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(54) **CALL PROCESSING DIGIT TRANSLATION AND CHARACTERIZATION**

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(52) **U.S. Cl.** **379/220.01**; 379/201.01; 379/207.03; 379/207.11; 379/221.06; 379/221.14

(58) **Field of Search** 379/201.01, 201.02, 379/201.12, 207.03, 207.11, 219, 220.01, 221.02, 221.06, 221.14

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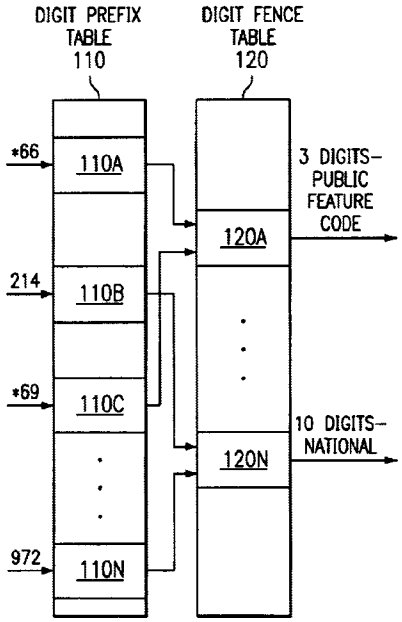
(57) **ABSTRACT**

An optimal digit translation and call processing system and method is provided. A prefix translation and digit characterization process are performed utilizing a digit prefix table and a second table interfaced therewith. The digit prefix table contains numerous records corresponding to prefixes of dialed digit streams. Each record includes an index to a record of a second table operable to output a termination type of the digit stream. The second table includes numerous records associated with various call termination types. Each index included within respective records of the digit prefix table may reference more than one record of the second table. The digit stream length is analyzed to resolve ambiguities in the digit stream when an index in a record of the digit prefix table references more than one record of the second table. Multiple records of the digit prefix table may have a common index to an identical record of the second table thus reducing the required number of records in the second table for characterizing call termination types. A call screening table is interrogated with termination type data obtained from the second table. The call screening table can pass call control to a national or international translator table which provide a route index on which further call processing is performed. The route index may be modified by an originator routing table, a carrier identification code routing table and a time of day routing table before the call is ultimately routed.

28 Claims, 2 Drawing Sheets



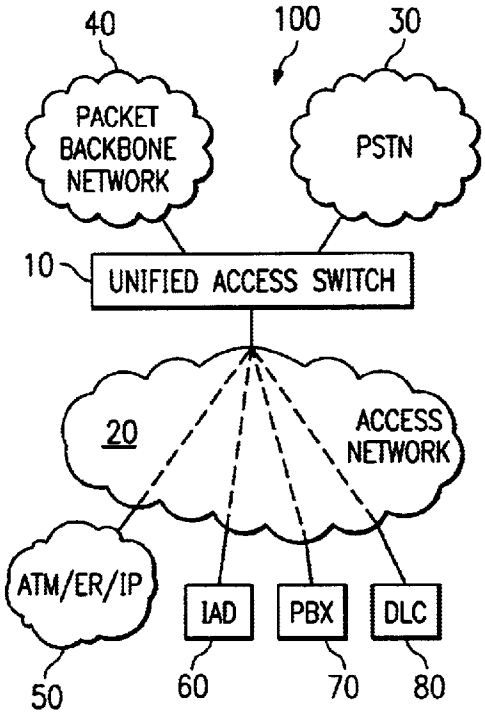


FIG. 1

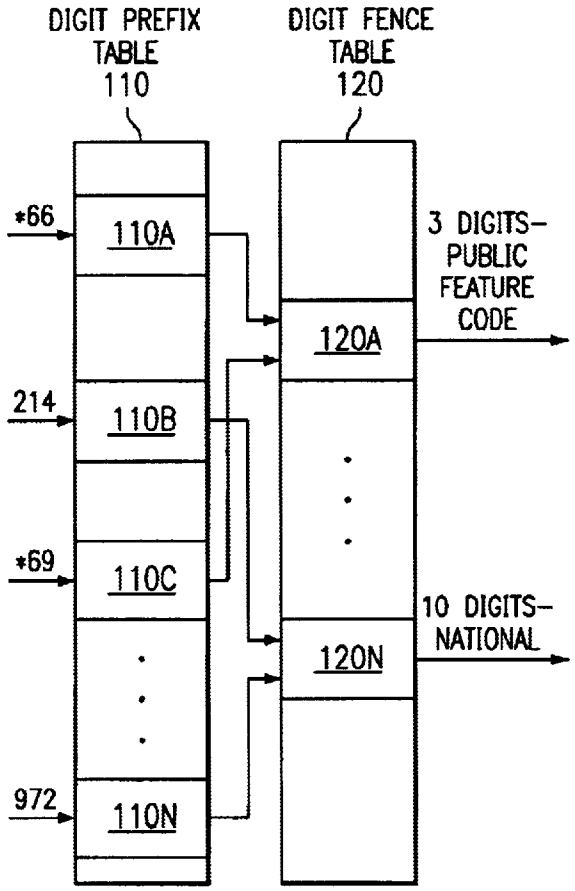


FIG. 2

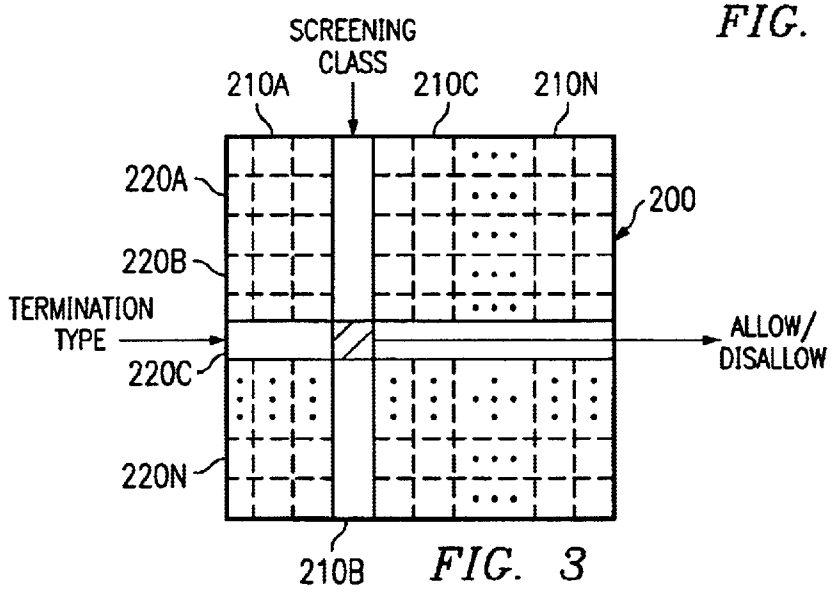
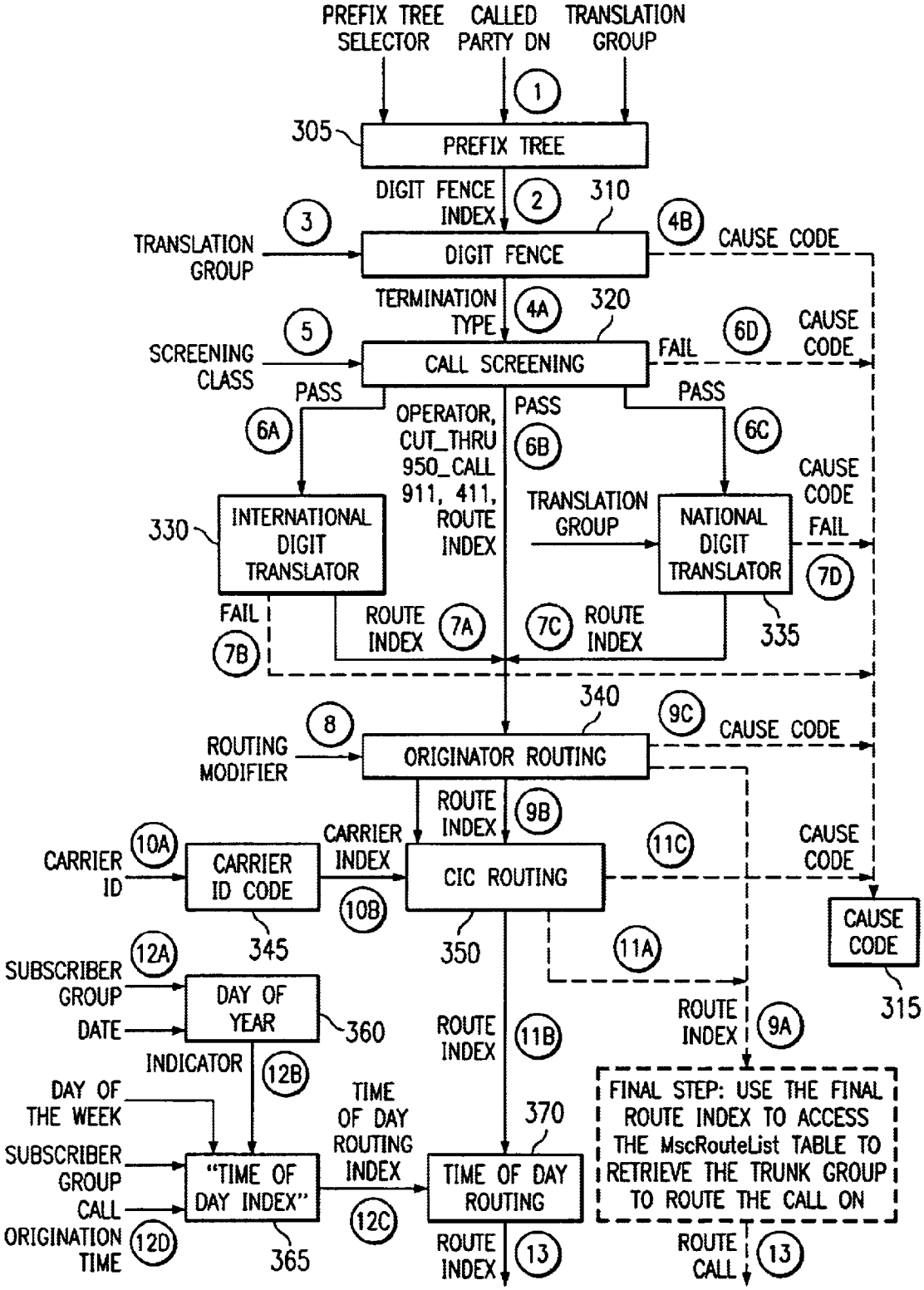


FIG. 3

FIG. 4



CALL PROCESSING DIGIT TRANSLATION AND CHARACTERIZATION

TECHNICAL FIELD OF THE INVENTION

The invention relates to telecommunication switching systems and, in particular, to a unified access switch digit translation system for providing digit translation and call routing in a telecommunication system.

BACKGROUND OF THE INVENTION

Telecommunication carriers are increasingly deploying multi-service packages, or bundled services, to customers to provide reduced overall access charges in an attempt to increase customer retention. For example, the boom in digital subscriber line subscriptions has led many carriers to bundle high bandwidth Internet service with traditional voice services. The carrier can advantageously charge a higher fee for the bundled service than the individual service fees of any of the services that are bundled together while still offering a bundled service fee less than the sum of typical fees of the individual services thus providing an incentive for customers to subscribe to additional services. Recent market trends indicate an extensive consumer demand for these bundled services. Numerous cable carriers also provide bundled services in the form of traditional pay cable television services bundled with high bandwidth cable Internet access. Deregulation in the telecommunication industry that is now allowing long distance carriers to compete with local carriers promises to bring additional bundled services to the consumer. Wireless services are also being bundled with numerous combinations of the above-mentioned services. Market trends with regard to bundled services are unmistakable. Successful carriers of the future will have the ability to offer various packages of voice and data services. Already, carriers are feeling the strain of successfully upgrading existing infrastructures to meet the high-bandwidth services being demanded by customers. Some local carriers are currently reporting up to three year back logs of orders for DSL services, for example.

Transition networks are commonly utilized to provide customer access to voice and data networks. An access network interfaces with voice and data switches each respectively interfacing with a data network, for example a packet backbone network, and the public switched telephone network. Typically, various classes of voice switches, for example class 4 switches for providing interexchange carrier (IXC) voice services and class 5 switches for providing end office voice services, are required within the transition network. Multiple media gateways are then required to interface with a data access switch. However, work towards a truly integrated voice and data network is underway.

Significant amounts of labor are expended to maintenance and upgrade the transition networks as new services become available. A move to unified access is clearly advantageous and promises to propel emerging technologies that are not easily implemented over current large scale networks, for example voice over IP (VoIP) and voice over DSL (VoDSL), to a broader degree of acceptance.

Unified access will require greatly improved switching systems that are commonly found in the PSTN today. The switching fabric will require various services to be switched to numerous other disparate networks. For example, a inbound time division multiplex message would need to be able to be switched to another time division multiple channel as well as various other networks, for example IP for a terminating VoIP customer. Similarly, the unified switch would need to be capable of switching an IP originating call to an IP, TDM, frame relay and ATM network, to name just a few. Clearly, a switch required to realize unified access will have sophistication not embodied in typical switches found in carrier networks today.

Typically, digit translation performed in telecommunication switching systems is limited in the amount of servicing provided for data networks. A unified access switch would preferably be capable of handling translation for all calls being translated and routed therefrom. Furthermore, in today's switching systems, the lookup tables (referred to hereinafter simply as 'table') generally have records for each termination type capable of being routed from the switch. By integrating data services into a unified access switch, the size of these tables will undoubtedly grow as services, for example screening services, now common with many voice services become deployed for data services.

SUMMARY OF THE INVENTION

In accordance with an embodiment of the present invention, an optimal digit translation and call processing system and method is provided that reduces the size of the tables required for performing digit translation. A prefix translation and digit characterization process are performed utilizing a digit prefix table and a second table interfaced therewith. The digit prefix table contains numerous records corresponding to prefixes of dialed digit streams. Each record includes an index to a record of a second table operable to output a termination type of the digit stream. The second table includes numerous records associated with various call termination types. Each index included within respective records of the digit prefix table may reference more than one record of the second table. The digit stream length is analyzed to resolve ambiguities in the digit stream when an index in a record of the digit prefix table references more than one record of the second table. Multiple records of the digit prefix table may have a common index to an identical record of the second table thus reducing the required number of records in the second table for characterizing call termination types. In accordance with another embodiment of the present invention, a call screening table is interrogated with termination type data obtained from the second table. The call screening table can pass call control to a national or international translator table which provide a route index on which further call processing is performed. The route index may be modified by an originator routing table, a carrier identification code routing table and a time of day routing table before the call is ultimately routed.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, the objects and advantages thereof, reference is now made to the following descriptions taken in connection with the accompanying drawings in which:

FIG. **1** is a simplified telecommunication system including a unified access switch on which the present invention may be deployed;

FIG. **2** is a simplified digit prefix table and digit fence table for performing digit prefix characterization including a termination type analysis;

FIG. **3** is a simplified screening table according to an embodiment of the present invention; and

FIG. **4** is a flowchart of the prefix translation and digit characterization process of the present invention including call screening and routing processes thereof.

DETAILED DESCRIPTION OF THE DRAWINGS

The preferred embodiment of the present invention and its advantages are best understood by referring to FIGS. **1–4** of the drawings, like numerals being used for like and corresponding parts of the various drawings.

In FIG. **1**, there is illustrated a simplified telecommunication system **100** including a unified access switch **10** according to the present invention. The unified access switch **10** provides an interface for an access network **20** to, for example, a packet backbone network **40** and the public switched telephone network (PSTN) **30**. The access network **20** may interface to various telecommunications equipment, for example asynchronous transmission mode, frame relay, and Internet protocol devices all generally designated by reference numeral **50**, as well as an integrated access device (IAD) **60**, private branch exchanges (PBXs) **70**, and digital loop carriers (DLCs) **80**, operating under disparate protocols and transmission techniques. The unified access switch **10** provides interfacing of subscriber lines to switching hardware and software for connection to other subscriber lines and communication facilities.

The unified access switch **10** preferably includes various protocol translation modules that may be embodied in various hardware and software. Pursuant to providing digit translation according to the present invention, various tables are maintained within the unified access switch **10**. These tables are preferably stored within memory modules within the unified access switch **10**. The tables may contain numerous records each respectively storing various parameters and identifier fields respectively associated with and defining various subscriber services. It should be understood that the term table as used herein is not intended to limit the data contained therein to traditional record-field table formats but may include data stored in various tree structures, for example, for facilitating data searches thereof. A database of subscriber profiles is preferably maintained within the unified access switch **10** and defines various services subscribed to by the subscribers. These services may define appropriate routing procedures for respective call termination types and may be associated with voice as well as data services calls. The subscriber profiles are preferably maintained within read-write memory modules for facilitating modification of the data, that is the subscription services, defined therein. Preferably, each of the subscriber profiles include a prefix tree selector, a translation group, a screening class, a carrier identification and a subscriber group although the information contained within each of the subscriber's profile is not limited thereto.

The call processing digit translator of the present invention includes a dialed digit recognition module, a dialed digit classification module, a call termination screening module and routing module. The digit translator provides digit recognition and interpretation capabilities and, based on the digit recognition and interpretation functions, determines how the call is to be processed, for example routed though the network, denied access, etc. The digit translator is a programmable translator that can be configured to handle various call scenarios in the emerging integrated voice and data services switches. The digit translator is advantageously programmable and accordingly can provide call processing for services currently being offered and future services yet to be deployed.

Digit translation according to the present invention is performed universally on all call originations, regardless of whether these calls are subscriber line originated calls or trunked originations. Furthermore, the translator is adaptable to process call originations irrespective of the protocol, the call features invoked by the call and customer specific data included in the call origination.

The call processing digit translation and call processing of the present invention is performed in three general steps and includes a prefix translation and digit prefix characterization step, a call screening step and a routing step. Each of these steps is carried out by interrogation of various tables maintained within the switch. Generally, the prefix translation step is implemented to recognize pre-designated calling prefixes. When the prefix translation step determines pre-designated calling prefixes exist in the digit stream, the pre-designated prefix is removed from the stream. The called party (destination) number is then recovered from the remaining stream. The final call type, that is the termination type, is then evaluated from the digit stream. Finally, the digit stream is analyzed for ambiguously dialed number combinations.

The call screening step is generally implemented to determine whether the originating (calling) party is allowed to perform the call under the evaluated scenario. A screening class associated with the call originator is retrieved from a subscriber profile maintained on the originating party. Generally, each calling party accessing the switch for originating a call therefrom will have a subscriber profile maintained within the switch describing the originator's subscription services. The originator's profile may include various data relating to call services of the subscriber and includes any call screening functions and special routing services subscribed to by the originator. The termination type, as evaluated in the prefix translation and digit prefix characterization step, is then compared with the screening class to determine if the call is allowed. If the call screening step affirms that the originating party is allowed to place the call, a routing step is implemented for refining the call type analysis and evaluating a route for trunk terminated calls. Screening services for voice and data services may be distinguished by the screening class, for example, or other subscriber data such as the subscriber group.

The call processing digit translator of the present invention is preferably implemented in various computer executable code modules, or application programming interfaces, maintained with the unified access switch **10** of the present invention. Two data tables are accessed by the prefix translation of the present invention.

A digit fence table contains data to characterize the dialed number. The digit fence table includes a fence index field for identifying various records therein. A digit prefix table contains a list of prefixes each having an associated digit fence table index. These two tables are used, in conjunction with one another, to recognize and separate any special prefixes, for example prefixes used for designating an invocation of public features, to determine the called party number. The digit fence table and the digit prefix table are collectively utilized to determine the general nature of the called number and resolve any ambiguously dialed number as well.

A prefix translation module, or prefix translation API, provides initial call screening and digit manipulation by accessing the digit fence table and a profile associated with the calling originator. The dialed digit prefix may be classified according to various defined prefixes, for example a standard prefix such as *, 101, 0, 1, etc., a directory prefix number, an international number, etc. By using two tables to specify the prefix and identify the call type, two distinct advantages are realized. Multiple, identical prefixes entered

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