holder AID and the Enabler corresponding to this holder AID to the PAT processing device can edit the list of AIDs contained in the PAT. In this case, the following processing rules are used.

(1) Generating a new PAT (MakePAT) (see Fig. 10):
   The AID list (ALIST<holder AID | member AID_1, member AID_2, ·····, member AID_n>) is newly generated, and the validity period value and the transfer control flag value are set with respect to the generated ALIST.

AID_A + AID_B + Enabler of AID_B + Enabler of AID_A

→ ALIST<AID_A | AID_B>

ALIST<AID_A | AID_B > + Enabler of AID_A

+ validity period value

+ transfer control flag value

→ PAT<AID_A | AID_B >

(2) Merging PATs (MergePAT) (see Fig. 11):

A plurality of ALISTs of the same holder AID are merged and the validity period value and the transfer control flag value are set with respect to the merged ALIST.

ALIST<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · >

+ ALIST<AID_A | AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_A

→ ALIST<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · , AID_{C1}, AID_{C2}, · · · · · · · · >

ALIST<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · , AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_A + validity period value

+ transfer control flag value

→ PAT<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · , AID_{C1}, AID_{C2}, · · · · · · · · >

(3) Splitting a PAT (SplitPAT) (see Fig. 12):

The ALIST is split into a plurality of ALISTs of the same holder AID, and the respective validity period value and transfer control flag value are set with respect to each one of the split ALISTs.

ALIST<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · , AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_A

→ ALIST<AID_A | AID_{B1}, AID_{B2}, · · · · · · · · >

+ ALIST<AID_A | AID_{C1}, AID_{C2}, · · · · · · · · >

ALIST<AID_A | AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_A + validity period value

+ transfer control flag value

→ PAT<AID_A | AID_{C1}, AID_{C2}, · · · · · · · · >

(4) Changing a holder of a PAT (TransPAT) (see Fig. 13):

The holder AID of the ALIST is changed, and the validity period value and the transfer control flag value are set with respect to the changed ALIST.

ALIST<AID_A | AID_B > + ALIST<AID_A | AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_A + Enabler of AID_B

→ ALIST<AID_B | AID_{C1}, AID_{C2}, · · · · · · · · >

ALIST<AID_B | AID_{C1}, AID_{C2}, · · · · · · · · >

+ Enabler of AID_B + validity period value

+ transfer control flag value

→ PAT<AID_B | AID_{C1}, AID_{C2}, · · · · · · · · >

[0210] In the operation for setting the validity period value, in order to permit the setting of the validity period value only to a user who holds both the holder AID and the corresponding Enabler, the following operation is defined.

PAT<AID_A | AID_B > + Enabler of AID_A

+ validity period value

→ PAT<AID_A | AID_B >

[0211] In the operation for setting the transfer control flag value, in order to permit the setting of the transfer control flag value only to a user who holds both the holder AID and the corresponding Enabler, the following operation is defined.

PAT<AID_A | AID_B > + Enabler of AID_A

+ transfer control flag value

→ PAT<AID_A | AID_B >

[0212] Next, with references to Fig. 14 to Fig. 20, the overall system configuration of this second embodiment will be described. In Fig. 14 to Fig. 20, the user-A who has AID_A allocated from the CA stores AID_A and Enabler of AID_A in a computer of the user-A, and the input/output devices such as floppy disk drive, CD-ROM drive, communication board, microphone, speaker, etc., are connected. Else, AID_A and Enabler of AID_A are stored in a communication terminal (telephone, cellular phone, etc.) which has a storage device and a data input/output function.

[0213] Similarly, the user-B who has AID_B allocated from the CA stores AID_B and Enabler of AID_B in a computer of the user-B, and the input/output devices such as floppy disk drive, CD-ROM drive, communication board, microphone, speaker, etc., are connected. Else, AID_B and Enabler of AID_B are stored in a communication terminal (telephone, cellular phone, etc.) which has

a storage device and a data input/output function.

[0214] In the following, a procedure by which the user-A generates PAT<AID_A | AID_B > will be described.

(1) The user-A acquires AID_B and Enabler of AID_B using any of the following means.

- AID_B and Enabler of AID_B are registered at the ADS 7, and it is waited until the user-A acquires them as a search result (Fig. 14).
- AID_B and Enabler of AID_B are directly transmitted to the user-A by the email, signaling, etc. (Figs. 15, 16).
- AID_B and Enabler of AID_B are stored in a magnetic, optic, or electronic medium such as floppy disk, CD-ROM, MO, IC card, etc., and this medium is given to the user-A. Else, it is waited until the user acquires them by reading this medium (Figs. 17, 18).
- AID_B and Enabler of AID_B are printed on a paper medium such as book, name card, etc., and this medium is given to the user-A. Else, it is waited until the user-A acquire them by reading this medium (Figs. 19, 20).

(2) The user-A who has acquired AID_B and Enabler of AID_B by any of the means described in the above (1) issues the MakePAT command to the PAT processing device. This procedure is common to Fig. 14 to Fig. 20, and defined as follows.

(a) The user-A requests the issuance of the MakePAT command by setting AID_A, Enabler of AID_A, AID_B, Enabler of AID_B, the validity period value, and the transfer control flag value into the communication terminal of the user-A.
(b) The communication terminal of the user-A generates the MakePAT command.
(c) The communication terminal of the user-A transmits the generated MakePAT command to the PAT processing device by means such as the email, signaling, etc. (the issuance of the MakePAT command).
(d) The PAT processing device generates PAT<AID_A | AID_B > by processing the received MakePAT command according to Fig. 21 and Fig. 23. More specifically, this is done as follows.

AID_A + AID_B + Enabler of AID_B + Enabler of AID_A

→ ALIST<AID_A | AID_B >

ALIST<AID_A | AID_B > + Enabler of AID_A

+ validity period value + transfer control flag value

→ PAT<AID_A | AID_B >

(e) The PAT processing device transmits the generated PAT<AID_A | AID_B > to the communication terminal of the user-A, or to the communication terminal of the user-B according to the need, by means such as the email, signaling, etc.
(f) The communication terminal of the user-A (or the user-B) stores the received PAT<AID_A | AID_B > in the storage device of the communication terminal of the user-A.

[0215] The merging of PATs (MergePAT, Fig. 21, Fig. 23), the splitting of a PAT (SplitPAT, Fig. 22, Fig. 23), and the changing of a holder of a PAT (TransPAT, Fig. 21, Fig. 23) are also carried out by the similar procedure.

[0216] Next, the procedure of MakePAT, MergePAT and TransPAT will be described with reference to Fig. 21.

(1) The holder AID is specified (step S4411).
(2) All the member AIDs are specified (step S4412).
(3) The AID list is generated from the specified holder AID and all the specified member AIDs (step S4413). More specifically, the specified holder AID and all the specified member AIDs are concatenated using arbitrary means.
(4) A tentative PAT is generated using arbitrary means, similarly as in the case of a tentative AID (step S4414).
(5) The generated AID list is copied to a prescribed region of the generated tentative PAT (step S4415).
(6) The holder index value is written into the tentative pat to which the AID list has been copied (step S4416).
(7) The transfer control flag value is written into the tentative PAT into which the holder index value has been written (step S4417).
(8) The validity period value is written into the tentative PAT into which the transfer control flag value has been written (step S4418).
(9) The PAT processing device identifier is written into the tentative PAT into which the validity period value has been written (step S4419).
(10) The tentative PAT into which the PAT processing device identifier has been written is signed using the secret key of the PAT processing device (step S4420).

[0217] Next, the procedure of SplitPAT will be described with reference to Fig. 22.

(1) The holder AID is specified (step S4511).
(2) All the AIDs to be the member AIDs of the PATs after the splitting are specified (step S4512).
(3) The AID list is generated from the specified holder AID and all the specified member AIDs (step

S4513). More specifically, the specified holder AID and all the specified member AIDs are concatenated using arbitrary means.

(4) A tentative PAT is generated using arbitrary means, similarly as in the case of a tentative AID (step S4514).

(5) The generated AID list is copied to a prescribed region of the generated tentative PAT (step S4515).

(6) The holder index value is written into the tentative pat to which the AID list has been copied (step S4516).

(7) The transfer control flag value is written into the tentative PAT into which the holder index value has been written (step S4517).

(8) The validity period value is written into the tentative PAT into which the transfer control flag value has been written (step S4518).

(9) The PAT processing device identifier is written into the tentative PAT into which the validity period value has been written (step S4519).

(10) The tentative PAT into which the PAT processing device identifier has been written is signed using the secret key of the PAT processing device (step S4520).

(11) In the case of continuing the splitting (step S4521 YES), the procedure returns to (2), and repeats (2) to (10) sequentially.

[0218] Note that, in the procedures of Fig. 21 and Fig. 22, the AID list generation is carried out according to Fig. 23 as follows. Namely, a buffer length is determined first (step S4611) and a buffer is generated (step S4612). Then, the holder AID is copied to a vacant region of the generated buffer (step S4613). Then, the member AID is copied to a vacant region of the resulting buffer (step S4614), and if the next member AID exists (step S4615 YES), the step S4614 is repeated.

[0219] Next, the determination of the holder AID will be described. Each of the MakePAT, the MergePAT, the SplitPAT, and the TransPAT commands is defined to have two or more arguments, where AID, PAT, or Enabler can be specified as an argument. In this case, the PAT processing device specifies the holder AID of the PAT to be outputted after executing each command according to the following rules.

* Case of the MakePAT:

  For the MakePAT command, it is defined that AIDs are to be specified for the first argument to the N-th argument (N = 2, 3, · · · · · · · ·) and Enablers are to be specified for the N+1-th and subsequent arguments. For example, they can be specified as follows.

  MakePAT AID_1, AID_2, · · · · · · · · , AID_N, Enabler of AID_1, Enabler of AID_2, Enabler of AID_N

  The PAT processing device interprets the AID of the first argument of the MakePAT command as the holder AID.

  Only when one of the Enablers of the N+1-th and subsequent arguments corresponds to the AID of the first argument, the PAT processing device specifies this AID (that is the AID of the first argument) as the holder AID of the PAT to be outputted after executing the MakePAT command.

* Case of the MergePAT:

  For the MergePAT command, it is defined that PATs are to be specified for the first argument to the N-th argument (N = 2, 3, · · · · · · · ·) and Enabler is to be specified for the N+1-th argument. Namely, they can be specified as follows.

  MergePAT PAT_1 PAT_2 · · · · · · · · PAT_N Enabler of AID

  The PAT processing device interprets the holder AID of the PAT of the first argument of the MergePAT command as the holder AID of the PAT to be outputted after executing the MergePAT command.

  Only when the Enabler of the N+1-th argument corresponds to the holder AID of the PAT of the first argument, the PAT processing device specifies this AID (that is the holder AID of the PAT of the first argument) as the holder AID of the PAT to be outputted after executing the MergePAT command.

* Case of the SplitPAT:

  For the SplitPAT command, it is defined that PAT is to be specified for the first argument, a set of one or more AIDs grouped together by some prescribed symbols (assumed to be parentheses () in this example) are to be specified for the second argument to the N-th argument (N = 3, 4, · · · · · · · ·), and Enabler is to be specified for the N+1-th argument. Namely, they can be specified as follows.

  SplitPAT PAT_1 (AID_{11}) $(AID_{21}$ $AID_{22})$ · · · · · · · · $(AID_{N1}$ AID_{N2} · · · · · · · · $AID_{NM})$ Enabler of AID

  The PAT processing device interprets the holder AID of the PAT of the first argument of the SplitPAT command as the holder AID of the PAT to be outputted after executing the SplitPAT command.

  Only when the Enabler of the N+1-th argument corresponds to the holder AID of the PAT of the first argument, the PAT processing device specifies this AID (that is the holder AID of the PAT of the first argument) as the holder AID of the PAT to be outputted after executing the SplitPAT command.

* Case of the TransPAT:

  For the TransPAT command, it is defined that

PATs are to be specified for the first argument and the second argument, AID is to be specified for the third argument, and Enablers are to be specified for the fourth argument and the fifth argument. Namely, they can be specified as follows.

TransPAT PAT_1 PAT_2 AID Enabler of AID_1 Enabler of AID_2

The PAT processing device interprets the AID of the third argument as the holder AID of the PAT to be outputted after executing the TransPAT command provided that the AID of the third argument of the TransPAT command is contained in the PAT of the second argument.

Only when the Enabler of the fourth argument corresponds to both the PAT of the first argument and the PAT of the second argument and the Enabler of the fifth argument corresponds to the AID of the third argument, the PAT processing device specifies the AID of the third argument as the holder AID of the PAT to be outputted after executing the TransPAT command.

Next, the determination of the member AIDs will be described. The definitions of the MakePAT, the MergePAT, the SplitPAT, and the TransPAT commands are as described above. The PAT processing device specifies the member AIDs of the PAT to be outputted after executing each command according to the following rules.

* Case of the MakePAT:

Only when the holder AID of the PAT to be outputted after executing the MakePAT command is formally determined, the PAT processing device interprets all the AIDs of the second and subsequent arguments of the MakePAT command as the member AIDs of the PAT to be outputted after executing the MakePAT command.

The PAT processing device specifies only those AIDs among all the AIDs of the second and subsequent arguments which correspond to the Enablers specified by the N+1-th and subsequent arguments as the member AIDs of the PAT to be outputted after executing the MakePAT command.

* Case of the MergePAT:

Only when the holder AID of the PAT to be outputted after executing the MergePAT command is formally determined, the PAT processing device specifies the member AIDs of all the PATs specified by the first to N-th arguments of the MergePAT as the member AIDs of the PAT to be outputted after executing the MergePAT command.

* Case of the SplitPAT:

Only when the holder AID of the PAT to be outputted after executing the SplitPAT command is formally determined, the PAT processing device specifies the member AID of the PAT specified by the first argument of the SplitPAT command as the member AID of the PAT to be outputted after executing the SplitPAT command. At this point, the member AIDs are distributed into different PATs in units of parentheses (). For example, in the case of:

SplitPAT PAT (AID_{11}) (AID_{21} AID_{22}) ・・・・・・・・ (AID_{N1} AID_{N2} ・・・・・・・・ AID_{NM}) Enabler of AID

(AID_{11}), (AID_{21} AID_{22}) and (AID_{N1} AID_{N2} ・・・・・・・・ AID_{NM}) will be the member AIDs of different PATs having a common holder AID.

* Case of TransPAT:

Only when the holder AID of the PAT to be outputted after executing the TransPAT command is formally determined, the PAT processing device specifies all the member AIDs remaining after excluding the member AID that is scheduled to be a new holder AID from all the member AIDs of the PAT specified by the first argument of the TransPAT command and the member AIDs of the PAT specified by the second argument as the member AIDs of the PAT to be outputted after executing the TransPAT command.

[0220] Next, the verification of the properness of the Enabler will be described. This verification of the properness of the Enabler is common to the MakePAT, the MergePAT, the SplitPAT and the TransPAT, and carried out according to Fig. 24 as follows.

(1) AID and Enabler are entered (step S5511).
(2) Each of these entered AID and Enabler is verified using the public key of the CA 1 (step S5512). If at least one of them is altered (step S5513 YES), the processing is terminated.
(3) A character string for certifying that it is Enabler is entered (step S5514).
(4) The top field of the Enabler of the step S5511 and the character string of the step S5514 are compared (step S5515). If they do not match (step S5516 NO), the processing is terminated.
(5) If they match (step S5516 YES), the AID of the step S5511 and the AID within the Enabler are compared (step S5517).
(6) A comparison result is outputted (step S5519).

[0221] Next, with references to Fig. 25 to Fig. 28, the third embodiment of the email access control scheme according to the present invention will be described in detail.

[0222] In the generation of a new PAT (MakePAT) and the PAT holder change (TransPAT) of the above described embodiment, it is necessary to give member AIDs and Enablers of member AIDs to the holder of the PAT, but when they are given to the holder, it becomes possible for that holder to participate the group communications hosted by the other holders by using the

acquired member AIDs. Namely, there arises a problem that the pretending using the member AIDs become possible. Moreover, if that holder places the acquired member AIDs and Enablers of member AIDs on a medium that is readable by unspecified many, these member AIDs become accessible to anyone so that there arises a problem that the harassment to the users of the member AIDs may occur and the pretending using the member AIDS by a third person also become possible.

[0223] For this reason, in this third embodiment, it is made possible to carry out the MakePAT and the TransPAT without giving the Enablers of member AIDs to the holder.

[0224] To this end, in this third embodiment, the generation of a new PAT and the content change of the existing PAT are carried out by using Null-AID (AID_{Null}) and Enabler of Null-AID (Enabler of AID_{Null}).

[0225] Here, the processing involving the Null-AID obeys all of the following rules:

(a) the processing rules of MakePAT, MergePAT, SplitPAT and TransPAT as in the above described embodiment; and
(b) the rules applicable only to the Null-AID, including:

(i) Null-AID is known to every user, and
(ii) Enabler of Null-AID is known to every user.

[0226] Here, the processing rules as defined in the above described embodiment in the case of this third embodiment will be described.

(1) Making a PAT from plural AIDs (MakePAT):

$AID_{holder} + AID_{member1} + AID_{member2} + \cdots\cdots\cdots + AID_{memberN}$

$+$ Enabler of $AID_{member1}$ $+$ Enabler of $AID_{member2} + \cdots\cdots\cdots$

$+$ Enabler of $AID_{memberN}$ $+$ Enabler of AID_{holder}

$\rightarrow PAT<AID_{holder} \mid AID_{member1}, AID_{member2}, \cdots\cdots\cdots, AID_{memberN}>$

(2) Merging plural PATs of the same holder (MergePAT):

$PAT<AID_{holder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}>$

$+ PAT<AID_{holder} \mid AID_{memberb1}, AID_{memberb2}, \cdots\cdots\cdots, AID_{memberbN}>$

$+$ Enabler of AID_{holder}

$\rightarrow PAT<AID_{holder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}, AID_{memberb1}, AID_{memberb2}, \cdots\cdots\cdots, AID_{memberbN}>$

(3) Splitting a PAT into plural PATs of the same holder (SplitPAT):

$PAT<AID_{holder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}, AID_{memberb1}, AID_{memberb2}, \cdots\cdots\cdots, AID_{memberbN}>$

$+$ Enabler of AID_{holder}

$\rightarrow PAT<AID_{holder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}>$

$+ PAT<AID_{holder} \mid AID_{memberb1}, AID_{memberb2}, \cdots\cdots\cdots, AID_{memberbN}>$

(4) Changing a holder AID of a PAT (TransPAT):

$PAT<AID_{holder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}> + PAT<AID_{holder} \mid AID_{newholder}>$

$+$ Enabler of AID_{holder} $+$ Enabler of $AID_{newholder}$

$\rightarrow PAT<AID_{newholder} \mid AID_{membera1}, AID_{membera2}, \cdots\cdots\cdots, AID_{memberaM}>$

[0227] The method for specifying the validity period value and the transfer control flag value in the PAT containing the Null-AID is similar to the method for specifying the validity period value and the transfer control flag value in the second embodiment described above. Next, the exemplary processings involving the Null-AID will be described.

(1) Case of producing $PAT<AID_{Null} \mid AID_A>$ from AID_A and Enabler of AID_A:

(a) According to the above described rules (b)(i) and (b)(ii) of the Null-AID, AID_{Null} and Enabler of AID_{Null} are known.
(b) Using MakePAT,

$AID_{Null} + AID_A +$ Enabler of $AID_A +$ Enabler of AID_{Null}

$\rightarrow PAT<AID_{Null} \mid AID_A>$.

(2) Case of producing $PAT<AID_{Null} \mid AID_A, AID_B>$ from $PAT<AID_{Null} \mid AID_A>$ and $PAT<AID_{Null} \mid AID_B>$:

(a) According to the above described rules (b)(i) and (b)(ii) of the Null-AID, AID_{Null} and Enabler of AID_{Null} are known.

(b) Using MergePAT,

$PAT<AID_{Null} \mid AID_A> + PAT<AID_{Null} \mid AID_B>$

+ Enabler of AID_{Null}

$\rightarrow PAT<AID_{Null} \mid AID_A, AID_B>$.

(3) Case of producing $PAT<AID_A \mid AID_B>$ from $PAT<AID_{Null} \mid AID_A>$, $PAT<AID_{Null} \mid AID_B>$ and Enabler of AID_A:

(a) According to the above described rules (b)(i) and (b)(ii) of the Null-AID, AID_{Null} and Enabler of AID_{Null} are known.
(b) Using TransPAT,

$PAT<AID_{Null} \mid AID_A> + PAT<AID_{Null} \mid AID_B>$

+ Enabler of AID_{Null} + Enabler of AID_A

$\rightarrow PAT<AID_A \mid AID_B>$.

[0228] As shown in Fig. 25, the data structure of the Null-AID comprises a character string uniquely indicating that it is Null-AID (a character string defined by the CA, for example), which is signed by the CA using the secret key of the CA.

[0229] Also, as shown in Fig. 26, the data structure of the Enabler of Null-AID comprises a character string uniquely indicating that it is Enabler (a character string defined by the CA, for example) and the Null-AID itself, which is signed by the CA using the secret key of the CA.

[0230] Note that the Null-AID and the Enabler of Null-AID are maintained at secure PAT processing devices and secure PAT certification authority.

[0231] Next, the first exemplary application of this third embodiment will be described with reference to Fig. 27, which includes the following operations.

(1) The user-B (PAT member) generates $PAT<AID_{Null} \mid AID_B>$ by executing the above described exemplary processing (1) involving the Null-AID at the secure PAT processing device which is connected with the terminal of the user-B, and gives it to the user-A (PAT holder) by arbitrary means.
(2) The user-A who received $PAT<AID_{Null} \mid AID_B>$ carries out the following operations at the secure PAT processing device which is connected with the terminal of the user-A.

(a) $PAT<AID_{Null} \mid AID_A>$ is produced by executing the above described exemplary processing (1) involving the Null-AID.
(b) $PAT<AID_A \mid AID_B>$ is produced by executing the above described exemplary processing (3) involving the Null-AID.

(3) The user-A gives the generated $PAT<AID_A \mid AID_B>$ to the user-B by arbitrary means.

[0232] Note that the method for determining the validity period is the same as described above so that it will not be repeated here. Also, the processing involving the Null-AID is the same as described above so that it will not be repeated here.

[0233] In the case of giving $PAT<AID_{Null} \mid AID_A, AID_B>$ to the user-B, the above described exemplary processing (2) involving the Null-AID will be executed in the operation (2) described above.

[0234] Next, the second exemplary application of this third embodiment will be described with reference to Fig. 28, which includes the following operations.

(1) The user-B (PAT member) produces $PAT<AID_{Null} \mid AID_B>$ by executing the above described exemplary processing (1) involving the Null-AID at the secure PAT processing device which is connected with the terminal of the user-B, and registers it along arbitrary disclosed information at the ADS.
(2) The user-A produces $PAT<AID_{Null} \mid AID_A>$ by executing the above described exemplary processing (1) involving the Null-AID at the secure PAT processing device which is connected with the terminal of the user-A, and presents it along arbitrary search conditions to the ADS.
(3) When the personal information of the user-B satisfies the search conditions presented by the user-A, the secure PAT processing device connected with the ADS carries out the following operations.

(a) $PAT<AID_{Null} \mid AID_A, AID_B>$ is produced by executing the above described exemplary processing (2) involving the Null-AID.
(b) The produced $PAT<AID_{Null} \mid AID_A, AID_B>$ is given to the ADS.

(4) The ADS gives $PAT<AID_{Null} \mid AID_A, AID_B>$ produced by the PAT processing device to the user-A.
(5) The user-A who received $PAT<AID_{Null} \mid AID_A, AID_B>$ produces $PAT<AID_A \mid AID_B>$ by executing the following TransPAT processing at the secure PAT processing device which is connected with the terminal of the user-A.

$PAT<AID_{Null} \mid AID_A> + PAT<AID_{Null} \mid AID_A, AID_B>$

+ Enabler of AID_{Null} + Enabler of AID_A

$\rightarrow PAT<AID_A \mid AID_B>$.

[0235] Note that the method for determining the validity period is the same as described above so that it will not be repeated here. Also, the processing involving the Null-AID is the same as described above so that it will not be repeated here.

[0236] In the case of generating PAT<AID_A | AID_B > at the PAT processing device connected with the ADS, Enabler of AID_A will be given to that PAT processing device, and the above described exemplary processing (3) involving the Null-AID will be executed in the operation (3) described above.

[0237] In the case of generating PAT<AID_B | AID_A > at the PAT processing device connected with the ADS and giving it to the user-B, Enabler of AID_B will be given to that PAT processing device, and the above described exemplary processing (3) involving the Null-AID will be executed in the operation (3) described above.

[0238] Next, with references to Fig. 29 to Fig. 31, the fourth embodiment of the email access control scheme according to the present invention will be described in detail.

[0239] In the group communication, a situation where it is desired to fix the participants is frequently encountered, but the above described embodiment does not have a function for making it impossible to change the PAT so that the participants cannot be fixed. Namely, in the above described embodiment, whether or not to fix the participants is left to the judgement of the holder of the PAT.

[0240] For this reason, in this fourth embodiment, a read only attribute is set up in the PAT. More specifically, in this fourth embodiment, the read only attribute is set up in the PAT by using God-AID (AID_{God}).

[0241] Here, the processing involving the God-AID obeys all of the following rules:

(a) God-AID is known to every user, and
(b) the processing involving God-AID is allowed only in the following cases:

(i) a case where the AID_{holder} is neither AID_{Null} nor AID_{God}:

PAT<AID_{holder} | $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ > + Enabler of AID_{holder}

→ PAT<AID_{god} | AID_{holder}, $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ >

(ii) a case where AID_{holder} is AID_{Null}:

PAT<AID_{Null} | $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ >

+ Enabler of AID_{Null}

→ PAT<AID_{god} | $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ >

[0242] As shown in Fig. 29, the data structure of the God-AID comprises a character string uniquely indicating that it is God-AID (a character string defined by the CA, for example), which is signed by the CA using the secret key of the CA. The God-AID is maintained at the secure PAT processing devices and the secure PAT certification authority described above.

[0243] The processings of a PAT that contains the Null-AID are according to Fig. 21 to Fig. 24. When the holder AID is neither Null-AID nor God-AID, the God-AID is appended to the AID list and the holder index value is specified to be a position of the God-AID in the AID list after appending the God-AID. When the holder AID is Null-AID, the Null-AID is deleted from the AID list, the God-AID is appended to the AID list, and then the holder index value is specified to be a position of the God-AID in the AID list after appending the God-AID.

[0244] Next, the exemplary application of this fourth embodiment will be described with reference to Fig. 30.

[0245] In the case of producing PAT<AID_{God} | AID_A, AID_B > from PAT<AID_{Null} | AID_A > and PAT<AID_{Null} | AID_B >, the following processing is executed at the secure PAT processing device which is connected with the terminal of the PAT holder (user-A in Fig. 30).

(1) Using MergePAT,

PAT<AID_{Null} | AID_A > + PAT<AID_{Null} | AID_B >

+ Enabler of AID_{Null}

→ PAT<AID_{Null} | AID_A, AID_B >.

(2) According to the above described rule (a) of the God-AID, AID_{God} is known.
(3) According to the above described rule (b)(ii) of the God-AID,

PAT<AID_{Null} | AID_A, AID_B > + Enabler of AID_{Null}

→ PAT<AID_{god} | AID_A, AID_B >

[0246] The above processing is also executed at the secure PAT processing device connected with a computer (search engine, etc.) of the third person (Fig. 31) or at the secure PAT certification authority.

[0247] Next, with reference to Fig. 32, the fifth embodiment of the email access control scheme according to the present invention will be described in detail.

[0248] When the Null-AID is added as described in the third embodiment, there arises a problem that it becomes possible for the holder of the PAT (the user of the holder AID) to transfer the access right with respect to the member (the user of the member AID) to the third person, and moreover this transfer can be done without a permission of the member, as will be described now.

(1) The holder-A of PAT<AID_A | AID_B > (for the member-B) produces PAT<AID_{Null} | AID_B > by using PAT<AID_A | AID_B >, AID_A and Enabler of AID_A. Here, it is assumed that the holder-A knows all of AID_A, Enabler of AID_A, AID_{Null}, and Enabler of AID_{Null} in addition to PAT<AID_A | AID_B >.

(a) The holder-A produces PAT<AID_A | AID_{Null} > using the MakePAT as follows.

AID_A + AID_{Null} + Enabler of AID_{Null} + Enabler of AID_A

→ PAT<AID_A | AID_{Null} >

(b) The holder-A produces PAT<AID_{Null} | AID_B > using the TransPAT as follows.

PAT<AID_A | AID_B > + PAT<AID_A | AID_{Null} >

+ Enabler of AID_A + Enabler of AID_{Null}

→ PAT<AID_{Null} | AID_B >

After the above described operation (1)(b), the holder-A gives PAT<AID_{Null} | AID_B > to the third person-C, the following operation (2) becomes possible.

(2) The third person-C produces PAT<AID_C | AID_B > by using PAT<AID_{Null} | AID_B >. Here, it is assumed that the third person-C knows all of AID_C, Enabler of AID_C, AID_{Null}, and Enabler of AID_{Null} in addition to PAT<AID_{Null} | AID_B >.

(a) The third person-C produces PAT<AID_{Null} | AID_C > using the MakePAT as follows.

AID_{Null} + AID_C + Enabler of AID_C + Enabler of AID_{Null}

→ PAT<AID_{Null} | AID_C >

(b) The third person-C produces PAT<AID_C | AID_B > using the TransPAT as follows.

PAT<AID_{Null} | AID_B > + PAT<AID_{Null} | AID_C >

+ Enabler of AID_{Null} + Enabler of AID_C

→ PAT<AID_C | AID_B >

[0249] As a result of the above described operation (2)(b), the third person-C obtains PAT<AID_C | AID_B > so that accesses to the member-B become possible.

[0250] For this reason, in this fifth embodiment, it is made impossible for the holder of PAT<AID_{holder} | AID_{member} > to produce PAT<AID_{Null} | AID_{member} > from this PAT<AID_{holder} | AID_{member} > as long as the holder does not know Enabler of AID_{member}.

[0251] In the third embodiment described above, in order for the PAT holder to produce PAT<AID_{Null} | AID_{member} > without using Enabler of AID_{member}, it is necessary to produce PAT<AID_{holder} | AID_{Null} >.

[0252] To this end, in this fifth embodiment, for the Null-AID described in the third embodiment, the following rule is added:

* the Null-AID can be used only as the holder AID of the PAT (the Null-AID cannot be used as the member AID).

That is, PAT<AID_{Null} | $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ > is allowed, but PAT<AID_{holder} | AID_{Null}, $AID_{member1}$, $AID_{member2}$, ·····, $AID_{memberN}$ > is not allowed.

Each of the secure PAT processing devices and the secure PAT certification authority is additionally equipped with a function for checking whether the Null-AID is contained as the member AID or not. This member AID checking processing is carried out according to Fig. 32 as follows.

(1) Null-AID and PAT are entered (step S6911).
(2) All the member AIDs are taken out from the PAT entered at the step S6911 (step S6913).
(3) Each of the taken out member AIDs is compared with the Null-AID entered at the step S6911 (step S6915).

If all the member AIDs do not completely match with the Null-AID (step S6917 NO, step S6919 NO), the processing proceeds to the MergePAT, SplitPAT or TransPAT processing (Fig. 21 or Fig. 22) (step S6921).

If there is a member AID that completely matches with the Null-AID (step S6917 YES), the processing is terminated.

[0253] Next, with reference to Fig. 33 to Fig. 39, the sixth embodiment of the email access control scheme according to the present invention will be described in detail.

[0254] This sixth embodiment differs from the first embodiment described above in that a link information is added to the AID of Fig. 2 used in the first embodiment, as shown in a part (b) of Fig. 34, while a link information of the AID is set instead of the AID itself that is contained in the 1-to-1 PAT of Fig. 2, as shown in a part (c) of Fig. 34, such that the AID is uniquely identified by the link information.

[0255] Note that such an AID to which the link information is added will be referred to as a link information attached AID, and a 1-to-1 PAT having the link information of the AID will be referred to as a link specifying 1-to-1 PAT. Also, the link information is an information

capable of uniquely identifying the AID, which is given by a kind of data generally known as identifier such as a serial number uniquely assigned to the AID by the CA for example.

[0256] Fig. 33 shows an overall configuration of a communication system in this sixth embodiment.

[0257] In Fig. 33, the CA (Certification Authority) 1 has a right to authenticate OIDs and a right to issue AIDs, and functions to allocate AIDs to users 3.

[0258] The SCS (Secure Communication Service) 5 transfers emails among the users 3, carries out the receiving refusal and the identity judgement and the extraction of the OID according to the need.

[0259] The ADS (Anonymous Directory Service) 7 is a database for managing the AID, the transfer control flag value, the validity period value, and the disclosed information of each user 3. The ADS 7 has a function to generate the PAT from the AID of a searcher and the AID of a registrant who satisfies the search conditions, and issue it to the searcher.

[0260] A series of processing from generating the AID from the OID according to a request from a user until allocating the AID to that user is basically the same as in the first embodiment, except that the link information is to be added, which will now be described with reference to Fig. 34.

[0261] Fig. 34 shows exemplary formats of the OID, the link information attached AID, and the link specifying 1-to-1 PAT. As shown in a part (a) of Fig. 34, the OID is an information comprising an arbitrary character string according to a rule by which the CA 1 can uniquely identify the user and a public key, which is signed by the CA 1.

[0262] Also, as shown in a part (b) of Fig. 34, the link information attached AID is an information comprising fragments of the OID and their position information, redundant character strings, an SCS information given by an arbitrary character string (host name, real domain name, etc.) by which a host or a domain that is operating the SCS 5 can be uniquely identified on the network, and the link information, which is signed by the CA 1.

[0263] Also, as shown in a part (c) of Fig. 34, the link specifying 1-to-1 PAT is an information comprising the transfer control flag, the link information of AID_ϕ, the link information of AID_1, and the validity period, which is signed by the ADS 7 using a secret key of the ADS 7.

[0264] A procedure by which the user 3 requests the link information attached AID to the CA 1 is the same as that of the first embodiment. A procedure by which the CA 1 issues the link information attached AID to the user 3 in response to a request for the AID is also the same as that of the first embodiment.

[0265] Next, the link information attached AID generation processing at the CA will be described with reference to Fig. 35.

[0266] In the procedure of Fig. 35, the CA 1 generates an information of a length equal to the total length L of the OID, and sets this information as a tentative AID (step S7211). Then, in order to carry out the partial copying of the OID, values of parameters p_i and ℓ_i for specifying a copying region are determined using arbitrary means such as random number generation respectively (step S7213). Here, L is equal to the total length L of the OID, and ℓ_i is an arbitrarily defined value within a range in which a relationship of $0 \leq \ell_i \leq L$ holds. Then, an information in a range between a position p_i to a position $p_i + \ell_i$ from the top of the OID is copied to the same positions in the tentative AID (step S7215). In other words, this OID fragment will be copies to a range between a position p_i and a position $p_i + \ell_i$ from the top of the tentative AID. Then, the values of p_i and ℓ_i are written into a prescribed range in the tentative AID into which the OID has been partially copied, in a form encrypted by an arbitrary means (step S7217). Then, an SCS information given by an arbitrary character string (host name, real domain, etc.) that can uniquely identify a host or a domain that is operating the SCS 5 on the network is written into a prescribed range in the tentative AID into which these values are written (step S7219). Then, the link information is written (step S7220). Then, the tentative AID into which the above character string and the link information are written is signed using a secret key of the CA 1 (step S7221).

[0267] Next, a procedure for registering the AID of a user-B 3 and the disclosed information into the ADS 7 will be described. First, the bidirectional authentication by arbitrary means using the AID of the user-B 3 and the certificate of the ADS 7 is carried out between the user-B 3 who is a registrant and the ADS 7. Then, the user-B 3 transmits the transfer control flag value, the validity period value, and the disclosed information such as interests to the ADS 7. Then, the ADS 7 stores the transfer control flag value, the validity period value, and the entire disclosed information in relation to the AID of the user-B 3 in its storage device. Here, there can be cases where communications between the user-B 3 who is the registrant and the ADS 7 are to be encrypted.

[0268] Next, a procedure by which a user-A 3 searches through the disclosed information that is registered in the ADS 7 will be described. First, the bidirectional authentication by arbitrary means using the AID of the user-A 3 and the certificate of the ADS 7 is carried out between the user-A 3 who is a searcher and the ADS 7. Then, the user-A 3 transmits arbitrary search conditions to the ADS 7. Then, the ADS 7 presents all the received search conditions to its storage device, and extracts the AID of a registrant which satisfies these search conditions. Then, the ADS 7 generates the link specifying 1-to-1 PAT from the link information of the AID of the user-A 3 and the link information of the AID of the registrant who satisfied the search conditions, the transfer control flag value, and the validity period value. Then, the ADS 7 transmits the generated PAT to the user-A 3. Here, there can be cases where communications between the user-A 3 who is a searcher and the ADS 7 are to be encrypted. Note that the link specifying

1-to-1 PAT is generated as a search result of the ADS 7.

[0269] Next, the link specifying 1-to-1 PAT generation processing at the ADS 7 will be described with reference to Fig. 36.

[0270] First, an information of a prescribed length is generated, and this information is set as a tentative PAT (step S7510). Then, the link information of the AID of the user-A 3 who is a searcher and the link information of the AID of the user-B 3 who is a registrant are copied into a prescribed region of the tentative PAT (step S7516). Then, the transfer control flag value and the validity period value are written into respective prescribed regions of the tentative PAT into which the link informations of the AIDs are copied (step S7517). Then, the tentative PAT into which these values are written is signed using a secret key of the ADS 7 (step S7519).

[0271] Next, the transfer control using the link specifying 1-to-1 PAT will be described. The transfer control is a function for limiting accesses to a user who has a proper access right from a third person to whom the PAT has been transferred or who has eavesdropped the PAT (a user who originally does not have the access right).

[0272] The ADS 7 and the user-B 3 of the registrant AID can prohibit a connection to the user-B 3 from a third person who does not have the access right, by setting a certain value in to the transfer control flag of the PAT.

[0273] When the transfer control flag value is set to be 1, the sender's AID is authenticated between the SCS 5 and the sender according to an arbitrary challenge/response process, so that even if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will not be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0274] On the other hand, when the transfer control flag value is set to be 0, no challenge/response process will be carried out between the SCS 5 and the sender, so that if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will also be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0275] Next, the email access control method at the SCS 5 will be described with reference to Fig. 37.

[0276] The sender specifies "[sender's AID]@[real domain of SCS of sender]" in From: line, and "[PAT]@[real domain of SCS of sender]" in To: line.

[0277] The SCS 5 acquires a mail received by an MTA (Message Transfer Agent) such as SMTP (Simple Mail Transfer Protocol), and executes the processing of Fig. 37 as follows.

(1) The signature of the PAT is verified using a public key of the ADS 7 (step S7713).

When the PAT is found to have been altered (step S7715 YES), the mail is discarded and the processing is terminated (step S7716).

When the PAT is found to have been not altered (step S7715 NO), the following processing (2) is executed.

(2) The search is carried out by presenting the link information of the sender's AID to the PAT (steps S7717, S7720, S7722).

When a link information that completely matches with the link information of the sender's AID is not contained in the PAT (step S7723 NO), the mail is discarded and the processing is terminated (step S7716).

When a link information that completely matches with the link information of the sender's AID is contained in the PAT (step S7723 YES), the following processing (3) is executed.

(3) The validity period value of the PAT is evaluated (steps S7725, S7727).

When the PAT is outside the validity period (step S7727 NO), the mail is discarded and the processing is terminated (step S7716).

When the PAT is within the validity period (step S7727 YES), the following processing (4) is executed.

(4) Whether or not to authenticate the sender is determined by referring to the transfer control flag value of the PAT (steps S7731, S7733).

When the value is 1 (step S7733 YES), the SCS 5 acquires the sender's AID itself and the public key of the sender's AID by presenting the link information to the CA 1, and then the challenge/response authentication between the SCS 5 and the sender is carried out, and the signature of the sender is verified (step S7735). When the signature is valid, the recipient is specified and the PAT is attached (step S7737). When the signature is invalid, the mail is discarded and the processing is terminated (step S7716).

When the value is 0 (step S7733 NO), the recipient is specified and the PAT is attached without executing the challenge/response authentication (step S7737).

[0278] The challenge/response authentication between the SCS 5 and the sender is the same as that for the 1-to-1 PAT described above.

[0279] Next, a method for specifying the recipient at the SCS 5 will be described. First, the SCS 5 carries out the search by presenting the link information of the sender's AID to the PAT, so as to acquire all the link informations which do not completely match the link information of the sender's AID. Then, the search is carried out by presenting all these acquired link informations to the CA 1 so as to acquire the AIDs. All these acquired AIDs will be defined as recipient's AIDs hereafter. Then, for every recipient's AID, the real domain of SCS of recipient is taken out from the recipient's AID. Then, the recipient is specified in a format of "[recipient's AID]@[real domain of SCS of recipient]". Finally, the SCS 5 changes the sender from a format of

"[sender's AID]@[real domain of SCS of sender]" to a format of "sender's AID".

[0280] The method for attaching the PAT at the SCS 5 is the same as that for the 1-to-1 PAT described above.

[0281] Next, a method of receiving refusal with respect to the PAT at the SCS 5 will be described.

[0282] Receiving refusal setting: The bidirectional authentication is carried out by an arbitrary means between the user and the SCS 5. Then, the user transmits a registration command, his/her own AID, and arbitrary PATs to the SCS 5. Then, the SCS 5 verifies the signature of the received AID. If the signature is invalid, the processing of the SCS 5 is terminated. If the signature is valid, the SCS 5 next verifies the signature of each received PAT using a public key of the ADS. Those PATs with the invalid signature are discarded by the SCS 5. When the signature is valid, the SCS 5 takes out the link information from the received AID, and then carries out the search by presenting the taken out link information to each PAT. For each of those PATs which contain the link information that completely matches with the link information of the received AID, the SCS 5 presents the registration command and the PAT to the storage device such that the PAT is registered into the storage device. Those PATs which do not contain the link information that completely matches with the link information of the received AID are discarded by the SCS 5 without storing them into the storage device. Here, there can be cases where communications between the user and the SCS 5 are to be encrypted.

[0283] Receiving refusal execution: The SCS 5 carries out the search by presenting the PAT to the storage device. When a PAT that completely matches the presented PAT is registered in the storage device, the mail is discarded. When a PAT that completely matches the present PAT is not registered in the storage device, the mail is not discarded.

[0284] Receiving refusal cancellation: The bidirectional authentication is carried out by an arbitrary means between the user and the SCS 5. Then, the user presents his/her own AID to the SCS 5. Then, the SCS 5 verifies the signature of the received AID. If the signature is invalid, the processing of the SCS 5 is terminated. If the signature is valid, the SCS 5 next takes out the link information from the presented AID, and presents the taken out link information as a search condition to the storage device and acquire all the PATs that contain the presented link information, and then presents all the acquired PATs to the user. Then, the user selects all the PATs for which the receiving refusal is to be cancelled by referring to all the PATs presented from the SCS 5, and transmits all the selected PATs along with a deletion command to the SCS 5. Upon receiving the deletion command and all the PATs for which the receiving refusal is to be cancelled, the SCS 5 presents the deletion command and all the PATs received from the user to the storage device, such that all the received PATs are deleted from the storage device.

[0285] Note that the method of receiving refusal with respect to the link specifying 1-to-N PAT at the SCS 5 is the same as the method of receiving refusal with respect to the link specifying 1-to-1 PAT described above.

[0286] Next, the judgement of identity will be described with reference to Fig. 38 and Fig. 39.

(1) An initial value of a variable OID_M is defined as a bit sequence with a length equal to the total length L of the OID and all values equal to "0". Also, an initial value of a variable OID_V is defined as a bit sequence with a length equal to the total length of the OID and all values equal to "0" (step S7911).

(2) One link information attached AID is selected from a set of processing target link information attached AIDs, and the following bit processing is carried out (step S7913).

(a) Values of variables AID_M and AID_V are determined according to the position information contained in the link information attached AID (step S7915). Here, AID_M is defined as a bit sequence with a length equal to the total length L of the OID and a value of a position at which the OID information is defined is "1" while a value of a position at which the OID information is not defined is "0" (see Fig. 39). Also, AID_V is defined as a bit sequence with a length equal to the total length L of the OID and a value of a position at which the OID information is defined is an actual value of the OID information while a value of a position at which the OID information is not defined is 0 (see Fig. 39).

(b) AND processing of OID_M and AID_M is carried out and its result is substituted into a variable OVR_M (step S7917).

(c) AND processing of OVR_M and AID_M as well as AND processing of OVR_M and OID_M are carried out and their results are compared (step S7919). When they coincide, OR processing of OID_M and AID_M is carried out and its result is substituted into OID_M (step S7921), while OR processing of OID_V and AID_V is also carried out and its result is substituted into OID_M (step S7923). On the other hand, when they do not coincide, the processing proceeds to the step S7925.

(d) A link information attached AID to be processed next is selected from a set of processing target link information attached AIDs. When at least one another link information attached AID is contained in the set, the steps S7913 to S7923 are executed for that another link information attached AID. When no other link information attached AID is contained in the set, the

processing proceeds to the step S7927.

(e) Values of OID_M and OID_V are outputted (step S7927).

[0287] The value of OID_M that is eventually obtained indicates all positions of the OID information that can be recovered from the set of processing target link information attached AIDs. Also, the value of OID_V that is eventually obtained indicates all the OID information that can be recovered from the set of processing target link information attached AID. In other words, by using the values of OID_M and OID_V, it is possible to obtain the OID albeit probabilistically when the value of OID_V is used as a search condition, and it is possible to quantitatively evaluate a precision of the above search by a ratio OID_M/L with respect to the total length L of the OID.

[0288] As described above, in this sixth embodiment, the CA 1 which is a Trusted Third Party with high secrecy and credibility generates the link information attached AID in which the personal information is concealed, from the OID that contains the highly secret personal information such as name, telephone number, real email address, etc., according to a user request, and issues the AID to the user. By identifying the user by this AID on the communication network as well as in various services provided on the communication network, it becomes possible to provide both the anonymity guarantee and the identity guarantee for the user. In other words, it becomes possible for the user to communicate with another user without revealing the own real name, telephone number, email address, etc., to that another user, and it also becomes possible to disclose the disclosed information to unspecified many through the ADS 7 as will be described below.

[0289] The user registers the disclosed information, that is an information which is supposed to have a low secrecy compared with the personal information at the ADS 7. In the case of searching the disclosed information and the registrant AID, the searcher presents the link information attached AID of the searcher and arbitrary search conditions to the ADS 7. The ADS 7 then extracts the registrant link information attached AID that satisfies these search conditions, and generates the link specifying 1-to-1 PAT from the link information of the AID of the searcher and the link information of the AID of the registrant who satisfied the search conditions, the transfer control flag value, and the validity period value.

[0290] In this link specifying 1-to-1 PAT, the transfer control flag value and the validity period value are set as shown a part (c) of Fig. 34, and by setting up this validity period in advance, it is possible to limit connections from the sender.

[0291] It is also possible to prohibit connections from a third person who does not have the access right, by using the transfer control flag value. Namely, when the transfer control flag value is set to be 1, the sender's AID is authenticated between the SCS 5 and the sender according to an arbitrary challenge/response process, so that even if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will not be able to make a connection to the registrant of the ADS 7 through the SCS 5. On the other hand, when the transfer control flag value is set to be 0, no challenge/response process will be carried out between the SCS 5 and the sender, so that if the sender gives both the sender's AID and the PAT to another user other than the sender, that another user will also be able to make a connection to the registrant of the ADS 7 through the SCS 5.

[0292] It is also possible to make a connection request to the communication network such that a call for which the recipient is specified by the link specifying 1-to-1 PAT will be received by the recipient's AID or the sender's AID specified by the link information of the link specifying 1-to-1 PAT. In addition, it is also possible to refuse receiving calls with the link specifying 1-to-1 PAT selected by the recipient among calls which are specified by the link specifying 1-to-1 PAT. It is also possible to cancel the receiving refusal of the calls with the link specifying 1-to-1 PAT selected by the recipient. In addition, as a measure against the sender who repeats the personal attack using a plurality of sender's AIDs by taking an advantage of the anonymity, it is possible to judge the identity of the OID from these plurality of sender's AIDs and it is possible to extract that OID at some probability.

[0293] Next, with references to Fig. 40 to Fig. 49, the seventh embodiment of the email access control scheme according to the present invention will be described in detail.

[0294] In contrast to the sixth embodiment described above which is directed to the case where a sender and a recipient are set in 1-to-1 correspondence, this seventh embodiment is directed to the case where a sender and recipients are set in 1-to-N correspondence and a generation of a new link specifying 1-to-N PAT and a content change of the existing link specifying 1-to-N PAT can be made by the initiative of a user, similarly as in the second embodiment described above. Here, the sender is either a holder of the PAT or a member of the PAT. Similarly, the recipient is either a holder of the PAT or a member of the PAT.

[0295] As described in the second embodiment, in general, a membership of a group communication (mailing list, etc.) is changing dynamically so that it is necessary for a host of the group communication to manage information on a point of contact such as telephone number, email address, etc., of each member. In contrast, in the case where it is possible to newly generate a 1-to-1 PAT as in the sixth embodiment, the management of a point of contact is difficult. For example, it is difficult to manage the group collectively, and even if it is given to the others for the purpose of the transfer control, it does not function as an address of the group communication such as mailing list.

[0296] In this seventh embodiment, in order to resolve

such a problem, it is made possible to carry out a generation of a new link specifying 1-to-N PAT and a content change or the existing link specifying 1-to-N PAT by the initiative of a user.

[0297] First, the definition of various identifications used in this seventh embodiment will be described with references to Fig. 40 and Fig. 41.

[0298] As shown in a part (a) of Fig. 40, the OID is an information comprising an arbitrary character string (telephone number, email address, etc.) according to a rule by which the CA 1 can uniquely identify the user and a public key, which is signed by the CA 1.

[0299] Also, as shown in a part (b) of Fig. 40, the link information attached AID is an information comprising fragments of the OID and their position information, redundant character strings, an SCS information given by an arbitrary character string (host name, real domain name, etc.) by which a host or a domain that is operating the SCS 5 can be uniquely identified on the network, and a link information, which is signed by the CA 1. Note that the AID may be encrypted at the SCS 5 or the CA 1. The link information is the same as in the sixth embodiment.

[0300] Also, as shown in a part (c) of Fig. 40, the link specifying 1-to-N PAT is an information comprising two or more link informations of AIDs, a holder index, the validity period, the transfer control flag, and a PAT processing device identifier, which is signed using a secret key of the PAT processing device.

[0301] Here, one of the link informations of AIDs is the link information of the holder AID of this PAT, where the change of the information contained in the PAT such as an addition of the link information of AID to the PAT, a deletion of the link information of AID from the PAT, a change of the validity period in the PAT, a change of the transfer control flag value in the PAT, etc., can be made by presenting the link information of the holder AID and a corresponding Enabler to the PAT processing device.

[0302] On the other hand, the link informations of AIDs other than the link information of the holder AID that are contained in the PAT are all link information of member AIDs, where a change of the information contained in the PAT cannot be made even when the link information of the member AID and a corresponding Enabler are presented to the PAT processing device.

[0303] The holder index is a numerical data for identifying the link information of the holder AID, which is defined to take a value 1 when the link information of the holder AID is a top link information of AID in the link specifying AID list formed from the link information of the holder AID and the link informations of the member AIDs, a value 2 when the link information of the holder AID is a second link information of AID from the top of the link specifying AID list, or a value n when the link information of the holder AID is an n-th link information of AID from the top of the link specifying AID list.

[0304] The transfer control flag value is defined to take either 0 or 1 similarly as in the case of the link specifying 1-to-1 PAT.

[0305] The link information of the holder AID is defined to be a link information of AID which is written at a position of the holder index value in the link specifying AID list. The link informations of the member AIDs are defined to be all the link informations of AIDs other than the link information of the holder AID.

[0306] The validity period is defined by any one or combination of the number of times for which the PAT is available, the absolute time (UTC) by which the PAT becomes unavailable, the absolute time (UTC) by which the PAT becomes available, and the relative time (lifetime) since the PAT becomes available until it becomes unavailable.

[0307] The identifier of a PAT processing device (or a PAT processing object on the network) is defined as a serial number of the PAT processing device (or an distinguished name of the PAT processing object on the network). The secret key of the PAT processing device (or the PAT processing object on the network) is defined to be uniquely corresponding to the identifier.

[0308] Also, in this second embodiment, an Enabler is introduced as an identifier corresponding to the AID. As shown in Fig. 41, the Enabler is an information comprising a character string uniquely indicating that it is an Enabler and a link information attached AID itself, which is signed by the CA 1.

[0309] Next, the operations for a generation of a new PAT and a content change of the existing PAT will be described. Here, the following operations are defined at a secure PAT processing device on the communication terminal or a PAT processing object on the CA or on a network which is properly requested from the CA (which will also be referred to as a PAT processing device hereafter). These operations are similar to those of the second embodiment described above so that they will be described by referring to Fig. 10 to Fig. 13 but it is assumed that each occurrence of AID in Fig. 10 to Fig. 13 should be replaced by the link information of AID in the following.

1. Editing of link specifying AID list:

A link specifying AID list, which is a list of link informations of AIDs contained in the PAT, is edited using link information attached AIDs and Enabler. Else, the link specifying AID list is newly generated.

2. Setting of the validity period and the transfer control flag:

The validity period value and the transfer control flag value contained in the PAT are changed using a link information attached AID and Enabler. Also, a new validity period value and a new transfer control flag value are set in the newly generated link specifying AID list.

[0310] A user who presented the holder AID and the Enabler corresponding to this holder AID to the PAT processing device can edit the list of link informations of

AIDs contained in the PAT. In this case, the following processing rules are used.

(1) Generating a new PAT (MakePAT) (see Fig. 10):

The link specifying AID list (LALIST<(link)holder AID | (link)member AID_1, (link)member AID_2, ・・・・・・・・, (link)member AID_n >) where (link)AID_x denotes the link information of AID_x is newly generated, and the validity period value and the transfer control flag value are set with respect to the generated LALIST.

(link)AID_A + (link)AID_B + Enabler of AID_B

+ Enabler of AID_A

→ LALIST<(link)AID_A | (link)AID_B >

LALIST<(link)AID_A | (link)AID_B > + Enabler of AID_A

+ validity period value

+ transfer control flag value

→ PAT<(link)AID_A | (link)AID_B >

(2) Merging PATs (MergePAT) (see Fig. 11):

A plurality of LALISTs of the same holder AID are merged and the validity period value and the transfer control flag value are set with respect to the merged LALIST.

LALIST<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・ >

+ LALIST<(link)AID_A | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_A

→ LALIST<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・, (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

LALIST<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・, (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_A + validity period value

+ transfer control flag value

→ PAT<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・, (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

(3) Splitting a PAT (SplitPAT) (see Fig. 12):

The LALIST is split into a plurality of LALISTs of the same holder AID, and the respective validity period value and transfer control flag value are set with respect to each one of the split LALISTs.

LALIST<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・, (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_A

→ LALIST<(link)AID_A | (link)AID_{B1}, (link)AID_{B2}, ・・・・・・・・ >

+ LALIST<(link)AID_A | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

LALIST<(link)AID_A | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_A + validity period value

+ transfer control flag value

→ PAT<(link)AID_A | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

(4) Changing a holder of a PAT (TransPAT) (see Fig. 13):

The holder AID of the LALIST is changed, and the validity period value and the transfer control flag value are set with respect to the changed LALIST.

LALIST<(link)AID_A | (link)AID_B >

+ LALIST<(link)AID_A | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_A + Enabler of AID_B

→ LALIST<(link)AID_B | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

LALIST<(link)AID_B | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

+ Enabler of AID_B + validity period value

+ transfer control flag value

→ PAT<(link)AID_B | (link)AID_{C1}, (link)AID_{C2}, ・・・・・・・・ >

[0311] In the operation for setting the validity period value, in order to permit the setting of the validity period value only to a user who holds both the holder AID and the corresponding Enabler, the following operation is defined.

PAT<(link)AID_A | (link)AID_B > + Enabler of AID_A

+ validity period value

→ PAT<(link)AID_A | (link)AID_B >

[0312] In the operation for setting the transfer control flag value, in order to permit the setting of the transfer control flag value only to a user who holds both the holder AID and the corresponding Enabler, the following operation is defined.

PAT<(link)AID_A | (link)AID_B > + Enabler of AID_A

+ transfer control flag value

→ PAT<(link)AID_A | (link)AID_B >

[0313] Next, with references to Fig. 42 to Fig. 48, the overall system configuration of this seventh embodiment will be described. In Fig. 42 to Fig. 48, the user-A who has AID_A allocated from the CA stores AID_A and Enabler of AID_A in a computer of the user-A, and the input/output devices such as floppy disk drive, CD-ROM drive, communication board, microphone, speaker, etc., are connected. Else, AID_A and Enabler of AID_A are stored in a communication terminal (telephone, cellular phone, etc.) which has a storage device and a data input/output function.

[0314] Similarly, the user-B who has AID_B allocated from the CA stores AID_B and Enabler of AID_B in a computer of the user-B, and the input/output devices such as floppy disk drive, CD-ROM drive, communication board, microphone, speaker, etc., are connected. Else, AID_B and Enabler of AID_B are stored in a communication terminal (telephone, cellular phone, etc.) which has a storage device and a data input/output function.

[0315] In the following, a procedure by which the user-A generates PAT<(link)AID_A | (link)AID_B > will be described.

(1) The user-A acquires AID_B and Enabler of AID_B using any of the following means.

- AID_B and Enabler of AID_B are registered at the ADS 7, and it is waited until the user-A acquires them as a search result (Fig. 42).
- AID_B and Enabler of AID_B are directly transmitted to the user-A by the email, signaling, etc. (Figs. 43, 44).
- AID_B and Enabler of AID_B are stored in a magnetic, optic, or electronic medium such as floppy disk, CD-ROM, MO, IC card, etc., and this medium is given to the user-A. Else, it is waited until the user acquires them by reading this medium (Figs. 45, 46).
- AID_B and Enabler of AID_B are printed on a paper medium such as book, name card, etc., and this medium is given to the user-A. Else, it is waited until the user-A acquire them by reading this medium (Figs. 47, 48).

(2) The user-A who has acquired AID_B and Enabler of AID_B by any of the means described in the above (1) issues the MakePAT command to the PAT processing device. This procedure is common to Fig. 42 to Fig. 48, and defined as follows.

(a) The user A requests the issuance of the MakePAT command by setting AID_A , Enabler of AID_A, AID_B, Enabler of AID_B , the validity period value, and the transfer control flag value into the communication terminal of the user-A.
(b) The communication terminal of the user-A generates the MakePAT command.
(c) The communication terminal of the user-A transmits the generated MakePAT command to the PAT processing device by means such as the email, signaling, etc. (the issuance of the MakePAT command).
(d) The PAT processing device generates PAT<(link)AID_A | (link)AID_B > by processing the received MakePAT command according to Fig. 21 and Fig. 49. More specifically, this is done as follows.

(link)AID_A + (link)AID_B

+ Enabler of AID_B + Enabler of AID_A

→ LALIST<(link)AID_A | (link)AID_B >

LALIST<(link)AID_A | (link)AID_B > + Enabler of AID_A

+ validity period value + transfer control flag value

→ PAT<(link)AID_A | (link)AID_B>

(e) The PAT processing device transmits the generated PAT<(link)AID_A | (link)AID_B > to the communication terminal of the user-A, or to the communication terminal of the user-B according to the need, by means such as the email, signaling, etc.
(f) The communication terminal of the user-A (or the user-B) stores the received PAT<(link)AID_A | (link)AID_B > in the storage device of the communication terminal of the user-A.

[0316] The merging of PATs (MergePAT, Fig. 21, Fig. 49), the splitting of a PAT (SplitPAT, Fig. 22, Fig. 49), and the changing of a holder of a PAT (TransPAT, Fig. 21, Fig. 49) are also carried out by the similar procedure.