UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FIRST DATA CORPORATION

Petitioner

v.

CARDSOFT INTERNATIONAL PTY LIMITED

Patent Owner

U.S. Patent No. 6,934,945

Filing Date: October 22, 1999

Issue Date: August 23, 2005

Title: METHOD AND APPARATUS FOR CONTROLLING COMMUNICATIONS

Inter Partes Review No. Unassigned

DECLARATION OF STEPHEN GRAY

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I, Stephen Gray, declare as follows:

I. INTRODUCTION

1. I have been retained by First Data Corporation ("First Data" or "Petitioner") as an independent expert consultant in this proceeding before the United States Patent and Trademark Office.

2. I am being compensated at a rate of $405/hour for my work.

3. My compensation is in no way contingent on the nature of my findings, the presentation of my findings in testimony, or the outcome of any proceeding.

4. I understand that this proceeding involves U.S. Patent No. 6,934,945 ("the '945 patent"). The application for the '945 patent was filed on October 22, 1999, as U.S. Patent Application No. 09/381,143 ("the '143 application") with priority to a PCT filed March 16, 1998. The '143 application issued as the '945 patent on August 23, 2005.

5. I have been asked to consider whether certain references disclose or suggest the features recited in the claims of the '945 patent. My opinions are set forth below.

II. QUALIFICATIONS

6. I am an independent consultant. All of my opinions stated in this declaration are based on my own personal knowledge and professional judgment. In forming my opinions, I have relied on my knowledge and experience in designing, developing, and deploying digital image processing systems, distributed client/server systems, graphical user interfaces, and website platforms, and e-commerce systems, and on the documents and information referenced in this declaration.

7. I am over 18 years of age and, if I am called upon to do so, I would be competent to testify as to the matters set forth herein. I have attached to this declaration a copy of my

current curriculum vitae, which details my education and experience, and a list of all other cases during the previous four years in which I testified as an expert at trial or by deposition. The following provides an overview of some of my experience that is relevant to the matters set forth in this declaration.

8. I graduated from California Polytechnic University in 1973 with a Bachelor's Degree in Economics.

9. Since the mid-1970s, I have designed, developed, and deployed distributed computing systems and products that operate in distributed computing environments, including image processing systems. As such, I have acquired expertise and am an expert in the areas of distributed computing architecture and design, graphical user interfaces, website platforms, eCommerce systems, image processing systems, operating systems, local area and wide area networks, and various programming languages used in the development of those systems and products. I have been employed by or retained as a consultant, including acting as a litigation consultant, for numerous companies such as Burroughs, Filenet, Fujitsu, Marriott Corporation, MCI, Northern Telecom, Olivetti, TRW, and Xerox, as well as other companies.

10. As a consultant to TRW Financial Systems (TFS) in the late 1980s and early 1990s, I worked on several projects that performed various aspects of image-assisted item processing. I worked on a joint project with TFS and IBM to develop a distributed remote item processing system using IBM components including Check Processing Control System (CPCS), High Performance Transaction Systems (HPTS), CIMS, and others. Also I led the design of a high performance, LAN-based image capture and statement printing subsystem using IBM system components including CPCS, Multiple Virtual Storage/Enterprise Systems Architecture (MVS/ESA) and DB2 relational database for TFS. Finally, I led the design of an image assisted,

remittance processing system using IBM system components such as CPCS, MVS/ESA and Sybase relational database in a client/server architecture for TFS.

11. I have developed and presented numerous public and in-house courses in computer system technology, including courses relating to applications for IBM MVS, UNIX, Linux, IBM OS/2, Microsoft Windows, and related networking technologies. I have lectured on distributed image processing in numerous publicly offered training sessions oriented to engineers interested in maintaining their professional credentials with continuing education units.

12. As my curriculum vitae shows, much of my career has been spent as a software development professional. As a software development professional, I have had numerous occasions to write, modify, analyze, and otherwise review bodies of source code. I have analyzed source code written in several variants of C, SQL, COBOL, RPG, variants of Basic, Java, Perl, several Assembler languages, and others. For example, as an individual contributor at Xerox during the mid-1980s to 1990, I evaluated the quality of source code from third party software providers for possible inclusion in the Xerox product line. Also, as another example, I evaluated the source code of several application software packages for completeness and maintainability for possible inclusion into the NTN product line in 2000-2001. During my early career, I spent time maintaining source code written by others. In each of these assignments, I analyzed the source code to identify the data structures, logical flow, algorithms and other aspects.

13. In addition, on several occasions, I have served as an expert witness where source code analysis was required to render an opinion. These matters include Autobytel v. Dealix; NetRatings v. Coremetrics, et al.; Ampex v. Kodak, et al.; AB Cellular v. City of Los Angeles;

Oracle v. Mangosoft; Harrah's Casino v. Station's Casino; Autobytel v. Dealix; MediaTek v. Sanyo; MathWorks v. Comsol; and other matters still pending.

14. Also, I have served as an expert witness where operating system technology was an issue in the matter. These matters include SuperSpeed v. IBM; FedEx v. U.S.; MathWorks v. Comsol; Ametron-American Electronic Supply v. Entin, et al; BMC Software v. Peregrine Systems, Inc.; and ADV Freeman v. Boole & Babbage.

15. I was retained as an expert witness by US Bank in the DataTreasury v. Wells Fargo et al. litigation and testified during that litigation.

III. MATERIALS REVIEWED

16. In forming my opinions, I have reviewed the '945 patent and its file history, as well as the following documents:

Exhibit No.	Description
1001	Ogilvy U.S. Patent No. 6,934,945 (the "'945 Patent,")
1002	EMV '96, Integrated Circuit Card Terminal Specification for Payment Systems, Version 3.0, June 30, 1996 (EMV '96) 102(b) prior art
1004	OMNI 300 Series Terminal, Programmer's Manual, Volume 1 and Volume 2 ("OMNI 300"), 102(b) prior art)
1005	Custy US Pat. No. 5,774,879, assigned to First Data ("First Data '879 Patent") 102(e) prior art
1008	Claim Construction Order in Cardsoft, Inc., et al. v. Verifone Holdings, Inc., et al., case no. 2:08-CV-98-CE
1010	Europay Open Terminal Architecture – A Forth-based Token System for Payment Terminals ("OTA") 102(b) prior art

17. All of the opinions contained in this declaration are based on the documents I reviewed and my knowledge and professional judgment. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art would have understood the claims of the '945 patent at the time of the alleged invention, which I have been asked to initially consider as March 16, 1998, the PCT filing date of the '143 application, and earlier.

IV. LEGAL STANDARDS

18. For purposes of this declaration, I have been asked to opine only on issues regarding 35 U.S.C. §§ 102 and 103. I have been informed of the following legal standards, which I have applied in forming my opinions.

19. I have been advised that a claim is invalid under 35 U.S.C. § 102 when a single prior art reference discloses all of the subject matter of the claim, and the claim is said to be "anticipated by the prior art."

20. I have been advised that a patent claim may be invalid as obvious under 35 U.S.C. § 103 if the differences between the subject matter patented and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. I have also been advised that several factual inquiries underlie a determination of obviousness. These inquiries include (1) the scope and content of the prior art, (2) the level of ordinary skill in the field of the invention, (3) the differences between the claimed invention and the prior art, and (4) any objective evidence of non-obviousness.

21. I also have been advised that the law requires a "common sense" approach of examining whether the claimed invention would have been obvious to a person skilled in the art. For example, I have been advised that combining familiar elements according to known methods

and in a predictable way is likely to suggest obviousness when such a combination would yield predictable results.

V. PERSON OF ORDINARY SKILL IN THE ART

22. In my opinion, the art relevant to the '945 patent relates to controlling remote payment transactions over a distributed network.

23. I have been advised that "a person of ordinary skill in the art in the relevant field" is a hypothetical person to whom one could assign a routine task in the relevant field (e.g., the field of networking or software for business or financial activities) with reasonable confidence that the task would be successfully carried out.

24. I was asked to give an opinion as to the level of one of ordinary skill in the art pertinent to the subject matter set forth in the '945 patent at the time of the invention.

25. I am familiar with the level of experience required of a person of ordinary skill in the art to be able to understand, make, and use the technology presented in the '945 patent. In my opinion, a person of ordinary skill in the art would be someone with a degree in Management Information Systems, Computer Science, or Electrical Engineering, or equivalent professional system development experience, plus two years of work experience with payment systems and computer networking. It is my opinion that work experience would substitute for formal education and that additional formal education, such as graduate studies, could substitute for work experience.

26. The basis for my familiarity with the level of ordinary skill is my interaction with large numbers of workers in the computing field who were at this level of skill as well as my own professional experience in the pertinent field. The pertinent art was the configuration and arrangement of commercially available computer components, networks, systems, and software

to satisfy particular customer payment system specifications, together with such programming as might be necessary to tie the components together to operate in the desired manner.

27. In reaching this opinion as to the hypothetical person of ordinary skill in the art, I have considered the types of problems encountered in the art, the prior art solutions to those problems, the rapidity with which innovations are made, the sophistication of the technology, and the educational level and professional capabilities of workers in the field.

VI. OVERVIEW OF THE '945 PATENT

28. The '945 patent is entitled "METHOD AND APPARATUS FOR CONTROLLING COMMUNICATIONS" and issued to Ian Charles Ogilivy on August 23, 2005. (Ex. 1001). The application that resulted in the '945 patent was filed on March 16, 1998 as Appl. No.: 09/381,143. There are seventeen claims in the '945. Claims 1, 12 and 14 are the independent claims.

29. The '945 Patent is directed to "preparing and processing information to be communicated via a network" using a "virtual machine" (see Abstract). The main embodiment discussed is a POS device for payment transactions using credit cards.

30. Figure 2 is a schematic that illustrates the architecture of the purported invention:

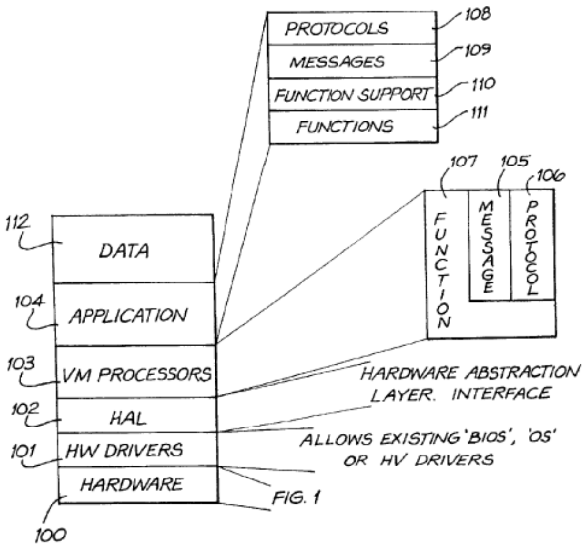


FIG. 2

31. The patent describes the "virtual machine" as containing two separate virtual processors 103, (1) a "virtual function processor" 107 for controlling operation of the device, including calling (2) a "virtual message processor" 105 to carry out "message handling tasks." The message handling tasks include such things as receiving the input card number, PIN, etc. and transmitting them to a remote financial institution for authorization. The use of dual virtual processors is a common technique in computer operating systems of having different modules or subroutines for different tasks.

32. According to the '945 specification, the application of the concept of a virtual machine is not inventive: "The technique of creating a virtual processor (or in this case microprocessor) is well known and referred to as an interpreter" ('945 Patent, col. 3, ll 34-36). The '945 specification describes the "virtual machine" as being emulatable on different hardware platforms but, again, the specification states that the use of emulations is well understood prior art. Cardsoft '945 Patent, col. 3, 34-36.

33. However, the '945 specification claims that the specific embodiment of the virtual machine emulation is done in "native code" which is claimed to be inventive. Since "emulatable" logically means the code implementing the virtual machine can be rewritten to run on different machines, any code would satisfy this:

> A virtual machine is computer programmed to emulate a hypothetical computer. Different incompatible computers may be programmed to emulate the same hypothetical computer.
>
> ('945 Patent, col. 3, ll. 40-43).

34. It should be noted that the use of "native code" is not required in the independent claims as discussed under claim construction below.

35. Some of the dependent claims are directed to various combinations of different modules being in native code (e.g., claim 3 claims a protocol processor in native code; claim 5 claims a message processor in native code; claim 6 claims a function processor in native code). These are all shown by prior art where all modules are in native code.

VII. CLAIM CONSTRUCTION

36. In preparing this declaration, I was asked to consider the meaning that certain claim terms would have had to those of ordinary skill in the art. I understand that, for each claim term construed, I should use the broadest reasonable interpretation that would have been understood by one of ordinary skill in the art reading the specification of the '945 patent at the time of the patent filings.

37. I understand that the standard for claim construction at the United States Patent and Trademark Office is different from the standard used in United States District Courts. I understand that a U.S. District Court interprets claim terms based on the plain and ordinary

meaning. I understand also that the United States Patent and Trademark Office interprets claim terms based on the broadest reasonable interpretation.

38. I understand that the broadest reasonable interpretation may be broader in scope than the plain and ordinary meaning. Accordingly, I understand that the United States Patent and Trademark Office may adopt a different construction from a district court when the broadest reasonable interpretation is different from the plain and ordinary meaning. The table below defines the meaning of terms used in this declaration:

Claim Term	Adopted or Proposed Meaning
virtual function processor	software which controls and/or selects general operations of a communication device
function processor instructions	a set of instructions that control operation of the communications device
virtual message processor	software that processes messages, including assembling, disassembling and/or comparing messages, for communication to and/or from a communications device
virtual machine means	not construed as means plus function language
protocol processor means	not construed as means plus function language
emulatable in different computers having incompatible hardware or operating systems	the code can be rewritten to run on otherwise incompatible hardware
protocol processor instruction means	instructions for the protocol processor
message instruction means	the function is: providing directions for operation of the

	virtual message processor; the structure is: 13:29-14:2; 15:23-34; Figure 11 and Figure 8, and equivalents thereof.
processing means	processor

39. I note that the meanings for several of the terms stated above are the same as those definitions found in the claim construction order from Cardsoft v. Verifone (Ex. 1008). Any proposed differences between the claims construed in the Cardsoft v. Verifone matter and those proposed above are discussed below.

40. The term *virtual message processor* was construed by the court in the Cardsoft v. Verifone matter to mean "software implemented in the native code of the communications device that processes messages, including assembling, disassembling and/or comparing messages, for communication to and/or from a communications device." First Data has proposed that the words "implementation in the native code of the communication device" be eliminated from this construction. The term "native code" does not appear in claim 1 with this language, but does appear in dependent claim 5, which recites the native code of the processor. There would be no difference between the native code of the processor and native code of the device. The doctrine of claim differentiation would thus suggest that the claim 1 language is broader under the IPR standard of "broadest reasonable interpretation." I have considered First Data's proposal and agree with the change to the definition of the term *virtual message processor* for the purposes of this declaration.

41. The term *emulatable in different computers having incompatible hardware or operating systems* was construed by the court in the Cardsoft v. Verifone matter to mean

"capable of executing programs on different computers having incompatible hardware or operating systems." *See '945 Patent at 3:43-46 ("Any computer programmed to emulate the hypothetical computer will thus be capable of executing programs for the virtual computer.")* First Data has proposed that the term "emulatable" means that the code can be rewritten to run on otherwise incompatible hardware, and thus would cover any code under a broadest reasonable construction. The patent says "the virtual machine processors are constructed using C" ('945 patent 11:10-11) in the preferred embodiment,C is a popular source code language that multiple application programs can be written in. I have considered First Data's proposal and agree with the change to the definition of the term *emulatable in different computers having incompatible hardware or operating systems* for the purposes of this declaration.

VIII. PRIOR ART CONSIDERED

42. 1. EMV '96, Integrated Circuit Card Terminal Specification for Payment Systems, Version 3.0, June 30, 1996 (EMV '96) 102(b) prior art. This is a specification by EMV (Europay, MasterCard & Visa) for terminals that accept integrated circuit cards (smart cards with chips, as opposed to mag stripe cards). It describes a virtual machine instruction set to allow terminals to emulate a virtual machine.

43. 2. OMNI 300 Series Terminal, Programmer's Manual, Volume 1 and Volume 2 ("OMNI 300"), 102(b) prior art). This manual was provided with the 300 series terminals and includes description of the message assembling, disassembling and comparison functions.

44. 3. Custy US Pat. No. 5,774,879, assigned to First Data ("First Data '879 Patent") 102(e) prior art. This is a patent of the petitioner that describes dividing the software for a terminal into a virtual execution control processor (the claimed function processor) and a virtual communication processor (the claimed message processor).

45. 4. Europay Open Terminal Architecture – A Forth-based Token System for Payment Terminals ("OTA") 102(b) prior art. This 1996 paper was presented at the June 19-22, 1996 Rochester Forth Conference - Open Systems, in Toronto Canada. It describes prototypes exhibited and used for 4060 transactions at an Europay Members meeting in Seville, Spain June 5-7, 1996 (see Ex. __, p. 29). The paper describes a "virtual machine" with a "kernel" having functions that "can be run on any [POS] terminal" in "native code." The functions include "message management" (the claimed virtual message processor).

IX. APPLICATION OF THE PRIOR ART TO THE CLAIMS

46. It is my opinion that claims 1 to 17 of the '945 patent are anticipated by EMV '96. Details regarding my analysis and opinion are found in Exhibit A to this declaration.

47. It is my opinion that claims 1 to 17 of the '945 patent are obvious over EMV '96 in view of OMNI 300. Details regarding my analysis and opinion are found in Exhibit A to this declaration.

48. It is my opinion that claims 1 to 17 of the '945 patent are obvious over EMV '96 in view of OTA, OMNI 300 and First Data's '879 Patent. Details regarding my analysis and opinion are found in Exhibit A to this declaration.

X. MOTIVATION TO COMBINE REFERENCES

49. EMV '96 and OMNI 300. OMNI 300 describes software for mag stripe POS terminals using Verifone's TXO operating system with source code in the standard C language. EMV '96 provides standards for terminals reading integrated circuit cards (ICCs). EMV '96 basically describes desired upgrades for mag stripe terminals, such as the OMNI 300 series, to support ICC cards. EMV '96 states "This specification provides the requirements necessary to support the implementation of ICCs. These requirements are in addition to those already defined

by individual payment systems and acquirers for terminals that accept magnetic stripe cards." (p. vii). Both EMV '96 and OMNI 300 are directed to POS devices and one of skill in the art looking at updating the OMNI 300 in 1998 would want to make sure it complied with EMV '96, the de facto industry standard.

50. EMV '96, OTA, OMNI 300 and First Data '879. It would be obvious to combine these references because all relate to POS terminals. In 1998, it would have been obvious to a person looking to improve EMV '96 to incorporate aspects of OTA because both documents are directed to point of service (POS) terminals, both relate to ICC readers, and both relate to Europay terminals. The OTA title refers to Europay, the E in EMV '96. The First Data '879 Patent describes a virtual processor with virtual processor modules for a POS terminal, and thus would be obvious to combine with the virtual machines of EMV '96 and OTA. Both deal with virtual processors for such devices. EMV '96 and the First Data '879 Patent disclose financial processing systems that are intended to be portable among various software and hardware platforms (see First Data '879 col. 2, lines 43-45), and thus are not just related POS subject matter, but are both directed to the same "emulation" concept. The First Data '879 Patent would show one of skill in the art the division of the virtual machine into different modules, to provide a robust implementation of the EMV and OTA systems. The OMNI 300 would need to comply with the EMV and OTA industry standards as described in paragraph 52 above. OMNI 300 would provide one of skill in the art with the details of message processing that would need to be accomplished by a virtual machine as described in EMV and OTA, and to implement a virtual communication processor as described in the First Data '879 Patent.

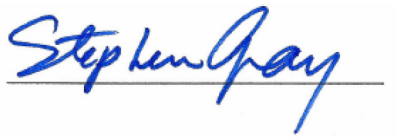
XI. CONCLUSION

51. In summary, as set forth in this declaration and in the attached exhibits, it is my opinion that all of the features recited in claims 1-17 of the '945 patent are invalid as anticipated or obvious to a person of ordinary skill in the art at the time of the invention.

52. In signing this declaration, I understand that the declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

53. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: April 30, 2014



66242189V.1

EXHIBIT A

Claim Charts

Preamble. The preamble simply refers to admitted prior art. Further, EMV '96 – Integrated Circuit Card Terminal Specification for Payment Systems ("EMV '96") and Europay Open Terminal Architecture – A Forth-based Token System for Payment Terminals ("OTA") both refer to the use of a virtual machine being implemented.

The '945 Patent	
1. A communication device which is arranged to process messages for communications, comprising a virtual machine means which includes	**EMV '96** A point-of-service terminal which communicates with a host via messages is presented: "This specification applies to all terminals operating in attended or unattended environments, having offline or online capabilities, and supporting transaction types such as purchase of goods, services, and cash. Terminals include but are not limited to automated teller machines (ATMs), branch terminals, cardholder-activated terminals, electronic cash registers, personal computers, and point of service (POS) terminals." *EMV '96*, at p. vii, ¶2. "An interpreter implementation defines a single software kernel, common across multiple terminal types. This kernel creates a virtual machine …." *Id.*, at §1.4.1, pp. II-3–II-4. **The '945 Patent – Admitted Prior Art** "The technique of creating a virtual processor (or in this case microprocessor) is well known and referred to as an interpreter. This allows programs to operate independent of processor. With the newer technique of also creating virtual peripherals then the whole is referred to as a 'virtual machine'." *The '945 Patent*, col. 3, ll. 34-39.

	OTA "The hardware environments include . . . a target which is some form of payment terminal." *OTA*, p. 73, ¶3. "Such payment terminals are used for communication: "In the embedded systems for which OTA is targeted, system functions cover not only OTA functions such as communications . . . ." *Id*. at p. 75, ¶8. "A virtual machine is used on OTA terminals by implementing code that controls the device**:** **"**OTA terminal code is based on a single virtual machine which is emulated on the actual devices." *Id*., at p. 74, ¶3. "The software in every OTA terminal is written in terms of a common virtual machine." Id., at p. 74, ¶4.

Element A. The first element of the '945 Patent is directed to a virtual function processor that includes instructions for controlling operating of the communication device. The concept of using a virtual machine that includes instructions for controlling operation of a device is taught by EMV '96. EMV'96 describes "a theoretical microprocessor" which is the claimed "virtual function processor." A "virtual processor" is actually redundant with a "virtual machine," since the processor is what necessarily runs the machine. In EMV '96, a virtual processor interprets instructions and allows a point of service terminal to be controlled based on such instructions. Further, OTA indicates that a virtual machine may be implemented in the form of software on an OTA terminal.

[A] a virtual function processor	**EMV '96** "In the case of an interpreter capability, these

and function processor instructions for controlling operation of the device, and	modules will be code, written in a virtual machine instruction set implemented within the terminal, to be interpreted by the terminal control program." *EMV '96*, at §1.2, p. II-2 (emphasis added). "An interpreter implementation defines a single software kernel, common across multiple terminal types. This kernel creates a virtual machine that may be implemented on each CPU type and that provides drivers for the terminal's input/output (I/O) and all low-level CPU-specific logical and arithmetic functions. High-level libraries, terminal programs and payment applications using standard kernel functions may be developed and certified once; thereafter, they will run on any conforming terminal implementing the same virtual machine without change. Therefore, a significant consequence of an interpreter is a simplified and uniform set of test and certification procedures for all terminal functions." *Id.*, at §1.4.1, pp. II-3–II-4. "The application software in every terminal using the interpreter approach is written in terms of a common virtual machine. The virtual machine is a theoretical microprocessor with standard characteristics that define such things as addressing mode, registers, address space, etc." *Id.*, at §1.4.2, p. II-4 (emphasis added). "Virtual machine emulation may be accomplished by one of three methods: interpreting virtual machine instructions, translating the virtual machine language into a directly executable 'threaded code' form, or translating it into actual code for the target CPU." *Id.*, at §1.4.4, p. II-5. "Programs may be converted to an intermediate language, between the high level source language used by the programmer and the low-level machine code required by the microprocessor, and subsequently transported to the target terminal to be processed by the terminal into an executable form." *Id.*, at §1.4.4, p. II-5.

	OTA "The software in every OTA terminal is written in terms of a common virtual machine. This is a theoretical 32-bit microprocessor with standard characteristics defining addressing modes, stack usage, register usage, address space, etc. The kernel for each particular CPU type is written to make that processor emulate the virtual machine." *Id.*, at p. 74, ¶4. "Virtual machine emulation may be accomplished by one of three methods: interpreting token representing VM instructions (like Java), translating these token into a directly executable 'threaded code' form (like Open Firmware), or translating them into actual code for the target CPU. The latter two methods offer improved performance at a modest cost in added target complexity." *Id.*, at p. 74, ¶5.

Element B. This element of the '945 Patent is directed to having stored instructions on the communication device that describe message data. POS devices have the ability to interpret received messages and compose messages for transmission. Therefore, POS devices necessarily have stored instructions that describe the format of such messages such that received messages can be understood and messages can be sent that will be understandable to the recipient device. On point, the POS device of EMV '96 creates messages to be sent (e.g., to a host system) and interprets received messages (e.g., from the host system). EMV '96 explicitly states that the ISO 8583 standard, which defines how messages for financial card transactions are composed, is used by the device of EMV '96.

OMNI 300 explicitly defines how data packets that are exchanged as messages on a network are defined. Since these message definitions are used by the device, the device necessarily has a stored description of such messages.

OTA indicates that the I/O of the terminal may be tested. This testing involves a download to the target terminal from another system, such as a PC host. Such a download would involve the reception of messages by the terminal. In order to receive and interpret such messages, a description of at least the formatting of such messages would need to be stored by the terminal. Further, I/O of a payment terminal necessarily includes messages being transmitted because payment terminals rely on the ability to communicate with a host system to conduct transactions.

[B] message induction [sic - instruction] means including a set of descriptions of message data:	**EMV '96** "Messages typically flow from the terminal to the acquirer and from the acquirer to the issuer." *Id.*, at §2.1, III-6. "The data transmitted in messages as defined in ISO 8583:1987 and bit 55 from ISO 8583:1993 . . . ." *EMV '96*, at p. D-1. **OMNI 300** The arrangement of data within packets for transmission via a network is defined:

LAN messages are exchanged on the LAN using a data packet, which consists of an 18-byte header, 0 to 1500 bytes of binary data and a 2-byte checksum. The packet header is defined as `struct packet_header` in `<lan.h>`.

Control	Name	Label (<lan.h>)	Range	Size (bytes)
ignored	Source address	src_reserved	—	1
ignored		src_net	—	1
ignored		src_socket	—	1
firmware		src_addr	1 – 32	1
ignored	Destination address	dst_reserved	—	1
ignored		dst_net	—	1
ignored		dst_socket	—	1
application		dst_addr	1 – 32, 254	1
firmware/ application	Sequence number	tx_seq	0 – 0xFFFFFFFF	4
ignored	Protocol	protocol	—	2
application	Application message type	app_type	app.-defined	1
firmware/ application	Message type	type	0x0000–0x0082	1
firmware	Data length	dg_length	0 – 1500	2
application	Data	—	binary data	< 1500
firmware	CRC-16	—	0 – 0xFFFF	2

OMNI 300, p. 10-4.

Data Packet Fields

This section describes the fields within a data packet that are used by the firmware or the application.

Source Address—Byte #4

Identifies terminal sending the packet.

Defined as `unsigned char src_addr;`

Range of values: 1 – 32

❖ *The first three bytes in the source address field are not currently used and are reserved for future use. The value of* `src_addr` *is obtained from the* `*LAD` *entry in the CONFIG.SYS file.*

Destination Address—Byte #8

Identifies terminal to receive packet or specifies a send to all terminals—BROADCAST.

Defined as `unsigned char dst_addr;`

Range of values: 1 – 32, 254 = BROADCAST

❖ *The first three bytes of the destination address field are not currently used and are reserved for future use. The value of this field is controlled by the application.*

❖ *If* `dst_addr` *is set to 254, the packet is sent to all terminals on the LAN (BROADCAST type message). Although all terminals receive the broadcast destination packets, they do not need to send any acknowledgment (ACK or NAK) to the packet.*

Id., at p. 10-5 (excerpt of packet definition).

	OTA "For final testing using the terminal's own kernel and I/O, these programs would be tokenized (see discussion below) and downloaded to the target terminal." *OTA*, p. 74.

Element C. This element of the '945 Patent is directed to handling the assembly, disassembly, and comparison of messages in accordance with the message definitions of element **[B]**. These functions are performed by a software module that is called by the software module of element **[A]**. Assembly of a message can be understood as creating a message for transmission to another device. Disassembly of a message can be understood as extracting data from a message received from another device. Comparison of a message can be understood as analyzing an "incoming message against the description specified by the message instruction means . . . ." *Ogilvy '945 patent*, col. 16, ll. 58-63. Therefore, a received message is checked against the descriptions of element **[B]**.

EMV '96 discloses such reception, transmission, and comparison of messages. Such handling of messages would be invoked by instructions executed by the virtual machine of the terminal. For instance, EMV '96 notes that a transaction message may be used when online data capture is being used. The terminal is further configured to receive a message that is a transaction response and transmit results in a message. Therefore, for such transmission and reception