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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G07F 19/00, G06F 17/60

A2

(11) International Publication Number: WO 98/13796

(43) International Publication Date: 2 April 1998 (02.04.98)

(21) International Application Number: PCT/US97/17377

(22) International Filing Date: 26 September 1997 (26.09.97)

(30) Priority Data:
08/721,167 26 September 1996 (26.09.96) US

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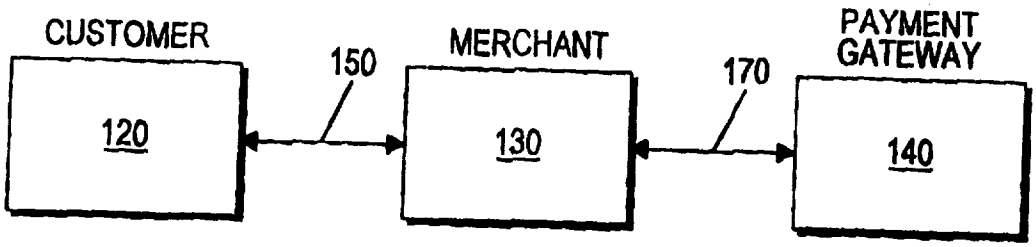
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), 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
Without international search report and to be republished upon receipt of that report.

(54) Title: A SYSTEM, METHOD AND ARTICLE OF MANUFACTURE FOR A GATEWAY SYSTEM ARCHITECTURE WITH SYSTEM ADMINISTRATION INFORMATION ACCESSIBLE FROM A BROWSER



(57) Abstract

Secure transmission of data is provided between a plurality of computer systems over a public communication system, such as the Internet. Secure transmission of data is provided from a customer computer system to a merchant computer system, and for the further secure transmission of payment information from the merchant computer system to a payment gateway computer system. The payment gateway system receives encrypted payment requests from merchants, as HTTP POST messages via the Internet. The gateway then unwraps and decrypts the requests, authenticates digital signatures of the requests based on certificates, supports transaction types and card types as required by a financial institution, and accepts concurrent VPOS transactions from each of the merchant servers. Then, the gateway converts transaction data to host–specific formats and forwards the mapped requests to the host processor using the existing financial network. The gateway system architecture includes support for standard Internet access routines which facilitate access to system administration information from a commercial web browser.

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A SYSTEM, METHOD AND ARTICLE OF MANUFACTURE FOR A GATEWAY SYSTEM ARCHITECTURE WITH SYSTEM ADMINISTRATION INFORMATION ACCESSIBLE FROM A BROWSER

Field Of The Invention

The present invention relates to the secure, electronic payment in exchange for goods and services purchased over a communication network, and more specifically, to a system, method and article of manufacture for securely transmitting payment information from a customer to a merchant to a payment gateway and returning a certification, including a credit confidence factor to allow a merchant to determine whether to accept or reject payment information utilizing a flexible, extensible architecture.

The present invention relates to an electronic graphical representation of a monetary system for implementing electronic money payments as an alternative medium of economic exchange to cash, checks, credit and debit cards, and electronic funds transfer. The Electronic-Monetary System is a hybrid of currency, check, card payment systems, and electronic funds transfer systems, possessing many of the benefits of these systems with few of their limitations. The system utilizes electronic representations of money which are designed to be universally accepted and exchanged as economic value by subscribers of the monetary system.

Today, approximately 350 billion coin and currency transactions occur between individuals and institutions every year. The extensive use of coin and currency transactions has limited the automation of individual transactions such as purchases, fares, and bank account deposits and withdrawals. Individual cash transactions are burdened by the need to have the correct amount of cash or providing change therefor. Furthermore, the handling and managing of paper cash and coins is inconvenient, costly and time consuming for both individuals and financial institutions.

Although checks may be written for any specific amount up to the amount available in the account, checks have very limited transferability and must be supplied from a physical inventory. Paper-based checking systems do not offer sufficient relief from the limitations of

cash transactions, sharing many of the inconveniences of handling currency while adding the inherent delays associated with processing checks. To this end, economic exchange has striven for greater convenience at a lower cost, while also seeking improved security.

Automation has achieved some of these qualities for large transactions through computerized electronic funds transfer ("EFT") systems. Electronic funds transfer is essentially a process of value exchange achieved through the banking system's centralized computer transactions. EFT services are a transfer of payments utilizing electronic "checks," which are used primarily by large commercial organizations.

The Clearing House (ACH) where a user can enter a pre-authorized code and download information with billing occurring later, and a Point Of Sale (POS) system where a transaction is processed by connecting with a central computer for authorization for the transaction granted or denied immediately are examples of EFT systems that are utilized by retail and commercial organizations. However, the payments made through these types of EFT systems are limited in that they cannot be performed without the banking system. Moreover, ACH transactions usually cannot be performed during off business hours.

Home Banking bill payment services are examples of an EFT system used by individuals to make payments from a home computer. Currently, home banking initiatives have found few customers. Of the banks that have offered services for payments, account transfers and information over the telephone lines using personal computers, less than one percent of the bank's customers are using the service. One reason that Home Banking has not been a successful product is because the customer cannot deposit and withdraw money as needed in this type of system.

Current EFT systems, credit cards, or debit cards, which are used in conjunction with an on-line system to transfer money between accounts, such as between the account of a merchant and that of a customer, cannot satisfy the need for an automated transaction system providing an ergonomic interface. Examples of EFT systems which provide non-ergonomic interfaces are disclosed in US Patents Numbers 5,476,259; 5,459,304; 5,452,352; 5,448,045; 5,478,993; 5,455,407; 5,453,601; 5,465,291; and 5,485,510.

To implement an automated, convenient transaction that can dispense some form of economic value, there has been a trend towards off-line payments. For example, numerous ideas have been proposed for some form of "electronic money" that can be used in cashless payment transactions as alternatives to the traditional currency and check types of payment systems. See U.S. Pat. No. 4,977,595, entitled "METHOD AND APPARATUS FOR IMPLEMENTING ELECTRONIC CASH," and U.S. Pat. No. 4,305,059, entitled "MODULAR FUNDS TRANSFER SYSTEM."

The more well known techniques include magnetic stripe cards purchased for a given amount and from which a prepaid value can be deducted for specific purposes. Upon exhaustion of the economic value, the cards are thrown away. Other examples include memory cards or so called smart cards which are capable of repetitively storing information representing value that is likewise deducted for specific purposes.

It is desirable for a computer operated under the control of a merchant to obtain information offered by a customer and transmitted by a computer operating under the control of the customer over a publicly accessible packet-switched network (e.g., the Internet) to the computer operating under the control of the merchant, without risking the exposure of the information to interception by third parties that have access to the network, and to assure that the information is from an authentic source. It is further desirable for the merchant to transmit information, including a subset of the information provided by the customer, over such a network to a payment gateway computer system that is designated, by a bank or other financial institution that has the responsibility of providing payment on behalf of the customer, to authorize a commercial transaction on behalf of such a financial institution, without the risk of exposing that information to interception by third parties. Such institutions include, for example, financial institutions offering credit or debit card services.

One such attempt to provide such a secure transmission channel is a secure payment technology such as Secure Electronic Transaction (hereinafter "SET"), jointly developed by the Visa and MasterCard card associations, and described in Visa and MasterCard's *Secure Electronic Transaction (SET) Specification*, February 23, 1996, hereby incorporated by reference. Other such secure payment technologies include Secure Transaction Technology ("STT"), Secure Electronic Payments Protocol ("SEPP"), Internet Keyed Payments ("iKP"), Net Trust, and

Cybercash Credit Payment Protocol. One of ordinary skill in the art readily comprehends that any of the secure payment technologies can be substituted for the SET protocol without undue experimentation. Such secure payment technologies require the customer to operate software that is compliant with the secure payment technology, interacting with third-party certification authorities, thereby allowing the customer to transmit encoded information to a merchant, some of which may be decoded by the merchant, and some which can be decoded only by a payment gateway specified by the customer.

Another such attempt to provide such a secure transmission channel is a general-purpose secure communication protocol such as Netscape, Inc.'s Secure Sockets Layer (hereinafter "SSL") , as described in Freier, Karlton & Kocher (hereinafter "Freier"), *The SSL Protocol Version 3.0*, March 1996, and hereby incorporated by reference. SSL provides a means for secure transmission between two computers. SSL has the advantage that it does not require special-purpose software to be installed on the customer's computer because it is already incorporated into widely available software that many people utilize as their standard Internet access medium, and does not require that the customer interact with any third-party certification authority. Instead, the support for SSL may be incorporated into software already in use by the customer, e.g., the Netscape Navigator World Wide Web browsing tool. However, although a computer on an SSL connection may initiate a second SSL connection to another computer, a drawback to the SSL approach is each SSL connection supports only a two-computer connection. Therefore, SSL does not provide a mechanism for transmitting encoded information to a merchant for retransmission to a payment gateway such that a subset of the information is readable to the payment gateway but not to the merchant. Although SSL allows for robustly secure two-party data transmission, it does not meet the ultimate need of the electronic commerce market for robustly secure three-party data transmission. Other examples of general-purpose secure communication protocols include Private Communications Technology ("PCT") from Microsoft, Inc., Secure Hyper-Text Transport Protocol ("SHTTP") from Terisa Systems, Shen, Kerberos, Photuris, Pretty Good Privacy ("PGP") which meets the IPSEC criteria. One of ordinary skill in the art readily comprehends that any of the general-purpose secure communication protocols can be substituted for the SSL transmission protocol without undue experimentation.

Banks desire an Internet payment solution that emulates existing Point of Sale (POS) applications that are currently installed on their host computers, and require minimal changes to their host systems. This is a critical requirement since any downtime for a bank's host computer system represents an enormous expense. Currently, VeriFone supports over fourteen hundred different payment-related applications. The large number of applications is necessary to accommodate a wide variety of host message formats, diverse methods for communicating to a variety of hosts with different dial-up and direct-connect schemes, and different certification around the world. In addition, there are a wide variety of business processes that dictate how a Point of Sale (POS) terminal queries a user for data and subsequently displays the data. Also, various vertical market segments, such as hotels, car rental agencies, restaurants, retail sales, mail sales / telephone sales require interfaces for different types of data to be entered, and provide different discount rates to merchants for complying with various data types. Moreover, a plethora of report generation mechanisms and formats are utilized by merchants that banking organizations work with.

Banks are unwilling to converge on "standards" since convergence would facilitate switching from one acquiring bank to another by merchants. In general, banks desire to increase the cost that a merchant incurs in switching from one acquiring bank to another acquiring bank. This is accomplished by supplying a merchant with a terminal that only communicates utilizing the bank's proprietary protocol, and by providing other value-added services that a merchant may not be able to obtain at another bank.

Internet-based payment solutions require additional security measures that are not found in conventional POS terminals. This additional requirement is necessitated because Internet communication is done over publicly-accessible, unsecured communication line in stark contrast to the private, secure, dedicated phone or leased line service utilized between a traditional merchant and an acquiring bank. Thus, it is critical that any solution utilizing the Internet for a communication backbone, employ some form of cryptography.

As discussed above, the current state-of-the-art Internet based payment processing is a protocol referred to as SET. Since the SET messages are uniform across all implementations, banks cannot differentiate themselves in any reasonable way. Also, since SET is not a proper superset of all protocols utilized today, there are bank protocols which cannot be mapped or

translated into SET because they require data elements for which SET has no placeholder. Further, SET only handles the message types directly related to authorizing and capturing credit card transactions and adjustments to these authorizations or captures. In a typical POS terminal in the physical world, these messages comprise almost the entire volume of the total number of messages between the merchant and the authorizing bank, but only half of the total number of different message types. These message types, which are used infrequently, but which are critical to the operation of the POS terminal must be supported for proper transaction processing.

SUMMARY OF THE INVENTION

According to a broad aspect of a preferred embodiment of the invention, a server communicates bidirectionally with a gateway over a first communication link, over which all service requests are initiated by the server. Secure transmission of data is provided from a customer computer system to a merchant computer system, and for the further secure transmission of payment information regarding a payment instrument from the merchant computer system to a payment gateway computer system. The payment gateway system receives encrypted payment requests from merchants, as HTTP POST messages via the Internet. The gateway then unwraps and decrypts the requests, authenticates digital signatures of the requests based on certificates, supports transaction types and card types as required by a financial institution, and accepts concurrent VPOS transactions from each of the merchant servers. Then, the gateway converts transaction data to host-specific formats and forwards the mapped requests to the host processor using the existing financial network. The gateway system architecture includes support for standard Internet access routines which facilitate access to system administration information from a commercial web browser.

DESCRIPTION OF THE DRAWINGS

The foregoing and other objects, aspects and advantages are better understood from the following detailed description of a preferred embodiment of the invention with reference to the drawings, in which:

Figure **1A** is a block diagram of a representative hardware environment in accordance with a preferred embodiment;

Figure **1B** depicts an overview in accordance with a preferred embodiment;

Figure **1C** is a block diagram of the system in accordance with a preferred embodiment;

Figure **2** depicts a more detailed view of a customer computer system in communication with merchant system under the Secure Sockets Layer protocol in accordance with a preferred embodiment;

Figure **3** depicts an overview of the method of securely supplying payment information to a payment gateway in order to obtain payment authorization in accordance with a preferred embodiment;

Figure **4** depicts the detailed steps of generating and transmitting a payment authorization request in accordance with a preferred embodiment;

Figures **5A** through **5F** depict views of the payment authorization request and its component parts in accordance with a preferred embodiment;

Figures **6A** and **6B** depict the detailed steps of processing a payment authorization request and generating and transmitting a payment authorization request response in accordance with a preferred embodiment;

Figures **7A** through **7J** depict views of the payment authorization response and its component parts in accordance with a preferred embodiment;

Figure **8** depicts the detailed steps of processing a payment authorization response in accordance with a preferred embodiment;

Figure **9** depicts an overview of the method of securely supplying payment capture information to a payment gateway in accordance with a preferred embodiment;

Figure **10** depicts the detailed steps of generating and transmitting a payment capture request in accordance with a preferred embodiment;

Figures **11A** through **11F** depict views of the payment capture request and its component parts in accordance with a preferred embodiment;

Figures **12A** and **12B** depict the detailed steps of processing a payment capture request and generating and transmitting a payment capture request response in accordance with a preferred embodiment;

Figures **13A** through **13F** depict views of the payment capture response and its component parts in accordance with a preferred embodiment;

Figure **14** depicts the detailed steps of processing a payment capture response in accordance with a preferred embodiment;

Figure **15A** & **15B** depicts transaction processing of merchant and consumer transactions in accordance with a preferred embodiment;

Figure **16** illustrates a transaction class hierarchy block diagram in accordance with a preferred embodiment;

Figure **17** shows a typical message flow between the merchant, VPOS terminal and the Gateway in accordance with a preferred embodiment;

Figures **18A-E** are block diagrams of the extended SET architecture in accordance with a preferred embodiment;

Figure **19** is a flowchart of VPOS merchant pay customization in accordance with a preferred embodiment;

Figures **20A-20H** are block diagrams and flowcharts setting forth the detailed logic of thread processing in accordance with a preferred embodiment;

Figure **21** is a detailed diagram of a multithreaded gateway engine in accordance with a preferred embodiment;

Figure **22** is a flow diagram in accordance with a preferred embodiment;

Figure **23** illustrates a Gateway's role in a network in accordance with a preferred embodiment;

Figure **24** is a block diagram of the Gateway in accordance with a preferred embodiment;

Figure **25** is a block diagram of the VPOS Terminal Architecture in accordance with a preferred embodiment;

Figure **26** is an architecture block diagram in accordance with a preferred embodiment;

Figure **27** is a block diagram of the payment manager architecture in accordance with a preferred embodiment;

Figure **28** is a Consumer Payment Message Sequence Diagram in accordance with a preferred embodiment of the invention;

Figure **29** is an illustration of a certificate issuance form in accordance with a preferred embodiment;

Figure **30** illustrates a certificate issuance response in accordance with a preferred embodiment;

Figure **31** illustrates a collection of payment instrument holders in accordance with a preferred embodiment;

Figure **32** illustrates the default payment instrument bitmap in accordance with a preferred embodiment;

Figure **33** illustrates a selected payment instrument with a fill in the blanks for the cardholder in accordance with a preferred embodiment;

Figure **34** illustrates a coffee purchase utilizing the newly defined VISA card in accordance with a preferred embodiment of the invention;

Figure **35** is a flowchart of conditional authorization of payment in accordance with a preferred embodiment;

Figures **36-48** are screen displays in accordance with a preferred embodiment;

Figure **49** shows how the VPOS authenticates an incoming response to a request in accordance with a preferred embodiment;

Figure **50** is a flowchart for the merchant interaction with the Test Gateway in accordance with a preferred embodiment;

Figures **51-61** are flowcharts depicting the detailed logic of the gateway in accordance with a preferred embodiment;

Figure **62** is the main administration display for the Gateway in accordance with a preferred embodiment;

Figure **63** is a configuration panel in accordance with a preferred embodiment;

Figure **64** is a host communication display for facilitating communication between the gateway and the acquirer payment host in accordance with a preferred embodiment;

Figure **65** is a Services display in accordance with a preferred embodiment;

Figure **66** is a graphical representation of the gateway transaction database in accordance with a preferred embodiment;

Figure **67** illustrates the gateway hardware architecture in accordance with a preferred embodiment;

Figure **68** is a block diagram setting forth the gateway software architecture in accordance with a preferred embodiment; and

Figure **69** is a block diagram setting forth the gateway components and interfaces in accordance with a preferred embodiment.

DETAILED DESCRIPTION

A preferred embodiment of a system in accordance with the present invention is preferably practiced in the context of a personal computer such as the IBM PS/2, Apple Macintosh computer or UNIX based workstation. A representative hardware environment is depicted in Figure **1A**, which illustrates a typical hardware configuration of a workstation in accordance with a preferred embodiment having a central processing unit **10**, such as a microprocessor, and a number of other units interconnected via a system bus **12**. The workstation shown in Figure **1A** includes a Random Access Memory (RAM) **14**, Read Only Memory (ROM) **16**, an I/O adapter **18** for connecting peripheral devices such as disk storage units **20** to the bus **12**, a user interface adapter **22** for connecting a keyboard **24**, a mouse **26**, a speaker **28**, a microphone **32**, and/or other user interface devices such as a touch screen (not shown) to the bus **12**, communication adapter **34** for connecting the workstation to a communication network (e.g., a data processing network) and a display adapter **36** for connecting the bus **12** to a display device **38**. The workstation typically has resident thereon an operating system such as the Microsoft Windows NT or Windows/95 Operating System (OS), the IBM OS/2 operating system, the MAC OS, or UNIX operating system. Those skilled in the art will appreciate that the present invention may also be implemented on platforms and operating systems other than those mentioned.

A preferred embodiment is written using JAVA, C, and the C++ language and utilizes object oriented programming methodology. Object oriented programming (OOP) has become increasingly used to develop complex applications. As OOP moves toward the mainstream of software design and development, various software solutions require adaptation to make use of

the benefits of OOP. A need exists for these principles of OOP to be applied to a messaging interface of an electronic messaging system such that a set of OOP classes and objects for the messaging interface can be provided.

OOP is a process of developing computer software using objects, including the steps of analyzing the problem, designing the system, and constructing the program. An object is a software package that contains both data and a collection of related structures and procedures. Since it contains both data and a collection of structures and procedures, it can be visualized as a self-sufficient component that does not require other additional structures, procedures or data to perform its specific task. OOP, therefore, views a computer program as a collection of largely autonomous components, called objects, each of which is responsible for a specific task. This concept of packaging data, structures, and procedures together in one component or module is called encapsulation.

In general, OOP components are reusable software modules which present an interface that conforms to an object model and which are accessed at run-time through a component integration architecture. A component integration architecture is a set of architecture mechanisms which allow software modules in different process spaces to utilize each others capabilities or functions. This is generally done by assuming a common component object model on which to build the architecture.

It is worthwhile to differentiate between an object and a class of objects at this point. An object is a single instance of the class of objects, which is often just called a class. A class of objects can be viewed as a blueprint, from which many objects can be formed.

OOP allows the programmer to create an object that is a part of another object. For example, the object representing a piston engine is said to have a composition-relationship with the object representing a piston. In reality, a piston engine comprises a piston, valves and many other components; the fact that a piston is an element of a piston engine can be logically and semantically represented in OOP by two objects.

OOP also allows creation of an object that "depends from" another object. If there are two objects, one representing a piston engine and the other representing a piston engine wherein

the piston is made of ceramic, then the relationship between the two objects is not that of composition. A ceramic piston engine does not make up a piston engine. Rather it is merely one kind of piston engine that has one more limitation than the piston engine; its piston is made of ceramic. In this case, the object representing the ceramic piston engine is called a derived object, and it inherits all of the aspects of the object representing the piston engine and adds further limitation or detail to it. The object representing the ceramic piston engine "depends from" the object representing the piston engine. The relationship between these objects is called inheritance.

When the object or class representing the ceramic piston engine inherits all of the aspects of the objects representing the piston engine, it inherits the thermal characteristics of a standard piston defined in the piston engine class. However, the ceramic piston engine object overrides these ceramic specific thermal characteristics, which are typically different from those associated with a metal piston. It skips over the original and uses new functions related to ceramic pistons. Different kinds of piston engines have different characteristics, but may have the same underlying functions associated with it (e.g., how many pistons in the engine, ignition sequences, lubrication, etc.). To access each of these functions in any piston engine object, a programmer would call the same functions with the same names, but each type of piston engine may have different/overriding implementations of functions behind the same name. This ability to hide different implementations of a function behind the same name is called polymorphism and it greatly simplifies communication among objects.

With the concepts of composition-relationship, encapsulation, inheritance and polymorphism, an object can represent just about anything in the real world. In fact, our logical perception of the reality is the only limit on determining the kinds of things that can become objects in object-oriented software. Some typical categories are as follows:

Objects can represent physical objects, such as automobiles in a traffic-flow simulation, electrical components in a circuit-design program, countries in an economics model, or aircraft in an air-traffic-control system.

Objects can represent elements of the computer-user environment such as windows, menus or graphics objects.

An object can represent an inventory, such as a personnel file or a table of the latitudes and longitudes of cities.

An object can represent user-defined data types such as time, angles, and complex numbers, or points on the plane.

With this enormous capability of an object to represent just about any logically separable matters, OOP allows the software developer to design and implement a computer program that is a model of some aspects of reality, whether that reality is a physical entity, a process, a system, or a composition of matter. Since the object can represent anything, the software developer can create an object which can be used as a component in a larger software project in the future.

If 90% of a new OOP software program consists of proven, existing components made from preexisting reusable objects, then only the remaining 10% of the new software project has to be written and tested from scratch. Since 90% already came from an inventory of extensively tested reusable objects, the potential domain from which an error could originate is 10% of the program. As a result, OOP enables software developers to build objects out of other, previously built, objects.

This process closely resembles complex machinery being built out of assemblies and sub-assemblies. OOP technology, therefore, makes software engineering more like hardware engineering in that software is built from existing components, which are available to the developer as objects. All this adds up to an improved quality of the software as well as an increased speed of its development.

Programming languages are beginning to fully support the OOP principles, such as encapsulation, inheritance, polymorphism, and composition-relationship. With the advent of the C++ language, many commercial software developers have embraced OOP. C++ is an OOP language that offers a fast, machine-executable code. Furthermore, C++ is suitable for both commercial-application and systems-programming projects. For now, C++ appears to be the most popular choice among many OOP programmers, but there is a host of other OOP languages, such as Smalltalk, common lisp object system (CLOS), and Eiffel. Additionally, OOP capabilities are being added to more traditional popular computer programming languages such as Pascal.

The benefits of object classes can be summarized, as follows:

Objects and their corresponding classes break down complex programming problems into many smaller, simpler problems.

Encapsulation enforces data abstraction through the organization of data into small, independent objects that can communicate with each other. Encapsulation protects the data in an object from accidental damage, but allows other objects to interact with that data by calling the object's member functions and structures.

Subclassing and inheritance make it possible to extend and modify objects through deriving new kinds of objects from the standard classes available in the system. Thus, new capabilities are created without having to start from scratch.

Polymorphism and multiple inheritance make it possible for different programmers to mix and match characteristics of many different classes and create specialized objects that can still work with related objects in predictable ways.

Class hierarchies and containment hierarchies provide a flexible mechanism for modeling real-world objects and the relationships among them.

Libraries of reusable classes are useful in many situations, but they also have some limitations. For example:

Complexity. In a complex system, the class hierarchies for related classes can become extremely confusing, with many dozens or even hundreds of classes.

Flow of control. A program written with the aid of class libraries is still responsible for the flow of control (i.e., it must control the interactions among all the objects created from a particular library). The programmer has to decide which functions to call at what times for which kinds of objects.

Duplication of effort. Although class libraries allow programmers to use and reuse many small pieces of code, each programmer puts those pieces together in a different way. Two different programmers can use the same set of class libraries to write two programs that do exactly the same thing but whose internal structure (i.e., design) may be quite different, depending on hundreds of small decisions each programmer makes along the way. Inevitably, similar pieces of code end up doing similar things in slightly different ways and do not work as well together as they should.

Class libraries are very flexible. As programs grow more complex, more programmers are forced to reinvent basic solutions to basic problems over and over again. A relatively new extension of the class library concept is to have a framework of class libraries. This framework is more complex and consists of significant collections of collaborating classes that capture both the small scale patterns and major mechanisms that implement the common requirements and design in a specific application domain. They were first developed to free application programmers from the chores involved in displaying menus, windows, dialog boxes, and other standard user interface elements for personal computers.

Frameworks also represent a change in the way programmers think about the interaction between the code they write and code written by others. In the early days of procedural programming, the programmer called libraries provided by the operating system to perform certain tasks, but basically the program executed down the page from start to finish, and the programmer was solely responsible for the flow of control. This was appropriate for printing out paychecks, calculating a mathematical table, or solving other problems with a program that executed in just one way.

The development of graphical user interfaces began to turn this procedural programming arrangement inside out. These interfaces allow the user, rather than program logic, to drive the program and decide when certain actions should be performed. Today, most personal computer software accomplishes this by means of an event loop which monitors the mouse, keyboard, and other sources of external events and calls the appropriate parts of the programmer's code according to actions that the user performs. The programmer no longer determines the order in which events occur. Instead, a program is divided into separate pieces that are called at unpredictable times and in an unpredictable order. By relinquishing control in this way to users, the developer creates a program that is much easier to use. Nevertheless, individual pieces of the program written by the developer still call libraries provided by the operating system to accomplish certain tasks, and the programmer must still determine the flow of control within each piece after it's called by the event loop. Application code still "sits on top of" the system.

Even event loop programs require programmers to write a lot of code that should not need to be written separately for every application. The concept of an application framework carries the

event loop concept further. Instead of dealing with all the nuts and bolts of constructing basic menus, windows, and dialog boxes and then making these things all work together, programmers using application frameworks start with working application code and basic user interface elements in place. Subsequently, they build from there by replacing some of the generic capabilities of the framework with the specific capabilities of the intended application.

Application frameworks reduce the total amount of code that a programmer has to write from scratch. However, because the framework is really a generic application that displays windows, supports copy and paste, and so on, the programmer can also relinquish control to a greater degree than event loop programs permit. The framework code takes care of almost all event handling and flow of control, and the programmer's code is called only when the framework needs it (e.g., to create or manipulate a proprietary data structure).

A programmer writing a framework program not only relinquishes control to the user (as is also true for event loop programs), but also relinquishes the detailed flow of control within the program to the framework. This approach allows the creation of more complex systems that work together in interesting ways, as opposed to isolated programs, having custom code, being created over and over again for similar problems.

Thus, as is explained above, a framework basically is a collection of cooperating classes that make up a reusable design solution for a given problem domain. It typically includes objects that provide default behavior (e.g., for menus and windows), and programmers use it by inheriting some of that default behavior and overriding other behavior so that the framework calls application code at the appropriate times.

There are three main differences between frameworks and class libraries:

Behavior versus protocol. Class libraries are essentially collections of behaviors that you can call when you want those individual behaviors in your program. A framework, on the other hand, provides not only behavior but also the protocol or set of rules that govern the ways in which behaviors can be combined, including rules for what a programmer is supposed to provide versus what the framework provides.

Call versus override. With a class library, the code the programmer instantiates objects and calls their member functions. It's possible to instantiate and call objects in the same way with a framework (i.e., to treat the framework as a class library), but to take

full advantage of a framework's reusable design, a programmer typically writes code that overrides and is called by the framework. The framework manages the flow of control among its objects. Writing a program involves dividing responsibilities among the various pieces of software that are called by the framework rather than specifying how the different pieces should work together.

Implementation versus design. With class libraries, programmers reuse only implementations, whereas with frameworks, they reuse design. A framework embodies the way a family of related programs or pieces of software work. It represents a generic design solution that can be adapted to a variety of specific problems in a given domain. For example, a single framework can embody the way a user interface works, even though two different user interfaces created with the same framework might solve quite different interface problems.

Thus, through the development of frameworks for solutions to various problems and programming tasks, significant reductions in the design and development effort for software can be achieved. A preferred embodiment of the invention utilizes HyperText Markup Language (HTML) to implement documents on the Internet together with a general-purpose secure communication protocol for a transport medium between the client and the merchant. HTTP or other protocols could be readily substituted for HTML without undue experimentation. Information on these products is available in T. Berners-Lee, D. Connoly, "RFC 1866: Hypertext Markup Language - 2.0" (Nov. 1995); and R. Fielding, H, Frystyk, T. Berners-Lee, J. Gettys and J.C. Mogul, "Hypertext Transfer Protocol -- HTTP/1.1: HTTP Working Group Internet Draft" (May 2, 1996). HTML is a simple data format used to create hypertext documents that are portable from one platform to another. HTML documents are SGML documents with generic semantics that are appropriate for representing information from a wide range of domains. HTML has been in use by the World-Wide Web global information initiative since 1990. HTML is an application of ISO Standard 8879:1986 Information Processing Text and Office Systems; Standard Generalized Markup Language (SGML).

To date, Web development tools have been limited in their ability to create dynamic Web applications which span from client to server and interoperate with existing computing resources. Until recently, HTML has been the dominant technology used in development of Web-based solutions. However, HTML has proven to be inadequate in the following areas:

- o Poor performance;
- o Restricted user interface capabilities;
- o Can only produce static Web pages;
- o Lack of interoperability with existing applications and data; and
- o Inability to scale.

Sun Microsystem's Java language solves many of the client-side problems by:

- o Improving performance on the client side;
- o Enabling the creation of dynamic, real-time Web applications; and
- o Providing the ability to create a wide variety of user interface components.

With Java, developers can create robust User Interface (UI) components. Custom "widgets" (e.g. real-time stock tickers, animated icons, etc.) can be created, and client-side performance is improved. Unlike HTML, Java supports the notion of client-side validation, offloading appropriate processing onto the client for improved performance. Dynamic, real-time Web pages can be created. Using the above-mentioned custom UI components, dynamic Web pages can also be created.

Sun's Java language has emerged as an industry-recognized language for "programming the Internet." Sun defines Java as: "a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high-performance, multithreaded, dynamic, buzzword-compliant, general-purpose programming language. Java supports programming for the Internet in the form of platform-independent Java applets." Java applets are small, specialized applications that comply with Sun's Java Application Programming Interface (API) allowing developers to add "interactive content" to Web documents (e.g. simple animations, page adornments, basic games, etc.). Applets execute within a Java-compatible browser (e.g. Netscape Navigator) by copying code from the server to client. From a language standpoint, Java's core feature set is based on C++. Sun's Java literature states that Java is basically "C++, with extensions from Objective C for more dynamic method resolution".

Another technology that provides similar function to JAVA is provided by Microsoft and ActiveX Technologies, to give developers and Web designers wherewithal to build dynamic content for the Internet and personal computers. ActiveX includes tools for developing animation, 3-D virtual

reality, video and other multimedia content. The tools use Internet standards, work on multiple platforms, and are being supported by over 100 companies. The group's building blocks are called ActiveX Controls, small, fast components that enable developers to embed parts of software in hypertext markup language (HTML) pages. ActiveX Controls work with a variety of programming languages including Microsoft Visual C++, Borland Delphi, Microsoft Visual Basic programming system and, in the future, Microsoft's development tool for Java, code named "Jakarta." ActiveX Technologies also includes ActiveX Server Framework, allowing developers to create server applications. One of ordinary skill in the art readily recognizes that ActiveX could be substituted for JAVA without undue experimentation to practice the invention.

Figure **1B** depicts an overview of the present invention. Customer computer system **120** is in communication with merchant computer system **130**. The customer-merchant session **150** operates under a general-purpose secure communication protocol such as the SSL protocol. Merchant computer system **130** is additionally in communication with payment gateway computer system **140**. A payment gateway is a system that provides electronic commerce services in support of a bank or other financial institution, and that interfaces to the financial institution to support the authorization and capture of transactions. The customer-institution session **170** operates under a variant of a secure payment technology such as the SET protocol, as described herein, referred to as Merchant-Originated Secure Electronic Transactions ("MOSET"), as is more fully described herein.

Customer-to-Merchant Communication

Figure **2** depicts a more detailed view of customer computer system **120** in communication with merchant system **130** using customer-merchant session **150** operating under the SSL protocol as documented in Freier and incorporated by reference.

Customer computer system **120** initiates communication with merchant computer system **130** using any well-known access protocol, e.g., Transmission Control Protocol/Internet Protocol ("TCP/IP"). A description of TCP/IP is provided in Information Sciences Institute, "Transmission Control Protocol DARPA Internet Program Protocol Specification (RFC 793)" (September, 1981), and Information Sciences Institute, "Internet Protocol DARPA Internet Program Protocol Specification (RFC 791)" (September, 1981). In this implementation, customer computer system **120** acts as a client and merchant computer system **130** acts as a server.

Customer computer system **120** initiates communication by sending "client hello" message **210** to the merchant computer system **130**. When a client first connects to a server it is required to send the client hello message **210** as its first message. The client can also send a client hello message **210** in response to a hello request on its own initiative in order to renegotiate the security parameters in an existing connection. The client hello message includes a random structure, which is used later in the protocol. Specifically, the random structure includes the current time and date in standard UNIX 32-bit format according to the sender's internal clock and twenty-eight bytes of data generated by a secure random number generator. The client hello message **210** further includes a variable length session identifier. If not empty, the session identifier value identifies a session between the same client and server whose security parameters the client wishes to reuse. The session identifier may be from an earlier connection, the current connection, or another currently active connection. It is useful to specify the current connection if the client only wishes to update the random structures and derived values of a connection. It is useful to specify another currently active connection if the client wishes to establish several simultaneous independent secure connections to the same server without repeating the full handshake protocol. Client hello message **210** further includes an indicator of the cryptographic algorithms supported by the client in order of the client's preference, ordered according to client preference.

In response to client hello message **210**, if merchant computer system **130** wishes to correspond with customer computer system **120**, it responds with server hello message **215**. If merchant computer system **130** does not wish to communicate with customer computer system **120**, it responds with a message, not shown, indicating refusal to communicate.

Server hello message **215** includes a random structure, which is used later in the protocol. The random structure in server hello message **215** is in the same format as, but has contents independent of, the random structure in client hello message **210**. Specifically, the random structure includes the current time and date in standard UNIX 32-bit format according to the sender's internal clock and twenty-eight bytes of data generated by a secure random number generator. Server hello message **215** further includes a variable length session identifier. The session identifier value identifies a new or existing session between the same client and server. Server hello message **215** further includes an indicator of the cryptographic algorithms selected

from among the algorithms specified by client hello message **210**, which is utilized in further encrypted communications.

Optionally, Merchant computer system **130** transmits a server certificate **220**. If transmitted, server certificate **130** enables customer computer system **120** to authenticate the identity of merchant computer system **130**.

If merchant computer system **130** does not transmit a server certificate **220**, or if server certificate **220** is suitable only for authentication, it may optionally transmit a server key exchange message **225**. Server key exchange message **225** identifies a key that may be used by customer computer system **120** to decrypt further messages sent by merchant computer system **130**.

After transmitting server hello message **215**, and optionally transmitting server certificate **220** or server key exchange message **225**, merchant computer system **130** transmits a server hello done message **230** and waits for a further response from customer computer system **120**.

Customer computer system **120** optionally transmits client certificate **240** to merchant computer system **130**. If transmitted, client certificate **240** enables merchant computer system **130** to authenticate the identity of customer computer system **120**. Alternatively, customer computer system **120** may transmit a no-client-certificate alert **245**, to indicate that the customer has not registered with any certification authority.

If customer computer system **130** does not transmit a client certificate **240**, or if client certificate **240** is suitable only for authentication, customer computer system **130** may optionally transmit a client key exchange message **250**. Client key exchange message **250** identifies a key that may be used by merchant computer system **130** to decrypt further messages sent by customer computer system **120**.

After optionally transmitting client certificate **240**, no-client-certificate alert **245**, and/or client key exchange message **250**, customer computer system **120** transmits a finished message **260**.

At this point, customer computer system **120** and merchant computer system **130** have:

1) negotiated an encryption scheme that may be commonly employed in further communications, and

2) have communicated to each other a set of encryption keys that may be used to decrypt further communications between the two computer systems.

Customer computer system **120** and merchant computer system **130** may thereafter engage in secure communications **270** with less risk of interception by third parties.

Among the messages communicated by customer computer system **120** to merchant computer system **130** may be messages that specify goods or services to be ordered and payment information, such as a credit card number and related information, collectively referred to as "payment information," that may be used to pay for the goods and/or services ordered. In order to obtain payment, the merchant must supply this information to the bank or other payment gateway responsible for the proffered payment method. This enables the merchant to perform payment authorization and payment capture. Payment authorization is the process by which permission is granted by a payment gateway operating on behalf of a financial institution to authorize payment on behalf of the financial institution. This is a process that assesses transaction risk, confirms that a given transaction does not raise the account holder's debt above the account's credit limit, and reserves the specified amount of credit. Payment capture is the process that triggers the movement of funds from the financial institution to the merchant's account after settlement of the account.

Payment Authorization

Merchants utilize point-of-sale products for credit and debit transactions on a daily basis. An embodiment in accordance with the subject invention allows an acquirer processor to accept transactions from Internet storefronts without altering a current host environment. The system easily converts payment protocol messages and simultaneously manages transactions from a number of Internet merchant servers. As the number of transactions grows, the payment gateway can be scaled to handle the increased business, and it can be configured to work with specific business processes used by the acquirer/processor. Thus, the payment gateway supports Internet processing utilizing payment processing operations.

The payment gateway provides support for configuring and installing the Internet payment capability utilizing existing host point-of-sale technology. The payment gateway also provides an intuitive Graphical User Interface (GUI) with support built in to accommodate future payment instruments such as debit cards, electronic checks, electronic cash and micropayments. The payment gateway implements secure transactions using RSA public-key cryptography and the MasterCard/Visa Secure Electronic Transaction (SET) protocol. The gateway also provides full functionality for merchant payment processing including authorization, capture, settlement and reconciliation while providing monitor activity with reporting and tracking of transactions sent over the Internet. Finally, the payment gateway also implements Internet payment procedures that match current processor business models to ensure consistency for merchants. Handling Internet transactions is destined to become a necessary function for every payment processing system. Today, merchants often transmit data received over the Internet inefficiently. Some fax the information or waste time keying data into a non-Internet system.

Figure **3** depicts an overview of the method of securely supplying payment information to a payment gateway in order to obtain payment authorization. In function block **310**, merchant computer system **130** generates a payment authorization request **315** and transmits it to payment gateway computer system **140**. In function block **330**, payment gateway system **140** processes the payment authorization request, generates a payment authorization response **325** and transmits it to merchant computer system **130**. In function block **320**, merchant computer system **130** processes payment authorization response **325** and determines whether payment for the goods or services sought to be obtained by the customer has been authorized.

Payment Authorization Request Generation

Figure **4** depicts the detailed steps of generating and transmitting a payment authorization request. Figures **5A** through **5F** depict views of the payment authorization request and its component parts. In function block **410**, merchant computer system **130** creates a basic authorization request **510**. The basic authorization request is a data area that includes all the information for determining whether a request should be granted or denied. Specifically, it includes such information as the party who is being charged, the amount to be charged, the account number of the account to be charged, and any additional data, such as passwords, needed to validate the charge. This information is either calculated based upon prior customer

merchandise selection, or provided by the customer over the secure link **270** established in the customer-merchant general-purpose secure communication protocol session. Fig **5A** depicts a basic authorization request **510**.

In function block **420**, merchant computer system **130** combines basic authorization request **510**, a copy of its encryption public key certificate **515** and a copy of its signature public key certificate **520**. Merchant computer system **130** calculates a digital signature **525** for the combined contents of the combined block **530** comprising basic authorization request **510**, the encryption public key certificate **515** and the signature public key certificate **520**, and appends it to the combination of the combined basic authorization request **510**, the encryption public key certificate **515** and the signature public key certificate **520**. The merchant computer system calculates digital signature **525** by first calculating a "message digest" based upon the contents of the combined basic authorization request **510**, the encryption public key certificate **515** and the signature public key certificate **520**. A message digest is the fixed-length result that is generated when a variable length message is fed into a one-way hashing function. Message digests help verify that a message has not been altered because altering the message would change the digest. The message digest is then encrypted using the merchant computer system's **130** digital signature private key, thus forming a digital signature.

Figure **5B** depicts the combined block **530** formed by function block **420** and containing basic authorization request **510**, the encryption public key certificate **515**, the signature public key certificate **520**, and digital signature **525**.

In function block **430**, merchant computer system **130** generates a random encryption key RK-0 **540**, denoted as RK-0. Random encryption key RK-0 **540** is a symmetric encryption key. A symmetric encryption key is a key characterized by the property that a message encrypted with a symmetric key can be decrypted with that same key. This is contrasted with an asymmetric key pair, such as a public-key/private-key key pair, where a message encrypted with one key of the key pair may only be decrypted with the other key of the same key pair. Figure **5C** depicts random encryption key RK-0 **540**.

In function block **440**, merchant computer system **130** encrypts combined block **530** using random encryption key RK-0 **540** to form encrypted combined block **550**. Figure **5D** depicts

encrypted combined block **550**. The encryption state of encrypted combined block **550** is graphically shown by random key lock **555**, which indicates that encrypted combined block **550** is encrypted using random key RK-0 **540**.

In function block **450**, merchant computer system **130** encrypts random encryption key RK-0 **540** using the public key of payment gateway system **140** to form encrypted random key **560**. Figure **5E** depicts encrypted random key **560**. The encryption state of encrypted random key **560** is graphically shown by payment gateway public key lock **565**, which indicates that encrypted random key **560** is encrypted using the payment gateway public key.

In function block **460**, merchant computer system **130** concatenates encrypted combined block **550** and encrypted random key 560 to form merchant authorization request **315**. Figure **5F** depicts merchant authorization request **315** comprising encrypted combined block **550** and encrypted random key **560**. In function block **470**, merchant computer system **130** transmits merchant authorization request **315** to payment gateway system **140**.

Payment Authorization Request Processing

Figure **6** depicts the detailed steps of processing a payment authorization request and generating and transmitting a payment authorization request response. Function blocks **610** through **630** depict the steps of processing a payment authorization request, while function blocks **635** through **685** depict the steps of generating and transmitting a payment authorization request response.

In function block **610**, payment gateway computer system **140** applies its private key to encrypted random key **560** contained within received merchant authorization request **315**, thereby decrypting it and obtaining a cleartext version of random key RK-0 **540**. In function block **615**, payment gateway computer system **140** applies random key RK-0 **540** to encrypted combined block **550**, thereby decrypting it and obtaining a cleartext version of combined block **530**. Combined block **530** comprises basic authorization request **510**, a copy of merchant computer system's **130** encryption public key certificate **515** and a copy of merchant computer system's **130** signature public key certificate **520**, as well as merchant digital signature **525**.

In function block **620**, payment gateway computer system **140** verifies merchant computer system's **130** encryption public key certificate **515** and merchant computer system's **130** signature public key certificate **520**. Payment gateway computer system **140** performs this verification by making a call to the certification authorities associated with each certificate. If verification of either certificate fails, payment gateway computer system **140** rejects the authorization request.

In function block **625**, payment gateway computer system **140** validates merchant digital signature **525**. Payment gateway computer system **140** performs this validation by calculating a message digest over the contents of the combined basic authorization request **510**, the encryption public key certificate **515** and the signature public key certificate **520**. Payment gateway computer system **140** then decrypts digital signature **525** to obtain a copy of the equivalent message digest calculated by merchant computer system **130** in function block **420**. If the two message digests are equal, the digital signature **525** is validated. If validation fails, payment gateway computer system **140** rejects the authorization request.

In function block **630**, payment gateway computer system **140** determines the financial institution for which authorization is required by inspection of basic authorization request **510**. Payment gateway computer system **140** contacts the appropriate financial institution using a secure means, e.g, a direct-dial modem-to-modem connection, or a proprietary internal network that is not accessible to third parties, and using prior art means, obtains a response indicating whether the requested payment is authorized.

Payment Authorization Response Generation

Function blocks **635** through **685** depict the steps of generating and transmitting a payment authorization request response. Figures **7A** through **7J** depict views of the payment authorization response and its component parts.

In function block **635**, payment gateway computer system **140** creates a basic authorization response **710**. The basic authorization request is a data area that includes all the information to determine whether a request was granted or denied. Figure **7A** depicts basic authorization response **710**.

In function block **640**, payment gateway computer system **140** combines basic authorization response **710**, and a copy of its signature public key certificate **720**. Payment computer system **140** calculates a digital signature **725** for the combined contents of the combined block **730** comprising basic authorization response **710** and the signature public key certificate **720**, and appends the signature to the combination of the combined basic authorization response **710** and the signature public key certificate **720**. The payment gateway computer system calculates digital signature **725** by first calculating a message digest based on the contents of the combined basic authorization response **710** and signature public key certificate **720**. The message digest is then encrypted using the merchant computer system's **140** digital signature private key, thus forming a digital signature.

Figure **7B** depicts the combined block **730** formed in function block **640** and containing basic authorization response **710**, the signature public key certificate **720**, and digital signature **725**.

In function block **645**, payment gateway computer system **150** generates a first symmetric random encryption key **740**, denoted as RK-1. Figure **7C** depicts first random encryption key RK-1 **740**.

In function block **650**, payment gateway computer system **140** encrypts combined block **730** using random encryption key RK-1 **740** to form encrypted combined block **750**. Figure **7D** depicts encrypted combined block **750**. The encryption state of encrypted combined block **750** is graphically shown by random key lock **755**, which indicates that encrypted combined block **750** is encrypted using random key RK-1 **740**.

In function block **655**, payment gateway computer system **140** encrypts random encryption key RK-1 **740** using the public key of merchant computer system **130** to form encrypted random key RK **760**. Figure **7E** depicts encrypted random key RK-1 **760**. The encryption state of encrypted random key **760** is graphically shown by merchant public key lock **765**, which indicates that encrypted random key **760** is encrypted using the merchant public key.

In function block **660**, payment gateway computer system **140** generates a random capture token **770**. Random capture token **770** is utilized in subsequent payment capture processing

to associate the payment capture request with the payment authorization request being processed. Figure **7F** depicts capture token **775**.

In function block **665**, payment gateway computer system **140** generates a second symmetric random encryption key **775**, denoted as RK-2. Figure **7G** depicts second random encryption key RK-2 **775**.

In function block **670**, payment gateway computer system **140** encrypts capture token **770** using random encryption key RK-2 **770** to form encrypted capture token **780**. Figure **7H** depicts encrypted capture token **780**. The encryption state of encrypted capture token **780** is graphically shown by random key lock **785**, which indicates that encrypted capture token **780** is encrypted using random key RK-2 **770**.

In function block **675**, payment gateway computer system **140** encrypts second random encryption key RK-2 **775** using its own public key to form encrypted random key RK-2 **790**. Figure **7I** depicts encrypted random key RK-2 **790**. The encryption state of encrypted random key **790** is graphically shown by payment gateway public key lock **795**, which indicates that encrypted random key **790** is encrypted using the payment gateway public key.

In function block **680**, payment gateway computer system **140** concatenates encrypted combined block **750**, encrypted random key RK-1 **760**, encrypted capture token **780** and encrypted random key RK-2 **790** to form merchant authorization response **325**. Figure **7J** depicts merchant authorization response **325** comprising encrypted combined block **750**, encrypted random key RK-1 **760**, encrypted capture token **780** and encrypted random key RK-2 **790**. In function block **685**, payment gateway computer system **140** transmits merchant authorization response **325** to merchant system **130**.

Payment Authorization Response Processing

Figure **8** depicts the detailed steps of processing a payment authorization response. In function block **810**, merchant computer system **130** applies its private key to encrypted random key RK-1 **760** contained within received merchant authorization response **325**, thereby decrypting it and obtaining a cleartext version of random key RK-1 **740**. In function block **820**, merchant computer system **130** applies random key RK-1 **740** to encrypted combined block **750**, thereby

decrypting it and obtaining a cleartext version of combined block **730**. Combined block **730** comprises basic authorization response **710**, a copy of payment gateway computer system's **140** signature public key certificate **720**, as well as payment gateway digital signature **725**. In function block **830**, merchant computer system **130** verifies payment gateway computer system's **140** signature public key certificate **720**. Merchant computer system **130** performs this verification by making a call to the certification authority associated with the certificate. If verification of the certificate fails, merchant computer system **130** concludes that the authorization response is counterfeit and treats it though the authorization request had been rejected.

In function block **840**, merchant computer system **130** validates payment gateway digital signature **725**. Merchant computer system **130** performs this validation by calculating a message digest over the contents of the combined basic authorization request **710** and the signature public key certificate **720**. Merchant computer system **130** then decrypts digital signature **725** to obtain a copy of the equivalent message digest calculated by payment gateway computer system **140** in function block **640**. If the two message digests are equal, the digital signature **725** is validated. If validation fails, concludes that the authorization response is counterfeit and treats it though the authorization request had been rejected.

In function block **850**, merchant computer system **130** stores encrypted capture token **780** and encrypted random key RK-2 **790** for later use in payment capture. In function block **860**, merchant computer system **130** processes the customer purchase request in accordance with the authorization response **710**. If the authorization response indicates that payment in authorized, merchant computer system **130** fills the requested order. If the authorization response indicates that payment is not authorized, or if merchant computer system **130** determined in function block **830** or **840** that the authorization response is counterfeit , merchant computer system **130** indicates to the customer that the order cannot be filled.

Payment Capture

Figure **9** depicts an overview of the method of securely supplying payment capture information to payment gateway **140** in order to obtain payment capture. In function block **910**, merchant computer system **130** generates a merchant payment capture request **915** and transmits it to payment gateway computer system **140**. In function block **930**, payment gateway system **140**

processes the payment capture request **915**, generates a payment capture response **925** and transmits it to merchant computer system **130**. In function block **920**, merchant computer system **130** processes payment capture response **925** and verifies that payment for the goods or services sought to be obtained by the customer have been captured.

Payment Capture Request Generation

Figure **10** depicts the detailed steps of generating and transmitting a payment capture request. Figures **11A** through **11F** depict views of the payment capture request and its component parts. In function block **1010**, merchant computer system **130** creates a basic capture request **510**. The basic capture request is a data area that includes all the information needed by payment gateway computer system **140** to trigger a transfer of funds to the merchant operating merchant computer system **130**.

Specifically, a capture request includes a capture request amount, a capture token, a date, summary information of the purchased items and a Merchant ID (MID) for the particular merchant. Figure **11A** depicts basic authorization request **1110**.

In function block **1020**, merchant computer system **130** combines basic capture request **1110**, a copy of its encryption public key certificate **1115** and a copy of its signature public key certificate **1120**. Merchant computer system **130** calculates a digital signature **1125** for the combined contents of the combined block **1130** comprising basic capture request **1110**, the encryption public key certificate **1115** and the signature public key certificate **1120**, and appends it to the combination of the combined basic capture request **1110**, the encryption public key certificate **1115** and the signature public key certificate **1120**. The merchant computer system calculates digital signature **1125** by first calculating a message digest over the contents of the combined basic capture request **1110**, the encryption public key certificate **1115** and the signature public key certificate **1120**. The message digest is then encrypted using the merchant computer system's **130** digital signature private key, thus forming a digital signature.

Figure **11B** depicts the combined block **1130** formed by function block **1020** and containing basic capture request **1110**, the encryption public key certificate **1115**, the signature public key certificate **1120**, and digital signature **1125**. In function block **1030**, merchant computer

system **130** generates a random encryption key **1140**, denoted as RK-3. Random encryption key RK-3 **1140** is a symmetric encryption key. Figure **11C** depicts random encryption key RK-3 **1140**. In function block **1040**, merchant computer system **130** encrypts combined block **1130** using random encryption key RK-3 **1140** to form encrypted combined block **1150**. Figure **11D** depicts encrypted combined block **1150**. The encryption state of encrypted combined block **1150** is graphically shown by random key lock **1155**, which indicates that encrypted combined block **1150** is encrypted using random key RK-3 **1140**. In function block **1050**, merchant computer system **130** encrypts random encryption key RK-3 **1140** using the public key of payment gateway system **140** to form encrypted random key **1160**. Figure **11E** depicts encrypted random key **1160**. The encryption state of encrypted random key **1160** is graphically shown by payment gateway public key lock **1165**, which indicates that encrypted random key RK-3 **1160** is encrypted using the payment gateway public key.

In function block **1060**, merchant computer system **130** concatenates encrypted combined block **1150**, encrypted random key **1160**, and the encrypted capture token **780** and encrypted random key RK-2 **790** that were stored in function block **850** to form merchant capture request **915**. Figure **11F** depicts merchant capture request **915**, comprising encrypted combined block **1150**, encrypted random key **1160**, encrypted capture token **780** and encrypted random key RK-2 **790**. In function block **1070**, merchant computer system **130** transmits merchant capture request **915** to payment gateway system **140**.

Payment Capture Request Processing

Figure **12** depicts the detailed steps of processing a payment capture request and generating and transmitting a payment capture request response. Function blocks **1210** through **1245** depict the steps of processing a payment capture request, while function blocks **1250** through **1285** depict the steps of generating and transmitting a payment capture request response. In function block **1210**, payment gateway computer system **140** applies its private key to encrypted random key **1160** contained within received merchant capture request **915**, thereby decrypting it and obtaining a cleartext version of random key RK-3 **1140**. In function block **1215**, payment gateway computer system **140** applies random key RK-3 **1140** to encrypted combined block **1150**, thereby decrypting it and obtaining a cleartext version of combined block **1130**. Combined block **1130** comprises basic capture request **1110**, a copy of merchant computer system's **130** encryption public key certificate **1115** and a copy of merchant

computer system's **130** signature public key certificate **1120**, as well as merchant digital signature **1125**. In function block **1220**, payment gateway computer system **140** verifies merchant computer system's **130** encryption public key certificate **1115** and merchant computer system's **130** signature public key certificate **1120**. Payment gateway computer system **140** performs this verification by making a call to the certification authorities associated with each certificate. If verification of either certificate fails, payment gateway computer system **140** rejects the capture request.

In function block **1225**, payment gateway computer system **140** validates merchant digital signature **1125**. Payment gateway computer system **140** performs this validation by calculating a message digest over the contents of the combined basic capture request **1110**, the encryption public key certificate **1115** and the signature public key certificate **1120**. Payment gateway computer system **140** then decrypts digital signature **1125** to obtain a copy of the equivalent message digest calculated by merchant computer system **130** in function block **1020**. If the two message digests are equal, the digital signature **1125** is validated. If validation fails, payment gateway computer system **140** rejects the capture request. In function block **1230**, payment gateway computer system **140** applies its private key to encrypted random key RK-2 **790** contained within received merchant capture request **915**, thereby decrypting it and obtaining a cleartext version of random key RK-2 **775**. In function block **1235**, payment gateway computer system **140** applies random key RK-2 **775** to encrypted capture token **780**, thereby decrypting it and obtaining a cleartext version of capture token **770**.

In function block **1240**, payment gateway computer system **140** verifies that a proper transaction is being transmitted between capture token **780** and capture request **1110**. A capture token contains data that the gateway generates at the time of authorization. When the authorization is approved, the encrypted capture token is given to the merchant for storage. At the time of capture, the merchant returns the capture token to the gateway along with other information required for capture. Upon receipt of the capture token, the gateway compares a message made of the capture request data and the capture token data and transmits this information over a traditional credit/debit network. If an improperly formatted transaction is detected, payment gateway computer system **140** rejects the capture request. In function block **1245**, payment gateway computer system **140** determines the financial institution for

which capture is requested by inspection of basic capture request **1110**. Payment gateway computer system **140** contacts the appropriate financial institution using a secure means, e.g, a direct-dial modem-to-modem connection, or a proprietary internal network that is not accessible to third parties, and using prior art means, instructs a computer at the financial institution to perform the requested funds transfer after settlement.

Payment Capture Response Generation

Function blocks **1250** through **1285** depict the steps of generating and transmitting a payment capture request response. Figures **13A** through **13F** depict views of the payment capture response and its component parts.

In function block **1250**, payment gateway computer system **140** creates a basic capture response **710**. The basic capture request is a data area that includes all the information to indicate whether a capture request was granted or denied. Figure **13A** depicts basic authorization request **1310**.

In function block **1255**, payment gateway computer system **140** combines basic capture response **1310**, and a copy of its signature public key certificate **1320**. Payment computer system **140** calculates a digital signature **1325** for the combined contents of the combined block **1330** comprising basic capture response **1310** and the signature public key certificate **1320**, and appends the signature to the combination of the combined basic authorization request **1310** and the signature public key certificate **1320**. The payment gateway computer system calculates digital signature **1325** by first calculating a message digest over the contents of the combined basic capture response **1310** and signature public key certificate **720**. The message digest is then encrypted using the merchant computer system's **140** digital signature private key, thus forming a digital signature.

Figure **13B** depicts the combined block **1330** formed by function block **1255** and containing basic capture request **1310**, the signature public key certificate **1320**, and digital signature **1325**. In function block **1260**, payment gateway computer system **140** generates a symmetric random encryption key **1340**, denoted as RK-4. Figure **13C** depicts random encryption key RK-4 **1340**. In function block **1275**, payment gateway computer system **140** encrypts combined block **1330** using random encryption key RK-4 **1340** to form encrypted combined block **1350**.

Figure **13D** depicts encrypted combined block **1350**. The encryption state of encrypted combined block **1350** is graphically shown by random key lock **1355**, which indicates that encrypted combined block **1350** is encrypted using random key RK-4 **1340**. In function block **1275**, payment gateway computer system **140** encrypts random encryption key RK-4 **1340** using the public key of merchant computer system **130** to form encrypted random key RK-4 **1360**. Figure **13E** depicts encrypted random key RK-4 **1360**. The encryption state of encrypted random key **1360** is graphically shown by merchant public key lock **1365**, which indicates that encrypted random key **1360** is encrypted using the merchant public key. In function block **1280**, payment gateway computer system **140** concatenates encrypted combined block **1350** and encrypted random key RK-4 **1360** to form merchant capture response **925**. Figure **13F** depicts merchant capture response **925** comprising encrypted combined block **1350** and encrypted random key RK-4 **1360**. In function block **1285**, payment gateway computer system **140** transmits merchant capture response **925** to merchant system **130**.

Payment Capture Response Processing

Figure **14** depicts the detailed steps of processing a payment capture response. In function block **1410**, merchant computer system **130** applies its private key to encrypted random key RK-4 **1360** contained within received merchant capture response **925**, thereby decrypting it and obtaining a cleartext version of random key RK-4 **1340**. In function block **1420**, merchant computer system **130** applies random key RK-4 **1340** to encrypted combined block **1350**, thereby decrypting it and obtaining a cleartext version of combined block **1330**. Combined block **1330** comprises basic capture response **1310**, a copy of payment gateway computer system's **140** signature public key certificate **1320**, as well as payment gateway digital signature **1325**. In function block **1430**, merchant computer system **130** verifies payment gateway computer system's **140** signature public key certificate **1320**. Merchant computer system **130** performs this verification by making a call to the certification authority associated with the certificate. If verification of the certificate fails, merchant computer system **130** concludes that the capture response is counterfeit and raises an error condition.

In function block **1440**, merchant computer system **130** validates payment gateway digital signature **1325**. Merchant computer system **130** performs this validation by calculating a message digest over the contents of the combined basic authorization request **1310** and the

signature public key certificate **1320**. Merchant computer system **130** then decrypts digital signature **1325** to obtain a copy of the equivalent message digest calculated by payment gateway computer system **140** in function block **1255**. If the two message digests are equal, the digital signature **1325** is validated. If validation fails, merchant computer system **130** concludes that the authorization response is counterfeit and raises an error condition. In function block **1450**, merchant computer system **130** stores capture response for later use in by legacy system accounting programs, e.g. to perform reconciliation between the merchant operating merchant computer system **130** and the financial institution from whom payment was requested, thereby completing the transaction. The system of the present invention permits immediate deployment of a secure payment technology architecture such as the SET architecture without first establishing a public-key encryption infrastructure for use by consumers. It thereby permits immediate use of SET-compliant transaction processing without the need for consumers to migrate to SET-compliant application software.

VIRTUAL POINT OF SALE (VPOS) DETAILS

A Virtual Point of Sale (VPOS) Terminal Cartridge is described in accordance with a preferred embodiment. The VPOS Terminal Cartridge provides payment functionality similar to what a VeriFone PoS terminal ("gray box") provides for a merchant today, allowing a merchant to process payments securely using the Internet. It provides full payment functionality for a variety of payment instruments.

Payment Functionality

Figure **15A** illustrates a payment processing flow in accordance with a preferred embodiment. The payment functionality provided by the VPOS terminal is divided into two main categories: "Merchant-Initiated" **1510** and "Consumer-Initiated" **1500.** Some payment transactions require communication with the acquirer bank through the Gateway **1530**. The normal flow of a transaction is via the VPOS Cartridge API **1512** to the VPOS C++ API **1514** into the payment protocol layer **1516** which is responsible for converting into the appropriate format for transmission to the Gateway for additional processing and forwarding to existing host payment authorization systems. Host legacy format refers to an existing authorization system for credit card approval currently utilized with the VeriFone Point of Sale (POS) gray terminals. The output from the payment protocol layer **1516** is transmitted to the authorization processing center via the gateway **1530.** These transactions are referred to as "Online Transactions" or

"Host Payments." The transactions that can be done locally by the merchant without having to communicate with the acquirer bank are referred to as "Local Functions and Transactions." To support different types of payment instruments, the VPOS Terminal payment functionality is categorized as set forth below.

- **Host Payment Functionality:** These transactions require communication with the final host, either immediately or at a later stage. For example, an Online Authorization-Only transaction, when initiated, communicates with the host immediately. However, an Off-line Authorization-Only transaction is locally authorized by the VPOS terminal without having to communicate with the host, but at a later stage this off-line authorization transaction is sent to the host. Within the Host Payment Functionality some transactions have an associated Payment Instrument, while others do not. These two kinds of transactions are:
- **Host Financial Payment Functionality:** These transactions have a Payment Instrument (Credit Card, Debit Card, E-Cash, E-Check, etc.) associated with them. For example, the "Return" transaction, which is initiated upon returning a merchandise to the merchant.
- **Host Administrative Payment Functionality:** These transactions do not require a payment instrument, and provide either administrative or inquiry functionality. Examples of these transactions are "Reconcile" or the "Batch Close."
- **Local Functions and Transactions:** These transactions do not require communication with the host at any stage, and provide essential VPOS terminal administrative functionality. An example of this is the VPOS terminal configuration function, which is required to set up the VPOS terminal. Another example is the "VPOS Batch Review" function, which is required to review the different transactions in the VPOS Batch or the Transaction Log.

Payment Instruments

A preferred embodiment of a VPOS terminal supports various Payment Instruments. A consumer chooses a payment based on personal preferences. Some of the Payment Instruments supported include:

- Credit Cards
- Debit Cards
- Electronic Cash
- Electronic Checks
- Micro-Payments (electronic coin)
- Smart Cards

LOCAL FUNCTIONS & TRANSACTIONS

accum review	/VPOSt/mi/accum/review/	not allowed	merchant login/password
batch review	/VPOSt/mi/batch/review/	not allowed	merchant login/password
cdt review	/VPOSt/mi/cdt/review/	not allowed	merchant login/password
cdt update	/VPOSt/mi/cdt/update/	allowed	merchant login/password
cpt review	/VPOSt/mi/cpt/review	not allowed	merchant login/password
cpt update	/VPOSt/mi/cpt/update/	allowed	merchant login/password
clear accum	/VPOSt/accum/clear/	allowed	merchant login/password
clear batch	/VPOSt/mi/batch/clear/	allowed	merchant login/password
hdt review	/VPOSt/mi/hdt/review/	not allowed	merchant login/password
hdt update	/VPOSt/mi/hdt/update/	allowed	merchant login/password
lock VPOS	/VPOSt/mi/lock/	allowed	merchant login/password
query txn	/VPOSt/ci/querytxn/	not allowed	no access control
query txn	/VPOSt/mi/querytxn/	not allowed	merchant login/password
tct review	/VPOSt/mi/tct/review/	not allowed	merchant login/password
tct update	/VPOSt/mi/tct/update/	allowed	merchant login/password
unlock VPOS	/VPOSt/mi/unlock/	allowed	merchant

login/password

URL Descriptions

This section describes the GET and POST arguments that are associated with each transaction URL. It also describes the results from the GET and POST methods. For URLs that produce any kind of results, the following fields are present in the HTML document that is returned by the VPOS Terminal Cartridge:

txnDate	Date of the transaction (mm/dd/yy or dd/mm/yy)
txnTime	Time of the transaction (hh:mm:ss GMT or hh:mm:ss local time)
merchantId	Merchant ID of the merchant using the VPOS terminal
terminalId	VPOS Terminal Id
txnNum	Transaction number of the given transaction
txnType	Type of transaction

For URLs that deal with financial transactions, the following fields are present in the HTML document that is returned by the VPOS terminal cartridge:

txnAmount	Transaction amount that is being authorized, forced posted, voided, etc.
poNumber	Purchase order number
authIdentNum	Authorization ID number for the transaction
retRefNum	Retrieval reference number for the given transaction
piInfo	Payment instrument information. This varies for different payment instruments. For example, in the case of credit cards, the credit card number (piAcctNumber) and expiration date (piExpDate) are returned.

Accumulate Review

URL Functionality: This is a local information inquiry function that retrieves the local (merchant's) transaction totals (accumulators).

GET Arguments: None.

GET Results: Retrieves the transaction totals for the merchant. Currently, the total is returned as an HTML document. The transaction totals currently returned are:

creditAmt	Total Credit Amount since the last settlement logged in the VPOS terminal
creditCnt	Total Credit Count since the last settlement logged in the VPOS terminal
debitAmt	Total Debit Amount since the last settlement logged in the VPOS terminal
debitCnt	Total Debit Count since the last settlement logged in the VPOS terminal

Note: Accum Review is a local function, as opposed to Balance Inquiry which is done over the Internet with the host.

Adjust

URL Functionality: Corrects the amount of a previously completed transaction.

GET Arguments: None

GET Results: Because the Adjust transaction modifies data on the merchant server, the POST method should be used. Using the GET method returns an HTML form that uses the POST method to perform the transaction.

POST Arguments:

pvsTxnNum	Previous transaction number
txnAdjustedAmount	The adjusted transaction amount. Note that the original transaction amount is easily retrievable from the previous transaction number.

POST Results: On success, pvsTxnNum and txnAdjustedAmount are presented in the HTML document, in addition to the transaction fields described above.

Auth Capture

URL Functionality: This transaction is a combination of Auth Only (Authorization without capture) and Forced Post transactions.

GET Arguments: None

GET Results: Because the Auth Capture transaction modifies data on the merchant server side, the POST method should be used. Using the GET method returns an HTML form that uses the POST method to perform the transaction.

POST Arguments:

piAcctNumber	Payment Instrument account number, e.g., Visa credit card number
piExpDate	Expiration date
txnAmt	Transaction amount

POST Results: On success, an HTML document that contains the transaction fields described above is returned. On failure, an HTML document that contains the reason for the failure of the transaction is returned. The transaction is logged into a VPOS Terminal transaction log for both instances.

Auth Only

URL Functionality: Validates the cardholder's account number for a Sale that is performed at a later stage. The transaction does not confirm the sale to the host, and there is no host data capture. The VPOS captures this transaction record and later forwards it to confirm the sale in the Forced Post transaction request.

GET Arguments: None.

GET Results: Because the Auth Only transaction modifies data on the merchant server side, the POST method should be used. Using the GET method returns an HTML form that uses the POST method to perform the transaction.

POST Arguments:

piAcctNumber	Payment Instrument account number, e.g., Visa credit card number
piExpDate	Expiration date
txnAmt	Transaction amount

POST Results: On success, an HTML document that contains the transaction fields is returned. On failure, an HTML document that contains the reason for the failure of the transaction is returned. The transaction is logged into VPOS Terminal transaction log for both instances.

NOTE: The /VPOSt/ci/authonly/ URL should be used for customer-initiated transactions. /VPOSt/mi/authonly/ should be used for merchant-initiated transactions.

Balance Inquiry

URL Functionality: Performs an on-line inquiry or the merchant's balance.

GET Arguments: None

GET Results:

mrchtBlnceAmt	Merchant balance amount for a given merchant. The balance amount at any given time is the difference between the credit and debit amount since the last settlement between the merchant and the acquirer.

Batch Review

URL Functionality: Retrieves all records from the transaction log or the batch.

GET Arguments: None

GET Results: The GET method retrieves the transactions that have been batched in the VPOS terminal for future reconciliation. The batch can be cleared from the VPOS terminal after a manual reconciliation between the acquirer and the VPOS. The batch data is retrieved as a set of records and is formatted as a table in the HTML document. The following fields are present in a typical record:

nTransType	Transaction type
nPurchOrderNo	Purchase order number
szAcctNum	Customer's payment instrument account number
szExpDate	Customer's payment instrument expiration date
szTransAmt	Transaction amount
szTransDate	Transaction date
szTransTime	Transaction time
szRetrievalRefNum	Transaction's retrieval reference number
szAuthId	Authorization ID for the transaction
szOrigAmt	Original transaction amount
szBatchNum	Batch number for the given transaction
nCurrencyType	Currency in which the transaction was done
lnTransNum	Transaction number

CDT Review

URL Functionality: Displays the VPOS terminal configuration data corresponding to the Card Definition Table (CDT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be modified and posted using the /VPOSt/mi/cdt/update/ URL to update the card definition table. Not all fields in the card definition table are editable. The following fields are returned in a form to the user:

nHostIndex	Index into the Host Definition Table or the acquirer that maps to this card issuer.
szPANLo	Low end of the PAN (Primary Account Number) range
szPANHi	High end of the PAN range
nMaxPANDigit	Maximum number of digits in the PAN for this acquirer.
NMinPANDigit	Minimum number of dits in the PAN for the acquirer
szCardLabel	Card Issuer's name
Transactions	Specifies if a particular transaction is allowed for a given

Available bit vector	card range.

(Some of these fields are not editable by a merchant, and still need to be determined.)

CDT Update

URL Functionality: Updates the VPOS terminal configuration data corresponding to the Card Definition Table (CDT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be filled out and posted using the /VPOSt/mi/cdt/update URL to update the card definition table.

POST Arguments: (Editable CDT fields need to be decided.)

POST Results: (Depends on editable CDT fields, and therefore needs to be decided.)

Clear Accumulator

URL Functionality: Zeroes out the accumulator totals currently resident in the VPOS terminal.

GET Arguments: None.

GET Results: Presents a form that uses the POST method to zero the accumulators.

POST Arguments: None.

POST Results: Zeroes the accumulators/transaction totals in the VPOS terminal.

Clear Batch

URL Functionality: Zeroes out the transaction logs currently batched in the VPOS terminal.

GET Arguments: None.

GET Results: Presents a form that uses the POST method to clear the batch.

POST Arguments: None.

POST Results: Zeroes the transactions that comprise the batch in the VPOS terminal.

Forced Post

URL Functionality: Confirms to the host the completion of a sale, and requests for data capture of the transaction. This is used as a follow-up transaction after doing an Authorization (Online or Off-line) transaction.

GET Arguments: None.

GET Results: Returns the HTML form for performing the Forced Post transaction.

POST Arguments:

pvsTxnNum	the previous transaction number from an auth only transaction

POST Results: On success, pvsTxnNum is presented in the HTML document. On failure, an HTML document is returned that contains the reason for the failure of the transaction.

HDT Review

URL Functionality: Displays the VPOS terminal configuration data corresponding to the Host Definition Table (HDT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be modified and posted using the /VPOSt/mi/hdt/update URL to update the hosts definition table. Not all fields in the host definition table are editable. The following fields are returned in a form to the user:

szTermId	Terminal ID for this VPOS terminal
szMerchId	Merchant ID for this VPOS terminal
szCurrBatchNum	Current batch number existing on the VPOS
szTransNum	Reference number for the next transaction in the VPOS transaction log/batch. This is generated by VPOS and is not editable by the merchant.
szTPDU	Transport Protocol Data Unit. Required for building the

	ISO 8583 packet.
InSTAN	System trace number; message number of the next transaction to be transmitted to this acquirer.
szNII	Network International Number. Required for building the ISO 8583 packet.
szHostName	Name for identifying the host.
nHostType	Host type
nNumAdv	Number of off-line transactions that can be piggy-backed at the end of an on-line transaction.
Data Capture Required Bit vector:	Specifies for which transactions data capture is required.

(Some of these fields are not editable by a merchant and need to be determined.)

HDT Update

URL Functionality: Updates the VPOS terminal configuration data corresponding to the Host Definition Table (HDT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be filled out and posted to the merchant server using the /VPOSt/mi/hdt/update URL to update the host definition table

Unlock VPOS

URL Functionality: Local function that starts the VPOS at the start of the day.

GET Arguments: None.

GET Results: Returns an HTML form that uses the POST method to perform this transaction.

POST Arguments: None.

POST Results: Resets a Boolean flag on the merchant server that enables transactions to be accepted by the VPOS terminal.

Offline Auth

URL Functionality: This transaction is same as the "Authorization Only" transaction, except that the transaction is locally captured by the VPOS terminal without having to communicate with the host. A Forced Post operation is done as a follow-up operation of this transaction.

GET Arguments: None.

GET Results: Because the Offline Auth transaction modifies data on the merchant server side, the POST method should be used. Using the GET method returns an HTML form for using the POST method to perform the transaction.

POST Arguments:

piAcctNumber	Payment Instrument account number, e.g., Visa credit card number
piExpDate	Expiration date
txnAmt	Transaction amount

POST Results: On success, an HTML document that contains the transaction fields described in Section 4.1 is returned. On failure, an HTML document that contains the reason for the failure of the transaction is returned. The transaction is logged into VPOS terminal transaction log for both instances.

Parameter Download

URL Functionality: Downloads the VPOS configuration information from the host and sets up the VPOS in the event of the configuration data being changed.

GET Arguments: None

GET Results: Retrieves an HTML form that uses the POST method for the parameter download transaction.

POST Arguments: None.

POST Results: Downloads the following parameters from the host and uploads them into the VPOS terminal configuration table.

- card/issuer definition table (CDT)
- host/acquirer definition table (HDT)
- communications parameter table (CPT)
- terminal configuration table (TCT)

The various configuration parameters can be reviewed and modified using the URLs for the desired functionality.

Pre Auth

URL Functionality: Used in lodging and hotel establishments to pre-authorize a charge that is completed some time in future.

GET Arguments: None

GET Results: Retrieves the HTML form for posting the pre-authorizaton transaction.

POST Arguments:

piAcctNumber	Payment Instrument account number, e.g., Visa credit card number
piExpDate	Expiration date

Pre Auth Comp

URL Functionality: Completes a pre-authorization transaction.

GET Arguments: None

GET Results: Retrieves the HTML form for posting the pre-authorization completion transaction.

POST Arguments:

pvsTxnNum	Previous transaction number from an auth only transaction

POST Results: On success, pvsTxnNum is presented in the HTML document. On failure, an HTML document is returned that contains the reason for the failure of the transaction.

Reconcile

URL Functionality: This transaction is done at the end of the day to confirm to the host to start the settlement process for the transactions captured by the host for that particular VPOS batch.

GET Arguments: None

GET Results: Retrieves the HTML form for posting the Reconcile transaction.

POST Arguments: None.

POST Results: On success, the reconcile function prints any discrepancies in the merchant's batch of transactions and totals vis-a-vis the host's batch of transactions in totals. The output format is a combination of the output of the Batch Review and Accum Review transactions.

Return

URL Functionality: Credits the return amount electronically to the consumer's account when previously purchased merchandise is returned. The VPOS terminal captures the transaction record for this transaction.

GET Arguments: None

GET Results: Retrieves the HTML form for posting the Return transaction.

POST Arguments:

prevTxnNum	Reference to the previous transaction number

The previous transaction has access to the following fields:

txnAmount	Transaction amount
piAccountNum	Payment instrument account number
piExpDate	Payment instrument expiration date

POST Results: On success, pvsTxnNum is presented in the HTML document, in addition to

Test Host

URL Functionality: Checks the presence of the host and also the integrity of the link from the VPOS to the host.

GET Arguments: None.

GET Results: On success, an HTML document is returned that reports success in connecting to the host. On failure, an HTML document is returned that reports the error encountered in testing the host.

Lock VPOS

URL Functionality: This local function locks or stops the VPOS terminal from accepting any transactions.

GET Arguments: None.

GET Results: Returns an HTML form that posts the locking of the VPOS terminal.

POST Arguments: None.

POST Results: On success, an HTML document is returned that contains the status that VPOS terminal was successfully. On failure, an HTML document is returned that reports the cause of failure of the operation, e.g., access denied, the VPOS terminal is already locked or is presently processing a transaction, etc.

Void

URL Functionality: Cancels a previously completed draft capture transaction.

GET Arguments: None.

GET Results: Retrieves an HTML form for posting the Void transaction.

POST Arguments:

pvsTxnNum	Transaction number from a previous Auth Only transaction.

Host Logon

URL Functionality: Administrative transaction used to sign-on the VPOS with the host at the start of the day, and also to download encryption keys for debit transactions.

GET Arguments: None

GET Results: Retrieves an HTML form for posting the Host Logon transaction.

POST Arguments: None.

POST Results: Currently, debit card based transactions are not supported. The result is an HTML document indicating the success or failure of the host logon operation.

CPT Review

URL Functionality: Returns the VPOS terminal configuration data corresponding to the Communications Parameter Table (CPT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values corresponding to the VPOS terminal's communication parameters. The form can be filled out and posted to the merchant server using the /VPOSt/mi/cpt/update URL to update the communications parameter table. The following fields are returned in a form to the user:

szAcqPriAddress	Primary Host address
szAcqSecAddress	Secondary Host address
szActTerAddress	Tertiary Host address
nRespTimeOut	Time-out value (in seconds) before which the VPOS should receive a response from the host

CPT Update

URL Functionality: Updates the VPOS terminal configuration data corresponding to the Communications Parameter Table (CPT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be modified and posted to update the communication parameter table.

POST Arguments:

szAcqPriAddress	Primary Host address
szAcqSecAddress	Secondary Host address
szActTerAddress	Tertiary Host address
nRespTimeOut	Time-out value (in seconds) before which the VPOS

should receive a response from the host

POST Results: On success, the HTML document returned by the VPOS contains the values set by the merchant. On failure, the HTML document contains the reason for the failure of the invocation of the URL.

TCT Review

URL Functionality: Returns the VPOS terminal configuration data corresponding to the Terminal Configuration Table (TCT).

GET Arguments: None.

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be filled out and posted using the /VPOSt/mi/tct/update URL to update the terminal configuration table. The following fields are returned in a form to the user:

szMerchName	Merchant name
szSupervisorPwd	Supervisor password
fVPOSLock	1= VPOS locked, 0 = VPOS unlocked
szAuthOnlyPwd	Password for initiating auth-only transaction
szAuthCaptPwd	Password for initiating auth with capture transaction
szAdjustPwd	Password for adjust transaction
szRefundPwd	Password for refund transaction
szForcedPostPwd	Password for forced post transaction
szOfflineAuthPwd	Password for offline auth transaction
szVoidPwd	Password for void transaction
szPreAuthPwd	Password for pre-authorization transaction
szPreAuthCompPwd	Password for pre-authorization completion

TCT Update

URL Functionality: Updates the VPOS terminal configuration data corresponding to the Terminal Configuration Table (TCT).

GET Arguments: None

GET Results: The GET method returns a default HTML form that contains the current configuration values. The form can be filled out and posted using the /VPOSt/mi/tct/update URL to update the terminal configuration table.

POST Arguments: All arguments in TCT Review functionality are the returned values from the /VPOSt/mi/tct/update the URL.

szMerchName	Merchant name
szSupervisorPwd	Supervisor password
fVPOSLock	1= VPOS locked, 0 = VPOS unlocked
szAuthOnlyPwd	Password for initiating auth-only transaction
szAuthCaptPwd	Password for initiating auth with capture transaction
szAdjustPwd	Password for adjust transaction
szRefundPwd	Password for refund transaction
szForcedPostPwd	Password for forced post transaction
szOfflineAuthPwd	Password for offline auth transaction
szVoidPwd	Password for void transaction
szPreAuthPwd	Password for pre-authorization transaction
szPreAuthCompPwd	Password for pre-authorization completion

POST Results: On success, the POST modifies values of the terminal configuration table parameters. On failure, the HTML document contains the reason for the failure of the transaction.

Query Transactions

URL Functionality: Permits the merchant and customer to query a given transaction corresponding to a transaction number.

GET Arguments:

txnNum	Transaction number

GET Results: For a given transaction, the URL returns an HTML document. If a transaction refers to an older transaction, the transaction's entire history is made available.

URL results

Depending upon the method (GET/POST) as well as the success or failure of the HTTP request, different documents are returned to the user. The VPOS terminal provides a framework whereby different documents are returned based upon a number of preferences. Currently the language and content-type are supported as preferences.

A simple framework is proposed here. Each of the transaction has a set of documents associated with it: form for the payment transaction, GET success, GET failure, POST success, and POST failure.

In the directory structure defined below, documents are stored corresponding to the preferences. The top level of the directory structure is the content-type, the next level is language (for NLS support). For example, to create text/html content in US English & French, the directory structure given below would contain the HTML documents for each of the transactions. The VPOS terminal cartridge has a configuration file that allows the user to specify the content-type as well as the language to be used for a cartridge. The first release of the VPOS terminal cartridge supports one content-type and language for each server.

Data Structures & Functions

Functions

A brief description of the Virtual Point of Sale Terminal cartridge functions are provided below. VPOSTInit(), VPOSTExec() and VPOSTShut() are the entry points required for each cartridge in accordance with a preferred embodiment. The other functions implement some of the key VPOST cartridge functionality. A source listing of the VPOS code is provided below to further accentuate the detailed disclosure of a preferred embodiment.

VPOSTInit()

```
/* VPOST cartridge Initialization here */
WRBReturnCode
VPOSTInit( void **clientCtx ){
    VPOSTCtx *VPOSTCxp ;
    /* Allocate memory for the client context */
```

```
    if (!(VPOSTCxp = (VPOSTCtx *)malloc(sizeof(VPOSTCtx))))
            return WRB_ERROR ;
        *clientCtx = (void *)VPOSTCxp ;
        return (WRB_DONE) ;}
```

VPOSTShut()

```
WRBReturnCode
VPOSTShut( void *WRBCtx, void *clientCtx ){
        *WRBCtx ;      /* not used */
        assert( clientCtx ) ;
        /* Free the client context allocated in VPOSTInit() routine
                free( clientCtx ) ;
        return (WRB_DONE) ;}
```

VPOSTExec()

```
/* The driver cartridge routine */
WRBReturnCode
VPOSTExec( void *WRBCtx, void *clientCtx )
{
        VPOSTCtx      *VPOSTCxp ;
        char    *uri ;
        char    *txnMethod ;  /* HTTP method */
        enum eVPOSTTxn      *txn ;  /* VPOST transaction */
        char    *txnOutFile ; /* Output file from transaction */
        char    **txnEnv ; /* environment variables values for transaction */
        char    *txnContent ; /* transaction's POST data content */
        WRBEntry      *WRBEntries ;
        int             numEntries;
        VPOSTCxp = (VPOSTCtx *) clientCtx ;
        /* WRBGetURL gets the URL for the current request */
        if (!(uri = WRBGetURL( WRBCtx )))
```

```
            return (WRB_ERROR) ;
        /* WRBGetContent() gets the QueryString/POST data content */
        if (!(txnContent = WRBGetContent( WRBCtx ))) {
            return WRB_ERROR ;
    }
        /* WRBGetParserContent() gets the parsed content */
        if (WRB_ERROR == WRBGEtParsedContent( WRBCtx, &WRBEntries,
          &numEntries)) {
            return WRB_ERROR ;
    }

    /* WRBGetEnvironment() gets the HTTP Server Environment */
    if (!(txnEnv = WRBGetEnvironment( WRBCtx ))) {
        return WRB_ERROR ;
    }
        /* VPOSTGetMethod() gets the method for the current request */
        if (!(method = VPOSTGetMethod( txnEnv ))){
            return (WRB_ERROR) ;
        }

        /* VPOSTGetTxn() gets the VPOST transaction for the request */
        txn = VPOSTGetTxn( uri );
        if (eTxnError == txn) {
            return (WRB_ERROR) ;
        }

        /* VPOSTExecuteTransaction() executes the VPOST transaction */
        txnOutFile = VPOSTExecuteTransaction( WRBCtx, txn, txnMethod,
          txnEnv, txnContent ) ;
        if (!(txnOutFile)) {
            return (WRB_ERROR) ;
        }
        /* Write out the file */
```

```
        VPOSTWriteFile( txnOutFile ) ;
        return (WRB_DONE) ;
}
```

VPOSTGetTxn()

```
enum eVPOSTTxn
VPOSTGetTxn( char *uri )
{
        /*
      * The function scans the uri and extracts the string
      * corresponding to the transaction and returns it to the
      * caller.
      */
}
```

Transaction Log format

This section describes the format of a record for the transaction log for the VPOST cartridge.

Field Name	**Field Description**
nTransType	Transaction Type
nPurchOrderNo	Purchase Order Number
szAcctNum	Payment Instrument Account number
szExpDate	Payment instrument expiration date
szTransAmt	Transaction amount
szTransDate	Date of transaction (configurable to be mm/dd/yy or dd/mm/yy)
szTransTime	Time of transaction (configurable to be GMT or local time)
szRetrievalRefNum	Retrieval reference number
szAuthId	Authorization ID
szOrigAmt	Original transaction amount
szBatchNum	Batch number to which this particular transaction belongs in the VPOST batch
nCurrencyType	Currency

lnTransNum Transaction number

In the block diagram shown in Figure **15B**, the VPOS provides an interface for transactions which are initiated both by the consumer and the merchant. The merchant initiates a transaction from a Graphical User Interface (GUI) **1550** and all the transactions that are initiated by the consumer are routed by the Merchant WEB Server **1545**.

The Authorization/Data Capture Module **1560** processes the requests originated by the merchant or the consumer and routes them to the Protocol Module **1565**. The Protocol Module is responsible for building the payment protocol request packet (e.g., an SSL-encapsulated ISO 8583 packet) **1570** before sending the request to the Gateway **1579**. Then, the Gateway **1579** awaits a response from the Protocol Module **1565**, and upon receiving the response, the Gateway **1579** parses the data and provides unwrapped data to the Authorization/Data-Capture Module **1560**. The Authorization/Data-Capture Module **1560** analyzes the response and updates the Transaction Log **1580**. The Transaction Log **1580** contains information concerning any successfully completed transactions and the accumulators or the transaction totals. The VPOS terminal creates and maintains the Transaction Log **1580**, and the VPOS Configuration Data **1585** contains information which is used to configure the behavior of the VPOS. The entire VPOS functionality is thread-safe and hence using the VPOS in a multi-threaded environment does not require any additional interfacing requirements.

Figures **36-48** are VPOS screen displays in accordance with a preferred embodiment.

Payment Functionality

As discussed above, the different Payment Functionality provided by the VPOS terminal can be divided into two main categories as "Merchant Initiated" and "Consumer Initiated." Some of these transactions require communication with the Gateway and these transactions are referred to as "Online Transactions." The transactions which can be done locally to the merchant without having to communicate are referred to as "Local Functions/Transactions." In order to provide support for many different types of Payment Instruments, the VPOS Payment Functionality have been categorized.

Host payment functionality and transactions require communication with the host either immediately or at a later stage. Each of the host financial payment transactions come to this category and require a Payment Instrument. These transactions can be initiated with different types of Payment Instruments which the VPOS terminal supports.

An authorization without capture transaction is used to validate the card holder's account number for a sale that needs to be performed at a later stage. The transaction does not confirm a sale's completion to the host, and there is no host data capture in this event. The VPOS captures this transaction record and later forwards it to the host to confirm the sale in a forced post transaction request. An authorization without capture transaction can be initiated both by the consumer and the merchant.

A forced post transaction confirms to a host computer that a completion of a sale has been accomplished and requests data capture of the transaction. The forced post transaction is used as a follow-up transaction after doing an authorization (Online or Off-line) transaction. The transaction can be initiated only by the merchant.

The authorization with post transaction is a combination of authorization without capture and forced post transactions. This transaction can be initiated both by the consumer and the merchant.

The offline post transaction is identical to the "authorization without capture" transaction, except that the transaction is locally captured by the VPOS without initiating communication with a host. A forced post operation is done as a follow-up operation of this transaction. This transaction can be initiated by both the consumer and the merchant.

The return transaction is used to credit the return amount electronically to the consumer's account when a purchased merchandise is returned. The VPOS captures the return transaction record when the merchandise is returned, and this transaction can be initiated only by the merchant.

The void transaction cancels a previously completed draft capture transaction. The VPOS GUI provides an interface for retrieving a transaction record required to be voided from the batch

and passes it to the Authorization/Data-Capture module after confirmation. The batch record is updated to reflect the voided transaction after getting an approval from the gateway. This transaction can be initiated only by the merchant.

The pre-authorization transaction is identical to the authorization without capture transaction, but the consumers' "open-to-buy" amount is reduced by the pre-authorization amount. An example of this type of transaction is the "check-in" transaction in a hotel environment. A check-in transaction sends a pre-authorization request to the host, so that an amount required for the customers' stay in the hotel is reserved. The pre-authorization transaction is followed by a pre-authorization complete transaction. This transaction can be initiated both by the consumer and the merchant.

The pre-authorization complete transaction is done as a follow-up to the pre-authorization transaction. This transaction informs the host of the actual transaction amount. The pre-authorization complete transaction amount could be more or less than the pre-authorization amount. An example is the "check-out" transaction in a hotel environment. The check-out amount can be less than or more than the check-in amount. This transaction can only be initiated by a merchant.

The adjust transaction is initiated to make a correction to the amount of a previously completed transaction. The adjust transaction can be initiated only by the merchant. The host administrative transactions do not require any payment instrument. The balance inquiry transaction is used for on-line inquiry into the balance of the merchant's account. The batch data or the configuration data is not affected by this transaction.

The reconciliation or close transaction is processed at the end of the day to start the settlement process for the transactions captured by the host for that particular VPOS.

The host log-on transaction is an administrative transaction which is used to synchronize the VPOS with the host at the start of the day and also initiate a fresh batch at the VPOS terminal.

The parameters download transaction is used to download the VPOS configuration information from the host and set-up the VPOS in the event of any change in the configuration data. A test

transaction is used to detect the presence of a host and the status of a link from the VPOS to the host.

Local transactions or functions are initiated by a merchant and do not require communication with the gateway. These transactions can only be initiated by a merchant. The totals or accumulators review is a local information inquiry function and is used to retrieve the local (merchant's) totals. The detail transaction or the batch review function is used to retrieve all the records from the transaction log or the batch. The clear batch function is used to start a fresh batch. This transaction is utilized to electronically reconcile the VPOS with the host and to manually reconcile the VPOS with the host. After completing the manual reconciliation processing, the merchant can initiate this transaction to start a fresh batch.

The clear accumulator function is similar to the clear batch functionality and resets all VPOS terminal accumulators to zero. This function is required when the merchant is not able to reconcile the VPOS with the host electronically.

The VPOS unlock or start transaction is a local function used to start the VPOS at the start of the day. The VPOS lock or stop function is used to Lock or stop the VPOS from accepting any transactions. The VPOS configuration setup function is used to setup the VPOS configuration data. The VPOS configuration data is divided into different tables, for example, the Card/Issuer Definition Table (CDT), the Host/acquirer Definition Table (HDT), the Communications Parameters Table (CPT) and the Terminal Configuration Table (TCT). The following sections explain each of these configuration tables in detail.

Payment Instruments

As discussed above, the VPOS terminal supports different Payment Instruments and each of the Payment Functions described above can be initiated by these different Payment Instruments. The consumer making a purchase from a merchant provides a choice of payment methods depending upon their personal preference. The Payment Instrument Class Hierarchy which is used by the different VPOS terminal Payment Functions is described below.

Message Sequence Diagram

Figure **17** shows a typical message flow between the consumer, merchant, VPOS terminal and the Gateway. This section describes the different classes listed in the previous section, their data and members, and defines the type of the transaction that is to be performed. Processing commences at **1700** when a merchant server receives a sales order and passes it via the VPOS Graphical User Interfece (GUI) **1710** to an authorizer **1720** for approval and subsequent protocol processing **1730** and ultimately transmission via the gateway **1740** to the network.

Class Name :

CVPCLTransaction

Data :

Transaction Type (int)
Transaction Date and Time (CPCLDateTime)
Card Definition Table (CVPCL_CDT)
Host Definition Table (CVPCL_HDT)
Communications Parameters Table (CVPCL_CPT)
Terminal Configuration Parameters (CVPCL_TCT)
Batch Record (CVPCLBatch)
Accumulator Record (CVPCLAccum)

Member Functions :

```
CVPCLTransaction();
EStatus GetTransType();
EStatus GetTransDateTime(CPCLDateTime&);
EStatus SetTransType(const int);
virtual EStatus InitializeTrans(TVPOSParamsBlk *) = 0;
virtual EStatus ExecuteTrans(TVPOSResultsBlk *) = 0;
virtual EStatus ShutDown() = 0;
```

Host Transaction Class Definitions

This section contains all the host transaction class definitions.

Host Transaction Class (CVPCLHostTrans)

This is an abstract base class derived from the CVPCLTransaction class and is used for deriving transaction classes which need to communicate with the host either immediately or at a later stage.

Class Name :

CVPCLHostTrans

Data :

Member Functions :

CVPCLHostTrans();

Financial Transaction Class (CVPCLFinancialTrans)

This is an abstract base class derived from the CVPCLHostTrans. This class is used to derive transaction classes which require a payment instrument (e.g., a Credit Card) associated with them to perform the transaction.

Class Name :

CVPCLFinancialTrans

Data :

Transaction Amount (CVPCLAmt)
Purchase Order Number (char[]])
Transaction Number (char[])
Authorization Identification Number (char[])
Retrieval Reference Number (char[])
Batch (CVPCLBatch)
Accumulators (CVPCLAccumulators)

Member Functions :

CVPCLFinancialTrans();
EStatus GetTransAmt(CVPCLAmt&);
EStatus GetPurchOrderNum(char *);
EStatus GetTransRefNum(char *);
EStatus GetRetRefNum(char *);
EStatus GetAuthId(char *);

EStatus GetCurrencyType(EPCLCurrency *);
EStatus SetPurchOrderNum(const char *);
EStatus SetTransRefNum(const char *);
EStatus SetRetRefNum(const char *);
EStatus SetAuthId(const char *);
EStatus SetCurrencyType (const char *)

Financial Credit Card Transaction Class (CVPCLFinCCTrans)

This is the base abstract class for the financial host transaction which require a Credit Card payment instrument. This class is derived from the CVPCLFinancialTrans.

Class Name :

CVPCLFinCCTrans

Data :

Credit Card Payment Instrument (CPCLCreditCard)

Member Functions :

CVPCLFinCCTrans();

Credit Card Authorization Only Transaction Class (CVPCL_CCAuthOnly)

This is the class derived from the CVPCLFinCCTrans class and implements the Authorization Only Transaction.

Class Name :

CVPCL_CCAuthOnly

Data :

Member Functions :

CVPCL_CCAuthOnly();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Authorization with Capture Transaction Class (CVPCL_CCAuthCapt)

This is the class derived from the CVPCLFinCCTrans class and implements the Authorization with Data Capture Transaction.

Class Name :

CVPCL_CCAuthCapt

Data :

Member Functions :

CVPCL_CCAuthCapt();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Return Transaction Class (CVPCL_CCReturn)

This is the class derived from the CVPCLFinCCTrans class and implements the Return Transaction.

Class Name :

CVPCL_CCReturn

Data :

Member Functions :

CVPCL_CCReturn();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Pre-Authorization Transaction Class (CVPCL_CCPreAuth)

This is the class derived from the CVPCLFinCCTrans class and implements the Pre-Authorization Transaction.

Class Name :

CVPCL_CCPreAuth

Data :

Member Functions :

CVPCL_CCPreAuth();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Off-line Authorization Only Transaction Class (CVPCL_CCOfflineAuth)

This is the class derived from the CVPCLFinCCTrans class and implements the Offline Authorization Class Transaction.

Class Name :

CVPCL_CCOfflineAuth

Data :

Member Functions :

CVPCL_CCOfflineAuth();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Adjust Transaction Class (CVPCL_CCAdjust)

This is the class derived from the CVPCLFinCCTrans class and implements the Adjust Transaction.

Class Name :

CVPCL_CCAdjust

Data :

Member Functions :

CVPCL_CCAdjust();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Void Transaction Class (CVPCL_CCVoid)

This is the class derived from the CVPCLFinCCTrans class and implements the Void Transaction.

Class Name :

CVPCL_CCVoid

Data :

Member Functions :

CVPCL_CCVoid();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Forced Post Transaction Class (CVPCL_CCForcedPost)

This is the class derived from the CVPCLFinCCTrans class and implements the Forced Post Transaction.

Class Name :

CVPCL_CCForcedPost

Data :

Member Functions :

CVPCL_CCForcedPost();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Pre-Authorization Complete Transaction Class (CVPCL_CCPreAuthComp)

This is the class derived from the CVPCLFinCCTrans class and implements the Pre-Authorization Completion Transaction.

Class Name :

CVPCL_CCPreAuthComp

Data :

Member Functions :

CVPCL_CCPreAuthComp();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();
EStatus FormBatchRec();

Credit Card Balance Inquiry Class (CVPCL_CCBalanceInq)

This class is derived from the CVPCLFinCCTrans class and is used to perform the Merchant Balance Inquiry function.

Class Name :

CVPCL_CCBalanceInq

Data :

Member Functions :

CVPCL_CCBalanceInq();
EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();

Administrative Host Transaction Class (CVPCLAdminHostTrans)

This is an abstract base class derived from the CVPCLHostTrans class and is used to derive the administrative host transaction classes.

Class Name :

CVPCLAdminHostTrans

Data :

Member Functions :

CVPCLAdminHostTrans();
int GetHostIndex();
EStatus SetHostIndex (const int);

Reconcile Transaction Class (CVPCLReconcile)

This is the class derived from the CVPCLAdminHostTrans class and implements the Reconcile or Close functionality.

Class Name :

CVPCLReconcile

Data :

Member Functions :

CVPCLReconcile();
EStatus InitializeTrans(TVPOSParamsBlk *);
EStatus ExecuteTrans(TVPOSResultsBlk *);
EStatus ShutDownTrans();

Host Log-on Transaction Class (CVPCLHostLogon)

This is the class derived from the CVPCLAdminHostTrans class and implements the Host Log-on Transaction.

Class Name :

CVPCLHostLogon

Data :

Member Functions :

CVPCLHostLogon();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Parameters Download Transaction Class (CVPCLParamsDwnld)

This is the class derived from the CVPCLAdminHostTrans class and implements the Parameters Download (VPOS configuration information from the host) functionality.

Class Name :

CVPCLParamsDwnld

Data :

Member Functions :

CVPCLParamsDwnld();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Test Transaction Class (CVPCLTestHost)

This is the class derived from the CVPCLAdminHostTrans class and implements the Test functionality which is used to test the host and the link.

Class Name :

CVPCLTestHost

Data :

Member Functions :

Virtual POS UnLock/Start Class (CVPCLVPOSUnlock)

This class implements the VPOS UnLock or the Start Local functionality. The class is derived from the CVPCLLocalTrans base class.

Class Name :

CVPCLVPOSUnLock

Data :

Member Functions :

CVPCLVPOSUnlock();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Transaction Data Administration Class (CVPCLTransDataAdmin)

This is an abstract base class used to derive the classes which are required to review/manage the transaction data which includes the batch data and the accumulator data. The class is derived from the CVPCLLocalTrans base class.

Class Name :

CVPCLTransDataAdmin

Data :

Member Functions :

CVPCLTransDataAdmin();

Batch Review Class (CVPCLBatchReview)

This class is derived from the CVPCLTransDataAdmin base class and implements the batch review functionality

Class Name :

CVPCLBatchReview

Data :

CVPCLTestHost();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Local Transaction Class Definitions (CVPCLLocalTrans)

This is the abstract base class for all the transactions that are performed locally to the VPOS.

Class Name :

CVPCLLocalTrans

Data :

Record Number (int)

Host Index (int)

Member Functions :

CVPCLocalTrans();

int GetRecNum();

int GetHostIndex()

EStatus SetRecNum(const int);

EStatus SetHostIndex(const int);

Virtual POS Lock/Stop Class (CVPCLVPOSLock)

This class implements the VPOS Lock or the Stop Local functionality. Under the locked state the VPOS does not accept any transaction requests. The class is derived from the CVPCLLocalTrans base class.

Class Name :

CVPCLVPOSLock

Data :

Member Functions :

CVPCLVPOSLock();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Member Functions :

CVPCLBatchReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Clear Batch Class (CVPCLClearBatch)

This class is derived from the CVPCLTransDataAdmin base class and implements the clear batch functionality, which is used to clear the batch in the event of doing a manual reconciliation between the VPOS and the acquirer.

Class Name :

CVPCLClearBatch

Data :

Member Functions :

CVPCLClearBatch();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Accumulators Review Class (CVPCLAccumReview)

This class is derived from the CVPCLTransDataAdmin base class and implements the Accumulators Review functionality.

Class Name :

CVPCLAccumReview

Data :

Member Functions :

CVPCLAccumReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Clear Accumulators Class (CVPCLClearAccum)

This class is derived from the CVPCLTransDataAdmin base class and implements the Accumulators Clear functionality.

Class Name :

CVPCLClearAccum

Data :

Member Functions :

CVPCLClearAccum();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

VPOS Configuration Data Administration Class (CVPCLConfigDataAdmin)

This is an abstract base class and is used to derive classes which implement the functionality for managing the VPOS configuration data. The class is derived from the CVPCLLocalTrans base class.

Class Name :

CVPCLConfigDataAdmin

Data :

Member Functions :

acquirer Data or the Host Definition Table Review Class (CVPCL_HDTReview)

This class is derived from the CVPCLConfigDataAdmin class and implements the Host Definition Table Review functionality.

Class Name :

CVPCL_HDTReview

Data :

Member Functions :

CVPCL_HDTReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Issuer Data or the Card Definition Table Review Class (CVPCL_CDTReview)

This class is derived from the CVPCLConfigDataAdmin class and implements the Card Definition Table Review functionality.

Class Name :

CVPCL_CDTReview

Data :

Member Functions :

CVPCL_CDTReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Communication Parameters Table Review Class (CVPCL_CPTReview)

This class is derived from the CVPCLConfigDataAdmin class and implements the Communications Parameters Table Review functionality.

Class Name :

CVPCL_CPTReview

Data :

Member Functions :

CVPCL_CPTReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Terminal Configuration Table Review Class (CVPCL_TCTReview)

This class is derived from the CVPCLConfigDataAdmin class and implements the Terminal Configuration Table Review functionality.

Class Name :

CVPCL_TCTReview

Data :

Member Functions :

CVPCL_TCTReview();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

acquirer Data or the Host Definition Table Update Class (CVPCL_HDTUpdate)

This class is derived from the CVPCLConfigDataAdmin class and implements the Host Definition Table Update functionality.

Class Name :

CVPCL_HDTUpdate

Data :

Member Functions :

CVPCL_HDTUpdate();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Issuer Data or the Card Definition Table Update Class (CVPCL_CDTUpdate)

This class is derived from the CVPCLConfigDataAdmin class and implements the Card Definition Table Update functionality.

Class Name :

CVPCL_CDTUpdate

Data :

Member Functions :

CVPCL_CDTUpdate();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Communications Parameters Table Update Class (CVPCL_CPTUpdate)

This class is derived from the CVPCLConfigDataAdmin class and implements the Communications Parameters Table Update functionality.

Class Name :

CVPCL_CPTUpdate

Data :

Member Functions :

CVPCL_CPTUpdate();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Terminal Configuration Table Update Class (CVPCL_TCTUpdate)

This class is derived from the CVPCLConfigDataAdmin class and implements the Terminal Configuration Table Update functionality.

Class Name :

CVPCL_TCTUpdate

Data :

Member Functions :

CVPCL_TCTUpdate();

EStatus InitializeTrans(TVPOSParamsBlk *);

EStatus ExecuteTrans(TVPOSResultsBlk *);

EStatus ShutDownTrans();

Batch Class (CVPCLBatch)

This class defines the batch record and the operations which are performed on the batch.

Class Name :

CVPCLBatch

Data :

Batch Record Structure (TVPOSBatchRec)

```
// Definition of the TVPOSBatchRec is as below,
typedef struct _VPOSBatchRec
{
        char    szTransAmt[];
        char    szTransDate[];
        char    szTransTime[];
        char    szRetrievalRefNum[];        // Trans. Ref. No. sent by the host
        char    szAuthId[];                 // Approval Code sent by the host
        char    szOrigAmt[];                // Original amount for - Adjust
        char    szPurchOrderNum[];
        char    szBatchNum[];
        EPCLTransType  TransType;
        EPCLPmtInst    PmtInst;
        EPCLCurrency   CurrencyType;
        EPCLDecimals   NumDecDigits;
        unsigned int   nTransRefNum;    // Running Ref. Number gen. by the
                                        //VPOS for every approved txn.
    unsigned long  lnSTAN;              // Sys. Trace Number incr. by VPOS
                                                // for every trans. that is trans. to host
        TPmtInstData   PayInstData;
} TVPOSBatchRec;
```

Member Functions :

```
CVPCLBatch();
EStatus SetTransType(const EPCLTransType);
EStatus SetRetRefNum(const char *);
EStatus SetAuthId(const char *);
EStatus SetPurchOrderNum(const char *);
EStatus SetTransRefNum(const long);
EStatus SetTransAmt(const char *);
EStatus SetBatchNum(const char *);
EStatus SetSTAN(const long);
```

```
EStatus SetDateMMDDYYYY(const char *);
EStatus SetTimeHHMMSS(const char *);
EStatus SetPmtInst(const EPCLPmtInst);
EStatus SetCCAcctNum(const char *);
EStatus SetCCExpDate(const char *);
EStatus SetOrigAmt(const char *);
EStatus GetBatchRec(TVPOSBatchRec *);
EStatus InitBatch();
EStatus OpenBatch(const char *, FILE **, const char *);
EStatus CloseBatch(FILE *);
EStatus AddBatchRec ();                  // Adds a record to the batch
EStatus GetBatchRec (const long);        // Gets a record from the batch
EStatus UpdateBatchRec (const long);     // Update batch record with NR
EStatus DeleteBatchRec (const long);     // Deletes the batch record
```

Accumulator Class (CVPCLAccum)

This class defines the Accumulator record and the operations on the accumulators.

Class Name :

CVPCLAccum

Data :

```
Credit Amount (char szCreditAmt[AMT_SZ + 1])
Credit Count (int nCreditCnt)
Debit Amount (char szDebitAmt[AMT_SZ + 1)
Debit Count (int nDebitCnt)
```

Member Functions :

```
int OpenAccum(int fHandle);
int GetAccum (int nAccumType, int *pnAccumCnt, char *pszAccumAmt);
int CloseAccum(int fHandle);
int CleanAccum();
```

Host Definition Table Class (CVPCL_HDT)

This class defines the Host Definition Table record and the operations on the table.

Class Name :

CVPCL_HDT

Data :

Host Definition Table Record Structure (TVPOSHDTRec)

The TVPOSHDTRec structure contains the following fields,

```
typedef struct _VPOSHDTRec
{
        char    szTermId[];
        char    szMerchId[];
        char    szBatchNum[];
        char    szTPDU[];
        char    szNII[];
        char    szHostName[];
        EPCLHostProtType HostProtType;
        EPCLHostProtSubType  HostProtSubType;
        // Data Capture Required Flags
        VPOSBool fAuthOnlyDC;
        VPOSBool fAuthCaptDC;
        VPOSBool fForcedPostDC;
        VPOSBool fAdjustDC;
        VPOSBool fReturnDC;
        VPOSBool fOfflineAuthDC;
        VPOSBool fVoidDC;
        VPOSBool fPreAuthDC;
        VPOSBool fPreAuthCompDC;
        unsigned int  nNumAdv;      // Max. No. of piggy-back trans. allowed
        unsigned int  nTransRefNum;
        unsigned long lnSTAN;       // Systems Trace Number
} TVPOSHDTRec;
```

Member Functions :

```
CVPCL_HDT();
EStatus CleanHDT();
EStatus LoadHDTRec(const int);
```

```
EStatus SaveHDTRec(const int);
EStatus GetNumRecs(int *);
EStatus GetHDTRec(TVPOSHDTRec *);
EStatus GetTermId(char *);
EStatus GetMerchId(char *);
EStatus GetBatchNum(char *);
EStatus GetTransRefNum(unsigned int *);
EStatus GetTPDU(char *);
EStatus GetNII(char *);
EStatus GetHostName(char *);
EStatus GetHostProtType(EPCLHostProtType *);
EStatus GetHostProtSubType(EPCLHostProtSubType *);
EStatus GetNumAdv(unsigned int *);
EStatus GetSTAN(unsigned long *);
EStatus GetAuthOnlyDC(VPOSBool *);
EStatus GetAuthCaptDC(VPOSBool *);
EStatus GetAdjustDC(VPOSBool *);
EStatus GetReturnDC(VPOSBool *);
EStatus GetForcedPostDC(VPOSBool *);
EStatus GetOfflineAuthDC(VPOSBool *);
EStatus GetVoidDC(VPOSBool *);
EStatus GetPreAuthDC(VPOSBool *);
EStatus GetPreAuthCompDC(VPOSBool *);
EStatus SetHDTRec(TVPOSHDTRec *);
EStatus SetTermId(const char *);
EStatus SetMerchId(const char *);
EStatus SetBatchNum(const char *);
EStatus SetTransRefNum(const unsigned int);
EStatus SetTPDU(const char *);
EStatus SetSTAN(const unsigned long);
EStatus SetNII(const char *);
EStatus SetHostName(const char *);
EStatus SetHostProtType(const EPCLHostProtType);
```

```
EStatus SetHostProtSubType(const EPCLHostProtSubType);
EStatus SetNumAdv(const int);
EStatus SetAuthOnlyDC(const VPOSBool);
EStatus SetAuthCaptDC(const VPOSBool);
EStatus SetAdjustDC(const VPOSBool);
EStatus SetReturnDC(const VPOSBool);
EStatus SetForcedPostDC(const VPOSBool);
EStatus SetOfflineAuthDC(const VPOSBool);
EStatus SetVoidDC(const VPOSBool);
EStatus SetPreAuthDC(const VPOSBool);
EStatus SetPreAuthCompDC(const VPOSBool);
```

Card Definition Table Class (CVPCL_CDT)

This class defines the Card Definition Table record and the operations on the table.

Class Name :

CVPCL_CDT

Data :

Card Definition Table Record Structure (TVPOSCDTRec)

The TVPOSCDTRec structure contains the following fields,

```
typedef struct _VPOSCDTRec
{
        char    szPANLo[];
        char    szPANHi[];
        char    szCardLabel[];
        int     nHostIndex;
        int     nMinPANDigit;
        int     nMaxPANDigit;
        // Transaction Allowed Flags
        VPOSBool fAuthOnlyAllwd;
        VPOSBool fAuthCaptAllwd;
        VPOSBool fForcedPostAllwd;
        VPOSBool fAdjustAllwd;
        VPOSBool fReturnAllwd;
```

```
        VPOSBool fOfflineAuthAllwd;
        VPOSBool fVoidAllwd;
        VPOSBool fPreAuthAllwd;
        VPOSBool fPreAuthCompAllwd;
} TVPOSCDTRec;
```

Member Functions :

```
CVPCL_CDT();
EStatus CleanCDT();
EStatus LoadCDTRec(const int);
EStatus SaveCDTRec(const int);
EStatus GetNumRecs(int *);
EStatus GetCDTRec(TVPOSCDTRec *);
EStatus GetPANLo(char *);
EStatus GetPANHi(char *);
EStatus GetCardLabel(char *);
EStatus GetCDTHostIndex(int *);
EStatus GetMinPANDigit(int *);
EStatus GetMaxPANDigit(int *);
EStatus GetAuthOnlyAllwd(VPOSBool *);
EStatus GetAuthCaptAllwd(VPOSBool *);
EStatus GetAdjustAllwd(VPOSBool *);
EStatus GetReturnAllwd(VPOSBool *);
EStatus GetOfflineAuthAllwd(VPOSBool *);
EStatus GetVoidAllwd(VPOSBool *);
EStatus GetPreAuthAllwd(VPOSBool *);
EStatus GetPreAuthCompAllwd(VPOSBool *);
EStatus GetForcedPostAllwd(VPOSBool *);
EStatus SetCDTRec(TVPOSCDTRec *);
EStatus SetHostIndex(const int);
EStatus SetMinPANDigit(const int);
EStatus SetMaxPANDigit(const int);
EStatus SetPANLo(const char *);
```

```
EStatus SetPANHi(const char *);
EStatus SetCardLabel(const char *);
EStatus SetAuthOnlyAllwd(const VPOSBool);
EStatus SetAuthCaptAllwd(const VPOSBool);
EStatus SetAdjustAllwd(const VPOSBool);
EStatus SetReturnAllwd(const VPOSBool);
EStatus SetForcedPostAllwd(const VPOSBool);
EStatus SetOfflineAuthAllwd(const VPOSBool);
EStatus SetVoidAllwd(const VPOSBool);
EStatus SetPreAuthAllwd(const VPOSBool);
EStatus SetPreAuthCompAllwd(const VPOSBool);
```

Communications Parameters Table Class (CVPCL_CPT)

This class defines the communications parameters table and the operations on the table.

Class Name :

CVPCL_CPT

Data :

Communications Parameters Table Record Structure (TVPOSCPTRec)

The TVPOSCPTRec structure contains the following fields,

```
typedef struct _VPOSCPTRec
{
        char    szAcqPriAddress[];
        char    szAcqSecAddress[];
        char    szAcqTerAddress[];

        int     nRespTimeOut;
} TVPOSCPTRec;
```

Member Functions :

```
CVPCL_CPT();
EStatus CleanCPT();
EStatus LoadCPTRec(const int);
```

```
EStatus SaveCPTRec(const int);
EStatus GetNumRecs(int *);
EStatus GetCPTRec(TVPOSCPTRec *);
EStatus GetAcqPriAddress(char *);
EStatus GetAcqSecAddress(char *);
EStatus GetAcqTerAddress(char *);
EStatus GetRespTimeOut(int *);
EStatus SetCPTRec(TVPOSCPTRec *);
EStatus SetAcqPriAddress(const char *);
EStatus SetAcqSecAddress(const char *);
EStatus SetAcqTerAddress(const char *);
EStatus SetRespTimeOut(const int);
```

Terminal Configuration Table Class (CVPCL_TCT)

This class defines the VPOS terminal configuration parameters table and the operations on the table.

Class Name :

CVPCL_TCT

Data :

Terminal Configuration Table Record Structure (TVPOSTCTRec)

The TVPOSTCTRec structure contains the following fields,

```
typedef struct _VPOSTCTRec
{
   char    szMerchName[];
   VPOSBool fVPOSLock;                    // VPOS Lock/Unlock Toggle Flag
} TVPOSTCTRec;
```

Member Functions :

```
CVPCL_TCT();
EStatus LoadTCTRec();
EStatus SaveTCTRec();
EStatus CleanTCT();
```

EStatus GetTCTRec(TVPOSTCTRec *);
EStatus GetMerchName(char *);
EStatus GetVPOSLock(VPOSBool *);
EStatus SetMerchName(const char *);
EStatus SetVPOSLock(const VPOSBool);

Amount Class (CVPCLAmount)

This class defines the amount data items and the operations on them.

Class Name :

CVPCLAmount

Data :

Amount (char[])
Currency Type (EPCLCurrency)

Member Functions :

CVPCLAmount();
EStatus Initialize(const CPCLAmount&);
EStatus Initialize(const char *);
EStatus Initialize(const long);
void operator = (const char *);
void operator = (const long);
EStatus GetAmount(char *);
operator const char * () const;
operator const long ();

Payment Instruments Class (CPCLPmtInst)

This section defines the Payment Instrument Class hierarchy. Figure **16** illustrates a transaction class hierarchy in accordance with a preferred embodiment.

Class Name :

CPCLPmtInst

Data :

Payment Instrument Type (EPCLPmtInst)

Member Functions :

CPCLPmtInst();

EStatus GetPmtInstType(EPCLPmtInst *);

Bank Cards Class (CPCLBankCard)

This class is derived from the CPCLPmtInst class and implements the bank cards class.

Class Name :

CPCLBankCard

Data :

Account Number (char[ ])

Expiration Date (CPCLDateTime)

Index into the CDT table (int)

Member Functions :

CPCLBankCard();

EStatus Initialize();

EStatus SetAcctNum(const char *);

EStatus SetExpDate(const char *);

EStatus GetAcctNum(char *);

EStatus GetExpDate(char *);

EStatus ValidateCard();

int GetCDTIndex();

VPOSBool DoLuhnCheck();

VPOSBool DoCardRanging();

EStatus DoValidateExpDate();

Credit Cards Class (CPCLCreditCard)

This class is derived from the CPCLBankCard class and has the same data and the methods as the CPCLBankCard class.

Class Name :

CPCLCreditCard

Data :

Member Functions :

CPCLCreditCard();

Debit Cards Class (CPCLDebitCard)

This class is derived from the CVPCLBankCard class and implements the debit card class.

Class Name :

CPCLDebitCard

Data :

Card Holder Encrypted PIN (char[ ])

Member Functions :

CPCLDebitCard();

EStatus GetEncryptedPIN(char *);

EStatus SetEncryptedPIN(char *);

VPOS Class Library Interface and API Definition

This section explains the classes which provide the interface to the VPOS class library.

Data Structures required for the VPOS Interface Class

Transaction Parameters Structure (TVPOSParamsBlk) - This structure is a subset of all the transaction parameters required for the different transactions.

```
typedef struct _VPOSParamsBlk
{
        char szTransAmt[];    // Without decimal point.
                              // Left most two digits implied to be decimal digits
  char szPurchOrderNum[];
        char szRetRefNum[];
  char szBatchNum[];
        char szNewBatchNum[];
        char szOrigAmt[];
```

```
        char szCPSData[] ;
        char szAuthId[];        // Auth Id for offline auth-only transaction
        int HostIndex;
        unsigned int nTransRefNum;
        VPOSBool fVPOSLock;
        ECPSDataType eCPSType ;
        EPCLTransType TransType;
        EStatus TransResult;
        EPCLPmtInst PmtInst;
        EPCLCurrency CurrencyType;
        EPCLDecimals NumDecDigits;
        EVPCLAccumType AccumType;
        TPmtInstData PayInstData;
        union _VPOSConfigData
        {
                TVPOSHDTRec srHDTRec;
                TVPOSCDTRec srCDTRec;
                TVPOSCPTRec srCPTRec;
                TVPOSTCTRec srTCTRec;
        } VPOSConfigData;
        void *Context;                  // Context from the calling interface
        EStatus (*VPOSCallBack)(TVPOSResultsBlk *, void *);

} TVPOSParamsBlk;
```

Transaction Results Structure (TVPOSResultsBlk) - This structure contains all the fields returned from the host and other fields which are required for doing terminal data capture.

```
typedef struct _VPOSResultsBlk
{
        char szNewBatchNum[];
        int  nHostIndex;
        EStatus TransResult;
```

```
        TVPOSBatchRec srBatchRec;
        TVPOSAccumRec srAccumRec;
        char szCardLabel[];
        TVPOSHDTRec srHDTRec;
        TVPOSCDTRec srCDTRec;
        TVPOSCPTRec srCPTRec;
        TVPOSTCTRec srTCTRec;
} TVPOSResultsBlk;
```

The various status codes for the enumeration EStatus are detailed below.

VPOS Interface Class (CVPOSInterface)

This class provides the interface to the VPOS Transaction Class Library.

Class Name :

CVPOSInterface

Data :

Member Functions :

```
CVPOSInterface();
// Creates the Transaction Object, takes care
// of other initialization and executes the transaction.
CVPCLTransaction *pclTransFactory(TVPOSParamsBlk *);
EStatus DestroyTrans(CVPCLTransaction *);
```

VPOS API Definition

This section explains in the VPOS API which are required for interfacing with the VPOS Class Library. All the different VPOS transactions can be initiated using the API defined in this section.

VPOS Terminal Architecture

Figure **25** is a block diagram of the VPOS Terminal Architecture in accordance with a preferred embodiment. The Internet **2500** provides the communication processing necessary to enable the VPOS Terminal architecture. The terminal interface CGI **2520** communicates via the

Internet to provide information to the VPOS OLE Server **2550** which formats information in accordance with the VPOS API DLL **2560** which uses the protocol class DLL **2570** to flesh out the message for delivery to the Gateway Server **2580**. The collection of the VPOS OLE Server **2550**, VPOS API DLL **2560** and the Protocol Class DLL **2570** make up the VPOS Software Development ToolKit (SDK) which are used to enable VPOS applications for interfacing with an Operator **2540**.

VPOS/GATEWAY Architecture

The architecture of the Virtual Point of Sale (VPOS) and Virtual Gateway (GATEWAY) architecture maintains SET compliance while providing support for additional message types that are not enabled in SET. The architecture includes isolation of cryptographic details in a single module to facilitate single version government approval while maximizing the flexibility of the system for customization and facilitating transfer of updated versions on an acquirer specific basis. Figure **18** is a block diagram of the extended SET architecture in accordance with a preferred embodiment. Processing commences at function block **1800** for a consumer-originated transaction via the World Wide Web (WWW) or **1810** for a merchant-originated transaction on the Internet. In either case control passes immediately to the WWW server **1820** for the transaction to be appropriately formatted and the appropriate interface page presented, whether the transaction is a store front **1822**, shopping cart **1824**, pay page **1826**, standard terminal administration **1828-1830** transaction, or an extended terminal transaction **1834**. If processing requires authentication of the transaction, then control passes through the Virtual Point of Sale (VPOS) Application Programming Interface (API) library **1840** for SET compliant transactions and through the VPOS API extensions library for extensions to the SET protocol. Then, at function block **1842**, if the transaction is SET compliant, and function block **1864** if the transaction is not SET compliant, a library of protocol stack information is used to conform the message before it is transmitted to a Gateway site for ultimate delivery to a bank host **1874** for authorization.

Extended SET messages are processed at the Gateway site on a two track basis with the division criteria being SET compliance (which will change over time as more functionality is put into SET) or SET extensions. Set compliant messages are processed via the protocol stack library **1862**, while SET extensions are processed via the protocol stack extension library **1864**. Then, at function block **1870** the gateway engine processes SET and Host specific code

including gateway administration extensions **1872** that bypass the normal processing and flow directly from the merchant and consumer server **1820** to the gateway administration extensions **1872** to the Gateway Engine **1870**.

As described above, there are three channels by which messages are exchanged between VPOS **1846** and GATEWAY **1856**.

1. Standard SET messages

The standard SET messages are originated by the merchant software either via a pay page **1826** directly controlled by the consumer, or via an operator interface consisting of a set of HTML pages and associated executables launched by the pages (e.g. pay page **1826** and standard terminal administration **1828-1830**.)

Each SET message type (e.g., authorization v. capture) transmits a different set of data and each requires a different Protocol Data Unit (PDU) to describe its encoding. Examples of how Standard SET messages are encoded are given in the SET documentation previously incorporated by reference.

2. Extended SET messages

The Extended SET messages are utilized as an "escape mechanism" to implement acquirer-specific messages such as settlement/reconciliation, employee logon/logoff, and parameter download. The messages are developed as a set of name-value pairs encapsulated in a PKCS-7 wrapper and wrapped in Multipurpose Internet Mail Extensions (MIME), described in a book by N. Borenstein & N. Freed, "RFC 1521: MIME (Multipurpose Internet Mail Extensions) Part One: Mechanisms for Specifying and Describing the Format of Internet Message Bodies" (Sept. 1993). The name-value pairs can have arbitrary (8-bit) data, so arbitrary items can be passed through the extended SET channel, including executable programs and Dynamic Load Libraries (DLL)s.

Figure **18B** illustrates a multipart MIME message with one Extended SET message and one Standard SET authorizing message. Mime is utilized as an outer wrapper **1890** to allow an Extended SET message **1891** to be transmitted as a component of messages embedded in one MIME multipart message. In this manner, a standard SET message can be sent with an Extended SET message in one VPOS/GATEWAY communication transaction.

Embedding the Extended SET messages in a PKCS-7 wrapper enables the same message authentication to occur as in standard SET messages. Thus, for SET-compliant and non-SET-compliant messages, the same mechanism may be used to restrict which entities the VPOS or Gateway will trust in any communications. An important concept in Extended SET is that all messages, of any type, are sent in a uniform name/value pair format, thus allowing a single Protocol Data Unit to suffice for any type of message sent through the Extended SET channel. Since arbitrary data may be sent this way, a mechanism must be provided to preclude the use of the Extended SET channel by parties other than approved financial institutions. If this is not ensured, then the NSA and the US Department of Commerce will not approve the software for export.

SET itself to some degree ensures that this Extended SET channel is used only by financial institutions. The protocol stack extension library only processes messages that have been signed by a financial institution SET certificate that is in turn signed by a payment instrument brand certificate (such as Visa or MasterCard).
Stronger control over the Extended SET channel can be achieved by further restricting processing of messages to those signed (either instead of or in addition to the financial institution SET certificate) by a second certificate belonging to a third-party agency, either governmental or private (e.g., VeriFone, as manufacturer of the software).

In this way, a particular set of Extended SET messages can be implemented by Bank X, and a different set of messages by Bank Y. If a VPOS has an extended terminal transaction interface as shown in Figure **18A** at block **1834** for Bank X, and has been configured to only accept messages from a Gateway with Bank X's certificate, then it will be able to communicate those messages to a Gateway that has the certificate for Bank X, and accepts messages of the types in Bank X's message set. The VPOS will not be able to connect to the Bank Y gateway, or to any other system that purports to communicate via Extended SET. This restriction is further secured by utilizing a public key certificate that is "hard wired" into VPOS, and which is distributed only to gateways that use the Extended SET mechanism.

Figure **18C** is an example flowchart of message processing in accordance with a preferred embodiment. Processing commences at function block **1880** when a message is received by an

HTTPS server or other listener and passed to decision block **1883** to determine if the sending VPOS has transmitted an authentic message and if the VPOS is authorized to communicate with this gateway. If the message is not authentic, then the message is logged as an error and the error is handled as shown in function block **1889.** If the message is authentic, then the message is decrypted at function block **1884** and the PDU parses the message into name / value pairs. Then, based on the message type and the extended SET version information, the remaining message is parsed at function block **1885** and the message is checked for conformance to the appropriate specification as shown at decision block **1887.** If the message does not conform, then it is logged and the error handled at function block **1889.** If the message conforms to the proper specification in decision block **1887** then the message is translated into the appropriate host format and sent to the host as shown in function block **1888.** Thus, when a gateway receives an incoming message from a VPOS and parses the Extended SET portion of the message, a single MIME message can transmit a SET message and/or an Extended Set Message.

An export license for the encryption can be obtained on a case-by-case basis, and since there will be potentially millions of VPOS's, it is desirable to obtain a commodities jurisdiction for the VPOS, to enable a single version of the VPOS (rather than one version for each bank) to be supported by the VPOS architecture. The architecture described here ensures that the single version of VPOS, no matter how it is configured with extended terminal transaction interfaces, cannot be used to communicate any data other than that contained in the extended SET messages that have been approved for export by the US government to be used exclusively for a specific bank.

Figure **18D** is an example of a simple message between VPOS and Gateway using the Extended SET channel enabling an employee to sign on, or "logon" to a given terminal in accordance with the subject invention. The message must contain the employee's logon ID, a password to be verified by the bank host computer, and the date and time as shown at **1894**.

While the contents of the message are shown without encryption in Figure **18D**, it should be noted that the information (including the logon password) are SET encrypted inside the PKCS-7 wrapper **1894**. Certain fields may be designated as mandatory for an Extended SET message, to allow the Gateway or VPOS to decide how to handle the message. For the sake of clarity, in

this message **1894**, only two fields, "messagetype" and "ESETversion", are mandatory. These fields inform the Gateway that this message is of type "logon," and that the VPOS is using version "1.0A" of the ESET message formats defined for the Gateway. In this embodiment, the length indicator "[5]" is used to distinguish the length (in bytes) of the field of type "messagetype" in the message. In this way, there are no special end-of-data characters, and therefore arbitrary data need not have any "escaped" characters.

It should be noted that using escaped characters will work equally well. Total message integrity is assured by the digital signatures in the PKCS-7 wrapper. This does not, however, preclude the use of other checksumming schemes for additional pinpointing of transmission or encoding errors. The messagetype and ESETversion name/value pairs facilitate Gateway look up of what name/value pairs are expected in the "logon" message. Some name/value pairs may be mandatory, and others may be optional.

Figure **18E** is an example of a simple message between VPOS and Gateway using the Extended SET channel enabling an employee to sign on, or "logon" to a given terminal in accordance with the subject invention. In response to the logon request message from a VPOS, the Gateway may respond with a "logon accepted" message **1894**, as depicted in Figure **18E**, which VPOS, upon receipt and authentication, then uses to unlock the terminal for that user.

Figure **49** shows how the VPOS authenticates an incoming response to a request in accordance with a preferred embodiment. Processing commences at function block **4930** when a message is received by the HTTPS, SET server, or other listener that originated the request to which this reponse corresponds. The message is passed to decision block **4940** to determine if the sending Gateway has transmitted an authentic message and if the gateway is authorized to communicate with this VPOS. If the message is not authentic, then the message is logged as an error or possible attack and the error is handled as shown in function block **4970.** If the message is authentic, then the message is decrypted at function block **4950** and the PDU parses the message into name/value pairs. Then, based on the message type and the extended SET version information, the remaining message is parsed at function block **4960** and the message is checked for conformance to the appropriate specification as shown at decision block **4980.** If the message does not conform, then it is logged and the error handled at function block **4970.** If the message conforms to the proper specification in decision block **4980** then

the message is translated into a standardized argument string to be passed to the appropriate executable or code entry point in the VPOS, as shown in function block **4990.** Thus, when a VPOS receives an incoming message from a Gateway and parses the Extended SET portion of the message, the message may cause VPOS to execute a program that takes action or queries the user to take action.

3. Gateway-initiated messages

Since all SET messages between a merchant and an acquirer are currently merchant-initiated (as specified in the SET documentation), there must be a separate mechanism for initiating a message from a gateway, for example to request the upload of management information base (MIB) data, or to download new parameters. This is accomplished by requiring the gateway to send a message to the merchant via a MIME-encapsulated PKCS-7 conformant message containing name-value pairs to the merchant server directly, rather than to the SET module. This channel is shown in Figure **18A** at block **1860.**

The message is verified for origination from the acquirer, and is utilized to either initialize a merchant action, such as to update the merchant's administration page (for example by blinking a message saying, "PLEASE RE-INITIALIZE YOUR TERMINAL"), or by initiating a request/response message pair originating from the merchant (for example, "HERE ARE THE CONTENTS OF MY MIB"). This is achieved by calling one of the extended terminal transaction interfaces (Figure **18A** at **1834**), which in turn initiates a SET or Extended SET transaction.

Gateway Customization via the Extended SET Channel

Gateway customization in extended SET is extremely powerful and a novel concept for VPOS processing. Each VPOS contains one or more "serial numbers" unique to each copy of the software (a serial number may be embedded in the software, or may be a component of a public key certificate used in the software). Once a merchant has selected an acquirer and obtained the appropriate certificates, the VPOS can be customized utilizing the communication link and messages containing customization applications.

A bank distributes VPOS via different sales channels. The first is direct from a bank to an existing merchant with whom the bank already has an existing relationship. In this case, a version of VPOS already customized for a bank is sent to the merchant, either directly by a

bank, or through a third-party distributor or service bureau. The customizations may involve modification or replacement of, for example, a store front **1822,** shopping cart **1824,** pay page **1826,** standard terminal administration transaction interface **1828-1830** or an extended terminal transaction interface **1834.** This is a standard model of distribution of software that is customized for small target market segments.

The more interesting case, and the one that concerns the novel use of the Extended SET channel, is where the potential merchant acquires, through some non-bank channel, a "generic" VPOS which has not yet been customized to interact with a specific bank. This VPOS can communicate with a "test gateway", which the merchant may use to experiment with the various features of VPOS and to test the integration of the VPOS into a total online storefront.

In order to actually transact business over the Internet, the merchant must first obtain a merchant ID from the merchant bank with which he signs an acquiring agreement. For online payment processing, the merchant must also obtain an appropriate set of digital credentials in the form of public key certificates and possibly additional passwords, depending on the financial institution. Once these credentials are obtained, the merchant is ready to customize the already-obtained VPOS to communicate with a merchant bank's gateway.

Using the built-in "serial number" certificate and the Test Gateway public key certificate (which is "hard-wired" into the VPOS software), it is possible to securely download a particular bank's customization applications to a specific copy of the VPOS software . Once the VPOS is appropriately configured, the last stage of customization download is to configure the VPOS so that it only responds to a public key certificate of the merchant's acquirer. This process is illustrated here in the context of a merchant who obtains a VPOS that talks to the VeriFone test gateway, and desires to customize the VPOS to interact with a gateway at a bank.

The merchant has purchased a VPOS from a non-bank channel. The version communicates with the VeriFone Test Gateway. The merchant uses the gateway to learn about using VPOS, and to test the integration of his storefront system with his payment system. The merchant also obtains certificates for payment processing from a bank, the merchant bank of choice for the merchant. The merchant is now ready to customize VPOS to talk to the bank gateway. The flowchart for the merchant interaction with the Test Gateway is shown in Figure **50.**

The merchant begins at function block **5000**, where the newly-obtained merchant SET certificates are installed in the VPOS. The merchant then directs the VPOS to connect to the VeriFone Test Gateway, by selecting this option from the VPOS terminal administration home page **5005**. The choice of this option invokes an extended terminal admin page from the default set of such pages supplied with the generic version of VPOS. This program guides the customization process.

The merchant, interacting with the extended terminal admin page, navigates to the list of gateways which is maintained by the Test Gateway, and selects the bank to connect by selecting from the list of banks, at function block **5015**. During this process, the merchant's public key certificates are uploaded to the Test Gateway, and checked (at decision block **5025**) to verify that the certificates have been signed by the bank to customize the bank for the VPOS. If the certificates do not match, the merchant is advised of the situation in function block **5028**, and must select a different bank. If the certificates are not valid SET certificates as detected at decision block **5020**, the merchant is advised at function block **5028,** and the session terminates. If the certificates are valid and match the selected bank, customization continues at function block **5030**.

The extended terminal administration program in VPOS receives a list of the customizations from the Test Gateway that must be performed to specialize the VPOS for a specific bank. Some of these customizations are mandatory, while others are optional. In function block **5030**, the VPOS advises the merchant of the customizations, prompting for any choices that must be made by the merchant. The merchant's actions at this point drive decision block **5035**, in which the VPOS either returns itself to the "generic" state and terminates the interaction, or begins the configuration of the VPOS, depending on the merchant's confirmation of the request to begin the configuration.

If the merchant has authorized the changes, control is passed to function block **5040** where, the POS stores the certificates of any gateways that it will allow future configuration changes to be initiated from in its database. This may be only a specific bank, such as a bank and the Test Gateway, or other combinations. If only a single, non-Test, bank-owned, gateway is allowed to download changes, the VPOS is no longer customizable for any other bank. Then, a

new copy would be purchased by the merchant to have it customized for another bank. If the Test Gateway is still allowed to customize the VPOS, the merchant could switch to another merchant bank and have the current VPOS updated to work with the new bank.

In function block **5050**, the customizations are downloaded to the VPOS. The downloads comprise a set of HTML pages and a set of executable programs or scripts that read data from the merchant, perform various functions, and present data to the merchant. In general, the customizations downloaded may augment or replace in part or in whole any and all of function blocks **1822, 1824, 1826, 1828, 1830,** or **1834** in **Figure 18A.** At a minimum, the terminal "home page" will be replaced so that it points to the new functionality. At this point, the customization of the VPOS has been completed, and the merchant may now begin sending payment requests to the merchant bank or processor through the VPOS.

Thread Safe VPOS - TID Allocation

Physical terminals process a single transaction at a time since clerks are usually only able to process one transaction at a time. Web Servers can process many transactions at a time, so payment requests can often occur simultaneously. Thus, the VPOS Software must have support for multi-tasking and provide support for multiple threads to be active at the same time in the same system as well as the same process. This requirement is relatively straight forward. However, the authorizing banks require that all transaction requests include a Terminal ID (TID), and, for many banks, no single TID may be active in any two transaction requests that overlap in time. Thus, the VPOS requires dynamic allocation of TIDs to requesting threads.

One way of providing for multiple TID's is to assign a "base" TID, and either an "extension" (a set of extra digits appended to the base), or an increment (a number which is added to the base to obtain the complete TID). While such a solution can be used for the majority of banks and processors, not all banks/processors can accommodate this solution. One example is First Data Corporation. For its ENVOY protocol, the terminal ID must use the Luhn check as recited in an ISO remark, which adds a checksum digit to the terminal ID to reduce chances of fraud or of mistyped information. Thus, to be general enough to handle all bank/processor situations, a pool of TID's is used. The TID's stored in the pool need not be a sequential set of numbers; in fact they can be alpha/special/numeric combinations, and the TID's need have no

relation to one another. In a preferred embodiment, a TID is represented as a token in a pool that can be associated with a particular transaction.

To provide for this requirement, the VPOS provides a TID pool in tabular form in a database management system (DBMS). This table has two columns: TID NAME & Allocation date/time. If the TID date is null, then the TID is not in use and may be assigned. A date/time field is utilized to allow TID allocations to expire. TID requests are made utilizing a SQL query on the TID Pool to find the first null or expired date/time, which is replaced with the current date/time and the TID name returned.

REMOTE VPOS

The unique architecture of the Cardholder **120**, Merchant **130** and Gateway **140,** as shown in Figure **1B**, provides communication capability between the modules utilizing the Internet to support linkages **150** and **170**. Since the Internet is so pervasive, and access is available from virtually any computer, utilizing the Internet as the communication backbone for connecting the cardholder, merchant and access to the authorizing bank through a gateway allows the merchant VPOS software to be remotely located from the merchant's premises. For example, the cardholder could pay for goods from any computer system attached to the Internet at any location in the world. Similarly, the merchant VPOS system could be located at a central host site where merchant VPOS systems for various merchants all resided on a single host with their separate access points to the Internet. The merchant could utilize any other computer attached to the Internet utilizing a SSL or SET protocol to query the remote VPOS system and obtain capture information, payment administration information, inventory control information, audit information and process customer satisfaction information. Thus, without having to incur the overhead of maintaining sufficient computer processing power to support the VPOS software, a merchant can obtain the information necessary to run a business smoothly and avoid hiring IS personnel to maintain the VPOS system.

VPOS Multi-Merchant Processing

Multiple merchant processing refers to the ability of a plurality of merchants to process their individual VPOS transactions securely on a single computer. The architecture relies on each payment page obtaining the merchant name in a hidden field on the payment page. The VPOS engine receives the merchant name with a particular transaction and synchronizes the

processing utilizing a Set Merchant method. This command causes the VPOS API to look up a unique registry tree based on the merchant name. This process causes the VPOS engine to engage the appropriate configuration to process the transaction at hand utilizing a Registry Tree. A registry tree contains Card Definition Tables (CDT)s, acquirer Definition Tables (ADT)s, Merchant Definition Tables (MDT)s, Protocol Configuration Tables (PCT)s, etc. The CDTs point to specific ADTs since each supported card can be supplied by a distinct acquirer. This is one form of split connection. Each of the ADTs in turn point to PCTs, and some acquirers can support multiple parallel gateways. A merchant's name refers to a unique database in the database management system which contains for example, TIDs.

So, for example, to fully qualify a particular merchant in a multi-merchant system, the acquirer Definition Table is queried to ascertain the particular Gateway (VFITest), then if Bank of America requires verification of network communication information, the particular CardDT is accessed with for example VISA. The particular merchant will service VISA transactions utilizing a particular acquirer. The particular piece of merchandise will also be detailed in a data base. Finally, the merchant Configurations will l also be stored in the database to facilitate E-mail and name lookup.

VPOS CLIENT

The interaction between the VPOS and a client commences when a pay page solicits parameters of a transaction. Then, the parameters are validated to be sure the payment instrument, for example, cardnumber is not null. Then, a transaction object is created, eg. AUTHONLY, and the object is initialized and stuffed with parameters of the transaction, eg. ao.setpan(accnum), and the object is executed. This execution invokes the VPOS engine. The VPOS engine further validates the parameters based on the particular merchant's configuration. For example, some merchants do not accept American Express Cards, but will take Visa, and all merchants check the expiration date of the card. Assuming a valid and acceptable card has been tendered, then a TID is assigned (expiring, existing TIDs) or block a new TID from the TID Pool. This generates a STAN, XID, RRPID unique tag and creates an initial record in the transaction database which is flagged as before gateway processing in case the transaction crashes and must be backed out. Then the protocol parameters are identified in the registry based on card type, and a particular acquirer identified. Then, a protocol object is created and executed to extract results

from the protocol object and the before gateway "bit" is flipped to again flag the location of the transaction in the process as it is submitted to the Gateway.

The results received back from the Gateway are placed into a transaction object with is reported back to the pay page and ultimately back to the pay page user.

VPOS Merchant Pay Customization

A novel feature of the VPOS software provides payment page customization based on a merchant's preferences. This feature automatically lists cards that are accepted by a particular merchant based on the active terminal configuration. Each approved card for a particular merchant is linked to the display via an URL that provides a pointer to the credit card information supported by the merchant. Each card has an entry in a data structure referred to as the Card Definition Table (CDT).

A preferred embodiment of the VPOS merchant pay customization software in accordance with a preferred embodiment is provided in Figure **19** which illustrates the logic utilizing a flowchart, and a listing of the source code below. Processing commences at terminal **1900** and immediately flows to function block **1910** where an index variable is initialized for stepping through each of the accepted payment instruments for the merchant's page. Then, at function block **1930**, a URL key is obtained associated with the current merchant pay page and index value. The URL key is a registry key name that points to a picture of a credit card that the merchant has associated with the pay page and which the merchant accepts as payment. At output block **1940** the card image associated with the URL key is obtained and displayed on the terminal. The CDT entry is obtained at function block **1950** utilizing the URL key. The CDT is utilized for storing information associated with each card. Then, at decision block **1960**, a test is performed to determine if the last payment method card has been processed and displayed on the merchant display. If not, then the index is incremented at function block **1920** and the loop reiterated to process the next card at function block **1930**. If all the cards have been processed, then control is returned to the merchant program for processing the transaction at terminal **1970**.

Figures **20A** through **20H** are block diagrams and flowcharts setting forth the detailed logic of thread processing in accordance with a preferred embodiment. Figure **20A** illustrates a prior art approach to POS processing utilized in most grocery stores and department stores today. POS Terminal **2001** accepts transactions provided to it one at a time by customers **2000**. For each transaction, POS Terminal **2001** builds a transaction request **2002** and transmit it to acquiring bank **2004** over communications link **2003**.

Figure **20B** is a data structure **2002** representing a POS transaction request in accordance with a preferred embodiment. The data structure **2002** includes a TID field **2005**, which identifies the physical terminal from which the transaction originates. In addition to the TID field, the data structure also includes other data **2006** necessary to process a transaction. This data includes such fields as a transaction type, a transaction amount, a currency type (such as U.S. dollars), credit card account number, credit card expiration date, etc.

Figure **20C** illustrates a VPOS architecture with account requests being processed by a single acquiring bank. VPOS **2007** processes a plurality of customers **2000** concurrently. For each such customer **2000**, VPOS **2007** builds a data structure **2010**, representing the transaction to be performed for that customer. Each data structure **2010** contains a unique "virtual terminal" ID. VPOS **2007** selects a virtual terminal ID using database **2008**. For each data structure **2010**, VPOS **2007** initiates communication with acquiring bank 2004 using communication link **2003**.

Figure **20D** is a data structure **2010** representing a VPOS transaction request in accordance with a preferred embodiment. The data structure **2010** includes a TID field **2012**, which identifies a virtual terminal ID associated with a particular transaction. In addition to the TID

field **2012**, the data structure also includes other data **2006** necessary to process a transaction. This data includes such fields as a transaction type, a transaction amount, a currency type (such as U.S. dollars), credit card account number, credit card expiration date, etc.

Figure **20E** illustrates a TID allocation database **2008** in accordance with a preferred embodiment. Database **2008** includes a TID allocation table **2011**. TID allocation table **2011** includes a plurality of rows, one for each TID used by each acquiring bank. One such row **2013** is illustrated in detail. Row **2013** includes a good/service order (GSO) identifier **2014**, which identifies the order being transmitted; a TID field 2015, which identifies a terminal ID that may be used with a particular acquiring bank; and an acquiring bank field **2016**, which identifies the acquiring bank for which the TID is valid. In addition, row **2013** may optionally include other fields **2017** that may be used in conjunction with the order processing. A null GSO value indicates that the TID/acquirer combination is not currently in use.

Figures **20F** through **20H** are flowcharts of the detailed logic used to perform virtual terminal ID allocation. Figure **20F** illustrates the main line operation of virtual TID allocation. In step **2020**, execution begins. In step **2021**, a skeletal transaction request structure is prepared. In step **2022**, the main line routine obtains a virtual TID for inclusion within the transaction request structure, as will be more fully disclosed with reference to Figure 20G, below. In step **2023**, the routine verifies that a TID was obtained. If the TID was not obtained, for example, if more transactions are currently being processed than there are TIDs, then execution continues to step **2024**. In step **2024**, the transaction request is put on a queue for future processing. In step **2025**, the routine waits for a transaction process to end, which would free up a TID in

use. At that point, control resumes from step **2022**, and the routine again attempts to obtain a TID.

If the TID was successfully obtained in step **2023**, control proceeds to step **2026**. In step **2026**, the routine submits the transaction to the acquiring bank. In step **2027**, the transaction is processed. In step **2028**, the routine makes a database call to free up the TID that was used in the transaction. In step **2029**, transaction processing ends.

Figure **20G** depicts in detail the process of obtaining a TID from the database. Execution begins in step **2040**. In step **2041**, the routine constructs a database call to reserve a TID for processing, for example, by constructing an SQL statement to retrieve a TID row from the database. In step **2042**, the routine executes the database call that was constructed in step **2041**. In step **2043**, the routine constructs a second database call to extract the TID from the row that was reserved in step **2042**. In step **2044**, the database call constructed in step **2043** is executed to obtain the TID. In step **2045**, a return code is checked to verify whether the TID was successfully obtained. If the TID was successfully obtained, control proceeds to step **2046**, which returns to the calling program. If, however the TID was not obtained, control proceeds to step **2047**. In step **2047**, the routine checks to see whether an excessive number of retries have already been attempted. If there have been an excessive number of retries, control proceeds to step **2048**, which exits with an error indication. If there has not been an excessive number of retries, control proceeds once again to step **2043** to retry the extraction operation.

Figure **20H** depicts the operation of releasing a TID that had been used in a prior transaction. Execution begins in step **2060**. In step **2062**, the routine constructs a database call to update the row for the selected TID so that the value for the good and service order is null, thereby

indicating that the selected TID is not associated with any good or service order, and is therefore free for reuse. In step **2064**, the routine executes the SQL statements constructed in step **2062**, thereby releasing the TID for use in future transactions. In step **2069**, the routine returns to the calling program.

A source code listing for the transaction request processing is provided below in accordance with a preferred embodiment.

```
#include "rr.h"
#ifndef _NT
#define _NT
extern void _setenvp();
#endif

////////////////////////////////////////////////////////////////
// AcquireBillHtml
// On Pay page, output form entries to acquire billing information
////////////////////////////////////////////////////////////////
EStatus AcquireBillHtml(CWSINT& clWSINT, int nTot, CProf& clProfile, EPCLCurrency
eCurrency) {
        //Current time
        time_t tNow; //figure out current year for Credit card expiry
        struct tm *tmNow;
        char szYear[DB_YEAR_SZ + 1];
        char szAmount[FORMATTED_CURRENCY + 1];

        time(&tNow);
        tmNow = localtime(&tNow);
        strftime(&szYear[0], (size_t)DB_YEAR_SZ + 1, "%Y", tmNow); //needs extra 1 for null
        int nYear = atoi(szYear);
```

```
/*<TH>Payment Type</TH>\n<TD><INPUT SIZE = 20 NAME=b_instrument VALUE=\"" \
                << clProfile.m_b_instrument << "\"></TD>" \
                << "*/
        clWSINT << "<CENTER><TABLE BORDER=0><CAPTION ALIGN = TOP><B>Bill
To</B></CAPTION>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Account Number</TH><TD COLSPAN = 5><INPUT
SIZE = 56 MAXLENGTH = "
                << ACCT_NUM_SZ << " NAME=b_card> </TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Name on Card</TH><TD><INPUT SIZE= 20
MAXLENGTH= " << NAME_SZ
                << " NAME=b_name VALUE=\"" << clProfile.m_b_name
                << "\"> </TD><TH>Expiration</TH><TD>Month <SELECT NAME =
b_expire_month><OPTION> 01\n <OPTION> 02\n" <<
                "<OPTION> 03\n <OPTION> 04\n<OPTION> 05\n<OPTION> 06\n<OPTION>
07\n<OPTION> 08\n<OPTION> 09\n" <<
                "<OPTION> 10\n<OPTION> 11\n<OPTION> 12\n</SELECT> Year <SELECT
NAME = b_expire_year><OPTION>" << nYear <<
                "<OPTION>" << nYear + 1 << "<OPTION>" << nYear + 2 << "<OPTION>" << nYear
+ 3 << "<OPTION>" << nYear + 4 <<
                "</SELECT></TD></TR>\n";
        //<TH>Expires</TH><TD>Month <INPUT SIZE=3 NAME=b_expire_month> Year <INPUT
SIZE=5 NAME=b_expire_year></TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Address Line 1</TH><TD COLSPAN=5><INPUT
SIZE=56 MAXLENGTH= " << ADDR_SZ
                << " NAME=b_addr1 VALUE=\"" << clProfile.m_b_addr1 << "\"> </TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Address Line 2</TH><TD COLSPAN=5><INPUT
SIZE=56 MAXLENGTH= " << ADDR_SZ
                << " NAME=b_addr2 VALUE=\"" << clProfile.m_b_addr2 << "\"> </TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>City</TH><TD><INPUT MAXLENGTH= " <<
CITY_SZ << " NAME=b_city VALUE=\""
                << clProfile.m_b_city << "\"> </TD>" << "<TH>State/Province</TH><TD><INPUT
MAXLENGTH= " << STATE_SZ
                << " NAME=b_state VALUE=\"" << clProfile.m_b_state << "\"> </TD></TR>\n";
```

```
        clWSINT << "<TR ALIGN=LEFT><TH>Country</TH><TD><INPUT MAXLENGTH= " <<
COUNTRY_SZ
                << " NAME=b_country VALUE=\"" << clProfile.m_b_country << "\">
</TD><TH>Zip/Postal Code</TH><TD><INPUT MAXLENGTH= "
                << ZIP_SZ << " NAME=b_zip VALUE=\"" << clProfile.m_b_zip << "\">
</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Email</TH><TD><INPUT MAXLENGTH= " <<
BEMAIL_SZ << " NAME=b_email VALUE=\""
                << clProfile.m_b_email << "\"> </TD>"        << "<TH>Phone</TH><TD><INPUT
MAXLENGTH= " << BPHONE_NUM_SZ
                << " NAME=b_phone VALUE=\""       << clProfile.m_b_phone << "\">
</TD></TR>\n";
        clWSINT << "</TABLE></CENTER><P>\n";

        //NPW<< " NAME=b_addr1> </TD>" << "<TH>Payment
Instrument</TH>\n<TD><SELECT NAME =b_instrument>";
        //hack from ini (bug) which pay instruments supported
        //NPW clWSINT << "<OPTION> Credit Card\n" << "<OPTION> Debit
Card\n</SELECT></TD></TR>\n";
        CurrFormat(nTot, eCurrency, szAmount);
        clWSINT << "<CENTER><FONT SIZE=5>Total = " << szAmount <<
"</FONT></CENTER>";
        return (eSuccess);
}

////////////////////////////////////////////////////////////////
//PayButtonsHtml
// Output buttons on pay page: return to shop, pay, pay window,
// modify order
////////////////////////////////////////////////////////////////
void PayButtonsHtml(CWSINT& clWSINT, char* pszShopUrl, CRRReg& clReg) {

        char *pszHomeUrl = clWSINT.LookUp("home_url");
```

```
        char *pszModifyUrl = clWSINT.LookUp("modify_url");
        char *pszSoftUrl = clWSINT.LookUp("soft_url");

        if (!pszHomeUrl) pszHomeUrl = pszShopUrl; //Home Page
        //if (!pszModifyUrl) pszModifyUrl = pszShopUrl; //Shopping Cart typically

        clWSINT << "<CENTER><H4>By pressing the Pay! button I agree to pay the above total amount<br> according to the card issuer agreement<H4></CENTER>\n";
        clWSINT << "<CENTER>\n<A HREF = " << pszShopUrl << "> <IMG SRC=" << clReg.m_szReturnShop << " BORDER = 0></A>\n";
#ifdef _SC
        clWSINT << "<INPUT TYPE = IMAGE NAME = gso SRC = " << clReg.m_szModifyOrder << " BORDER = 0>\n";
#else
        if (pszModifyUrl)
                clWSINT << "<A HREF = " << pszModifyUrl << "> <IMG SRC=" << clReg.m_szModifyOrder << " BORDER = 0></A>\n";
#endif
        clWSINT << "<INPUT TYPE = HIDDEN NAME = home_url VALUE = " << pszHomeUrl << ">\n"
        << "<INPUT TYPE = IMAGE NAME = VPOS SRC = " << clReg.m_szPay << " BORDER = 0>\n"
        << "<INPUT TYPE = HIDDEN NAME = shop_url VALUE = " << pszShopUrl << ">\n"
        << "<INPUT TYPE = HIDDEN NAME = store VALUE = " << clWSINT.LookUp("store") << ">\n"; //Can't be NULL or error previously
        if (pszSoftUrl)
                clWSINT << "<INPUT TYPE = HIDDEN NAME = soft_url VALUE = " << pszSoftUrl << ">\n";
        clWSINT << "</CENTER>\n";
}
//////////////////////////////////////////////////////////////////
// DisplayPayPage
// Outputs billing form, buttons, and static gso
```

```
//////////////////////////////////////////////////////////////////
EStatus DisplayPayPage(CWSINT& clWSINT, CRRReg& clReg, int nError) {

        EStatus eStat;
        char szFileLine[BUFFER_SZ + 1];
        char *pszTag, *pszRefererUrl, *pszShopUrl, *pszExePath, *pszServerName;
        time_t tNow;
        int nTagExist = FALSE;
        HKEY hCardsKey; //To enumerate cards
        long retCode;
        int nNoCards;
        DWORD dwtype, dwlen;
        HKEY hCardKey;
        char szCardBuf[MAX_PATH + 1], szCardPic[MAX_PATH + 1];

#ifdef _SC
        CPOLBk clBkGso;
#else
        char *pszTxn, *pszGsoNum, *pszGsoOpaque, *pszTot;
#endif

        //Shipping headers.  If come from gso page and cookies are not set, set.
        CProf *pProfile;
        pProfile = new CProf();
        if (!pProfile) return (eRRNewFailed);
        eStat = pProfile->Init(clWSINT);
        if (eStat != eSuccess) return (eStat); //Init failed

#ifdef _SC /*No session cookie for the pay page.  This means the user will either use a long
                term cookie or type in their info each time*/
        clWSINT << "Set-Cookie: profile=" << pProfile->GetCookieLine() << "; path=/\n";
/*      if (clWSINT.LookUp("Server Name"))
                clWSINT << "; domain = " << clWSINT.LookUp("Server Name") << ";\n";*/
```

```
#endif

#ifdef _SC
        //Shipping filled in?
        if (!(pProfile->m_s_name[0] && pProfile->m_s_addr1[0] && pProfile->m_s_city[0] &&
pProfile->m_s_state[0] &&
                pProfile->m_s_zip[0] && pProfile->m_s_country[0] && pProfile->m_s_ship[0])) {
                eStat = DisplayGsoPage(clWSINT, clReg, ERROR_DISPLAY); //bug, return
correct?
                return eStat;
        }
        //Creates shopping basket from CGI/Cookies
        eStat = clBkGso.Init(clWSINT, *pProfile, clReg);
        if (eStat != eSuccess) return (eStat); //eRRBasketCreateError

        //Cookies then other headers
        clBkGso.ToCookies(clWSINT, REGULAR);
#endif

        //clWSINT << "Pragma: no-cache\n";
        clWSINT << "Content-type: text/html\n\n";

        //Where to position the page. if all information is filled in, here.
        if (!nError) {clWSINT << "<A NAME=jump></A>";}

        //Output HTML
        ifstream ifPay;
        ifPay.open(clReg.m_szPayTemplate, ios::in|ios::nocreate);
        if (ifPay.fail()) return (eRRCantOpenPayTemplate); //couldn't read pay template file

        //HTML Template
        while (ifPay) {
                ifPay.getline(szFileLine, BUFFER_SZ);
```

```
if (!(pszTag = strstr(szFileLine, DYNAMIC_TAG)))
        clWSINT << szFileLine << "\n";
else {
        nTagExist = TRUE;
        //Null the tag, Output the beginning of the line,
        //make the dynamic basket call, output the rest of the line
        if (strlen(szFileLine) == strlen(DYNAMIC_TAG))
                pszTag[0] = NULL;
        else {
                pszTag[0] = (char) NULL;
                pszTag += strlen(DYNAMIC_TAG) + 1; //was 9
        }
        clWSINT << szFileLine;
        //Dynamic call
        pszRefererUrl = clWSINT.LookUp("Referer");
        if (!pszRefererUrl) return (eRRNoRefererUrl);
        pszExePath = clWSINT.LookUp("Executable Path");
        if (!pszExePath) return (eRRNoExePath);
        pszServerName = clWSINT.LookUp("Server Name");
        if (!pszServerName) return (eRRNoServerName);
        clWSINT << "<FORM METHOD = POST ACTION = http";
        if (clReg.m_nUseSSL)
                clWSINT << "s";
        clWSINT << "://" << pszServerName << pszExePath << "#jump>";

        /*clWSINT << "<FORM METHOD = POST ACTION = " << pszExePath <<
"#jump>";*/

        //Setting Long Cookies
        clWSINT << "<CENTER>If you wish to have billing and shipping defaults
set in your browser, check this box "
                << "<INPUT TYPE = CHECKBOX
NAME=long_cookies></CENTER>\n";
```

```
                    //Fill it in message
                    if (nError) {
                            clWSINT << "<A NAME=jump></A>";
                            clWSINT << "<CENTER><H4>You must fill in <I>all</I> of the
billing information except for <I>address line 2</I> and <I>email</I>.</H4></CENTER>";
                    }
                    //GsoNum
#ifdef _SC
                    time(&tNow); //For multithreading, append instantiation number
                    clWSINT << "<TABLE ALIGN=RIGHT><TR><TH>Order
Number</TH><TD>" << tNow
                            << "</TD></TR></TABLE><BR CLEAR=ALL>\n<INPUT
TYPE=HIDDEN NAME=b_gso_num VALUE = " << tNow << ">\n";
#else
                     //Pay page API: transaction type, GSO #, gso opaque
                    pszGsoNum = clWSINT.LookUp("b_gso_num");
                    if (pszGsoNum)
                            clWSINT << "<TABLE ALIGN=RIGHT><TR><TH>Order
Number</TH><TD>" << pszGsoNum
                            << "</TD></TR></TABLE><BR CLEAR=ALL>\n<INPUT
TYPE=HIDDEN NAME=b_gso_num VALUE = " << pszGsoNum << ">\n";
                    else {
                            time(&tNow); //For multithreading, append instantiation number
                            clWSINT << "<TABLE ALIGN=RIGHT><TR><TH>Order
Number</TH><TD>" << tNow
                            << "</TD></TR></TABLE><BR CLEAR=ALL>\n<INPUT
TYPE=HIDDEN NAME=b_gso_num VALUE = " << tNow << ">\n";
                    }
                    //Some pay page only specifics: transaction to execute, gso opaque
                    pszTxn = clWSINT.LookUp("transaction");
                    if (pszTxn)
                            clWSINT << "<INPUT TYPE=HIDDEN NAME=transaction VALUE =
" << pszTxn << ">\n";
```

```
                    pszGsoOpaque = clWSINT.LookUp("gso_opaque");
                    if (pszGsoOpaque)
                        clWSINT << "<INPUT TYPE=HIDDEN NAME=gso_opaque VALUE =
\"" << pszGsoOpaque << "\">\n";
#endif

#ifdef _SC
                    //Bill to information & Payment Instrument
                    eStat = AcquireBillHtml(clWSINT, clBkGso.GetTot(), *pProfile,
(EPCLCurrency) clReg.m_eDefaultCurrency);
#else
                    //Pay Page alone requires a total
                    pszTot = clWSINT.LookUp("total");
                    if (!pszTot) return (eRRNoPayTotal);
                    eStat = AcquireBillHtml(clWSINT, atoi(pszTot), *pProfile, (EPCLCurrency)
clReg.m_eDefaultCurrency);
                    clWSINT << "<INPUT TYPE=HIDDEN NAME=total VALUE = " << pszTot <<
">\n";
#endif
                    if (eStat != eSuccess) return (eStat); //error from db? within
AcquireBillHtml
                    clWSINT << "<P>\n";

                    //Output Buttons on Form
                    pszShopUrl = clWSINT.LookUp("shop_url");
                    if (!pszShopUrl)
                        PayButtonsHtml(clWSINT, pszRefererUrl, clReg);
                    else
                        PayButtonsHtml(clWSINT, pszShopUrl, clReg);

                    //Registry Card LookUp
                    clWSINT << "<CENTER><TABLE CELLSPACING = 5><TR><TH>Cards
```

```
Accepted:</TH>";
                        RegOpenKeyEx(clReg.m_hStoreKey, "API\\CDT", 0, KEY_READ,
&hCardsKey);
                        dwlen = sizeof(int);
                        RegQueryValueEx(hCardsKey, "NoOfRows", 0, &dwtype,
(LPBYTE)&nNoCards, &dwlen);
                        for (int i = 0; i < nNoCards; i++) {
                                RegEnumKey(hCardsKey, i, szCardBuf, MAX_PATH + 1);
                                RegOpenKeyEx(hCardsKey, szCardBuf, 0, KEY_READ,
&hCardKey);
                                dwlen = MAX_PATH + 1;
                                retCode = RegQueryValueEx(hCardKey, "CardPicture", 0,
&dwtype, (LPBYTE)szCardPic, &dwlen);
                                if (retCode != ERROR_SUCCESS) return eRRRegistryFailure;
                                clWSINT << "<TD><IMG SRC = " << szCardPic << "></TD>";
                                RegCloseKey(hCardKey);
                        }
                        RegCloseKey(hCardsKey);
                        clWSINT << "</TR></TABLE></CENTER>";
                        clWSINT << "</FORM>\n<HR>\n";

#ifdef _SC
                        //Output static HTML Table
                        clBkGso.ToHtml(clWSINT, NOEDIT);
                        //Output static Shipping information
                        StaticShipHtml(clWSINT, *pProfile); //Also NO_EDIT
                        clWSINT << "<HR>\n";
#else
                        //Pay page alone takes and passes through a gso
                        if (pszGsoOpaque)
                                clWSINT << pszGsoOpaque << "\n";
#endif
                        //Rest of Line from template file
```

```
                    if (pszTag)     clWSINT << pszTag;
                }
        }
        if (nTagExist != TRUE)
                return(eRRNoDynamicTag);
        else
                return (eSuccess);
}

////////////////////////////////
//Receipt Page
////////////////////////////////////////////////////////////////////////////////
////////////////#ifdef _SC
////////////////////////////////////////////////////////////////
// StaticShipHtml
// On Pay page, output Static table of shipping information
// based on cookies set in prior page
////////////////////////////////////////////////////////////////
void StaticShipHtml(CWSINT& clWSINT, CProf clProfile) {
        clWSINT << "<CENTER><TABLE CELLSPACING=10><CAPTION ALIGN = TOP><B>Ship
To<B></CAPTION>\n";
        clWSINT << "<TR><TH ALIGN=LEFT>Name</TH><TD>" << clProfile.m_s_name <<
"</TD>" <<
                "<TH ALIGN=LEFT>Address Line 1</TH><TD>" << clProfile.m_s_addr1 <<
"</TD></TR>\n";
        clWSINT << "<TR><TH ALIGN=LEFT>Address Line 2</TH><TD>" << clProfile.m_s_addr2
<< "</TD>" <<
                "<TH ALIGN=LEFT>City</TH><TD>" << clProfile.m_s_city << "</TD></TR>\n";
        clWSINT << "<TR><TH ALIGN=LEFT>State/Province</TH><TD>" << clProfile.m_s_state
<< "</TD>" <<
                "<TH ALIGN=LEFT>Zip/Postal Code</TH><TD>" << clProfile.m_s_zip <<
"</TD></TR>\n";
        clWSINT << "<TR><TH ALIGN=LEFT>Country</TH><TD>" << clProfile.m_s_country <<
```

```
"</TD>" <<
                "<TH ALIGN=LEFT>Shipping Method</TH><TD>" << clProfile.m_s_ship <<
"</TD></TR>\n";
        clWSINT << "</TABLE></CENTER><P>";
}
#endif


////////////////////////////////////////////////////////////////
// StaticBillHtml
// On Receipt page, output static table of billing information
////////////////////////////////////////////////////////////////
void StaticBillHtml(CWSINT& clWSINT, CProf clProfile) {

        /*<TH>Payment Type</TH>\n<TD>" << clProfile.m_b_instrument
                << "</TD>*/
        clWSINT << "<CENTER><TABLE CELLSPACING=10><CAPTION ALIGN = TOP><B>Bill
To<B></CAPTION>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Account Number</TH><TD COLSPAN=3>" <<
clProfile.m_b_card << "</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Name on Card</TH><TD>" << clProfile.m_b_name
<<
                "</TD><TD><B>Expires:</B><I>Month</I> " << clProfile.m_b_expire_month <<
" <I>Year</I> " << clProfile.m_b_expire_year << "</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Address Line 1</TH><TD COLSPAN=3>" <<
clProfile.m_b_addr1 << "</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Address Line 2</TH><TD COLSPAN=3>" <<
clProfile.m_b_addr2 << "</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>City</TH><TD>" << clProfile.m_b_city << "</TD>"
                << "<TH>State/Province</TH><TD>" << clProfile.m_b_state << "</TD></TR>\n";
        clWSINT << "<TR ALIGN=LEFT><TH>Country</TH><TD>" << clProfile.m_b_country <<
                "</TD><TH>Zip/Postal Code</TH><TD>" << clProfile.m_b_zip <<
"</TD></TR>\n";
```

```
        clWSINT << "<TR ALIGN=LEFT><TH>Email</TH><TD>" << clProfile.m_b_email <<
"</TD>"
                << "<TH>Phone</TH><TD>" << clProfile.m_b_phone << "</TD></TR>\n";
        clWSINT << "</TABLE></CENTER><P>\n";
}
```

Default Gateway Configuration

The VPOS is initially shipped enabled to connect to a default gateway with a single instance of a gateway defined that accesses a predefined site for testing of an installation before bringing it online in a production mode. The test installation contacts and converses with an actual gateway that simulates live transactions. After the installation checks out utilizing a set of test transactions, the test gateway downloads the pre-checked customizations to the installation so that it can switch over to the production acquirer. This download processing is enabled in extensions to SET.

Internet Transaction Gateway

Payment methods that issue cards for conducting business utilize four major entities. These entities are the issuer, consumer, merchant and the acquirer. The issuing bank that provides the consumer with a credit card are usually not the same bank as the acquiring bank that serves the merchant. When the consumer utilizes a credit card to pay for a purchase, the merchant swipes the card through the POS terminal which makes a connection to the merchant's acquirer via the telephone network and transmits an authorization request with data read from the magnetic stripe. The acquirer's host processor, depending on the card number, will either perform local processing or switch the request to the correct issuing bank's host processor through the interchange network. In a few seconds, the authorization response is returned to the originating POS indicating either an approval or a rejection.

The Internet is a viable infrastructure for electronic commerce. Ubiquitous browser software for the World Wide Web provides around-the-clock access to a large base of information content provided by Web servers. Utilizing a preferred embodiment, consumers using browsers can shop at virtual stores and malls presented as Web pages managed by the merchants' servers. Consumers can make purchases and pay for them using credit cards or other digital payment

instruments in a secure manner. For such Internet-based payments to be authorized, a "gateway" is necessary at the back end to channel transactions to legacy processors and interchange networks.

Figure **21** is a detailed diagram of a multithreaded gateway engine in accordance with a preferred embodiment. Processing commences when a TCP transaction **2100** is received by a HTTPS Server **2102** and parsed to an appropriate Web Adaptor **2104** which posts an encrypted set transaction to the multithreaded gateway engine **2110**. The encrypted SET request is received at a decryptor **2120**, decrypted into a standard SET transaction and authenticated for converting by the forward converter **2124**. Inside the forward converter **2124,** decides if the request is an original request, and honest retry attempt or a replay attack. The converted transaction is passed to the socket multiplexor **2130** to communicate via an existing communication link **2140** to a host computer. A security logger **2150** is also utilized for passing security records back via a database server **2160** to a database administration application **2190**. A transaction logger **2155** also utilizes the database server **2160** to capture transaction logs in a database **2180**. Other system administration tasks **2195** include a web server administration task **2190** which logs web hits in a log **2170**.

Figure **22** is a flow diagram in accordance with a preferred embodiment. Processing flows from customers **2200** that are paying for products over the Internet or other communication medium utilizing HTTPS or other protocols to one or more merchants **2210**, **2220** or **2230** to a gateway **2240** which directs transactions to a particular host processor **2250** for authorization processing in accordance with the present invention.

Internet Payment Authorization

The Gateway is a secure computer system that mediates transactions between the merchants' servers and a payment processor. The Gateway supports secure communications between merchants using the Internet on one side, and a processor using standard secure financial networks on the other side. Between the two interfaces, the Gateway maintains a detailed log of all transactions, whether in-progress, completed, or failed. The Gateway accepts transactions from merchants and converts them into legacy compatible formats before

forwarding them to the host processor. Responses from the host, after the reverse conversions, will be returned to the originating merchants.

The Gateway performs many functions, including:

- Receives encrypted credit card transactions from the merchants via the Internet
- Unwraps and decrypts transactions
- Authenticates digital signatures of transactions based on certificates
- Supports all transaction types and card types
- Accepts concurrent transactions from each of the merchant servers
- Converts transaction data to legacy formats; forwards the mapped requests (in the clear) to a payment processor over existing communication links
- Converts transaction responses, correlates them with the original requests, and sends the mapped responses back to the merchants
- Provides logging, monitoring, reporting, and system administration

Figure **23** illustrates a Gateway's **2330** role in a network in accordance with a preferred embodiment. The Gateway **2330** strictly conforms to all SET stipulations regarding certificate management, PKCS signed data encapsulation, PKCS encrypted data encapsulation, ASN.1 representation, DER encoding, MIME encapsulation, and message sequencing. A merchant server **2300** communicates via the Internet **2310** using the SET protocol **2320** through a gateway server **2330** using a network interface processor **2340** to communicate to a legacy network **2360** in, for example the X.25 protocol **2350**. The legacy host **2370** ultimately receives and processes the transaction from the merchant server **2300** without modification to its code.

Internet Communication Protocols

As discussed above, the TCP/IP protocol suite is utilized at the transport level. At the application level, in compliance with SET, all requests arrive at the Gateway in MIME encapsulated HTTP format. Similarly, all responses from the Gateway to the merchant servers will be transferred in HTTP. The HTTP protocol stipulates that a request-response pair will go through the same TCP connection and that the originator, in this case a merchant server, will

establish a connection to send the request and will take down the connection when it has received the response.

Host Payment Protocols

Message conversions performed by the Gateway will be significantly more than format transliterations: per-protocol differences in data elements and message semantics must be considered carefully. Some of the transaction types that are supported are listed below.

Transaction Types
Credit card sale with capture
Credit card sale without capture
Credit card sale with capture including AVS (MasterCard and VISA)
Credit card sale without capture including AVS (MasterCard and VISA)
Credit card return (Credit)
Credit card post authorization (Force Post)
Credit card post authorization (Force Post) with partial reversal support, enhanced authorization data, and AVS result code (VISA)
Credit card sale with capture – Void
Credit card return (Credit) – Void
Totals request (for balancing)

Host Communications Protocols

A virtual, private network between the Gateway and the host processor is established to expedite host communication. In addition, two Network Interface Processors (NIP)s – a "near end" NIP that interfaces to the Gateway and a "far end" NIP that interfaces to the host. The NIPs will handle virtual connections between themselves. The far-end NIP will take care of specific communication details. The near-end NIP is an IP-addressable device that converts between TCP messages and packets. It is installed on a public network **2330**, which is a LAN

outside the corporate firewall. The Gateway, on the secure public network **2330**, utilizes TCP/IP **2320** to communicate with the near-end NIP.

GATEWAY FEATURES

Because the Gateway must sustain reliable operations and enable graceful evolution, it is designed with some important attributes, including: Security, Availability, Performance, Scalability, and Manageability.

Security

Channel Security

At the application level, SET provides signed and encrypted data encapsulations of payment information portions of the transaction messages. Transport-level encryption of the entire message packet is required for additional security. The HTTPS protocol – i.e., HTTP over SSL 3.0 – is utilized between the merchants and the Gateway. The virtual connections between the near-end NIP and the host are part of a private network. The termination will occur outside the firewall. Data between the Gateway and the host is sent in the clear with no encryption. In this network configuration, a transaction between a merchant's VPOS and the host will cross the firewall four times: SET request from VPOS to Gateway, legacy request from Gateway to NIP, LEGACY response from NIP back to Gateway, and SET response from Gateway back to VPOS.

Certificate Management

Payment Protocol Certificates

The Gateway uses certificates to authenticate the two parties involved in each MOSET transaction. Through a Certificate Authority, one certificate is issued for the Gateway and one certificate for each of the merchant servers.

Secure Channel Certificates

SSL will require separate certificates for the Gateway and the merchants.

Availability

Site redundancy and location redundancy allows the Gateway to sustain service through virtually instantaneous recovery from internal failures or external disasters that cause physical damages to the system. Minimum-outage recovery is possible with redundant configurations of important components.

Site Redundancy

The Gateway supports connections to a proprietary bank network and supports mirrored disk arrays.

Location Redundancy

The Gateway architecture supports location redundancy where a secondary remote system is connected to the primary system via dedicated WAN links for software-driven database duplication.

Scalability

The Gateway software architecture, the choice of third-party software components, and the selection of hardware platforms enable the system to gracefully adapt and evolve to take on new demands in different dimensions.

The Gateway resides on an HP 9000 that is housed in a standard 19" EIA rack.

Gateway Hardware Configuration

Server Hardware Description
K-Class SMP Server – Model K420 – Standard Configuration
120 MHz PA-RISC 7200 CPU
128 MB ECC RAM
Built-in I/O includes Fast/Wide/Differential SCSI-2, EtherTwist 802.3 LAN, AUI, RS-232C Connectors, Centronics Parallel Port, and Internal Modem

650 MB CD-ROM Drive	
HP-UX 10.10 Operating System (with two-user license)	
4 HP-PB Slots	
Additions	
1	SCSI-2 Disk Controller *to support disk mirroring over dual SCSI-2 buses*
1	2 GB Internal SCSI-2 Disk Drive, 20MB/s transfer rate, not mirrored *for systems software and swap space*
1	4 GB External High-Availability Disk Arrays *for databases – total of 4 x 2 MB modules required*
1	4 GB DAT drive with data compression
1	HP-PB Slot Expansion Option *provides 4 additional HP-PB slots for peripheral controllers*
2	FDDI interface cards (each card uses 2 HP-PB slots)
1	Option for eight-user license for HP-UX

Cryptographic Hardware

The encryption and decryption algorithms used in processing SET/SSL messages require significant computational power. A "security processor" is deployed with the Gateway to boost the performance of cryptographic algorithms. The processor is a networked peripheral device to the HP 9000 server. It provides cryptographic services suitable for SET/SSL processing, and its services are accessible via calls to software libraries running on HP-UX. Figure **24** is a block diagram of the Gateway in accordance with a preferred embodiment.

Gateway Architecture

Operating System Software

The Gateway runs under the HP-UX Version 10.10 operating system and is upgraded to support future significant system releases. HP-UX 10.10 conforms to major standards, including:

- X/Open UNIX 95 (conforming with the Single UNIX Specification, SPEC 1170)
- X/Open Portability Guide Issue 4 Base Profile (XPG4) OSF AES
- IEEE POSIX 1003.1 and 1003.2
- AT&T System V Interface Definition (SVID3 base and kernel extensions subset) Level 1 API support
- UC Berkeley Software Distribution 4.3 (BSD 4.3) including such features as job control, fast file system, symbolic links, long file names, and the C shell
- System V.4 File System Directory Layout

This compliance with various software standards assures that while a preferred embodiment of the invention is disclosed in association with a best mode of practicing the invention other similar software and hardware environments can be readily substituted without undue experimentation.

Relational Database Management System (RDBMS) Software

The Gateway uses Oracle7 Server version 7.3 as the RDMBS and will be upgraded to use future significant system releases. The multi-threaded, multi-server architecture of Oracle7 provides applications with scalability to high-volume transaction workloads. When deployed with the HP 9000 K-Class platform, Oracle7 performs a symmetrically parallel database operation across all available processors. In addition, Oracle7 includes options for creating high-availability systems:

- The Oracle7 *Parallel Server* option extends the reliability of applications by transparently harnessing the power of clustered computers in a single logical processing complex that can tolerate individual machine failures.
- Oracle7 *Symmetric Replication* provides high data availability. Data can be replicated from the primary system to one or more alternative sites.

HTTP Server

The Gateway utilizes Netscape's Enterprise Server 2.0 as the HTTP server. The server is designed for large-scale Internet commerce deployment, Enterprise Server 2.0 achieves performance and reliability with such features as optimized caching, SMP support, enhanced memory management, and SNMP-based performance monitoring. Efficient process management features minimize system load and increase server reliability. Security features are provided using the SSL 3.0 protocol.

Protocol Stacks

Internet and LAN - The TCP/IP protocol stack will be provided as part of the HP-UX operating system.

Other Application-Level Protocols

Application-level protocols enable client-server interoperability. Each of the following protocols are transported using TCP or UDP.

- **HTML.** HTML will be used to define screens for Gateway system administration.
- **HTTP.** The HTTP layer is part of Enterprise Server 2.0. The server is administered with a Web browser.
- **SQL*Net.** The Gateway's Oracle7 database can be accessed by administration clients using SQL*Net. Administration software can establish database connectivity to retrieve data for generating transaction reports.
- **SNMP.** Enterprise Server 2.0 can be monitored using SNMP. The Gateway utilizes SNMP for remote system management.

Transaction Performance Monitoring and Measurement

- The "hits" performance indicators are available from the Web server. Statistics can be generated at any time to highlight the load pattern or to pinpoint the time when the server was most active.

- Gateway statistics about transaction requests (by transaction type) and transaction results (e.g., success, failed due to host, failed due to authentication, etc.) can be determined at any time for a particular time interval by generating a report.

The Gateway is upgradeable to interoperate with a real-time event monitoring system such as OpenVision's Performance Manager.

TokenOpaque Contents

The Gateway requires information captured at the time of an *AuthReq* that must be repeated to the host at the time of the associated *CapReq*. The mechanism of choice (built into SET) for this is enabled utilizing this data in the *TokenOpaque* token of the *CapToken* which is sent in an *AuthRes*. This *CapToken* is stored at the Merchant system and represented to the Gateway at the time of the *CapReq*. The format of an *TokenOpaque* is an *OctetString*.
The following general format (not specific to LEGACY) is proposed for capturing this information:

Field Name	**Field Data Type**	**Explanation/Example**
VersionName	char(8)	e.g. "LEGACY"
VersionRevision	char(8)	e.g. "1.0" (generally <major, minor>)
PILength	integer	length of PI data
PI	unsigned char(PILength)	strongly encrypted
HostSpecDataLength	integer	length of host specific data
HostSpecData	unsigned char(HostSpecDataLength)	host specific data

Host Specific Data (LEGACY-only)

For "LEGACY" version "1.0", it is proposed that newline separated "name[length]=value" pairs be used to store the host specific data. A null character will terminate the host specific data. The following host specific data (name value pairs) will need to be included:

BrandID
CPSACIFlag
CPSTransactionId
CPSValidationCode
VisaResponseCode
MerchantCategoryCode
EntryMode

NOTE: *PI* contains *PAN* and *ExpiryDate*.

Certificate Processing

Merchants require a mechanism for verifying legitimate cardholders is of valid, branded bankcard account numbers. A preferred embodiment utilizes technology to link a cardholder to a specific bankcard account number and reduce the incidence of fraud and thereby the overall cost of payment processing. Processing includes a mechanism that allows cardholder confirmation that a merchant has a relationship with a financial institution allowing it to accept bankcard payments. Cardholders must also be provided with a way to identify merchants they can securely conduct electronic commerce. Merchant authentication is ensured by the use of digital signatures and merchant certificates.

In a preferred embodiment, a holder of a payment instrument (cardholder) surfs the web (Internet) for required items. This is typically accomplished by using a browser to view on-line catalog information on the merchant's World Wide Web page. However, order numbers can be selected from paper catalogs or a CD-ROM and entered manually into the system. This method allows a cardholder to select the items to be purchased either automatically or manually. Then, the cardholder is presented with an order form containing the list of items, their prices, and totals. The totals could include shipping, handling and taxes for example. The order form is delivered electronically from the merchant's server or created on the cardholder's computer by electronic shopping software. An alternative embodiment supports a negotiation for goods by presenting frequent shopper identification and information about a competitor's prices.

Once the price of goods sold and the means of payment has been selected, the merchant submits a completed order and the means for payment. The order and payment instructions

are digitally signed by cardholders who possess certificates. The merchant then requests payment authorization from the cardholder's financial institution. Then, the merchant sends confirmation of the order, and eventually ships the goods or performs the requested services from the order. The merchant also requests payment from the cardholder's financial institution.

Figure **1C** is a block diagram of a payment processing system in accordance with a preferred embodiment. The Certificate Issuance at the Bank Web Site **162** resides at the bank web site **182**. It is utilized for issuing SET complaint / X.500 certificates to consumers. The implementation of this system may vary from one bank to another. However, the system gathers consumer's personal information, and after processing the information, the system issues a certificate along with a payment instrument to the consumer.

The Single Account Wallet **160** at the bank web site **182** represents the MIME message that is created by the Certificate Issuance system. This MIME message contains a VeriFone wallet. The VeriFone wallet contains a single payment instrument and the certificate associated with it. For security reasons, the private key is not included in the wallet. The has to specify a private key before using the instrument for payment. When the consumer is issued the certificate, this MIME message is sent to the browser. The browser launches the Certificate Installation application **174, 144** which is defined as a helper application in the browser. The Certificate Installation application **174, 144** reads the MIME message and install the wallet into the wallet database **158**.

Various helper applications **198, 172, 174, 176** are provided to make the consumer's shopping experience easy and efficient including the following helper applications. The Paywindow helper application **188** is utilized by the consumer to authorize the payment to the merchant, to administer their wallets, to review their previously completed payment transactions and to perform housekeeping activities on the wallets. This application is defined as a 'helper' application on the consumer's desktop. The browser launches this application when the merchant system sends a MIME message requesting payment.

The PayWindow Setup Helper application **172** is used by the consumer to install helper applications and other modules from the web site onto the consumer desktop. When a

consumer attempts to install an application for a first time, the consumer does not have a helper application on the desktop. Thus, the first time installation of an application requires a consumer to perform two steps. First the user must download the system package to their desktop and then the user must run setup to decompress and install the system. Thereafter, whenever the consumer gets a new release of system software, the browser launches this helper application which in turn installs the appropriate other system modules.

The Certificate Installation Helper Application **174** is utilized to install a wallet that is issued by a bank. When the bank's certificate issuance web system sends the MIME message containing the VeriFone wallet, the browser launches this application. This application queries a consumer to determine if the payment instrument contained in the wallet is to be copied to an existing wallet or to be kept in the new wallet. This application then installs the payment instrument and the certificate into the wallet database **158**.

The Certificate Issuance CGI scripts **162** and the Single Account Wallet **160** at the Bank Web Site **182** is processed as described in the native system. The Certificate Installation Applet of the Bank Web Site **182** is utilized by the Certificate Issuance CGI scripts **162** system to deliver a consumer's certificate to the consumer's desktop.

Figure **26** is an architecture block diagram in accordance with a preferred embodiment of the subject invention. Processing commences at function block **2600** where the Graphical User Interface (GUI) part of the application is initialized. The GUI application **2600** provides the consumer with support for ordering and making payments during the shopping process. There are also GUI components provided for wallet creation; importing, certificate and payment method creation and maintenance; and for transaction register review and reporting. The screen designs, and their associated logic, for the helper applications and applets are individually discussed in detail below.

The Certificate Manager **2604** manages the automatic downloading of a consumer's certificate from a bank, validation of a consumer's and a merchant's certificates and automatic requisition of certificate renewal.

The Payment Manager **2606** coordinates and completes the payment request that is received from the merchant system. The payment request is received via a MIME message in the native code implementation or via an applet in the Java implementation. The payment request received contains the final GSO, Ship-To name, merchant certificate, merchant URL, coupons and the payment amount. The manager **2606** then communicates with the payment related GUI component to interact with the consumer to authorize and complete the payment transaction. The manager is also responsible for determining the payment protocol based on the consumer's payment instrument and the merchant's preferred payment protocol.

The manager **2606** includes a well defined Application Programming Interface (API) which enables OEMs to interface with the payment manager **2606** to make payments to specific HTTP sites. The detailed logic associated with the payment manager **2606** is presented in Figure **27**.

The payment manager **2606** enforces standard operations in the payment process. For example the receipt and the transaction record can automatically be transferred to the Wallet file once the payment is completed. The payment manager architecture in accordance with a preferred embodiment is presented in Figure **27**. A user interfaces with the payment manager **2730** via a user interface **2700** that responds to and sends a variety of transactions **2710**, **2708**, **2706**, **2704** and **2702**. The transactions include obtaining the next record, payment record, receipt, acceptance of the payment instrument and GSO components. In turn, the payment manager **2730** sends transactions **2714** and receipts **2720** to the wallet manager **2722** and receives payment instruments, certificates and private keys from the wallet manager **2722**.

The payment manager **2730** also sends and receives transactions to the protocol manager **2770** including a merchant's payment message **2760**, a consumer certificate and PK handle **2750**, a merchant URL **2742**, a payment **2740**, a signed receipt **2734** and a GSO, Selected Payment Protocol and Selected Payment Instrument **2732**. The payment manager **2730** also accepts input from the payment applet or MIME message from the merchant as shown at function block **2780**. One aspect of the payment processing is a Consumer Payments Class Library (CPCL) **2770** which encapsulates the payment protocols into a single API. By encapsulating the payment protocols, applications are insulated from protocol variations. A SET Protocol provides an implementation of the client-side component of the Secure Electronic

Transaction (SET) Protocol. A complete implementation of the client-side component of the CyberCash micro-payment protocol is also provided.

The Wallet Manager **2722** provides a standard interface to the wallet. It defines the wallet database structures and the payment instrument data structures, controls the access to the wallet and provides concurrency checking if more than one application attempts to open the same wallet. The interface to the wallet manager **2722** is published to allow OEMs to interface with the wallet manager and access the wallet database.

The wallet manager consists of the following sub-components:

Wallet Access. This component provides an interface to read and write wallet information.

Transaction Manager. This component provides an interface to read and write transaction corresponding to a wallet into the wallet database.

Payment Instrument Manager. This component manager provides a common interface to the specific payment instrument access components.

Credit Card Access, Debit Card Access, Check Access. These components deal with a specific payment instrument.

A Data Manager provides storage and retrieval of generic data items and database records. It is assumed that data fields, index fields or entire data records can be marked as encrypted and the encryption process is largely automated. The data manager has no specific knowledge of database records appropriate to different payment methods. This layer is separated out so as to reduce changes required when new payment methods are introduced. However RSA key pairs and certificates might be considered as "simple" data types. This component also provides an abstraction which supports wallet files on computer disk or contained in smart cards.

The Open Data Base Connectivity (ODBC)/Java Data Base Connectivity (JDBC) component provides Data Base Connectivity where formal database components are required. An embodiment of the Smart Card Wallet allows wallet data to be stored and/or secured by a cryptographic token.

A preferred embodiment includes a single file or directory of files comprising a "wallet" which contains personal information and information about multiple payment methods with the

preferred implementation. These payment methods (Visa cards, debit cards, smart cards, micro-payments etc.) also contain information such as account numbers, certificates, key pairs, expiration dates etc. The wallet is envisaged to also contain all the receipts and transaction records pertaining to every payment made using the wallet. A Cryptographic API component provides a standard interface for RSA and related cryptographic software or hardware. This support includes encryption, signature, and key generation. Choice of key exchange algorithm, symmetric encryption algorithm, and signature algorithm should all be configurable. A base class stipulates generic behavior, derived classes handle various semantic options (e.g. software based cryptography versus hardware based cryptography.)

The Cryptographic Software portion provides RSA and DES support. This may be provided utilizing the SUN, RSA or Microsoft system components depending on the implementation selected for a particular customer. Cryptographic Hardware creates a lower level API which can underpin the Cryptography API and be utilized to replace Cryptography Software with an off the shelf cryptography engine. The message sequence charts describe the flow of messages/data between the consumer, the browser and/or the various major components of the Semeru system. The major components of the system are the Merchant system which includes the VPOS, the PayWindow, and the Payment Gateway. The merchant system allows a consumer to shop, accept the payment transactions sent by the PayWindow application, and send payment transactions to the acquiring bank. The Consumer Payments Class Library (CPCL) module is a layer within the application which sends the payment transactions, securely, from the consumer to the merchant.

Figure **28** is a Consumer Payment Message Sequence Diagram in accordance with a preferred embodiment of the invention. The diagram presents the flow of messages between the consumer, the browser, the merchant system, the PayWindow application, and CPCL. This message flow describes the payment process from the time an order is completed and the consumer elects to pay, to the time the payment is approved and the receipt is returned to the consumer. The difference between the Native implementation and Java implementation of the PayWindow application is in the delivery of the order information to the PayWindow. Once the order information is received by the PayWindow, the flow of messages/data is the same for both implementations. In the case of the Native implementation, the order information is delivered via a MIME message. This MIME message is sent to the PayWindow by the browser

via a document file. In the Java implementation, the order information is delivered to the PayWindow by an applet. The merchant system sends an applet with the order information to the browser which in turn delivers the order to the PayWindow. Once the order is received, the PayWindow interacts with the consumer and the Protocol modules for the completion of the payment process.

Enters Order and Clicks Calculate Order **2820**

This message represent the consumer order entry and the clicking of the 'Calculate Order' button. The consumer's shopping experience is all condensed into this one message flow for the purpose of highlighting the payment process. The actual implementation of the shopping process varies, however, the purpose does not, which is the creation of the order.

Order **2830**

This message represents the order information which is sent by the browser to the merchant via an HTML form.

Payment Applet with GSO, PPPs, AIs, merchant certificate and URL **2840**

On receipt of the order, the merchant system calculates the payment amount. This message represents the HTML page which is sent by the merchant system detailing the payment amount along with the Java payment applet which contains the GSO, PPPs, AIs, merchant certificate and URL.

Run Payment Applet **2845**

The Java enabled browser runs the Payment applet. The applet displays a button called "Pay" for the consumer to click. This is embedded in the HTML page delivered by the merchant.

Clicks Pay **2850**

This message represents the clicking of the Pay button on the browser by the consumer after confirming the payment amount.

GSO, PPPs, AIs, merchant certificate and URL **2860**

This message represents the GSO, PPPs, AIs, merchant certificate and the merchant URL carried by the Java applet. The Java applet now delivers these to the PayWindow application.

Merchant certificate **2862**

This message represents the merchant's certificate which is sent to the CPCL module for checking the validity of the merchant.

Merchant's validity **2864**

The CPCL modules examines the merchant's certificate and send this message to the PayWindow indicating whether or not the merchant is a valid merchant.

Wallet, Payment Instruments **2866**

This message represents the wallets and payment instruments that is displayed to the consumer. Not all payment instruments from a wallet is shown to the consumer. Only the ones accepted by the merchant is shown.

Payment Instrument **2868**

This message represents the payment instrument selected by the consumer. This message is created in the current design when the user double clicks on the payment image in the "Select Payment Method" Window.

GSO **2870**

This indicates that the GSO is displayed to the consumer in the "Make Payment Authorization" screen.

Authorization of Payment **2872**

This message represents the authorization of the payment by the consumer. The consumer authorizes the payment by clicking the 'Accept' button on the "Payment Authorization" screen.

Decide Payment Protocol **2874**

Once the consumer authorizes the payment, the payment protocol is decided by PayWindow based on the merchant's Payment Protocol Preferences and the consumer selected payment instrument.

Payment Authorization **2875**

These messages represent the merchant's URL, the GSO, payment protocol (PP) to use, account number, certificate and the private key handle (PK) associated with the payment instrument which is sent to the protocol module.

GSO with Payment Authorization **2876**

This message represents the payment instructions which is sent by the protocol module to the Merchant system. The GSO, PI, consumer certificate and PK is packaged based on the payment protocol.

Signed Receipt **2878**

This message represents the digitally signed transaction receipt received by the protocol module from the merchant.

Save Receipt with hash value **2880**

The digitally signed transaction receipt is saved by the PayWindow for future reference.

Payment Successful **2882**

This indicates that the transaction receipt and the 'payment successful' have been displayed to the consumer.

Certificate Processing

A payment instrument must be certified by a "certificate issuing authority" before it can be used on a computer network. In the case of credit card payments, the issuer may be one of the card issuing banks, but it might also be a merchant (eg SEARS), a transaction acquiring bank or an association such as VISA or Mastercard.

Payment instrument information is stored in the consumer's wallet. The certificate which authorizes the payment instrument will be stored along with that data in a secured database. The process of acquiring a certificate is described below. A certificate can be delivered to a consumer in a preconfigured wallet. The consumer receives a wallet which contains the certificate together with the necessary details associated with a payment instrument including a payment instrument bitmap which is authorized by a certificate issuing authority or the agencies represented by the issuing authority.

Obtaining a certificate

A consumer will deliver or cause to be delivered information to a certificate issuing authority. Figure **29** is an illustration of a certificate issuance form in accordance with a preferred embodiment. A user may fill out the form on-line, on paper and mail it in, or get his bank or credit card company to deliver it. The consumer delivered data will usually contain a public key belonging to a security key pair generated by consumer software. This information will normally be mailed to the consumer's address and actuated by a telephone call from the consumer. The certificate authority takes this information and uses it to validate that he is indeed entitled to use the payment method. This processing normally takes a few days to accomplish. Information will normally be exchanged with the organization issuing the payment method in the physical space if there is one, and with credit agencies. The certificate information is loaded into the consumer's software to enable payment processing to proceed online.

In some cases the consumer will be able to select details about a payment instrument holder (wallet) he desires to own. This may be the icon representing a holder, the access password or other information. After creating the certificate, the issuing authority can use information received in the certificate application to create a custom payment instrument holder ready to use. This payment instrument holder will contain the following information. Payment instrument information including card number **2900** and expiration date **2902**. Personal information including name **2904**, address **2906**, social security number **2908** and date of birth **2910**.

The associated certificate (eg X509 standard), an associated public key or in some cases public/private key pair (eg RSA), and an approved bitmap representing the payment instrument are provided to the requesting consumer. Figure **30** illustrates a certificate issuance response in accordance with a preferred embodiment. An approved bitmap for a VISA card is shown at **3000**. Also a default payment holder **3010** and a default payment holder name are provided with the certificate issuance. After the consumer aquires the payment instrument holder **3010**, the payment instrument holder is immediately visible to him in his collection of payment instrument holders. Figure **31** illustrates a collection of payment instrument holders in accordance with a preferred embodiment. The predefined payment

instrument holder **3100** is the same JOHN's WALLET that was predefined based on defaults by the certificate issuance form. Figure **32** illustrates the default payment instrument bitmap **3200** associated with the predefined payment instrument holder **3210** resulting from the consumer filling in and obtaining approval for a VISA card.

Figure **33** illustrates a selected payment instrument with a fill in the blanks for the cardholder in accordance with a preferred embodiment. Next time the payment instrument holder is opened in a payment context the certificate issuing authority's approved instrument bitmap can be used to select the payment instrument and utilize it to make purchases. Figure **34** illustrates a coffee purchase utilizing the newly defined VISA card in accordance with a preferred embodiment of the invention.

Figure **35** is a flowchart of conditional authorization of payment in accordance with a preferred embodiment. Processing commences at **3500** where the program initializes the connection between the cardholder and the merchant for the purposes of shopping. After the cardholder completes shopping, a new SSL connection is established which provides authenticating information to the merchant. At this point the merchant is able to execute payment functionality (based on SSL or SET) conditionally, based upon the quality and character of the digital signature and the certificate used to validate said signature. Then, at function block **3510**, the cardholder selects the payment instrument for the particular transaction. Payment instruments could include VISA, MASTERCARD, AMERICAN EXPRESS, CHECK, SMARTCARD or DEBIT CARDS. The payment method is then submitted to the merchant at function block **3520**. The merchant then initializes the SET connection to the acquiring bank at function block **3530** if the connection is not already established. Then, at function block **3540**, the certificate is submitted to the merchant from the acquiring bank. The certificate includes a public key portion and a private key used as an irrebutable digital signature to authenticate the parties to the transaction. The certificate also includes information on the level of credit risk which allows a merchant to conditionally decide on the authorization or rejection of credit under a particular payment instrument based on their risk level and the merchant's personal comfort level with the ability of the cardholder to pay. This processing has not previously been possible because the information returned from the authorizing bank did not include a level of credit risk a cardholder posed, it only contained credit rejected or approved.

A detailed description of the gateway internals is presented below in accordance with a preferred embodiment.

Gw_ClearSetRequestHandler

Figure **51** depicts a flow diagram for the GatewayClearSetRequestHandler routine. Execution begins in Step **5105**. In Step **5110** an SET analysis routine is called to analyze the SET request, as will be more fully disclosed below. Step **5110** sets a status flag indicating the next stage to be performed by the Gateway. In Step **5120** the Gateway checks to see whether the status is set to indicate that a response should be provided to the user. If so, execution proceeds to Step 5190, which ends the request handling routine and returns control to a calling routine, which then provides a response to the user. Otherwise execution proceeds to Step **5130**. In Step **5130**, the Gateway checks to see if the status is set to indicate that forward translation is required. Forward translation is necessary to translate an outgoing message into a format that can be understood by the host computer. If forward translation is indicated, execution proceeds to Step **5135**. In Step **5135**, the outgoing message is forwarded translated, as more fully disclosed below with respect to Figure **53**. If no forward translation is indicated, for example, if an already-translated transaction is being retried, execution proceeds to Step **5140**. In Step **5140**, the Gateway checks to see if the next step is communication to the host. If so, the Gateway proceeds to Step **5145**, and initiates host communication as will be more fully discussed below with respect to Figure **54**. If not, execution proceeds to Step **5150**. In Step **5150**, the Gateway checks to see whether reverse translation is indicated. Reverse translation translates a response from a host into a format useable by the calling routine. If reverse translation is indicated, execution proceeds to Step **5155**, and the reverse translation is performed, as will be more fully discussed below with respect to Figure 55. In any case, after either forward translation in Step **5135**, host communication in Step **5145**, or reverse translation in Step **5155**, control returns to Step **5120** for further processing. As will be more fully disclosed below, the forward translation, host communication, and reverse translation routines manipulate status indicators to prevent the occurrence of an infinite loop.

The Gw_ClearSetRequestHandler routine as depicted in Fig. **51** may be implemented using the following C++ code:

```
int Gw_ClearSetRequestHandler(CPCLRequest *pRequest)
```

```
{
    gwAction            action;
    char                fatalError;

    CPCLCCRequest       *pVehicle = (CPCLCCRequest *) pRequest;
    CGW_Engine          *setTrans = (CGW_Engine *) pVehicle-
>GetContext();

    action = setTrans->AnalyzeSetRequest(pVehicle, &fatalError);

    while ( (action!=GW_PROCEED_TO_RESPOND) && (!fatalError) ) {
        switch (action) {
         case GW_PROCEED_TO_FWD_XLAT:
            action = setTrans->TranslateForward(pVehicle);
            break;

         case GW_PROCEED_WITH_HOST_COMMS:
            action = setTrans->DoHostCommunication(pVehicle);
            break;

         case GW_PROCEED_TO_REV_XLAT:
            action = setTrans->TranslateReverse(pVehicle);
            break;

         case GW_PROCEED_TO_RESPOND:
         default:
            break;
        }
    }

    // Response should be built, return up the protocol
    // stack so that it will encode and then crypt our response.
```

```
        if (fatalError) {
            // Set an error code for the protocol stack.
            pVehicle->SetError(eEInvalidRequest);
            return(0);
        }
        else {
            return(1);
        }
    }
```

AnalyzeSetRequest

Figures **52A** and **52B** describe the AnalyzeSetRequest routine. This routine is by Step **5110** as illustrated in Figure **51**. Execution begins in Step **5200**. In Step **5205** the various fields in the SET record are obtained, as will be more fully disclosed below with respect to Figures 56A and 56B. In Step **5210** the Gateway checks the retry count. A retry count is zero indicates that the request being analyzed is a new request, and control proceeds to Step **5212**, indicating a new request. If the retry account is non-zero, this means that the request is a retry of a prior request, and control proceeds to Step **5214** where a retry is indicated.

Following either step **5212** or **5214**, execution proceeds to Step **5215**. In Step **5215** the Gateway checks to see whether the request represents a "stale request," as will be more fully described below with respect to Figure **57**. In Step **5220,** the Gateway tests the result of the stale check from Step **5215**. If the request is stale it is marked as stale in Step **5222**. Otherwise the record is marked as not stale in Step **5224**. Following either Step **5222** or Step **5224**, control proceeds to Step **5230**. In Step **5230** a message representing the SET request is inserted into the database for tracking purposes, and control proceeds to Step **5240**.

In Step **5240** the Gateway checks to see if the request had been marked stale in Step **5222**. If so, it proceeds to Step **5242**, exiting with an error condition. In Step **5245**, the Gateway attempts to retrieve from the database a message corresponding to the current SET request, as will be fully disclosed below with respect to Figure **59**. Step **5260** checks to see whether the message was successfully retrieved from the database. If the message was not found in the database, this indicates that the SET request represents a new message, and control proceeds

to Step **5270**. In Step **5270** a new message representing the SET request is added to the database, as is more fully disclosed below with respect to Figure **60**. Because this is a new request, it must be processed from the beginning, including forward translation. Therefore, after the new message is added in Step **5270**, control proceeds to Step **5275**. In step **5275**, where a status flag is set indicating that the next step to be performed for this message is for translation. If the message was found in Step **5260**, this indicates that the request represents a request that is already in progress. Therefore, control proceeds to Step **5280** to update the database with current information representing the request status. The update process is described in further detail with respect to Figure **61**, below. Following Step **5280**, control proceeds to Step **5282**. In Step **5282** the Gateway checks to see the disposition in which the SET request was left as a result of partial processing. This is done, for example, by interrogating fields in the database record that indicate the steps that have already been performed for this request. In Step **5283**, based upon this status information, the Gateway indicates the next stage of processing to be performed: either forward translation, reverse translation, or communication with the host. After this status has been set, whether for a new request in Step **5275**, or for an already-existing request in Step **5283**, control proceeds to Step **5290**, which exits the AnalyzeSetRequest routine, returning control to Step **5110** in Figure **51**.

The AnalyzeSetRequest routine as depicted in Figs. **52A** and **52B** may be implemented using the following C++ code:

```
gwAction CGW_Engine::AnalyzeSetRequest(CPCLCCRequest *pVehicle, char
*fatalError)
{
    gwAction      action;
    gwDBRC        dbrc;
    gwRC          rc;
    int               retryCount;
    char          staleMsgFlag;

    *fatalError = _FALSE;   // Default to "all is OK".

    // Extract the key SET fields that are required. The key
```

```
// SET fields contain the primary key elements of the "setmsg"
// table.
if ( (rc=GetSetKeyFields(pVehicle)) != GW_SUCCESS) {
      switch(rc) {
        case GW_NOT_SUPPORTED:
            BuildSetErrorResponse(pVehicle, ISO_RESP_FUNC_NOT_SUPP);
            break;
        default:
            BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
            break;
      }
      *fatalError=_TRUE;      // Only place we return this!
      return (GW_PROCEED_TO_RESPOND);
}
else {
      // Set this so that the front-end will be able to tell
      // whether enough information was derived from the request
      // in order to do update the "setmsg" log.
      m_haveKeyFields = 1;
}

// If the count of SET messages with current xid and rrpidbase is
// non-zero then the message is an honest retry otherwise it
// is a new request.
if ( (dbrc=Gwdb_GetSetMsgRetryCount(&retryCount)) == GWDB_SUCCESS) {
      if (retryCount == 0)
            m_setRequestClass = GW_SREQCL_NEW_REQUEST;
      else
            m_setRequestClass = GW_SREQCL_HONEST_RETRY;
}
else {
      BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
      GW_LogError( LOG_ERR, "Gwdb_GetSetMsgRetryCount() : %d", dbrc);
```

```
        return (GW_PROCEED_TO_RESPOND);
    }

    // Check whether the message is stale.  If it is, we still
    // insert it into the database shortly but we will not process
    // it.
    Gwdb_IsSetMsgStale(&staleMsgFlag);
    if (staleMsgFlag == _TRUE)
        m_setRequestDisposition = GW_SREQDI_STALE;
    else
        m_setRequestDisposition = GW_SREQDI_OK; // Not stale.

    // Log the "SET message" in the database.  If the insert fails
    // then we must have a replay attack!
    dbrc = Gwdb_InsertSetMsg();

    switch (dbrc) {
     case GWDB_SUCCESS:
        break;
     case GWDB_DUPLICATE_ON_INSERT:
        BuildSetErrorResponse(pVehicle, ISO_RESP_SECURITY_VIOLATION);
        dbrc = Gwdb_InsertReplayAttack();
        if (dbrc != GWDB_SUCCESS) {
            GW_LogError( LOG_ERR, "Gwdb_InsertReplayAttack() : %d", dbrc);
        }
        return (GW_PROCEED_TO_RESPOND);
        break;
     default:
        BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
        GW_LogError( LOG_ERR, "Gwdb_InsertSetMsg() : %d", dbrc);
        return (GW_PROCEED_TO_RESPOND);
        break;
    }
```

```
// If the message is stale do no more.
if (m_setRequestDisposition == GW_SREQDI_STALE) {
    BuildSetErrorResponse(pVehicle, ISO_RESP_SECURITY_VIOLATION);
    return (GW_PROCEED_TO_RESPOND);
}

// If we reach this far in this function then:
//          i) the request is new or an honest retry AND
//          ii) the request is not stale AND
//          iii) a setmsg record has been added for this request.

// If there is already a "host message" then update the key
// with the new retry count.  If there was not a "host message"
// then insert one.
dbrc = Gwdb_GetHostMsg();

switch(dbrc) {
 case GWDB_SUCCESS:
    dbrc = Gwdb_UpdateHostMsgKeys();
    break;
 case GWDB_ROW_NOT_FOUND:
    dbrc = Gwdb_InsertHostMsg();
    if (dbrc != GWDB_SUCCESS) {
        BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
    }
    return(GW_PROCEED_TO_FWD_XLAT);
    break;
 default:
    BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
    GW_LogError( LOG_ERR, "Gwdb_GetHostMsg() : %d", dbrc);
    return (GW_PROCEED_TO_RESPOND);
    break;
```

```
}

if (dbrc != GWDB_SUCCESS) {
    BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
    GW_LogError( LOG_ERR, "Gwdb_UpdateHostMsgKeys() : %d", dbrc);
    return (GW_PROCEED_TO_RESPOND);
}

// If this request is an honest retry then determine if we
// can "short circuit" a) the forward translation, b) the
// communications to the host or c) the reverse translation
// all of which will save time.
if (m_setRequestClass == GW_SREQCL_HONEST_RETRY) {
    switch (m_hostResponseDisposition) {
    case GW_HRESDI_UNKNOWN:
        action = GW_PROCEED_TO_FWD_XLAT;
        break;

    case GW_HRESDI_RECEIVED_OK:
        action = GW_PROCEED_TO_REV_XLAT;
        break;

    case GW_HRESDI_REV_XLAT_FAILED:
        action = GW_PROCEED_TO_REV_XLAT;
        break;

    case GW_HRESDI_RECEIVE_FAILED:
    case GW_HRESDI_TIMEOUT:
        action = GW_PROCEED_WITH_HOST_COMMS;
        break;

    default:
        break;
```

```
            }
        }

        return (action);
    }
```

TranslateForward

Figure **53** depicts the execution of the TranslateForward routine, which is called by Step 5135 in Figure **51**. Execution begins at Step **5310**. In Step **5320**, the Gateway forward-translates the request to prepare it for transmission to the host. Forward translation consists of packaging the fields in the request into a format that is understandable by the legacy system at the financial institution. The exact format of the translated request will vary from institution to institution. However, in general, the format will consist of a fixed length record with predetermined fields, using a standard character set such as ASCII or EBCDIC. In Step **5330**, the Gateway checks to see whether the translation was successfully performed. If not control proceeds to Step **5340**, which returns an error condition. If the translation was successful, control proceeds to Step **5350**. In Step **5350**, the Gateway sets a status flag to indicate that the next stage to be performed for this SET request is to proceed to host communication. This will be used in the next iteration of the Gw_ClearSetRequestHandler routine as depicted in Figure **51**. After the status is set in Step **5350**, the translate forward routine returns control in Step **5360**.

The TranslateForward routine as depicted in Figure 51 may be implemented using the following C++ code:

```
gwAction CGW_Engine::TranslateForward(CPCLCCRequest *pVehicle)
{
    gwRC        rc;
    gwDBRC      dbrc;

    rc = HM_TranslateForward(m_hostSpecificMessage, pVehicle);

    if (rc == GW_SUCCESS) {
        return (GW_PROCEED_WITH_HOST_COMMS);
```

```
        }

        m_hostRequestDisposition = GW_HREQDI_FWD_XLAT_FAILED;
        BuildSetErrorResponse(pVehicle, ISO_RESP_FORMAT_ERR);

        dbrc = Gwdb_UpdateHostMsgRequestDisp();
        if (dbrc != GWDB_SUCCESS) {
            GW_LogError( LOG_ERR, "Gwdb_UpdateHostMsgRequestDisp() : %d",
    dbrc);
        }

        return (GW_PROCEED_TO_RESPOND);
    }
```

DoHostCommunication

Figure **54** depicts the step of host communication, as shown in Step **5145** in Figure **51**. Execution begins in Step **5400**. In Step **5405** the Gateway obtains from the request object the string representing the request text. In Step **5410** it obtains the sequence number for the request. In Step **5415** the Gateway determines the current time, in order to record the time at which the request is made. In Step **5420** the Gateway sends the request to the host and waits for a response from the host. When a response is received, execution continues in Step **5425**. In Step **5425**, the Gateway again checks the current time, thereby determining the time at which a response was received. In Step **5430**, the Gateway checks to see whether the communication was successfully performed. If a communication was not successful, the Gateway records that an error occurred in Step **5432**. If the communication was successful, the Gateway, in Step **5435**, indicates that the request was successfully sent and responded to. In Step **5437**, the Gateway sets the response string based upon the response received in Step **5420**. In Step **5439** the Gateway sets a status to indicate that reverse translation of the received response is required. Regardless of whether the communication was successful or unsuccessful, execution continues to Step **5450**. In Step **5450**, the database is updated with status information from the host communication. In Step **5490**, control is returned to the calling routine.

The DoHostCommunication routine as depicted in Fig. **54** may be implemented using the following C++ code:

```
gwAction CGW_Engine::DoHostCommunication(CPCLCCRequest *pVehicle)
{
    gwHMRC        hmrc;
    gwDBRC        dbrc;
    gwAction      action = GW_PROCEED_TO_RESPOND;
    unsigned char  hostRequestMessage[HOSTREQ_SZ+1];
    int                  hostRequestLength = 0;
    unsigned char  hostResponseMessage[HOSTREQ_SZ+1];
    int                  hostResponseLength = 0;
    long              sequenceNo;
  HM_GetRequestString( m_hostSpecificMessage, &hostRequestMessage[0],
                                  &hostRequestLength);
    HM_GetSequenceNo( m_hostSpecificMessage, &sequenceNo );
    time( &m_hostRequestTime );
    hmrc = SendToHostAndWait(
                  &hostRequestMessage[0], hostRequestLength,
                  &hostResponseMessage[0], &hostResponseLength);
    time( &m_hostResponseTime );
    switch(hmrc) {
     case GWHM_SUCCESS:
        m_hostRequestDisposition = GW_HREQDI_SENT_OK;
        m_hostResponseDisposition = GW_HRESDI_RECEIVED_OK;
    HM_SetResponseString( m_hostSpecificMessage, &hostResponseMessage[0],
                                  hostResponseLength);
        action = GW_PROCEED_TO_REV_XLAT;
        break;
     case GWHM_SEND_FAILED:
        m_hostRequestDisposition = GW_HREQDI_SEND_FAILED;
        m_hostResponseDisposition = GW_HRESDI_UNKNOWN;
        break;
```

```
            case GWHM_RCV_FAILED:
                m_hostRequestDisposition = GW_HREQDI_SENT_OK;
                m_hostResponseDisposition = GW_HRESDI_RECEIVE_FAILED;
                break;

            case GWHM_RCV_TIMEOUT:
                m_hostRequestDisposition = GW_HREQDI_SENT_OK;
                m_hostResponseDisposition = GW_HRESDI_TIMEOUT;
                break;

            default:
                break;
        }
        if (hmrc != GWHM_SUCCESS) {
            BuildSetErrorResponse(pVehicle, ISO_RESP_ISSUER_INOP);
        }
        dbrc = Gwdb_UpdateHostMsgAllInfo(sequenceNo,
                    &hostRequestMessage[0], hostRequestLength,
                    &hostResponseMessage[0], hostResponseLength);
        if (dbrc != GWDB_SUCCESS) {
            BuildSetErrorResponse(pVehicle, ISO_RESP_SYS_MALFUNC);
            GW_LogError( LOG_ERR, "Gwdb_UpdateHostMsgAllInfo() : %d", dbrc);
        }
        return (action);
    }
```

TranslateReverse

Figure **55** depicts the operation of the TranslateReverse routine, as executed in Step **5155** in Figure **51**. Execution begins at Step **5500**. In Step **5510** the Gateway reverse-translates the response received from the legacy system host. Reverse translation consists of extracting data from the data records received from the legacy system, and placing them in objects so that they are useable by the Gateway. In Step **5520**, the Gateway checks to verify that translation was

successful. If translation was successful control proceeds to Step **5530**, where a status flag is set indicating a successful translation. If translation was not successful, control proceeds to Step **5540**, in which the Status Flag is set to indicate an unsuccessful translation. Regardless of whether translation was successful or unsuccessful, execution proceeds to Step **5550**. In Step **5550**, a status flag is set to indicate that the next stage for the request is to provide a response from the Gateway. This step is always executed, because, regardless of whether the translation or any other aspect of the transaction was successful, a response indicating either success or failure must be returned by the Gateway. Control then proceeds to Step **5590**, in which the TranslateReverse routine returns control to the calling routine in Figure **51**. It will be seen that the TranslateForward routine in Figure 53, the DoHostCommunication routine depicted in Figure **54**, and the TranslateReverse routine depicted in Figure **55**, each alter the status of the request. As a result as the loop depicted in Figure **51** executes a particular request will proceed through all three stages and finally to exit in Step **5190**.

The TranslateReverse routine as depicted in Figure 55 may be implemented using the following C++ code:

```
gwAction CGW_Engine::TranslateReverse(CPCLCCRequest *pVehicle)
{
    gwRC        rc;
    gwDBRC      dbrc;
rc = HM_TranslateReverse(m_hostSpecificMessage, pVehicle);
if (rc == GW_SUCCESS) {
        // Success; we have a normal PDU to send back to VPOS!
        //  If there is any problem further to this (eg: PCL/ASN libs)
        //  that the frond-end is responsible for calling the method
        //  LogSetErrorResponse() on this engine instance.
        m_setResponseClass = GW_SRESCL_APP_NORMAL_PDU;
        m_setResponseDisposition = GW_SRESDI_SENT_OK;
        HM_GetResponseCode(m_hostSpecificMessage, m_setResponseCode);
  }
  else {
        m_hostResponseDisposition = GW_HRESDI_REV_XLAT_FAILED;
        BuildSetErrorResponse(pVehicle, ISO_RESP_INVALID_RESPONSE);
```

```
                dbrc = Gwdb_UpdateHostMsgResponseDisp();
                if (dbrc != GWDB_SUCCESS) {
                    GW_LogError( LOG_ERR, "Gwdb_UpdateHostMsgResponseDisp() :
5       %d", dbrc);
                }
            }

            // Whether there was a translation error or not we need to respond.
10          return (GW_PROCEED_TO_RESPOND);
        }
```

GetSetKeyFields

Figures 56A and 56B describe the GetSetKeyFields routine. This routine is called by Step **5205** 15 as illustrated in Figure 52A. Execution begins in Step **5600**. In Step **5610**, the Gateway interrogates the request object to determine the request type. In Step **5620**, the Gateway determines whether the request type is for authorization only. If the request type is not for authorization only, execution proceeds to Step **5625**. In Step **5625**, the Gateway checks to see whether the request type is for a sale. If the request type is neither for authorization only nor 20 for a sale, execution proceeds to Step **5630**. In Step **5360**, the Gateway indicates that the request type is not a supported request, and proceeds to Step **5635**, where it returns to the caller.

If the request type is either for authorization only or for a sale, execution proceeds with Step 25 **5640**. In step **5640**, the Gateway initializes a container object to represent the request. In Step **5650**, the Gateway extracts the [transaction identifier?] (XID) for the transaction. In Step **5652**, the Gateway extracts the merchant identifier (MID) for the transaction. In Step **5654**, the Gateway extracts the [what is the RRPID?] (RRPID) and the terminal identifier (TID) for the request. In Step **5656**, the Gateway extracts the retry count associated with the current 30 request. In Step **5660**, a message data area is initialized with the extracted contents. The message area can then be used for further processing by the called routine. In Step **5690**, the GetSetKeyFields routine returns control to the caller.

The GetSetKeyFields as depicted in Figures 56A and 56B may be implemented using the following C++ code:

```
gwRC CGW_Engine::GetSetKeyFields(CPCLCCRequest *pVehicle)
{
    gwRC            transRc = GW_SUCCESS;
    unsigned int    got;
    char            s_RrpidTid[2*XID_SZ];
    unsigned long   rrpid;
    unsigned long   tidOffset;
      m_setKeyFields.reqType = pVehicle->GetRequestType();
      switch(m_setKeyFields.reqType) {
      case CPCLRequest::CCAuthOnly:
      case CPCLRequest::CCSale:
        {
        // Initial cast to correct subclass.
        CASNAuthorizationRequestDataContainer *s_req =
            ((CPCLCCAuthOnlyRequest*)pVehicle)->GetRequestContainer()-
>get_data()->get_data();
// xid
        s_req->get_transaction_id()->get_x_id()->
        get_value( (unsigned char *) &m_setKeyFields.xid, XID_SZ, &got);
// mid
#ifdef JUNE_3RD
        strncpy(m_setKeyFields.mid, "42581", MID_SZ);
#else
        // TODO: get code from Deepak for pulling MID out of s_req!
        strncpy(m_setKeyFields.mid, "42581", MID_SZ);
        //bah!
#endif
//-----------------------------------------------------------------
    // NOTE: We have agreed with VPOS team that the RRPID field
    //     will contain the following:
    //
```

```
//      <rrpid> <space> <tid> <null>
//
//   where <rrpid> is a string representing the rrpid value
//   and   <tid> is a string representing the tid value.
//
//-------------------------------------------------------------
      memset(s_RrpidTid, '\0', sizeof(s_RrpidTid) );
      s_req->get_AuthorizationRequestData_extensions()->
            get_auth_req_res_pair_id()->
            get_value( (unsigned char *) &s_RrpidTid, sizeof(s_RrpidTid), &got);
      // get rrpid and offset to the tid.
sscanf(s_RrpidTid, "%d %n", &rrpid, &tidOffset);
      // rrpidBase and retryCount
      m_setKeyFields.retryCount = rrpid % 100;
      m_setKeyFields.rrpidBase = rrpid - m_setKeyFields.retryCount;
      // tid
strncpy(m_setKeyFields.tid, (s_RrpidTid+tidOffset), TID_SZ);
      // reqDate
      GW_GetTimeFromASNTime( &(m_setKeyFields.merchantTime),
                  s_req->get_authorization_request_date() );
      break;
      }

 case CPCLRequest::CCAuthReversal:          // == Void
 case CPCLRequest::CCCreditReversal:
 case CPCLRequest::CCCapture:
 case CPCLRequest::CCCredit:              // == Refund | Return
 case CPCLRequest::CCCaptureReversal:  // == Void
 // case eBalInquiry:

  transRc = GW_NOT_SUPPORTED;
     break;
```

```
            default:
                transRc = GW_NOT_SUPPORTED;
                break;
            }
        // Initialize the host message will with the key fields "in the clear"!
            if (m_hostSpecificMessage == NULL) {
                transRc = GW_FAILED;
            }
            else {
                HM_Initialize(m_hostSpecificMessage, &m_setKeyFields);
            }
            return (transRc);
        }
```

Gwdb_IsSetMsgStale

Figure **57** depicts the Gwdb_IsSetMsgStale routine. This routine is called by Step **5215** as illustrated in Figure **52A**. Execution begins in Step **5700**. In Step **5710**, the Gateway checks to see whether this is the first time the Gwdb_IsSetMsgStale has been called for this request. If this is the first time, Steps **5715** through **5730** are performed; otherwise those steps are skipped. In Step **5715**, a field representing the message life is initialized to a predetermined duration. The message life is a field that will be used to determine how long the message representing the transaction will remain valid. The use of the message life field prevents a transaction that is effectively lost due to extensive processing delays from being processed. In Step **5720**, the Gateway checks to see if the value of the message life is equal to zero. If the message life is equal to zero, a default value, i.e., 300 seconds or 5 minutes, is assigned to the message life in Step **5725**. In Step **5730**, an indicator for this request is set to indicate that first time processing has already been performed for this request. This flag is the same flag interrogated in Step **5710**, and is used to prevent successive reinitialization of the message life field.

In Step **5740**, the Gateway checks to see whether the merchant's time stamp, plus the value of the message life, is less than the time of the request. If so, then the request is considered stale, and is marked stale in Step **5750**. If not, the request is not stale, and is marked not stale in

Step **5755**. Following either of Step **5750** or **5755**, the Gwdb_IsSetMsgStale exits in Step **5790**. The Gwdb_IsSetMsgStale routine as depicted in Figure 57 may be implemented using the following C++ code:

```
void CGW_Engine::Gwdb_IsSetMsgStale(char *staleFlag)
{
    static char gotStaleDuration=0;
    static long setMsgLife;
    static char    *funcName = "Gwdb_IsSetMsgStale";
    // Only get this once per process lifetime.
    if (gotStaleDuration == 0) {
        FILE  *fp;
        char  duration[INI_MAXLNSZ+1];
      if ( (fp=OpenIniFile()) != NULL) {
            setMsgLife = 0;
            (void) iniGetParameter(fp, "GATEWAYADMIN", "SetMsgLife",
duration);
            setMsgLife = atol(duration); // could return 0; handled later.
            (void) CloseIniFile(fp);
        }
      if (setMsgLife == 0) {
            setMsgLife = 5 * 60;    // Default to 5 minutes;
        }
gotStaleDuration = 1;
    }
// If the message has expired its lifetime.
    if ( (m_setKeyFields.merchantTime+setMsgLife) < m_setRequestTime)
        *staleFlag = _TRUE;          // request is stale.
    else
        *staleFlag = _FALSE;    // honour request, it is not stale.
return;
}
```

Gwdb_InsertSetMsg

Figure **58** depicts the Gwdb_InsertSetMsg routine. This routine is called from Step **5230** as illustrated in Figure **52A**. Execution begins in **5800**. In Step **5810**, the routine invokes a database insert function by, for example, executing an SQL INSERT command. In Step **5820**, the database return code is obtained in order to be used as a return code from the Gwbd_InsertSetMsg routine. In Step **5830**, a database commit function is performed, thereby instructing the database engine to commit the database changes to a permanent recording, i.e., by writing the information to the file, and/or by journalizing the change made by INSERT function. In Step **5890**, the routine returns control to the calling program.

The Gwdb_InsertSetMsg as depicted in Figure **58** may be implemented using the following C++ code:

```
gwDBRC CGW_Engine::Gwdb_InsertSetMsg()
{
EXEC SQL BEGIN DECLARE SECTION;
    // Key.
    char   *h_xid                    = &(m_setKeyFields.xid[0]);
    long   h_rrpidBase               = m_setKeyFields.rrpidBase;
    int        h_retryCount          = m_setKeyFields.retryCount;
// Columns to insert into.
    char   *h_mid                    = &(m_setKeyFields.mid[0]);
    char   *h_tid                    = &(m_setKeyFields.tid[0]);
    char   h_merchantTime[26];
    int        h_requestType         = (int) m_setKeyFields.reqType;
char   h_requestTime[26];
    int        h_requestClass        = (int) m_setRequestClass;
    int        h_requestDisposition  = (int) m_setRequestDisposition;
char   h_responseTime[26];
    int        h_responseClass       = (int) m_setRequestClass;
    int        h_responseDisposition = (int) m_setResponseDisposition;
    char   *h_responseCode           = m_setResponseCode;
EXEC SQL END DECLARE SECTION;
static char    *funcName = "Gwdb_InsertSetMsg";
    gwDBRC dbrc;
```

```
GW_MakeDateString(h_merchantTime, &(m_setKeyFields.merchantTime) );
    GW_MakeDateString(h_requestTime, &m_setRequestTime);
    GW_MakeDateString(h_responseTime, &m_setResponseTime);
EXEC SQL INSERT INTO setmsg
        (
            xid, rrpidbase, retrycount, mid, tid,
            merchanttime,
            requesttype,
            requesttime,
            requestclass, requestdisposition,
            responsetime,
            responseclass, responsedisposition, responsecode
        )
    VALUES
        (
            :h_xid, :h_rrpidBase, :h_retryCount, :h_mid, :h_tid,
            TO_DATE(:h_merchantTime, 'DY MON DD HH24:MI:SS YYYY'),
            :h_requestType,
            TO_DATE(:h_requestTime, 'DY MON DD HH24:MI:SS YYYY'),
            :h_requestClass, :h_requestDisposition,
            TO_DATE(:h_responseTime, 'DY MON DD HH24:MI:SS YYYY'),
            :h_responseClass, :h_responseDisposition, :h_responseCode
        );

    dbrc = Db_Error(funcName);
(void) Db_Commit(funcName);
return (dbrc);
}
```

Gwbd_GetHostMsg

Figure **59** depicts the Gwbd_GetHostMsg routine. This routine is called by Step **5245** as shown in Figure **52B**. Execution begins in Step **5900**. In Step **5910**, the routine invokes a database select function by, for example, executing an SQL SELECT command. In Step **5920**,

the database return code is obtained in order to be used as a return code from the Gwbd_InsertSetMsg routine. In Step **5930**, the Gateway checks to see whether the database retrieve operation was successfully performed. If so, execution proceeds to Step **5935**. In Step **5935**, the Gateway sets a number of status variables from the values retrieved from the database records. This includes the time the request was made, the time a response was received, the contents of the request string, the contents of the response string, and a sequence number for this request. In Step **5940**, a commit operation is performed. [What is the point of a commit operation following a retrieval, as opposed to an insert or an update?] In Step **5900**, control returns to the calling program.

The Gwdb_GetHostMsg as depicted in Figure **59** may be implemented using the following C++ code:

```
gwDBRC CGW_Engine::Gwdb_GetHostMsg()
{
    struct tm     requestTimeTM;
    struct tm     responseTimeTM;
EXEC SQL BEGIN DECLARE SECTION;
    // Key.
    char   *h_xid                    = &(m_setKeyFields.xid[0]);
    long   h_rrpidBase               = m_setKeyFields.rrpidBase;
// Indicator Variables.
    short  h_requestStringInd;
    short  h_responseStringInd;
// Columns to retreive.
    long   h_sequenceNo              = 0;
    int        *h_reqYear = &requestTimeTM.tm_year;
    int        *h_reqMonth = &requestTimeTM.tm_mon;
    int        *h_reqDay = &requestTimeTM.tm_mday;
    int        *h_reqHour = &requestTimeTM.tm_hour;
    int        *h_reqMinute = &requestTimeTM.tm_min;
    int        *h_reqSecond = &requestTimeTM.tm_sec;
    int        *h_requestDisposition  = (int *) &m_hostRequestDisposition;
    VARCHAR h_requestString[128];
```

```
        int         *h_resYear  = &responseTimeTM.tm_year;
        int         *h_resMonth  = &responseTimeTM.tm_mon;
        int         *h_resDay  = &responseTimeTM.tm_mday;
        int         *h_resHour  = &responseTimeTM.tm_hour;
        int         *h_resMinute  = &responseTimeTM.tm_min;
        int         *h_resSecond  = &responseTimeTM.tm_sec;
        int         *h_responseDisposition  = (int *) &m_hostResponseDisposition;
        VARCHAR h_responseString[128];
    EXEC SQL END DECLARE SECTION;
        static char    *funcName = "Gwdb_GetHostMsg";
        gwDBRC dbrc;
        // Set the "tm" structures to null.  Set tm_isdst to -1 so that the
        // mktime() function will determine if whether Daylight Savings Time
        // is active.
        memset(&requestTimeTM, '\0', sizeof(tm) );
        requestTimeTM.tm_isdst=-1;
        memset(&responseTimeTM, '\0', sizeof(tm) );
        responseTimeTM.tm_isdst=-1;

        EXEC SQL SELECT
            sequenceno,
            TO_NUMBER( TO_CHAR(requesttime,'YYYY'))-1900,   // see "man
    mktime"
            TO_NUMBER( TO_CHAR(requesttime,'MM'))-1,        // see "man
    mktime"
            TO_NUMBER( TO_CHAR(requesttime,'DD')),
            TO_NUMBER( TO_CHAR(requesttime,'HH24')),
            TO_NUMBER( TO_CHAR(requesttime,'MI')),
            TO_NUMBER( TO_CHAR(requesttime,'SS')),
          requestdisposition, requeststring,
          TO_NUMBER(TO_CHAR(responsetime,'YYYY'))-1900,   // see "man mktime"
           TO_NUMBER(TO_CHAR(responsetime,'MM'))-1,       // see "man mktime"
            TO_NUMBER(TO_CHAR(responsetime,'DD')),
```

```
                TO_NUMBER(TO_CHAR(responsetime,'HH24')),
                TO_NUMBER(TO_CHAR(responsetime,'MI')),
                TO_NUMBER(TO_CHAR(responsetime,'SS')),
        responsedisposition, responsestring
            INTO
        :h_sequenceNo,
        :h_reqYear, :h_reqMonth, :h_reqDay, :h_reqHour, :h_reqMinute, :h_reqSecond,
        :h_requestDisposition, :h_requestString:h_requestStringInd,
        :h_resYear, :h_resMonth, :h_resDay, :h_resHour, :h_resMinute, :h_resSecond,
        :h_responseDisposition, :h_responseString:h_responseStringInd
            FROM
                hostmsg
            WHERE
                xid = :h_xid AND
                rrpidbase = :h_rrpidBase;
        dbrc = Db_Error(funcName);
        if (dbrc == GWDB_SUCCESS) {
                if (h_requestStringInd == -1) h_requestString.len=0;
                if (h_responseStringInd == -1) h_responseString.len=0;
                m_hostRequestTime = mktime( &requestTimeTM );
                m_hostResponseTime = mktime ( &responseTimeTM );
                    HM_SetRequestString( m_hostSpecificMessage,
                                h_requestString.arr,
                                h_requestString.len);
              HM_SetResponseString( m_hostSpecificMessage,
                                h_responseString.arr,
                                h_responseString.len);
              HM_SetSequenceNo( m_hostSpecificMessage, h_sequenceNo);
            }
        (void) Db_Commit(funcName);
        return (dbrc);
        }
```

Gwdb_InsertHostMsg

Figure **60** depicts the Gwdb_InsertHostMsg routine. This routine is called by Step **5270** as illustrated in Figure **52B**. Execution begins in Step **6000**. In Step **6010**, the routine invokes a database insert function by, for example, executing an SQL INSERT command. In Step **6020**, the database return code is obtained in order to be used as a return code from the Gwbd_InsertSetMsg routine. in Step **6040**, a commit operation is performed. In Step **6090**, the routine returns control to the calling program.

The Gwdb_InsertHostMsg as depicted in Figure **60** may be implemented using the following C++ code:

```
gwDBRC CGW_Engine::Gwdb_InsertHostMsg()
{
EXEC SQL BEGIN DECLARE SECTION;
    // Key.
    char   *h_xid                    = &(m_setKeyFields.xid[0]);
    long   h_rrpidBase               = m_setKeyFields.rrpidBase;
    int        h_retryCount          = m_setKeyFields.retryCount;
// Columns to insert into.
    long   h_sequenceNo              = 0;
    char   h_requestTime[26];
    int        h_requestDisposition  = (int) m_hostRequestDisposition;
    char   h_responseTime[26];
    int        h_responseDisposition = (int) m_hostResponseDisposition;
EXEC SQL END DECLARE SECTION;
    static char    *funcName = "Gwdb_InsertHostMsg";
    gwDBRC dbrc;
    GW_MakeDateString(h_requestTime, &m_hostRequestTime);
    GW_MakeDateString(h_responseTime, &m_hostResponseTime);
   EXEC SQL INSERT INTO hostmsg
        (
            xid, rrpidbase, retrycount,
            sequenceno,
```

```
                requesttime,
                requestdisposition,
                responsetime,
                responsedisposition
            )
        VALUES
            (
                :h_xid, :h_rrpidBase, :h_retryCount,
                :h_sequenceNo,
                TO_DATE(:h_requestTime, 'DY MON DD HH24:MI:SS YYYY'),
                :h_requestDisposition,
                TO_DATE(:h_responseTime, 'DY MON DD HH24:MI:SS YYYY'),
                :h_responseDisposition
            );
        dbrc = Db_Error(funcName);
       (void) Db_Commit(funcName);
        return (dbrc);
    }
```

Gwdb_UpdateSetMsgResponseInfo

Figure **61** depicts a flow diagram for the Gwdb_UpdateSetMsgResponseInfo routine. Execution begins at Step **6100**. In Step **6110**, the routine invokes a database update function by, for example, executing an SQL UPDATE command. In Step **6120**, the database return code is obtained in order to be used as a return code from the Gwbd_UpdateSetMsgResponseInfo routine. In Step **6190**, the routine returns control to the calling program.

The Gwdb_UpdateSetMsgResponseInfo as depicted in Figure 61 may be implemented using the following C++ code:

```
gwDBRC CGW_Engine::Gwdb_UpdateSetMsgResponseInfo()
{
EXEC SQL BEGIN DECLARE SECTION;
    // Key.
    char   *h_xid                          = &(m_setKeyFields.xid[0]);
```

```
        long    h_rrpidBase                 = m_setKeyFields.rrpidBase;
        int     h_retryCount                = m_setKeyFields.retryCount;

        // Columns to update.
        char    h_responseTime[26];
        int     h_responseClass             = (int) m_setResponseClass;
        int     h_responseDisposition   = (int) m_setResponseDisposition;
        char    *h_responseCode             = m_setResponseCode;
    EXEC SQL END DECLARE SECTION;
        static char     *funcName = "Gwdb_UpdateSetMsgResponseInfo";
        gwDBRC dbrc;
        GW_MakeDateString(h_responseTime, &m_setResponseTime);
        EXEC SQL UPDATE setmsg SET
        responsetime = TO_DATE(:h_responseTime, 'DY MON DD HH24:MI:SS YYYY'),
            responseclass = :h_responseClass,
            responsedisposition = :h_responseDisposition,
            responsecode = :h_responseCode
        WHERE
            xid = :h_xid AND
            rrpidbase = :h_rrpidBase AND
            retrycount = :h_retryCount;
        dbrc = Db_Error(funcName);
        (void) Db_Commit(funcName);
        return (dbrc);
    }
```

Figure **62** is the main administration display for the Gateway in accordance with a preferred embodiment. A set of menu selections are presented at **6200** which will be described in more detail for each display. Figure **63** is a configuration panel in accordance with a preferred embodiment. The configuration panel provides access to management information for configuring a gateway management information database. The Merchant Identifier (Mid) **6310** is a thirty character, alphanumeric field that uniquely defines a merchant. The Merchant Name **6320** is a fifty character, alphanumeric field, the Edit **6330** and Delete field **6340** are

hyperlinks to detailed panels for modifying information in the management information database. Figure **64** is a host communication display for facilitating communication between the gateway and the acquirer payment host. The IP Address Field **6410** contains the Internet Protocol address for communicating via TCP/IP to the Internet. The TCP logical port field **6430** uniquely identifies the port for accessing the Internet, and the SAVE field **6430** invokes storing of the host communication information in the database. Figure **65** is a Services display in accordance with a preferred embodiment. This display initiates portions of the Gateway such as the host mulitplixer **2130** of Figure **21**. Figure **66** is a graphical representation of the gateway transaction database in accordance with a preferred embodiment. Each of the fields represents a portion of the internet database schema in accordance with a preferred embodiment.

Gateway System Administration

As described above, the gateway is a secure computer system that mediates Internet based payment transactions between merchant servers and the acquiring bank's card processing host. The gateway supports secure communications between merchants using the Internet and acquirers using private financial networks and maintains appropriate logs of all transactions.

Figure **67** illustrates the gateway hardware architecture in accordance with a preferred embodiment. Internet **6730** based merchants communicate transaction information via merchant servers **6700** running the VPOS software described earlier to a gateway **6740**. The gateway **6740** performs all conversion necessary to route transaction requests through the bank network **6750** to the host processor **6760**. Results from the host legacy system **6760** are routed back through the bank network **6750** to the gateway **6740** which transfers the information through the Internet **6730** to the merchant system **6700**.

Figure **68** is a block diagram setting forth the gateway software architecture in accordance with a preferred embodiment. The gateway **6870** includes an SSL-compliant HTTP server **6800** that ensures transport-level security of HTTP communication between the gateway **6870** and the acquirer's data operations center. The VPOS transmits SET requests utilizing HTTP and public key certificates are used to facilitate authentication of merchant and gateway identity. The HTTP server **6800** facilitates the communication between the gateway **6870** and the VPOS

terminals over the Internet utilizing HTTP. The VPOS terminals are configured to communicate with the gateway utilizing the gateway IP address and port number. The HTTP server **6800** also supports HTML pages for gateway system administration, and utilizes Netscape's Enterprise Server 2.0 to support URL access to the port number. The administrative information contained on the gateway can be accessed by any commercial browser if the user has appropriate authority to access the gateway.

The gateway web adaptor **6820** is a Common Gateway Interface (CGI) program that is invoked by the HTTP Server **6800** when a request arrives from a VPOS terminal. The web adaptor **6820** extracts the contents of a posted transaction and passes it to the SET library **6850** which decrypts the SET request into a plain text SET object utilizing the cryptographic library **6810**. The SET library **6850** then calls the gateway engine **6870** to convert the plaintext SET object into a host specific request message utilizing the host message converter **6860**. When a response is received, it is passed to the SET library **6850** for encryption utilizing the cryptographic library **6810**. The encrypted SET response is sent back to the VPOS terminal. An error is logged if an invalid HTTP request is detected, if the library cannot decrypt the SET response, or if the library cannot encrypt the SET response. Stale messages are rejected.

For credit card transactions, the gateway **6870** supports Secure Electronic Transaction (SET) requests providing for message encryption, authentication and encapsulation. The SET library **6850**, converts SET requests into messages that are processed by the Host Message Converter. The SET Cryptographic library **6810** performs the following functions. 1) Converts an encrypted byte stream from an HTTP message sent by a POST method from a VPOS terminal to a plaintext SET object representing the request; and 2) converts a plaintext SET object representing the response into an encrypted byte stream which is transmitted back to the originating VPOS terminal. The SET library **6850** uses the cryptographic library for all standards based security operations. The cryptographic library also provides an interface to the cryptographic hardware.

The host message converter **6860** converts messages to bank-specific formats and routes messages to the appropriate host processor. The converter **6860** also converts messages from the host processor to the format used by the SET library **6850**. The multi-threaded gateway engine **6870** utilizes SET decryption and encryption and the host message converter **6860** to

support simultaneous SET requests from multiple VPOS terminals. The gateway also determines whether a plaintext SET request is an original request, an honest retry attempt, or a replay attack. The possible results include for an honest retry, possibly because an earlier response did not reach the VPOS, the gateway looks up the response from the database and returns it. If it is a replay attack, an error is logged. If it is an original request, then the VPOS engine proceeds to convert it to a host-specific request message. Then, it sends the request out to the remote host via the gateway host multiplexer **6890** and waits for a response. The gateway also logs all intermediate processing states, request messages and response messages, and groups all protocol-specific processing actions in a module with common API functions. The gateway also converts host responses to plaintext SET response objects, logs an error if the forward conversion fails, logs an error if the host multiplexer **6890** cannot send the request, logs an error if the gateway times out the response and logs an error if the reverse conversion fails.

The gateway host multiplexer **6890** communicates with the host based on the host's IO address and port number. If the host does not support TCP/IP, a link-level protocol converter must be installed. The gateway host multiplexer also sends multiple request messages to the host, serializes them, and receives messages asynchronously from the host and matches each of them with the corresponding request message which allows a particular gateway process to stop waiting and proceed with the reverse conversion.

The gateway **6870** stores all transaction information in a relational database **6845** controlled by a database server **6840** and specifically designed for high transaction volume. The database also records the details and state of every transaction processed by the gateway and generates transaction reports utilizing the gateway administrative interface. The sequence generator **6880** supplies the gateway with unique sequence numbers utilized in host request messages for identification of each transaction. An optional host simulator resides on the gateway server and transparently simulates a host for testing purposes. The gateway host communication configuration screen can utilize the IP address and port address of the host simulator to simulate a host processor that receives host requests and supplies host responses for testing purposes, and returns an authorization approval response message appropriately formatted. During normal transaction processing the host simulator is disabled and the gateway

communication configuration screen contains the IP address and port number of the host processor.

The gateway includes a set of tools for administering gateway, database, operating system and Web server software. Also, the database schemas and the gateway administrative interface allows system administrators to create custom database reports to remotely monitor gateway performance. A gateway merchants display is provided to manage the merchant information on a gateway. Merchants can be added, deleted or modified using a display. The gateway also incorporates a system variable reflective of the maximum length of time to allow for a transaction request to reach the gateway from the VPOS terminal. If the stale message time limit is exceeded, then the transaction request is rejected and the merchant must resend the transaction. All of the gateway tools are accessible from commercial browsers assuming the user requesting the access has appropriate authorization.

The gateway provides a secure server that mediates transactions between merchants VPOS (Virtual Point-Of-Sale) servers and a financial institution's host processor. The gateway supports secure communications between merchants using the Internet on one side, and the host processor using legacy secure financial networks on the other side. Between the two interfaces, the gateway maintains a detailed log of all transactions, whether completed or in-progress. The gateway can handle multiple requests simultaneously and is designed to be easily scaled to handle a high transaction load.

The gateway accepts transactions from merchants over the Internet and converts them to a host-specific format before forwarding them to a host processor belonging to an existing financial network. Responses from the host, after the reverse conversions, are returned to the originating merchants over the Internet. Transactions between VPOS and the gateway are made secure by utilizing the SET protocol for all communication.

GATEWAY CORE ENGINE COMPONENTS

This document details a software interface between the gateway ***core engine*** software component and the ***host message specific*** software that implements the host specific financial message formatting and conversion functions.

The gateway performs the following functions:

1. Receives encrypted payment requests from merchants, as HTTP POST messages via the Internet.
2. Unwraps and decrypts the requests.
3. Authenticates digital signatures of the requests based on certificates.
4. Supports transaction types and card types as required by a financial institution.
5. Accepts concurrent VPOS transactions from each of the merchant servers.
6. ***Converts transaction data to host-specific formats and forward the mapped requests (in the clear) to the host processor using the existing financial network.***
7. ***Receives transaction responses from the host.***
8. ***Converts the responses from host-specific formats and correlate the mapped responses with the original requests.***
9. Encrypts the responses, encapsulates them in HTTP reply messages, and sends them back to the originating merchants over the Internet.
10. Provides transaction logging in a relational database, symbolic transaction tracing, performance reporting, and other system administration functions.

The Host Message interface is the interface between the gateway ***core engine*** and the host specific functions that implement steps 6 through 8 in the above list. There may be more than one Host Message implementation but only one vGATE core software implementation.

Host Message Interface

Purpose

The Host Message interface grew from the desire to separate the core functions of the gateway software from those functions that are ***host specific***. There are a variety, currently over 1,400 understood by VeriFone equipment and software, of legacy financial networks and protocols that exist worldwide. We expect to have great demand for our VPOS and gateway payment solutions and must be in a position to quickly develop and deploy our Internet payment solutions for the top Banks and acquirers. The **H**ost **M**essage interface (HM interface) will be used by the various software development organizations of VeriFone to develop software that will enable the gateway product to be deployed with existing financial networks without

changing the interface point to the financial network. Gateway, along with VPOS allows the acquirers to offer Internet Payment solutions to their Merchant base without changing their current financial networks.

The VPOS software, although it too can be customized and branded for a particular acquirer, is not as tightly coupled with the financial network as is gateway. The protocol between the VPOS and gateway that is currently used is SET and this protocol, in principle, isolates the VPOS software from the legacy network that it is ultimately connected to (via gateway).

Overview

The host specific portion of gateway are accessed by the gateway core engine by calling the functions contained in the Host Message implementation. The software that implements the host message interface is linked to the gateway core engine software either statically or dynamically (shared object libraries in UNIX or DLLs on Windows NT). The Host Message API is defined in this document.

The software that implements the host message interface must be re-entrant. The gateway engine will call the host message interface from either a process or a thread. The gateway engine is designed to be multi-threaded and will be capable of handling multiple requests simultaneously.

The host message interface is a "C" based API. The implementation of the host specific library must be implemented in "C++" as some of the data that is needed is contained in "C++" objects and is only accessible using the methods for those objects. The host specific software need only use very basic features of "C++" and need not be completely designed and or programmed using object-oriented techniques.

Transaction Types

There are currently seven transaction types, or payment request types, that can arrive at gateway from VPOS. Each of these request types has an associated *request object* and *response object*. There are *methods* that are made public for each of these *request objects* that allow the host specific module to "get" the data from the incoming request in order to build the host specific request. There are also public "methods" for the *response object* allowing the host

specific functions to "set" the response data that will be communicated by the gateway engine back to VPOS.

VGATE API

Figure **69** illustrates the gateway components and interfaces in accordance with a preferred embodiment. The gateway API specifies the expected behaviors and information exchange for transaction processing functions, transaction data structures, SET access functions, certificate management functions, string utility functions and system configuration parameters. The architecture includes three distinct sections to enhance distribution of the functions. The upper API **6910** consists of concise functions which are available via a call out interface to custom modules **6901-6903** provided by application developers. The lower API **6940** allows the gateway **6930** and the custom modules **6901-6903** to call in to reusable helper functions **6950-6970** which facilitate isolation from possible future fluctuations in structural definitions of SET data elements. The system configuration custom parameters **6920** include the more static information elements required for such things as the network address of the host or its proxy equipment, timeout values, expected length of certain messages and other system configuration information. These parameters are specified as name-value pairs in the gateway system initialization file.

The vGATE SET Access API shields application developers from the structural complexities of the SET (Secure Electronic Transaction) protocol by providing high-level access functions to SET-defined data elements and allowing the use of such functions to be integrated seamlessly with the translations of a particular acquirer-specific message format. The need for the SET Access API is twofold: first, program abstraction and, second, separation of concerns. The forest of deeply nested data structures generated from compiling the textual SET ASN.1 definitions is very tedious to traverse, and direct exposition to multiple levels of pointer manipulation is a major distraction in developing acquirer-driven custom applications for vGATE. Furthermore, the SET proposed standard, still in draft form, has been and is expected to be going through various revisions in which the ASN.1 definitions are changed significantly. Any code that is involved in directly accessing the container structures will have to be rewritten.

The above two software-engineering considerations are serious enough to warrant a solution using abstract representations and access methods. The vGATE SET Access API provides the application developers with a set of predefined classes for each of the SET messages with simple access methods to get data from, and set values to, the different elements of the SET protocol data units. The present content of the API is a current implementation of the PCL (Payment Class Library) **6950**. In using the SET Access API, vGATE application developers will be able to insulate their code from all future fluctuations in SET structural definitions. For example, extensions to SET are segregated from the standard SET functions utilizing an extend SET PCL **6960**.

The system is partitioned to separate design concerns at different levels and to allow for graceful adaptations by external modules. The language was selected for the API by recognizing, classifying, distilling and exposing the programmatic activities that are typically required for translating legacy payment protocols and in communicating with host processors. Within a generic framework of reusable, prefabricated components (the core gateway), points of access have been defined to allow customization activities to occur (gateway API). The resulting architecture allows a software developer to focus on custom applications by freeing them from the underlying operational details already handled by the gateway core engine.

The gateway core handles basic transaction management (control flow, logging, error detection and recovery), internal interprocess communication, relational database access, communication with vPOS terminals over the Internet, interfacing with a host processor via a legacy network, and overall system administration. Whereas the gateway controls the processing of payment messages, it has no embedded knowledge of any acquirer-specific payment protocols.

The custom applications for a particular acquirer can be developed in C or C++ and linked to the gateway core software either statically or dynamically. If they are dynamically linked, then they are considered "shared objects" on Unix or "dynamic link libraries" on Windows NT. A gateway installation consists of the core gateway engine and the custom modules designed for a particular acquirer.

While various embodiments have been described above, it should be understood that they have been presented by way of example only, and not limitation. Thus, the breadth and scope of a preferred embodiment should not be limited by any of the above described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

CLAIMS

What is claimed is:

1. A method for processing information accumulated at a gateway between a network application and a host system utilizing a gateway administrative interface, comprising the steps of:

(a) receiving information at the gateway from the network;

(b) processing the information;

(c) storing gateway transaction and administrative information at the gateway in a database;

(d) receiving requests for gateway information from a network application at the gateway administrative interface and translating the requests into a query for the database;

(f) submitting the query to the database;

(g) receiving gateway information from the database in response to the query; and

(h) transmitting the gateway information to the network application.

2. A method, as recited in claim 1, further comprising the step of processing requests for gateway from a browser utilizing the Internet.

3. A method as recited in claim 1, wherein the gateway information includes dynamic tracing of transactions.

4. A method as recited in claim 1, wherein the gateway information includes status information.

5. A method as recited in claim 1, wherein the gateway information includes exception information associated with transactions.

6. A method as recited in claim 1, wherein the network communication utilizes HTTP for information exchange.

7. A method as recited in claim 1, wherein the gateway administrative interface provides system configuration parameters to the gateway.

8. A method as recited in claim 1, wherein the gateway administrative interface activates gateway functions.

9. A system for processing administrative information accumulated at a gateway between a network application and a host system utilizing a gateway administrative interface, comprising:

(a) a network adaptor that receives encrypted information at the gateway from the network;

(b) a software code segment that decrypts the information;

(c) a first application program interface to access custom modules and process the information;

(d) a database that stores gateway administrative information at the gateway;

(e) a gateway administrative interface that receives requests for gateway information from a network application and translates the requests into a query for the database;

(f) a software code segment that submits the query to the database;

(g) a software code segment that receives gateway information from the database in response to the query; and

(h) a software code segment that transmits the gateway information to the network application.

10. A system as recited in claim 9, further comprising the step of processing requests for gateway information from a browser utilizing the Internet.

11. A system as recited in claim 9, wherein the gateway information includes dynamic tracing of transactions.

12. A system as recited in claim 9, wherein the gateway information includes status information on transactions.

13. A system as recited in claim 9, wherein the gateway information includes exception information associated with transactions.

14. A method as recited in claim 9, wherein the network communication utilizes HTTP for information exchange.

15. A computer program embodied on a computer-readable for processing administrative information accumulated at a gateway between a network application and a host system utilizing a gateway administrative interface, comprising:

(a) a code segment that receives encrypted information at the gateway from the network;

(b) a code segment that decrypts the information;

(c) a first application program interface to access custom modules and process the information;

(d) a code segement that stores gateway administrative information at the gateway;

(e) a code segment that receives requests for gateway information from a network application and translates the requests into a query for the database;

(f) a code segment that submits the query to the database;

(g) a code segment that receives gateway information from the database in response to the query; and

(h) a code segment that transmits the gateway information to the network application.

16. A computer program as recited in claim 15, further comprising a code segment that processes requests for gateway information from a browser utilizing the Internet.

17. A computer program as recited in claim 15, wherein the gateway information includes dynamic tracing of transactions.

18. A computer program as recited in claim 15, wherein the gateway information includes status information on transactions.

19. A computer program as recited in claim 15, wherein the gateway information includes exception information associated with transactions.

20. A computer program as recited in claim 15, wherein the network communication utilizes HTTP for information exchange.

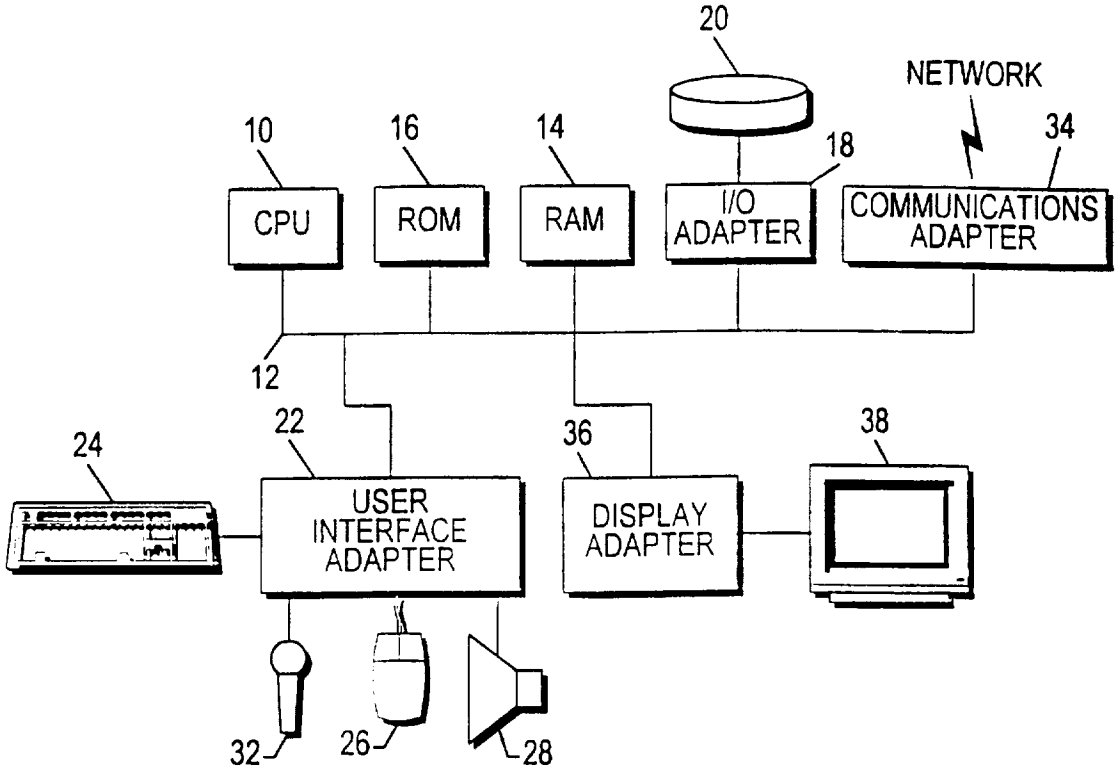
20
NETWORK
10
16
14
18
34
CPU
ROM
RAM
I/O ADAPTER
COMMUNICATIONS ADAPTER
12
22
36
38
24
USER INTERFACE ADAPTER
DISPLAY ADAPTER
32
26
28

FIG.-1A

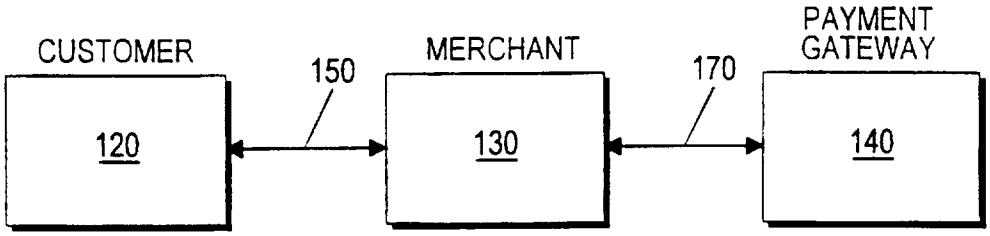
CUSTOMER
150
MERCHANT
170
PAYMENT GATEWAY
120
130
140

FIG.-1B

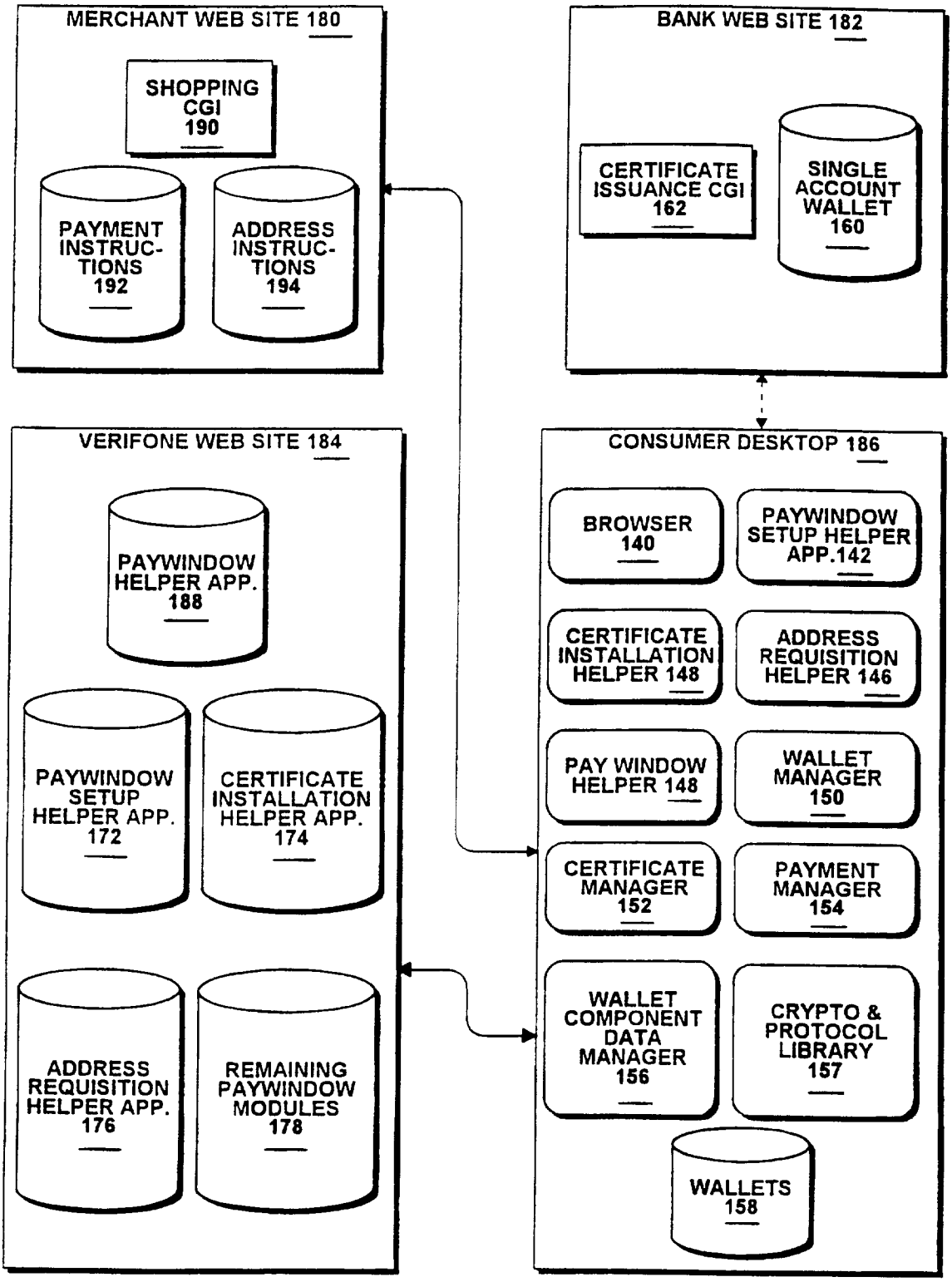
MERCHANT WEB SITE 180
SHOPPING CGI 190
PAYMENT INSTRUC-TIONS 192
ADDRESS INSTRUC-TIONS 194
BANK WEB SITE 182
CERTIFICATE ISSUANCE CGI 162
SINGLE ACCOUNT WALLET 160
VERIFONE WEB SITE 184
PAYWINDOW HELPER APP. 188
PAYWINDOW SETUP HELPER APP. 172
CERTIFICATE INSTALLATION HELPER APP. 174
ADDRESS REQUISITION HELPER APP. 176
REMAINING PAYWINDOW MODULES 178
CONSUMER DESKTOP 186
BROWSER 140
PAYWINDOW SETUP HELPER APP.142
CERTIFICATE INSTALLATION HELPER 148
ADDRESS REQUISITION HELPER 146
PAY WINDOW HELPER 148
WALLET MANAGER 150
CERTIFICATE MANAGER 152
PAYMENT MANAGER 154
WALLET COMPONENT DATA MANAGER 156
CRYPTO & PROTOCOL LIBRARY 157
WALLETS 158

FIG.-1C

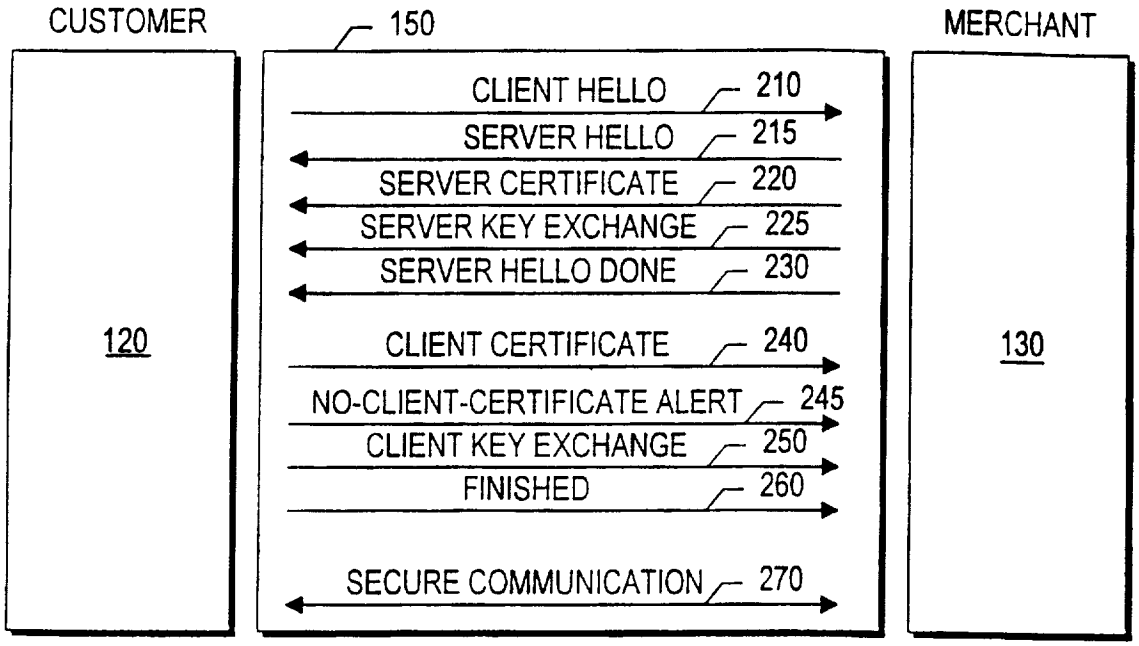
CUSTOMER
150
MERCHANT
CLIENT HELLO
210
SERVER HELLO
215
SERVER CERTIFICATE
220
SERVER KEY EXCHANGE
225
SERVER HELLO DONE
230
120
CLIENT CERTIFICATE
240
130
NO-CLIENT-CERTIFICATE ALERT
245
CLIENT KEY EXCHANGE
250
FINISHED
260
SECURE COMMUNICATION
270

FIG.-2

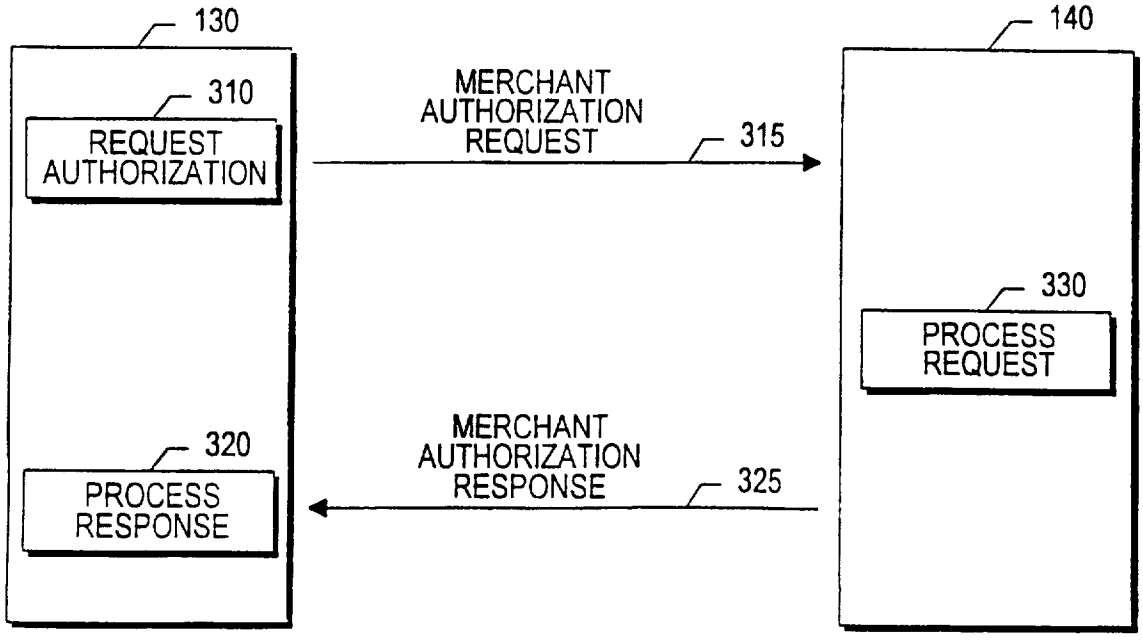
130
140
310
REQUEST AUTHORIZATION
MERCHANT AUTHORIZATION REQUEST
315
330
PROCESS REQUEST
320
PROCESS RESPONSE
MERCHANT AUTHORIZATION RESPONSE
325

FIG.-3

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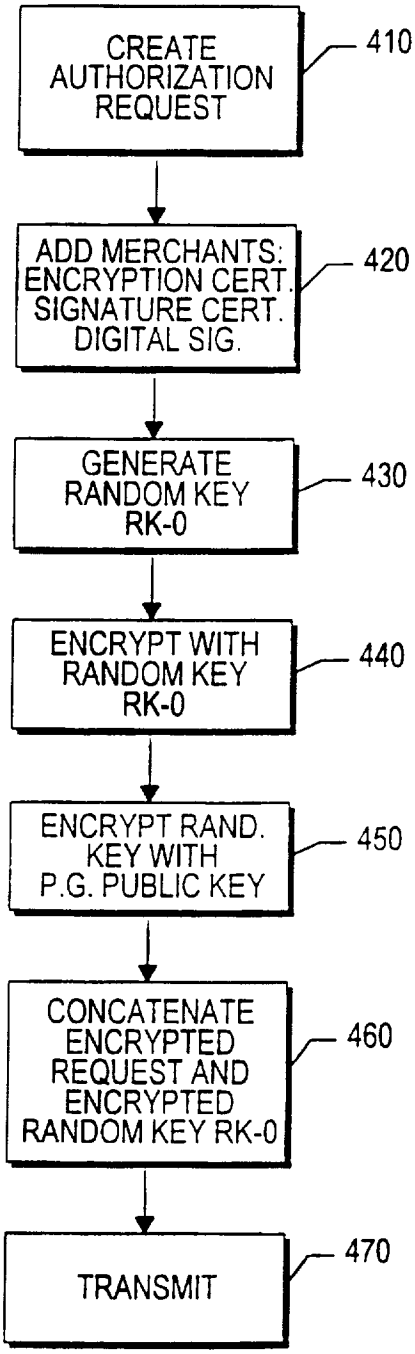
CREATE AUTHORIZATION REQUEST
410
ADD MERCHANTS: ENCRYPTION CERT. SIGNATURE CERT. DIGITAL SIG.
420
GENERATE RANDOM KEY RK-0
430
ENCRYPT WITH RANDOM KEY RK-0
440
ENCRYPT RAND. KEY WITH P.G. PUBLIC KEY
450
CONCATENATE ENCRYPTED REQUEST AND ENCRYPTED RANDOM KEY RK-0
460
TRANSMIT
470

FIG.-4



FIG.-5A

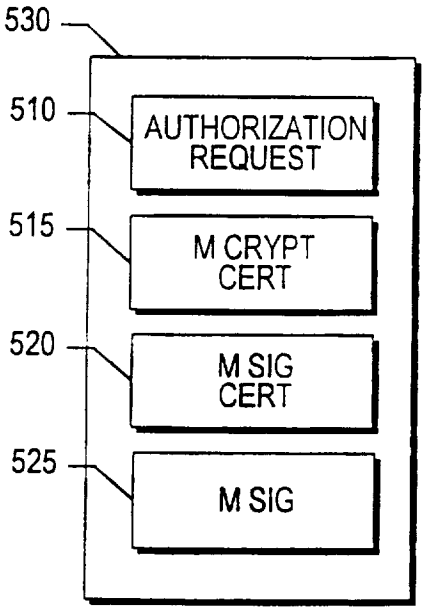

FIG.-5B



FIG.-5C

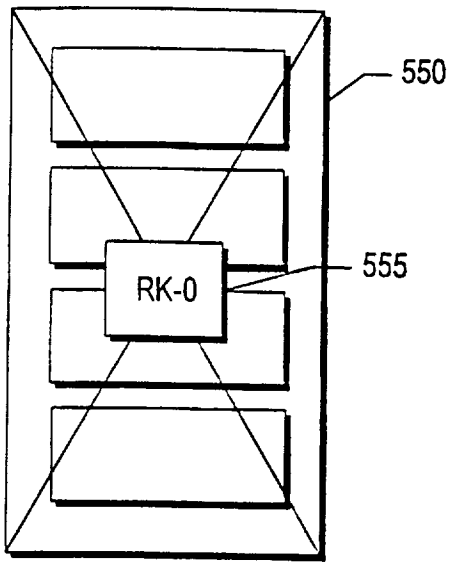

FIG.-5D

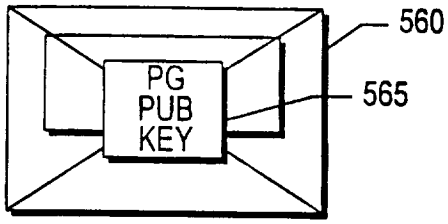

FIG.-5E

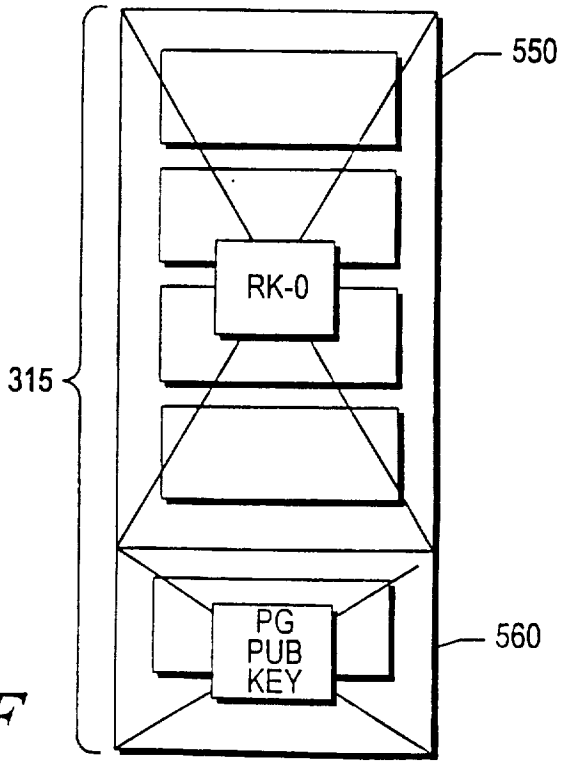

FIG.-5F

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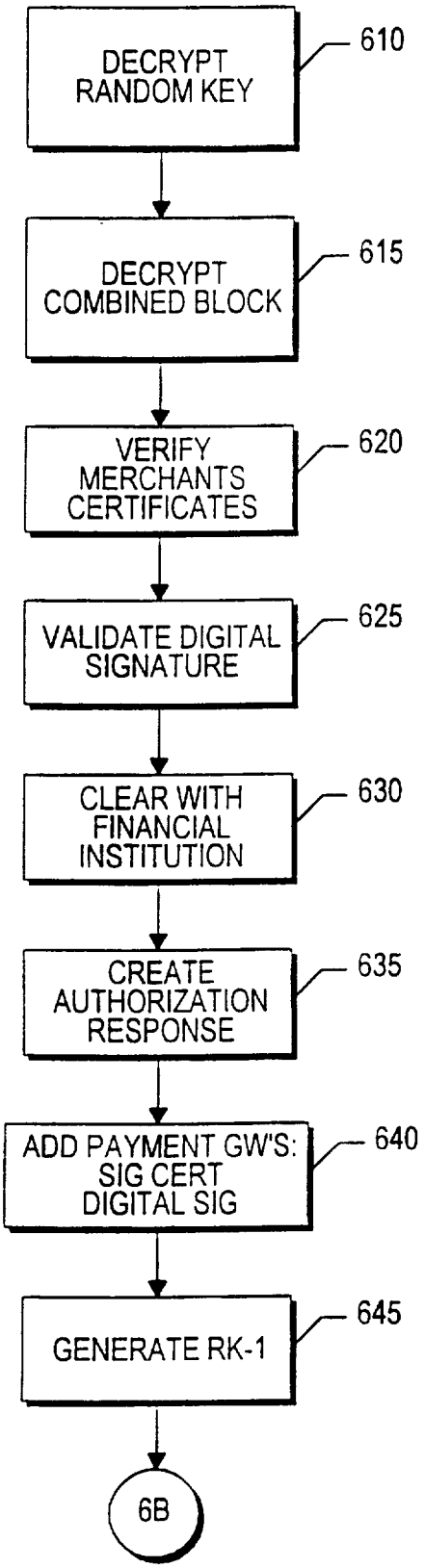

FIG.-6A

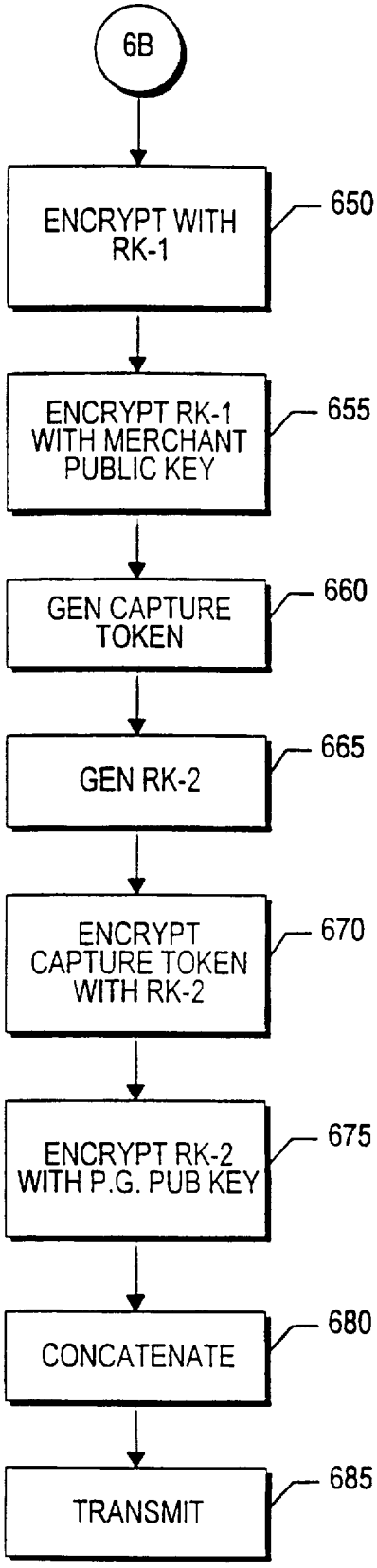

FIG.-6B



FIG.-7A

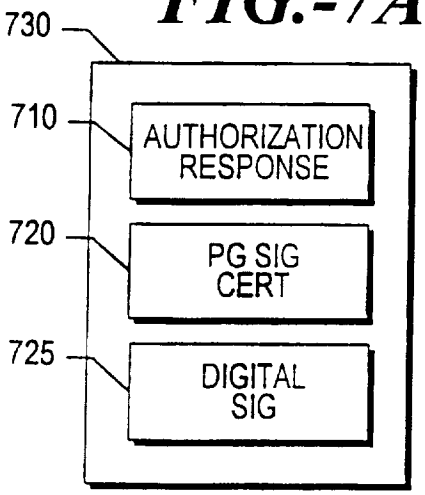

FIG.-7B



FIG.-7C

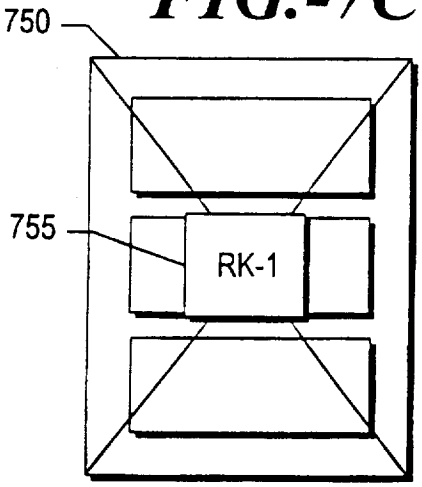

FIG.-7D

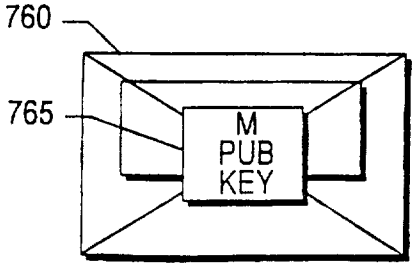

FIG.-7E



FIG.-7F



FIG.-7G

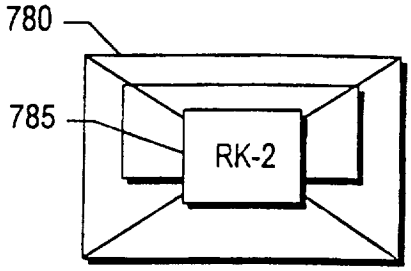

FIG.-7H

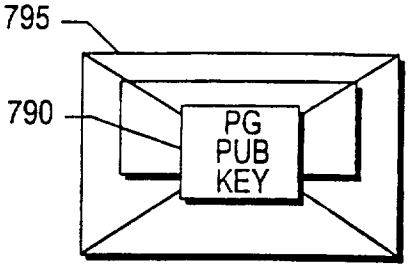

FIG.-7I

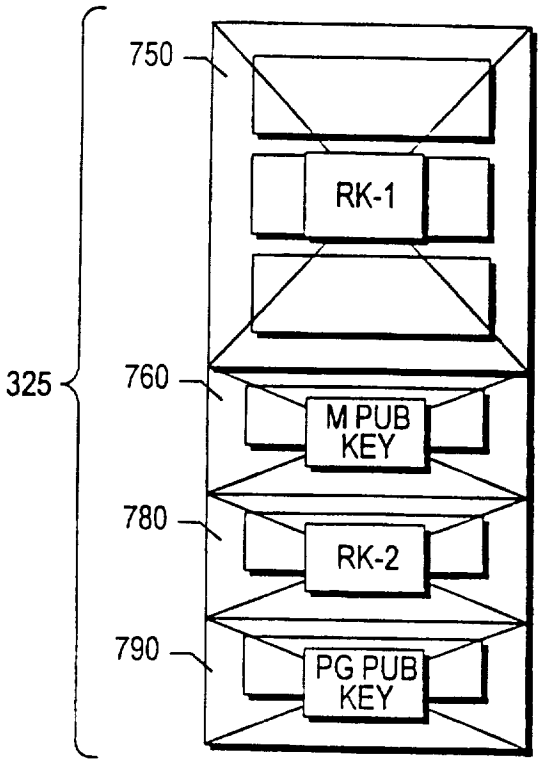

FIG.-7J

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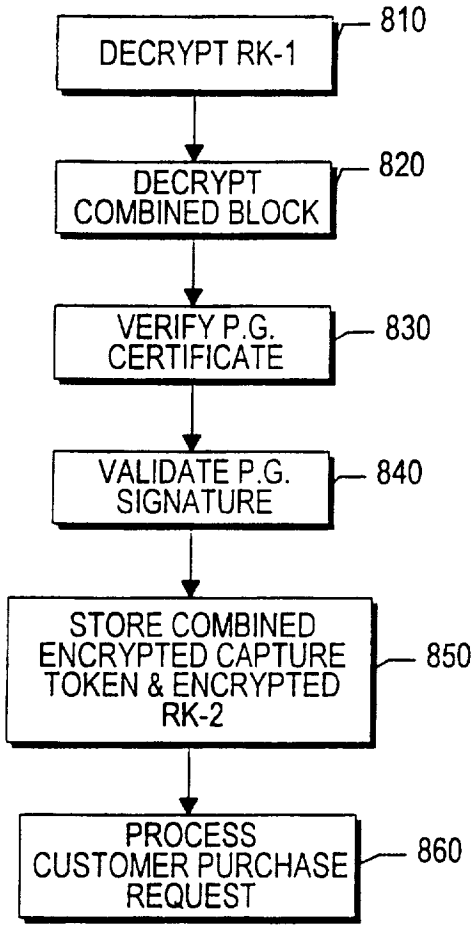

FIG.-8

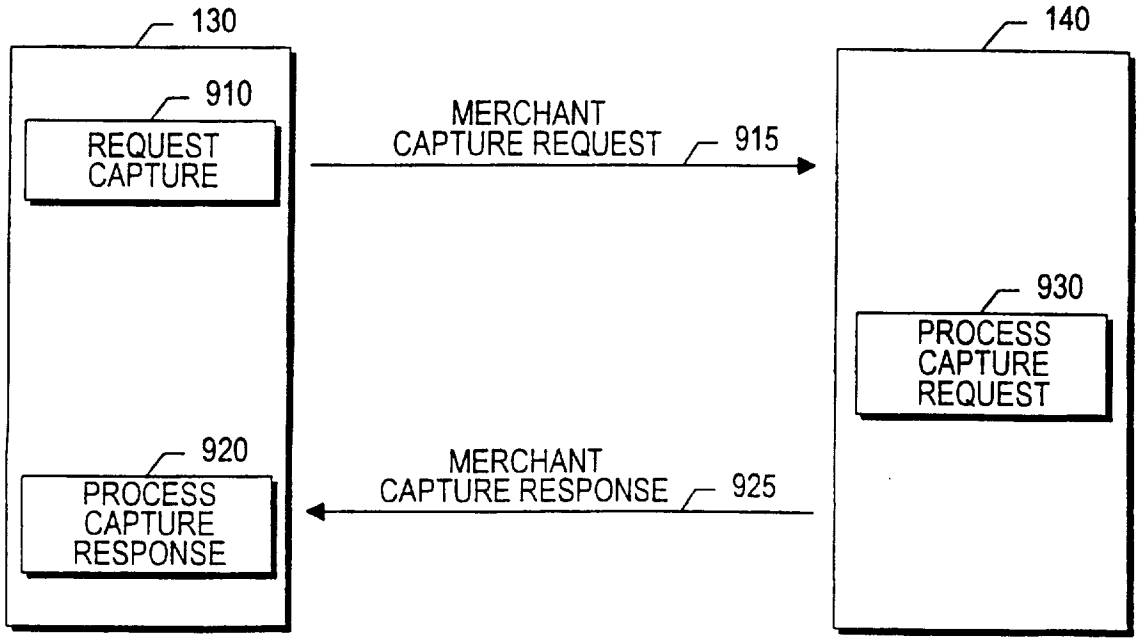

FIG.-9

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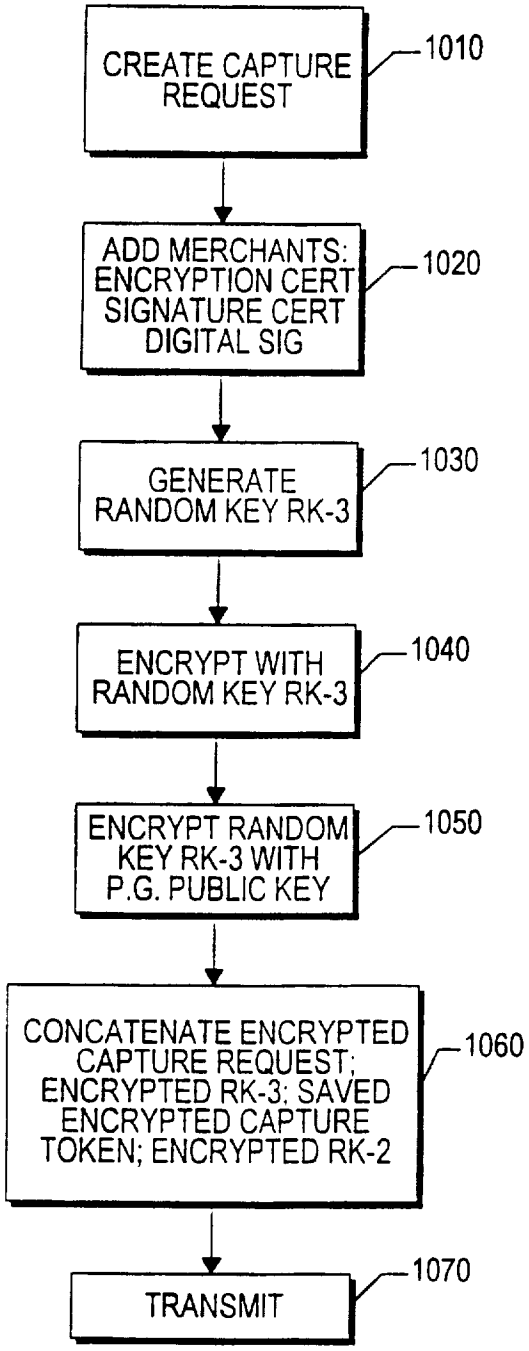

FIG.-10

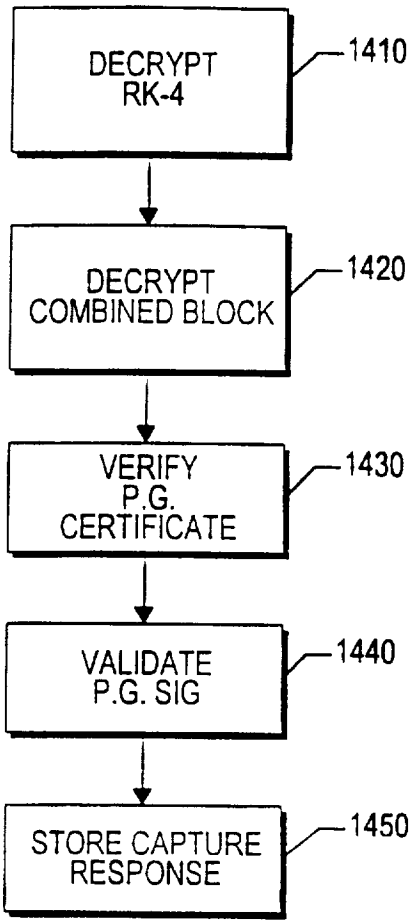

FIG.-14

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FIG.-11A

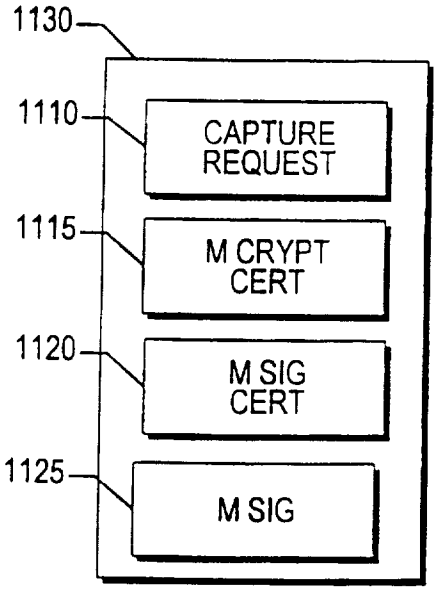

FIG.-11B



FIG.-11C

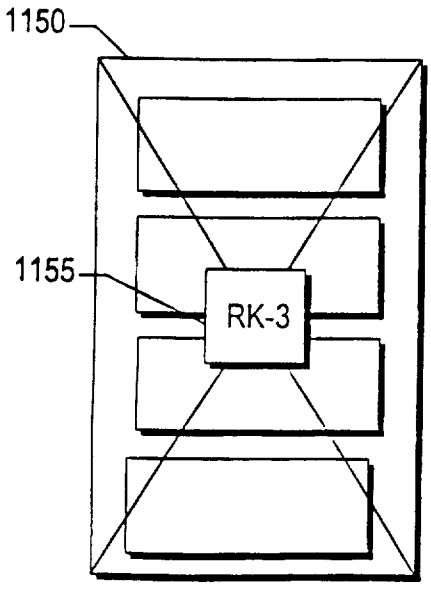

FIG.-11D

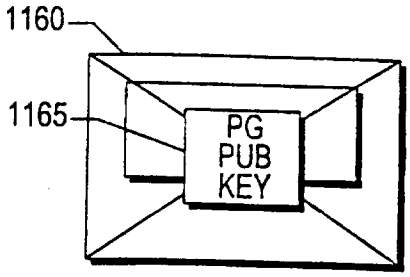

FIG.-11E

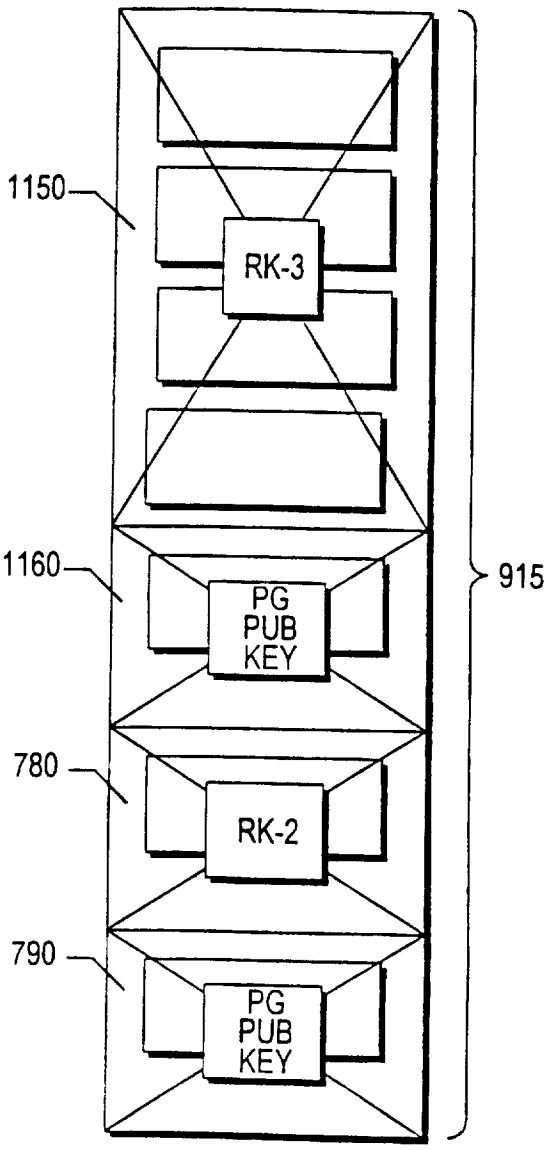

FIG.-11F

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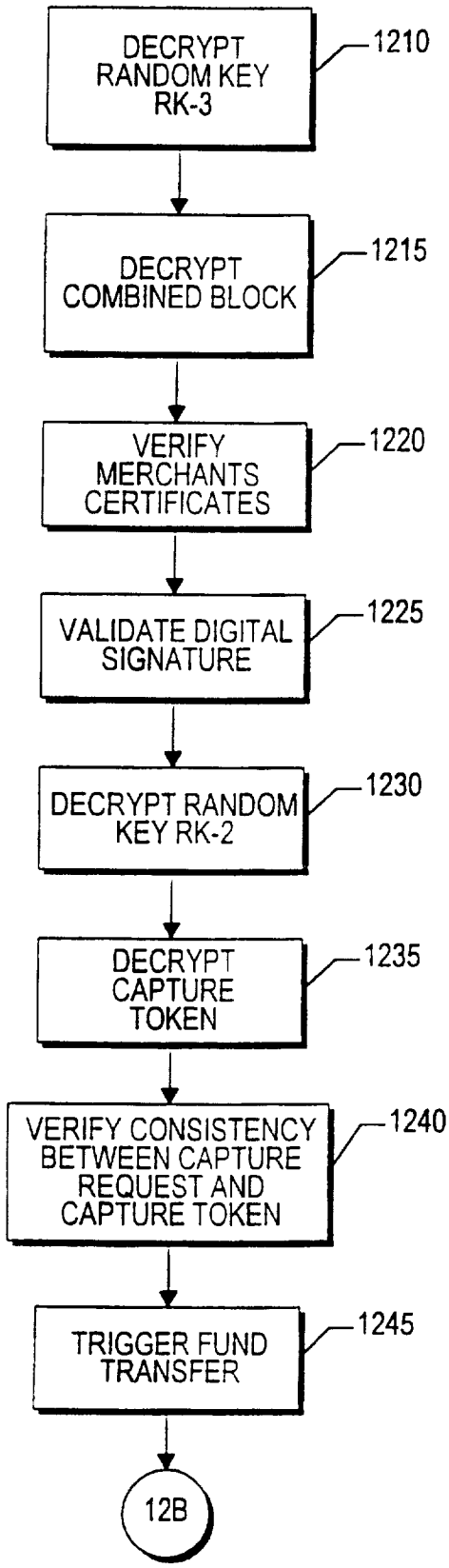

FIG.-12A

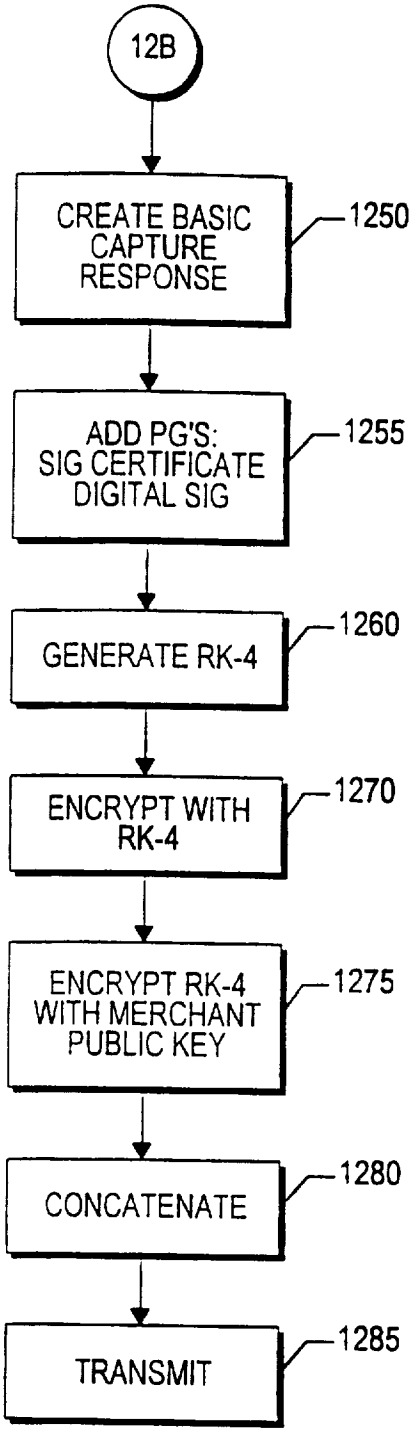

FIG.-12B

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FIG.-13A

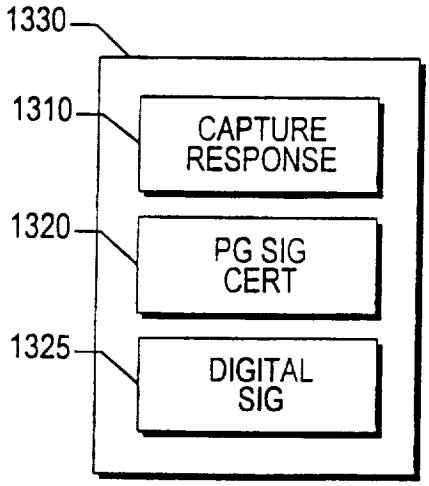

FIG.-13B



FIG.-13C

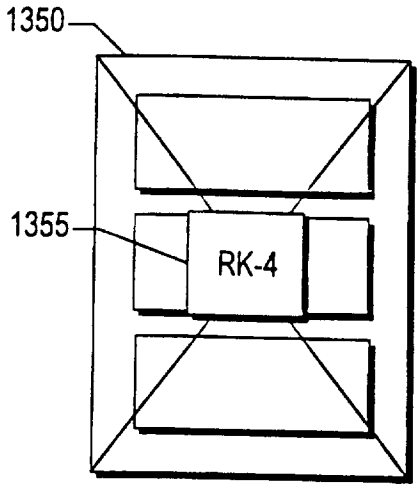

FIG.-13D

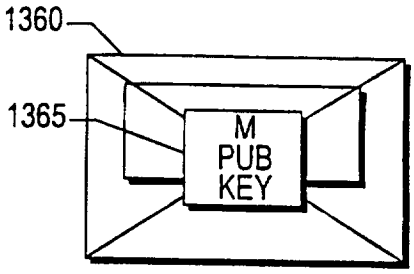

FIG.-13E

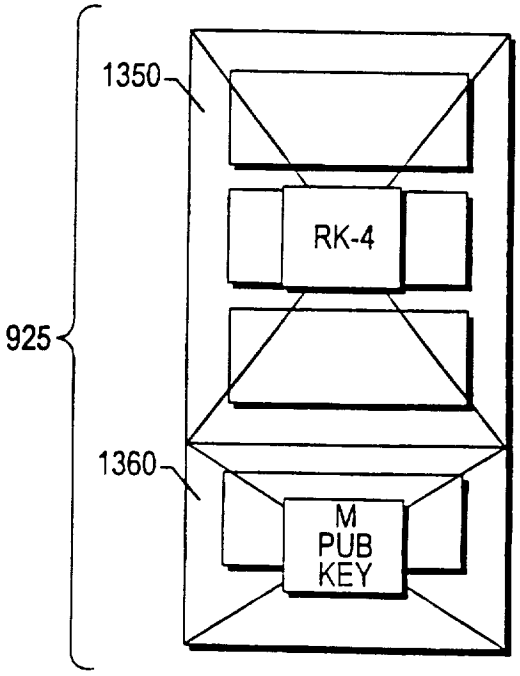

FIG.-13F

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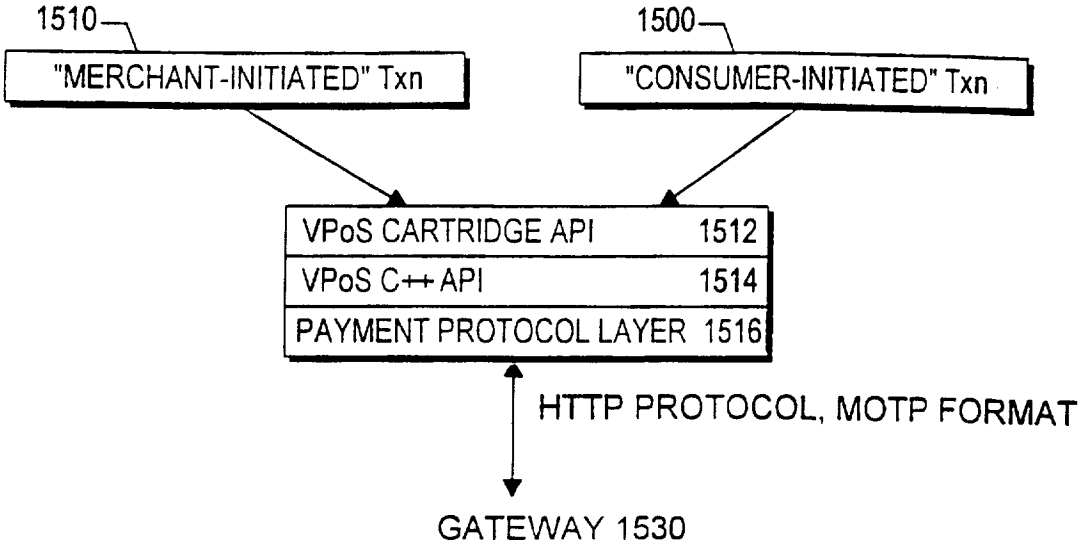

FIG.-15A

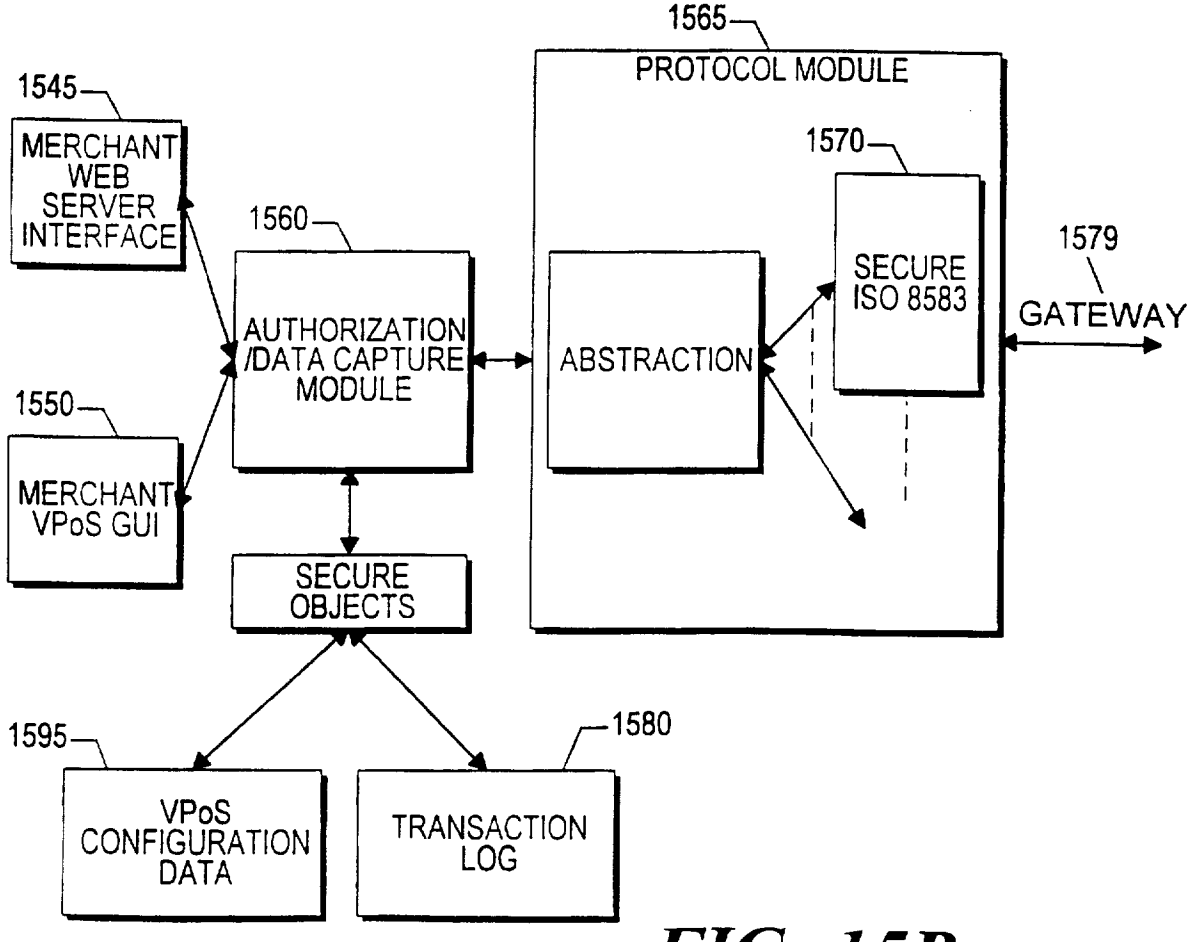

FIG.-15B

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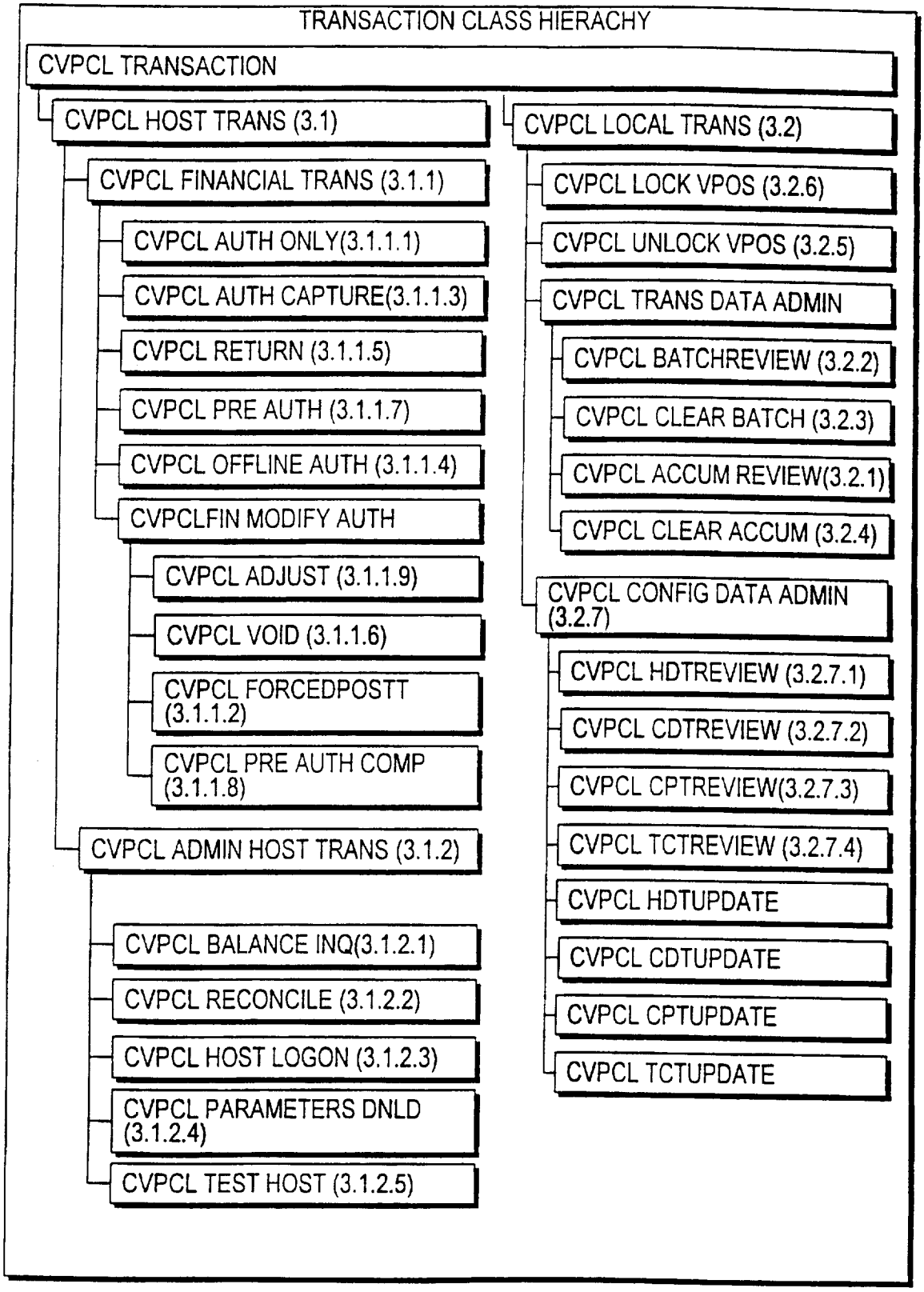
TRANSACTION CLASS HIERACHY
CVPCL TRANSACTION
CVPCL HOST TRANS (3.1)
CVPCL FINANCIAL TRANS (3.1.1)
CVPCL AUTH ONLY(3.1.1.1)
CVPCL AUTH CAPTURE(3.1.1.3)
CVPCL RETURN (3.1.1.5)
CVPCL PRE AUTH (3.1.1.7)
CVPCL OFFLINE AUTH (3.1.1.4)
CVPCLFIN MODIFY AUTH
CVPCL ADJUST (3.1.1.9)
CVPCL VOID (3.1.1.6)
CVPCL FORCEDPOSTT (3.1.1.2)
CVPCL PRE AUTH COMP (3.1.1.8)
CVPCL ADMIN HOST TRANS (3.1.2)
CVPCL BALANCE INQ(3.1.2.1)
CVPCL RECONCILE (3.1.2.2)
CVPCL HOST LOGON (3.1.2.3)
CVPCL PARAMETERS DNLD (3.1.2.4)
CVPCL TEST HOST (3.1.2.5)
CVPCL LOCAL TRANS (3.2)
CVPCL LOCK VPOS (3.2.6)
CVPCL UNLOCK VPOS (3.2.5)
CVPCL TRANS DATA ADMIN
CVPCL BATCHREVIEW (3.2.2)
CVPCL CLEAR BATCH (3.2.3)
CVPCL ACCUM REVIEW(3.2.1)
CVPCL CLEAR ACCUM (3.2.4)
CVPCL CONFIG DATA ADMIN (3.2.7)
CVPCL HDTREVIEW (3.2.7.1)
CVPCL CDTREVIEW (3.2.7.2)
CVPCL CPTREVIEW(3.2.7.3)
CVPCL TCTREVIEW (3.2.7.4)
CVPCL HDTUPDATE
CVPCL CDTUPDATE
CVPCL CPTUPDATE
CVPCL TCTUPDATE

FIG.-16

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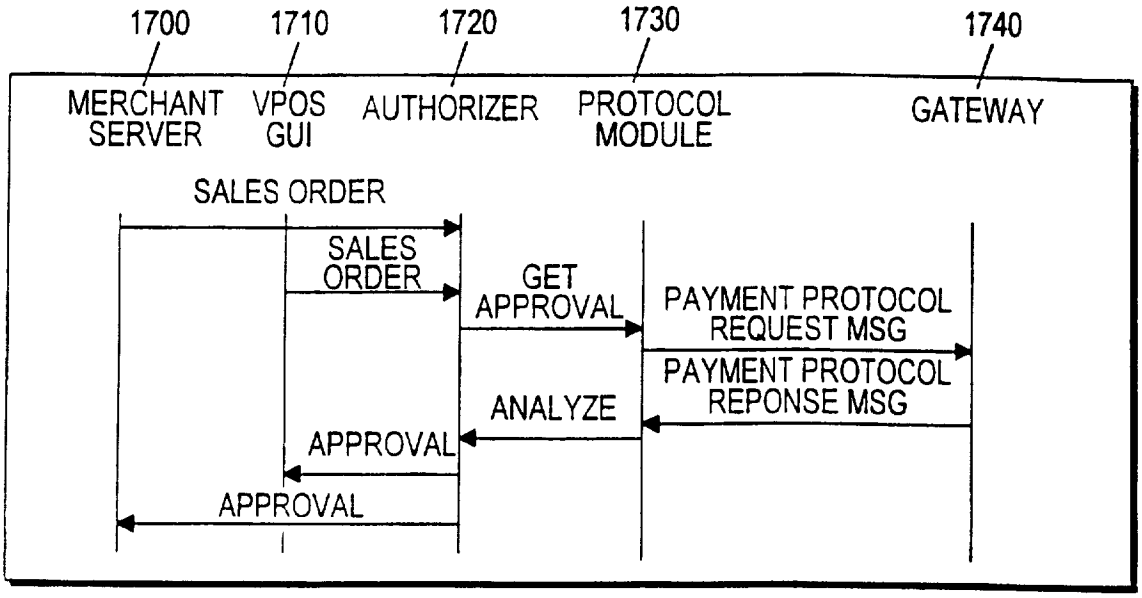

FIG.-17

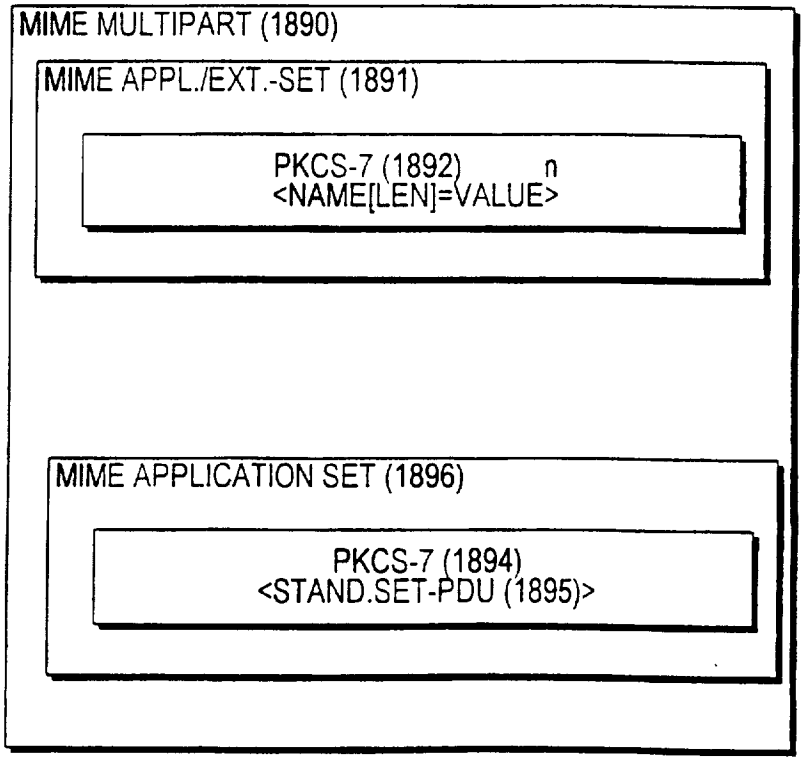

FIG.-18B

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ARCHITECTURE:

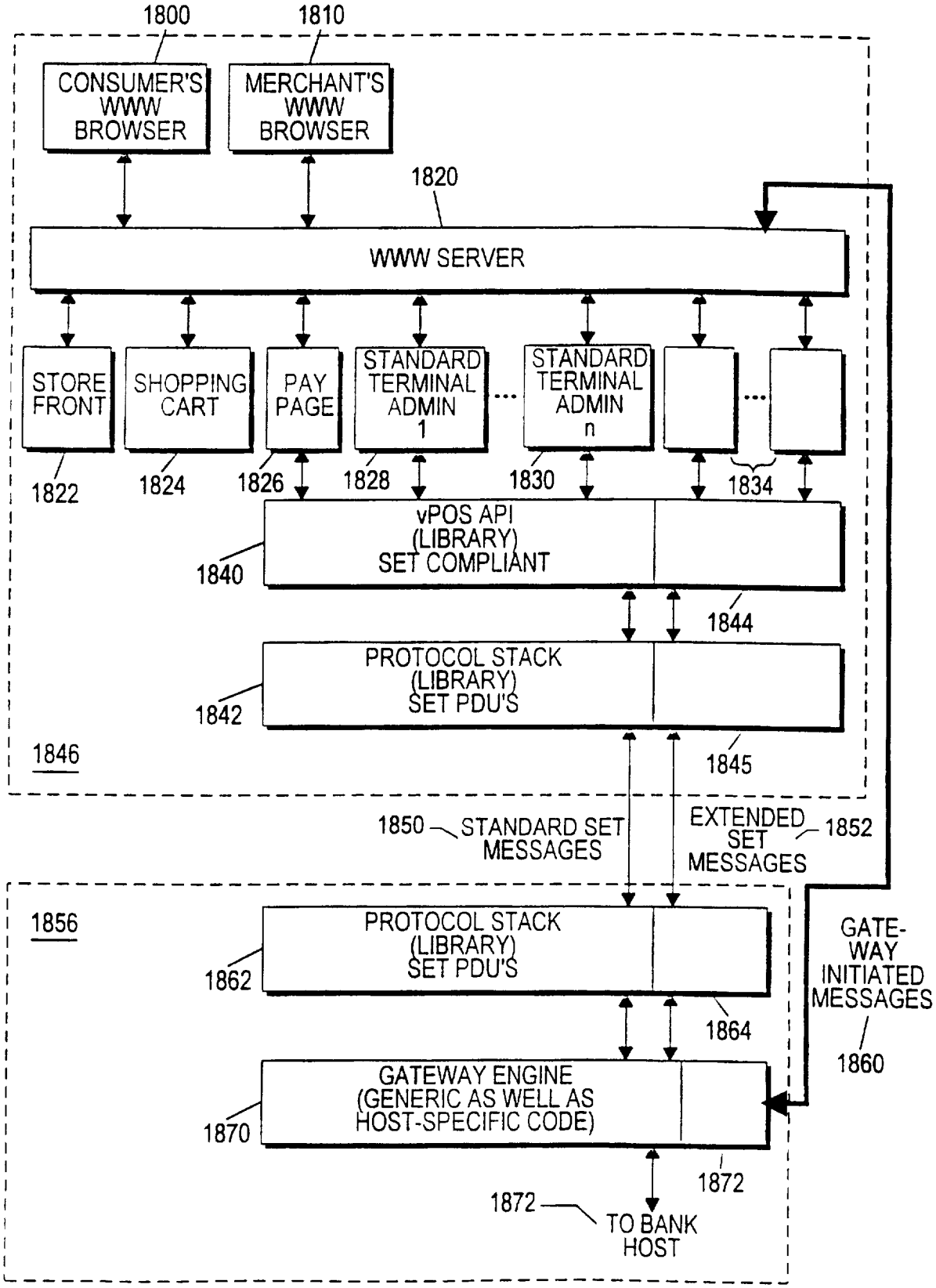

FIG.-18A

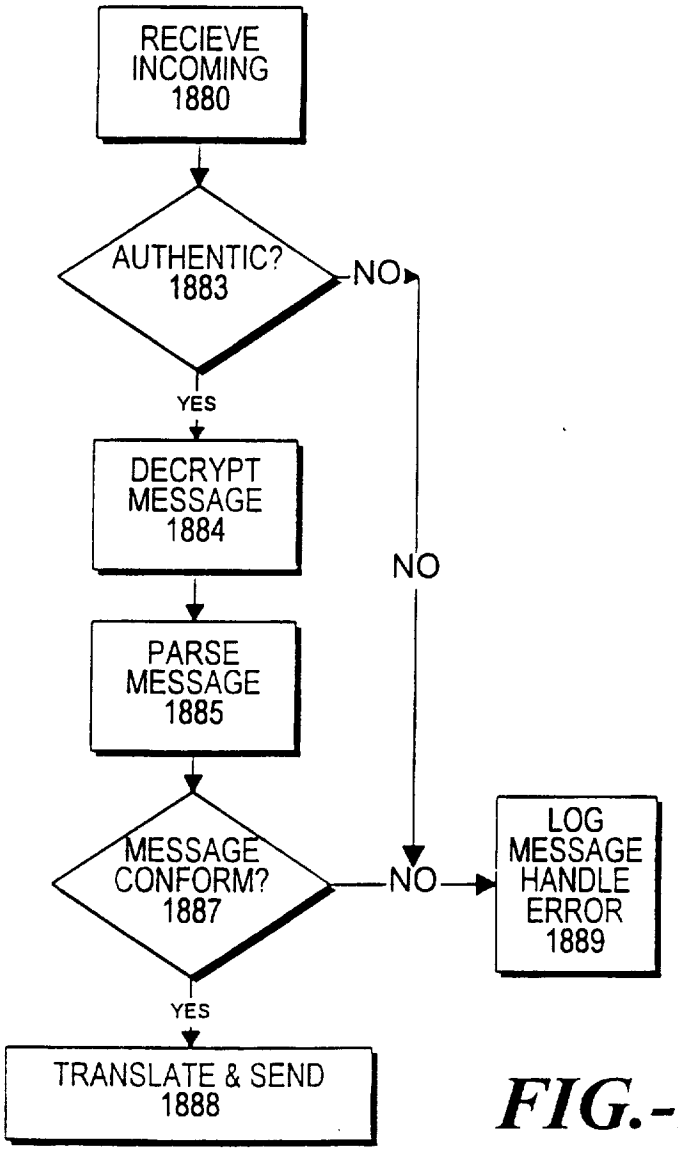

FIG.-18C

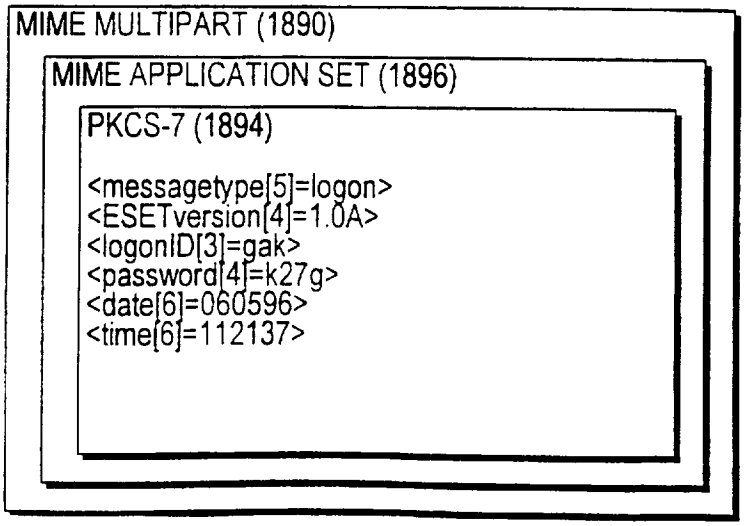

FIG.-18D

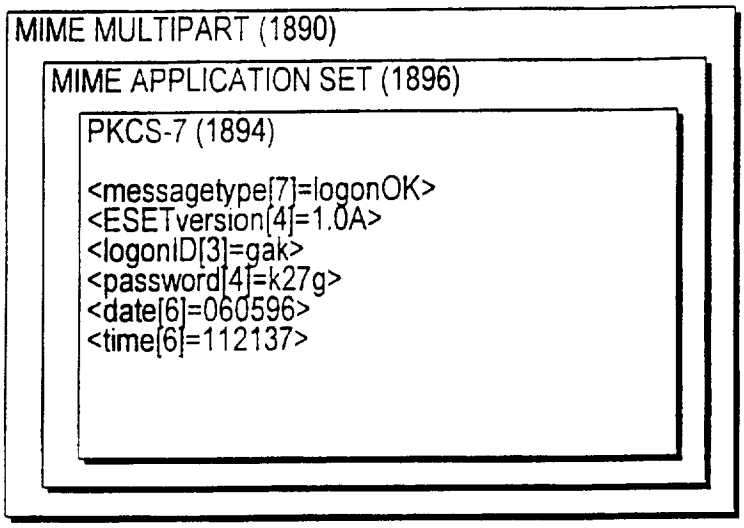

FIG.-18E

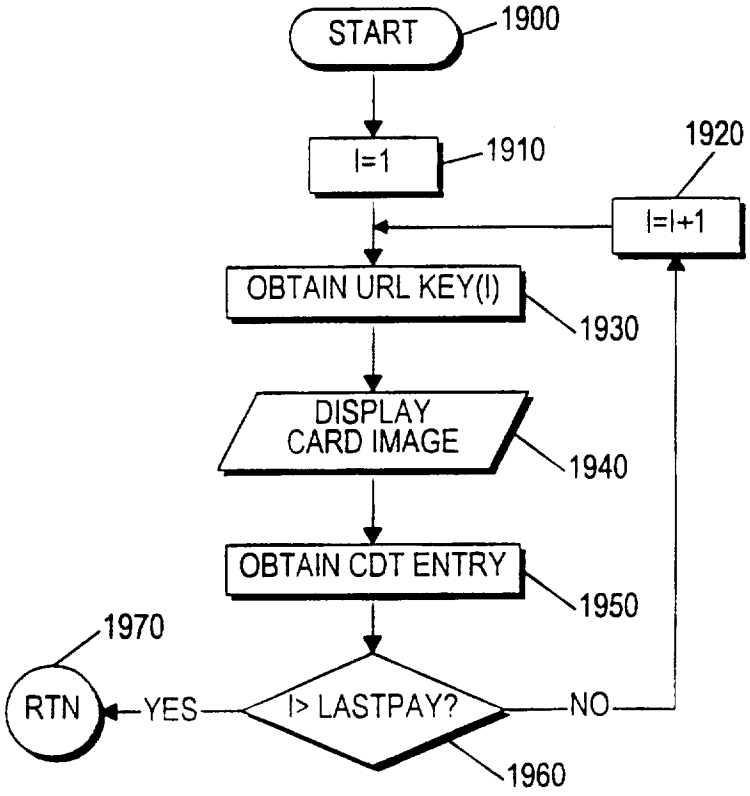

FIG.-19

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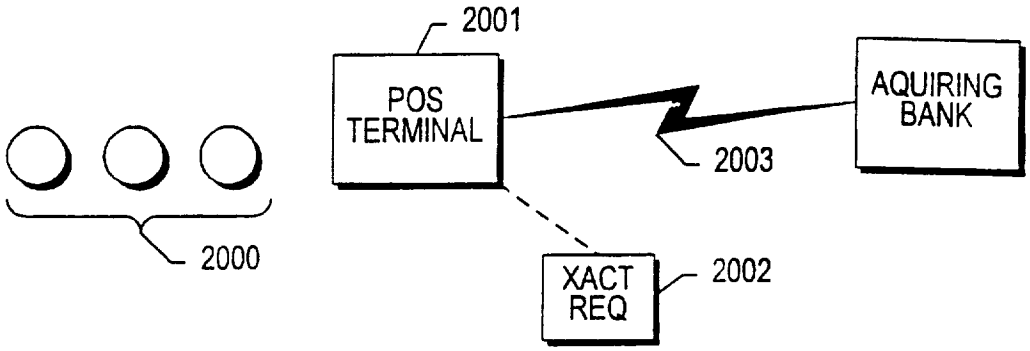

FIG.-20A

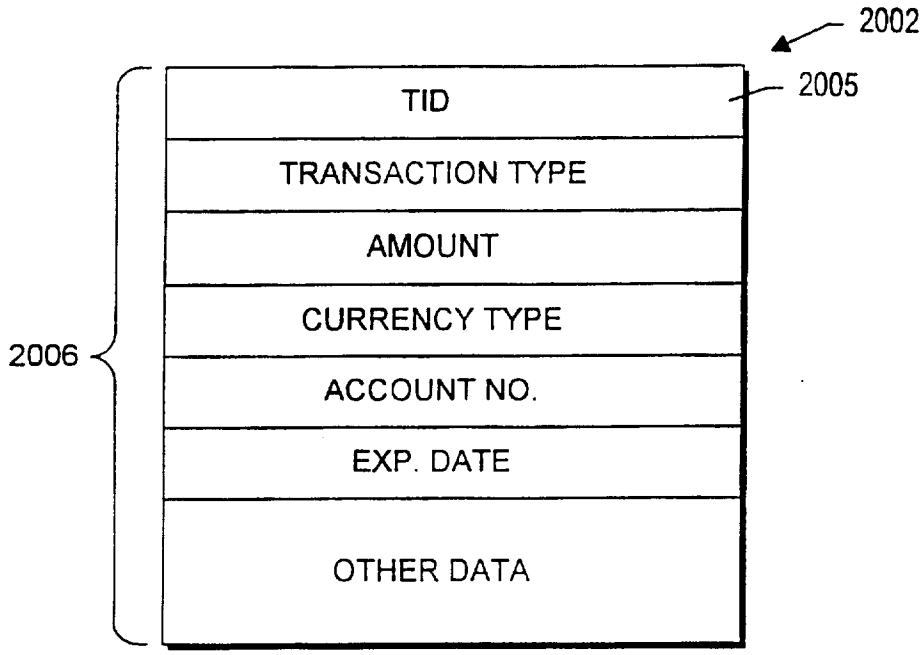

FIG.-20B

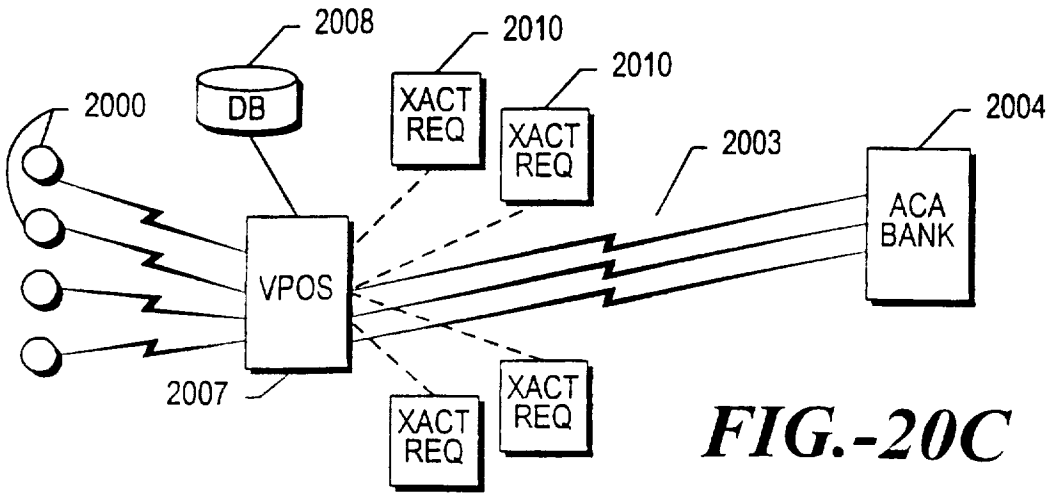

FIG.-20C

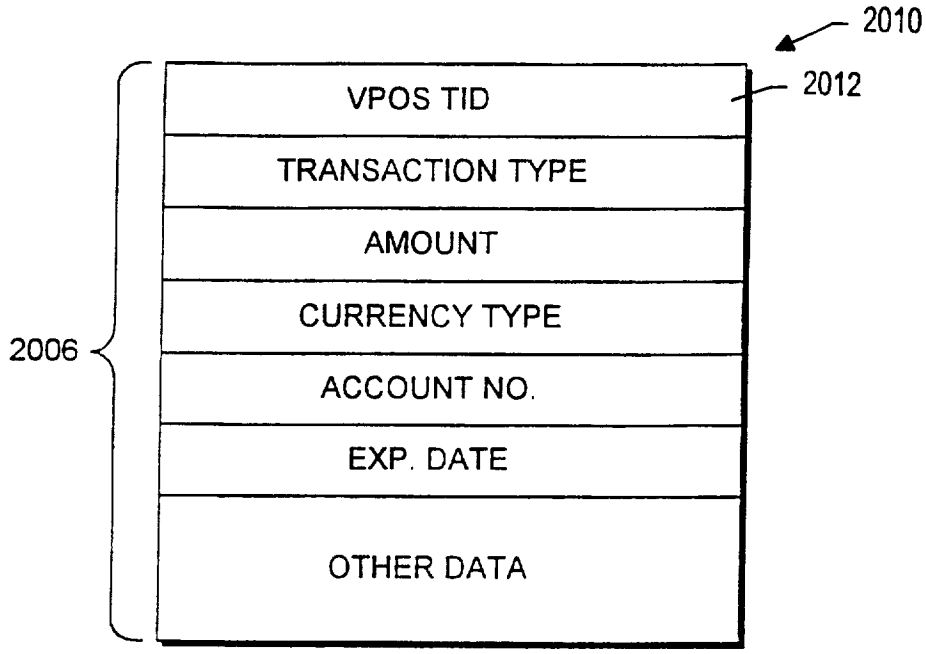

FIG.-20D

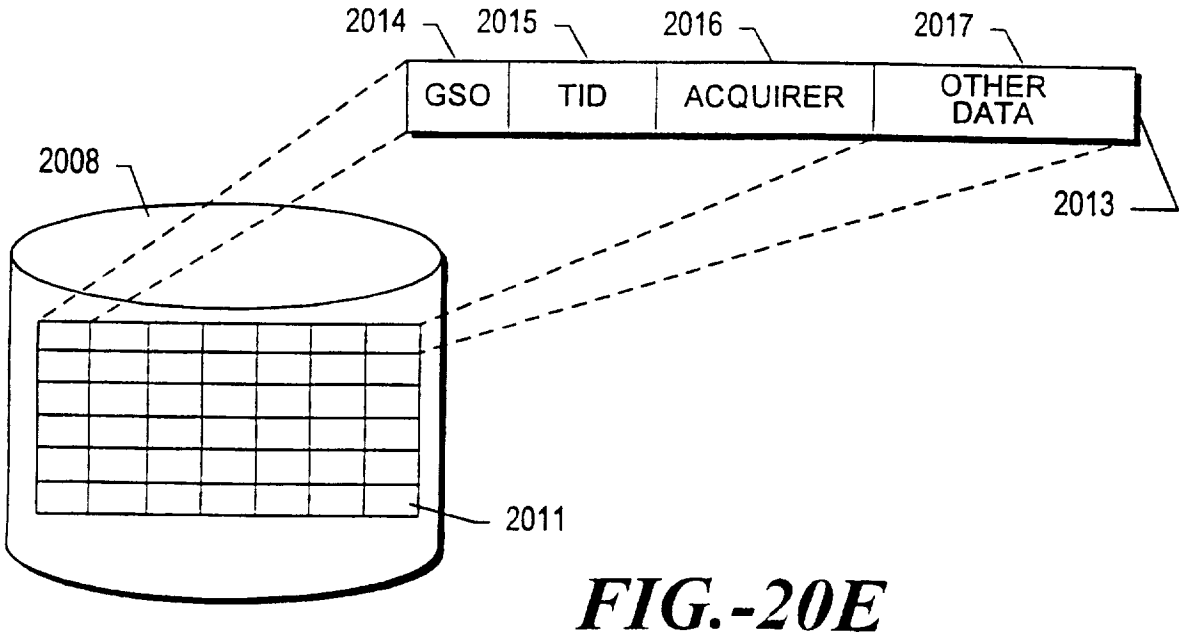

FIG.-20E

OVERVIEW USING TID
OBTAIN & RELEASE

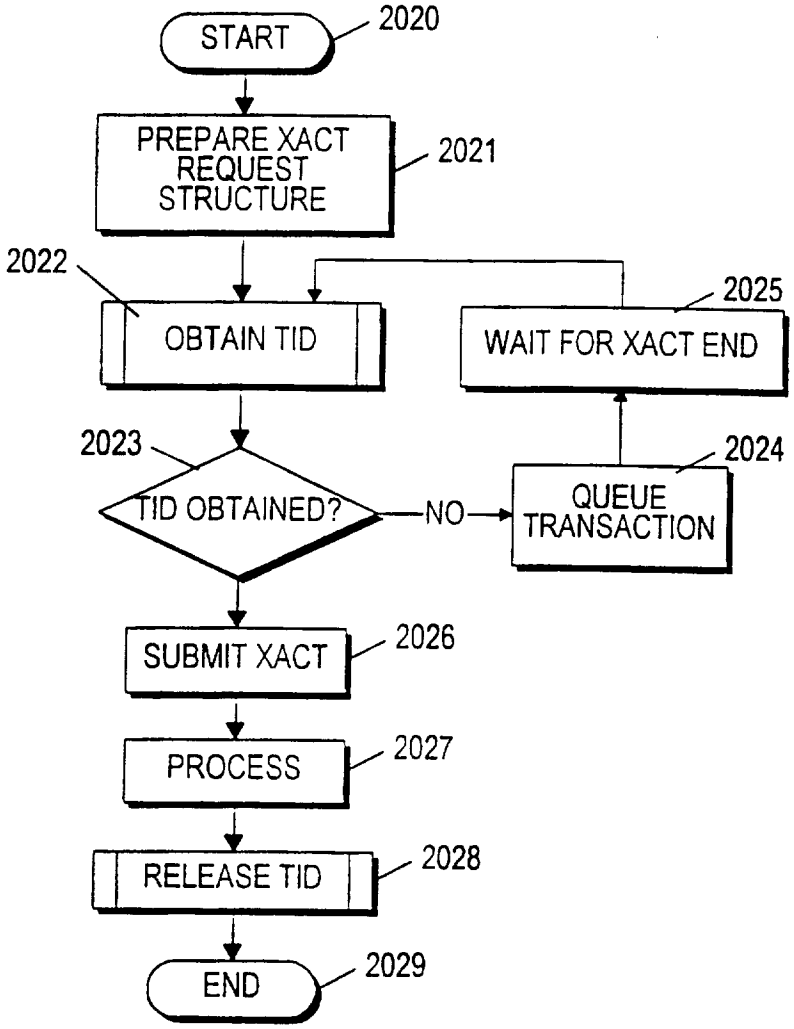

FIG.-20F

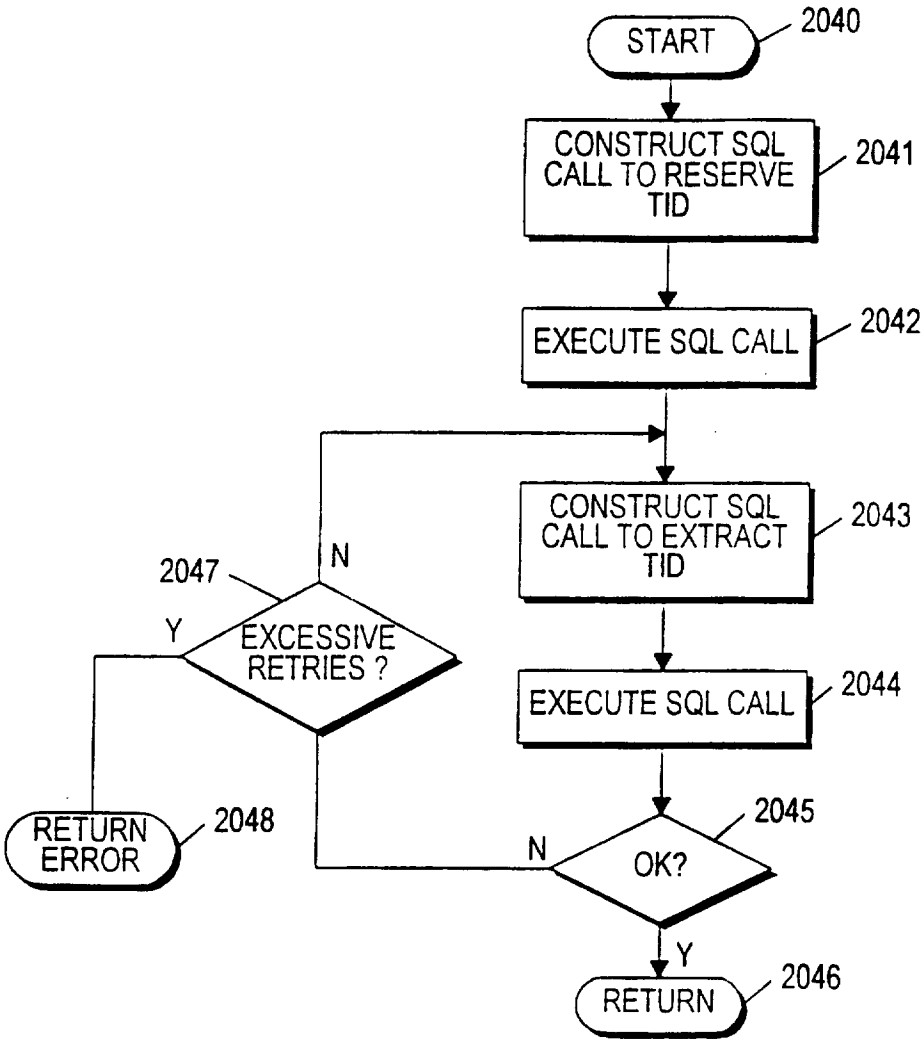

FIG.-20G

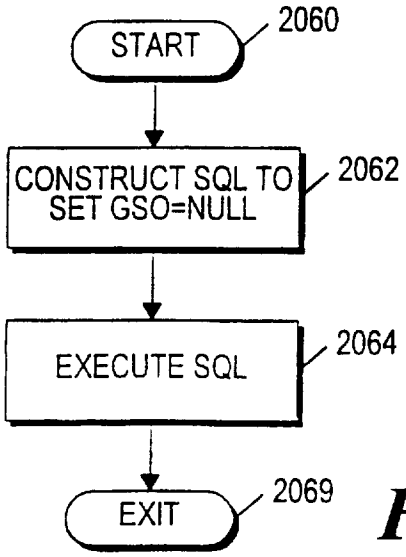

FIG.-20H

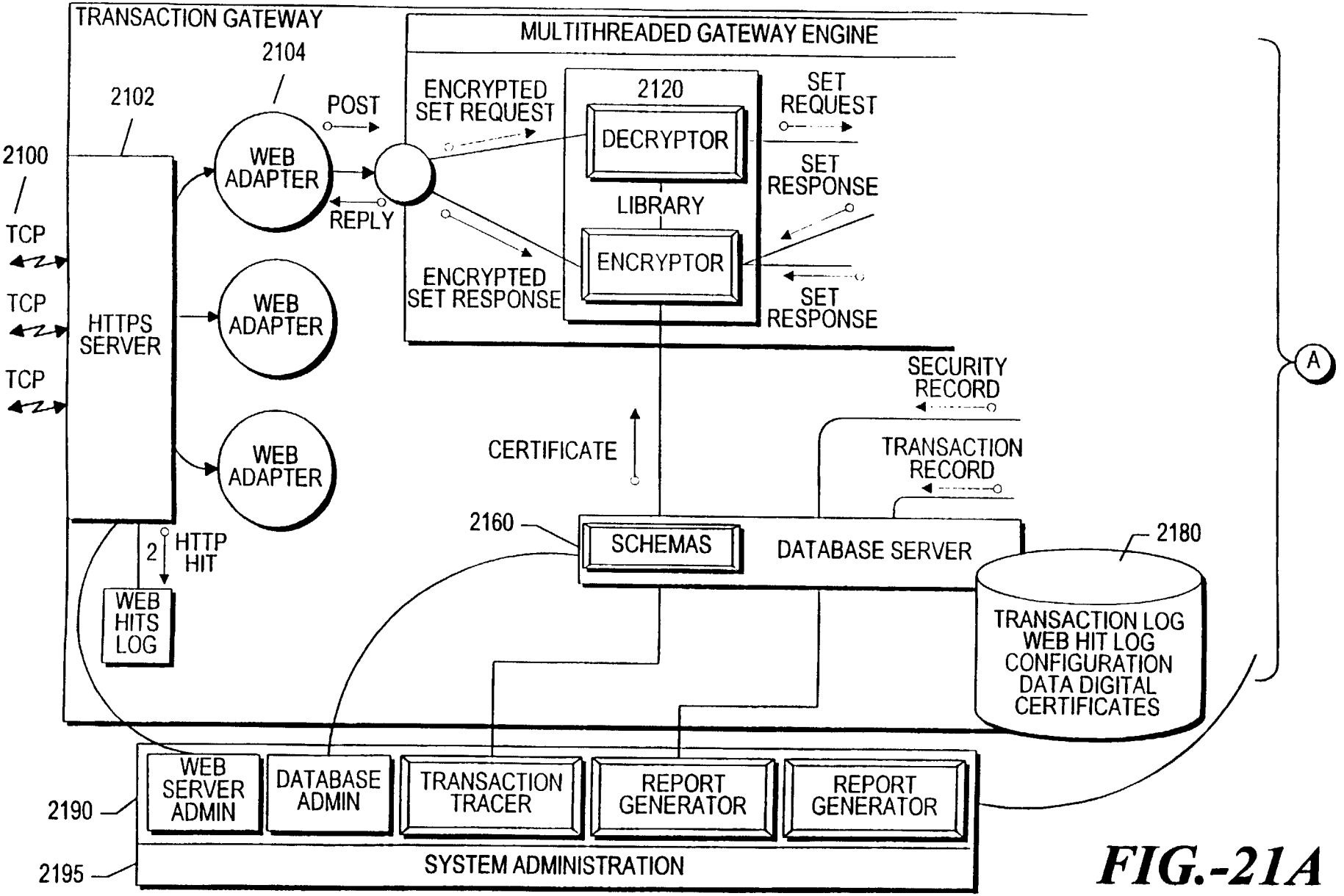
TRANSACTION GATEWAY
MULTITHREADED GATEWAY ENGINE
2104
2102
2100
POST
ENCRYPTED SET REQUEST
2120
SET REQUEST
WEB ADAPTER
DECRYPTOR
SET RESPONSE
REPLY
LIBRARY
TCP
TCP
TCP
HTTPS SERVER
WEB ADAPTER
ENCRYPTOR
ENCRYPTED SET RESPONSE
SET RESPONSE
WEB ADAPTER
SECURITY RECORD
CERTIFICATE
TRANSACTION RECORD
2160
SCHEMAS
DATABASE SERVER
2180
2 HTTP HIT
WEB HITS LOG
TRANSACTION LOG
WEB HIT LOG
CONFIGURATION DATA DIGITAL CERTIFICATES
A
WEB SERVER ADMIN
DATABASE ADMIN
TRANSACTION TRACER
REPORT GENERATOR
REPORT GENERATOR
2190
2195
SYSTEM ADMINISTRATION

FIG.-21A

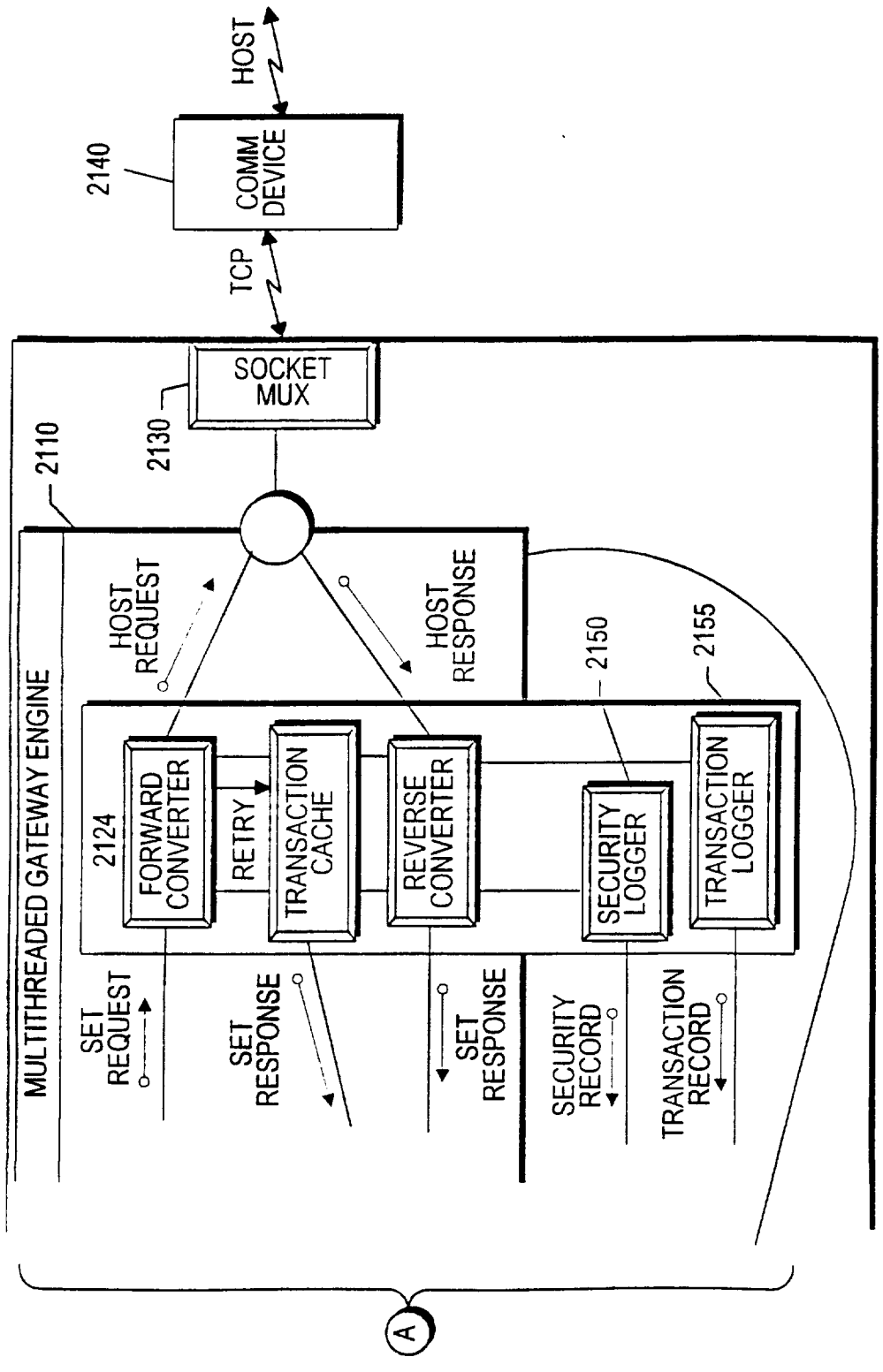
HOST
2140
COMM DEVICE
TCP
SOCKET MUX
2130
2110
MULTITHREADED GATEWAY ENGINE
HOST REQUEST
HOST RESPONSE
2150
2155
2124
FORWARD CONVERTER
RETRY
TRANSACTION CACHE
REVERSE CONVERTER
SECURITY LOGGER
TRANSACTION LOGGER
SET REQUEST
SET RESPONSE
SET RESPONSE
SECURITY RECORD
TRANSACTION RECORD
A

FIG.-21B

SUBSTITUTE SHEET (RULE 26)

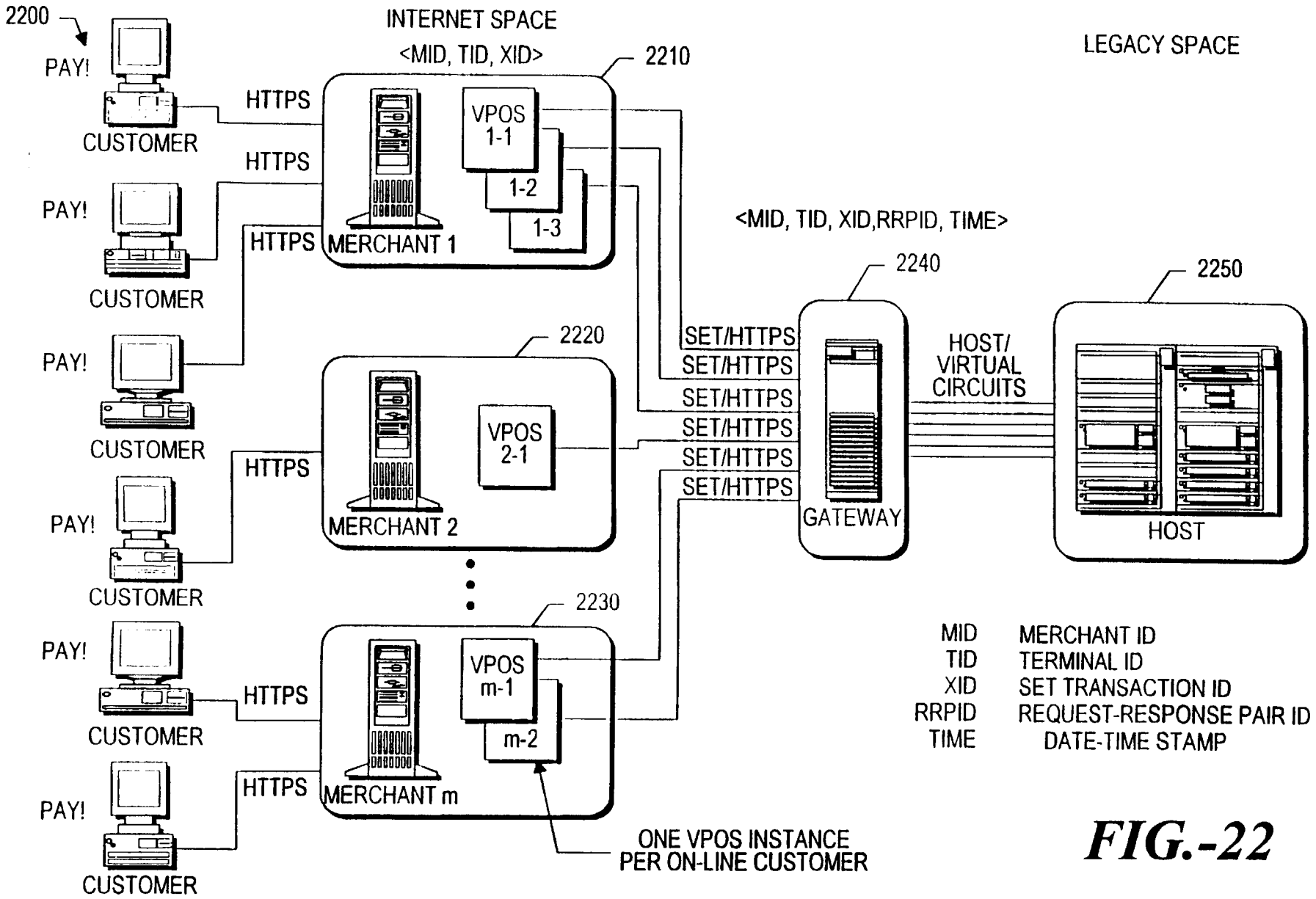

FIG.-22

MERCHANT SERVER
MERCHANT SERVER
MERCHANT SERVER
2300
INTERNET
2310
HTTP
SSL
TCP/IP
SET
2320
FW
GATEWAY SERVER
2330
BLUE NET
RED NET
NIP
2340
CRQ6
X.25
2350
TNS NETWORK
2360
CES HOST
2370

FIG.-23

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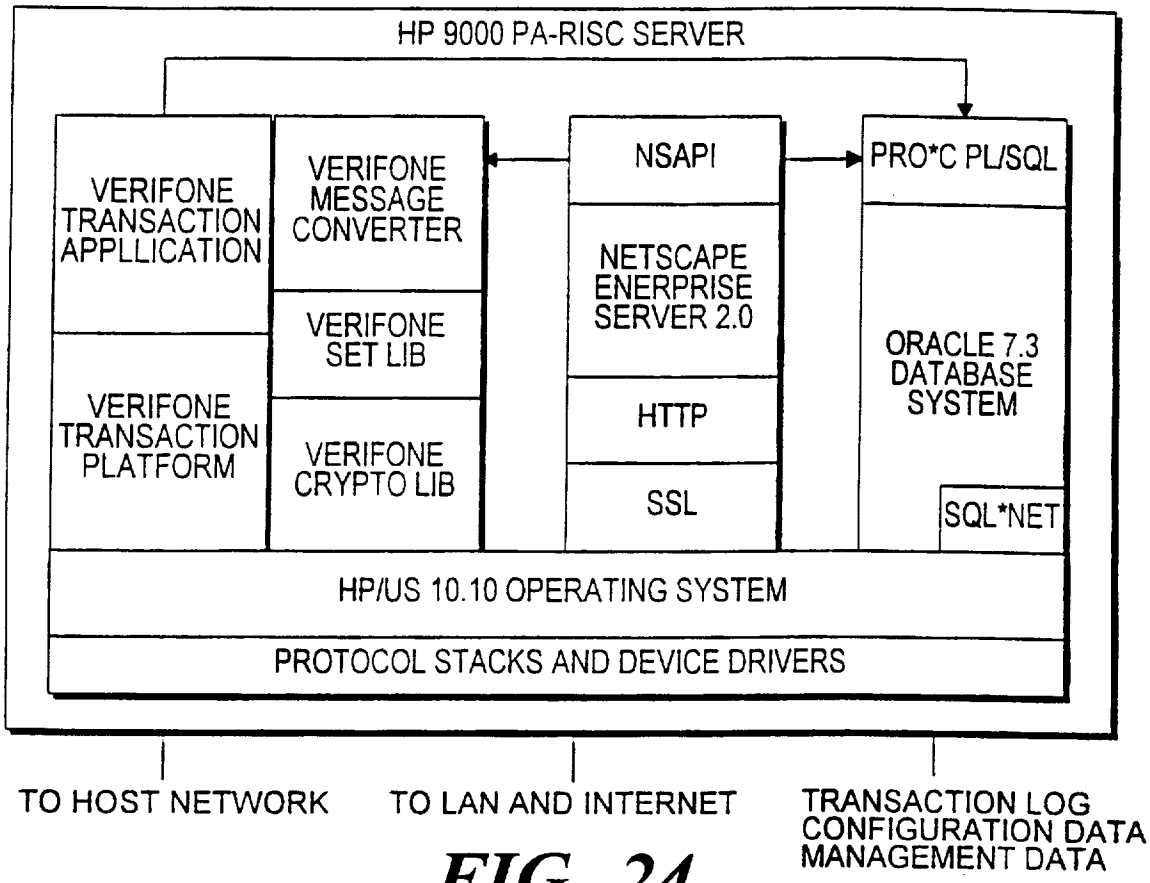

FIG.-24

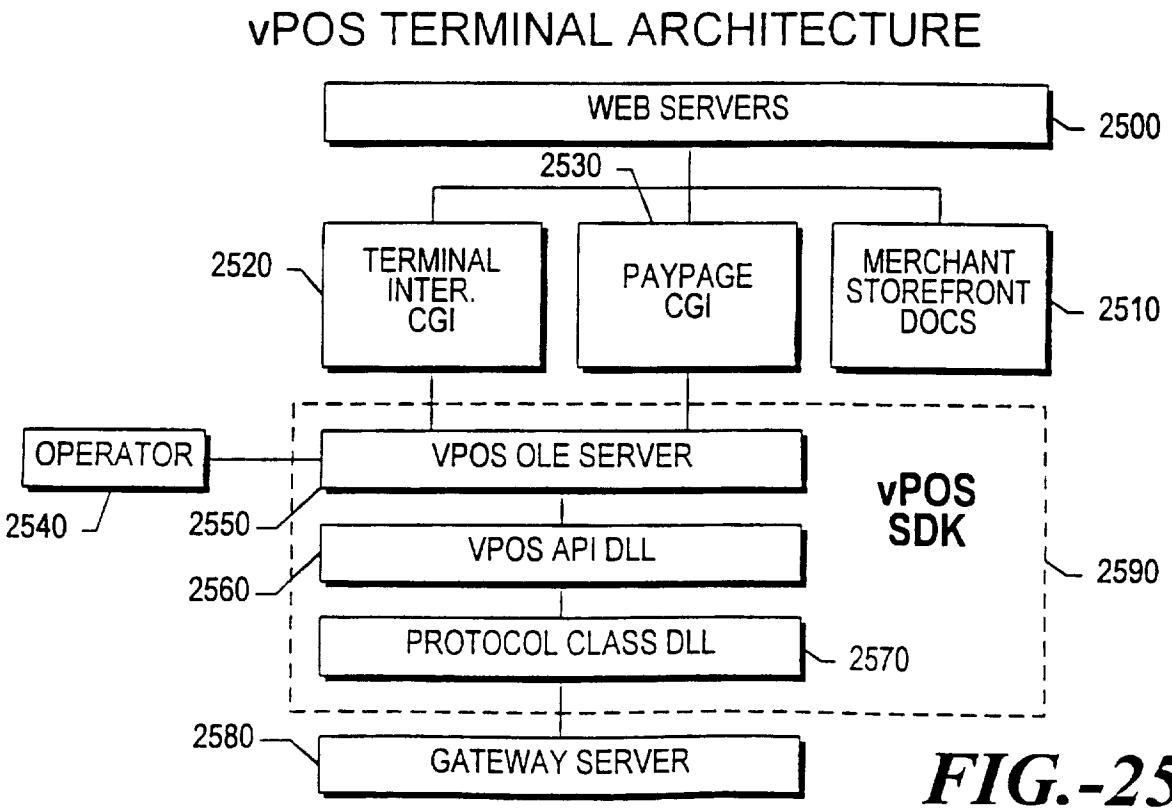

FIG.-25

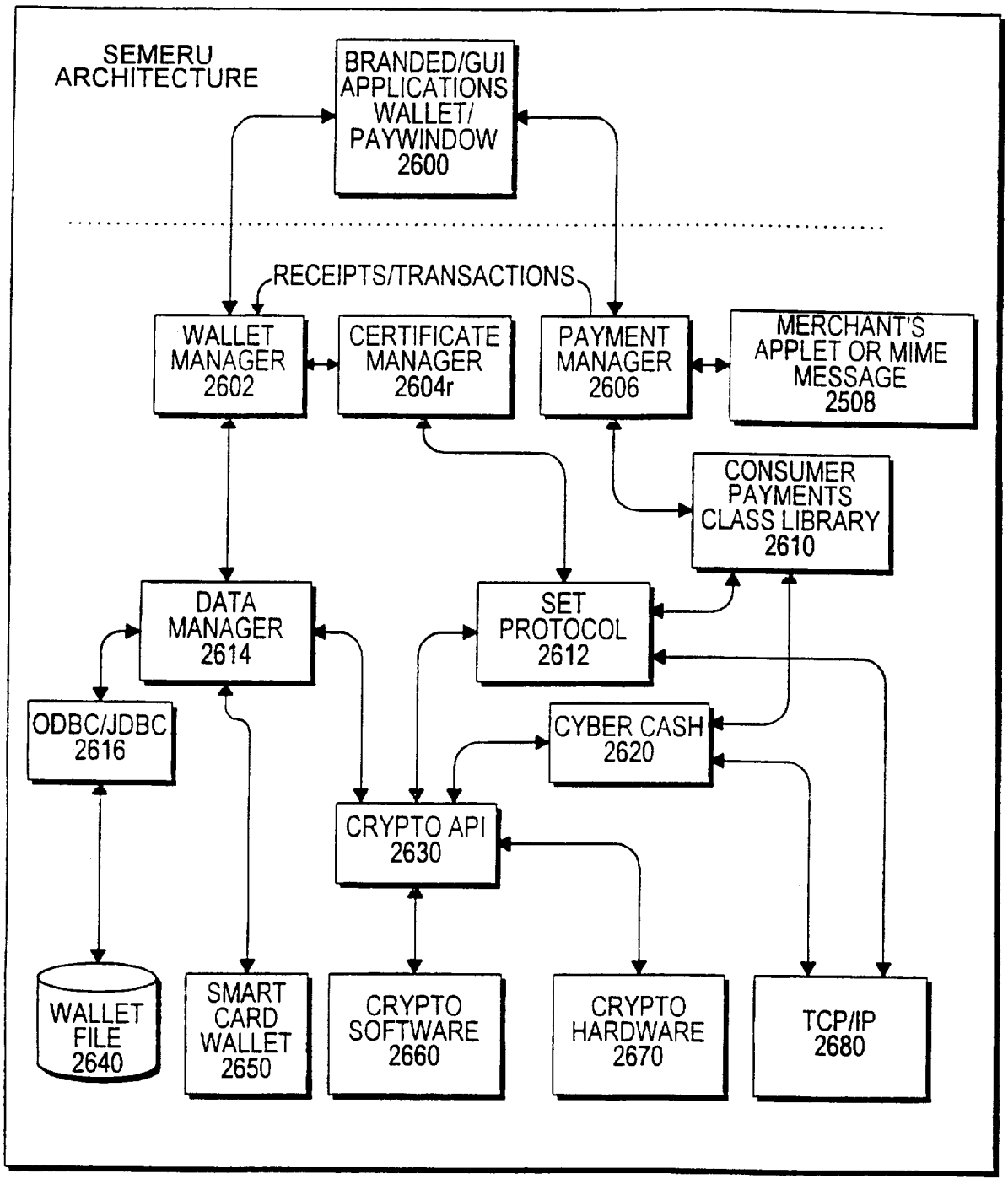
SEMERU ARCHITECTURE
BRANDED/GUI APPLICATIONS WALLET/ PAYWINDOW 2600
RECEIPTS/TRANSACTIONS
WALLET MANAGER 2602
CERTIFICATE MANAGER 2604r
PAYMENT MANAGER 2606
MERCHANT'S APPLET OR MIME MESSAGE 2508
CONSUMER PAYMENTS CLASS LIBRARY 2610
DATA MANAGER 2614
SET PROTOCOL 2612
ODBC/JDBC 2616
CYBER CASH 2620
CRYPTO API 2630
WALLET FILE 2640
SMART CARD WALLET 2650
CRYPTO SOFTWARE 2660
CRYPTO HARDWARE 2670
TCP/IP 2680

FIG.-26

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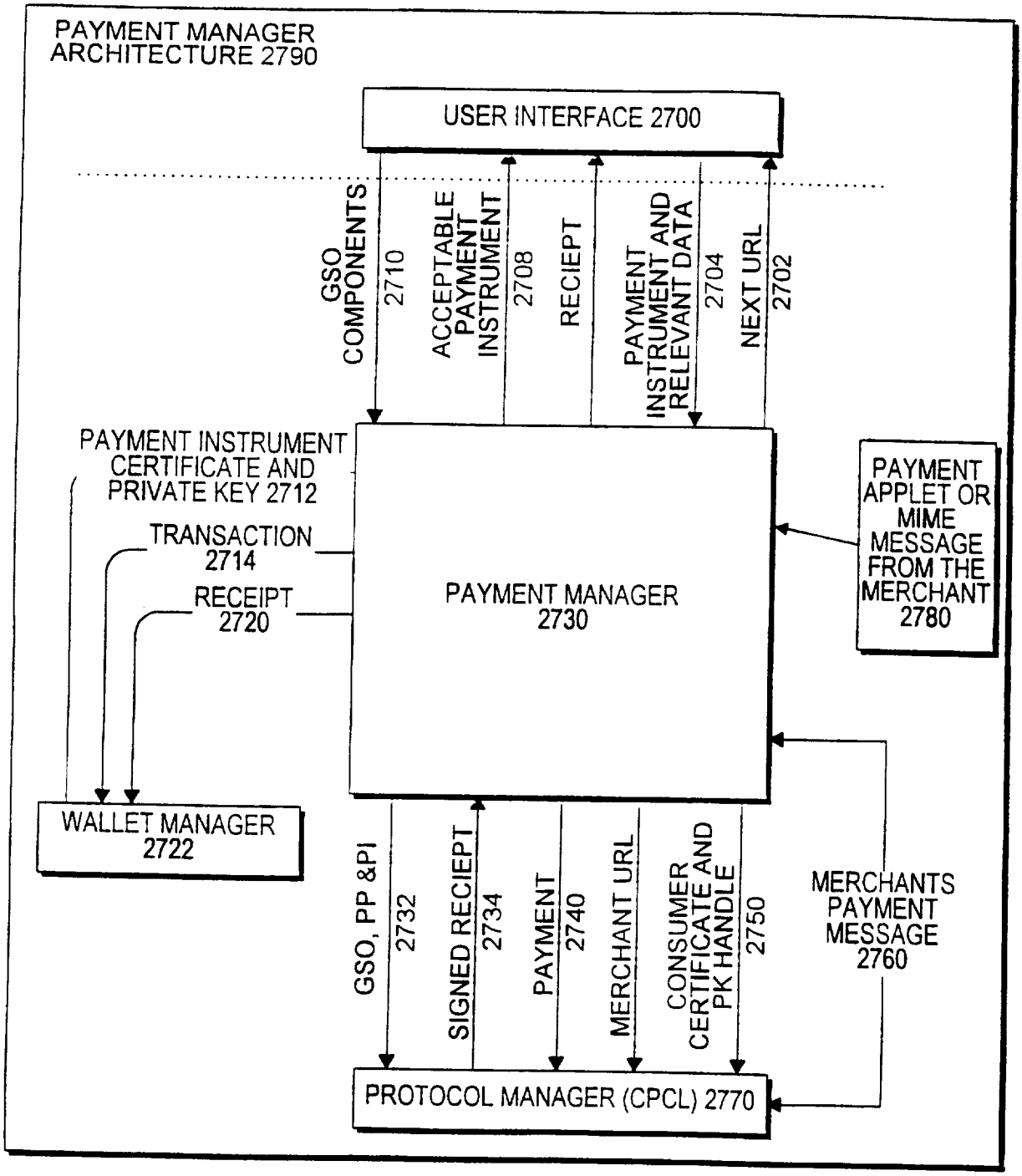
PAYMENT MANAGER ARCHITECTURE 2790
USER INTERFACE 2700
GSO COMPONENTS 2710
ACCEPTABLE PAYMENT INSTRUMENT 2708
RECIEPT
PAYMENT INSTRUMENT AND RELEVANT DATA 2704
NEXT URL 2702
PAYMENT INSTRUMENT CERTIFICATE AND PRIVATE KEY 2712
TRANSACTION 2714
RECEIPT 2720
PAYMENT MANAGER 2730
PAYMENT APPLET OR MIME MESSAGE FROM THE MERCHANT 2780
WALLET MANAGER 2722
GSO, PP &PI 2732
SIGNED RECIEPT 2734
PAYMENT 2740
MERCHANT URL
CONSUMER CERTIFICATE AND PK HANDLE 2750
MERCHANTS PAYMENT MESSAGE 2760
PROTOCOL MANAGER (CPCL) 2770

FIG.-27

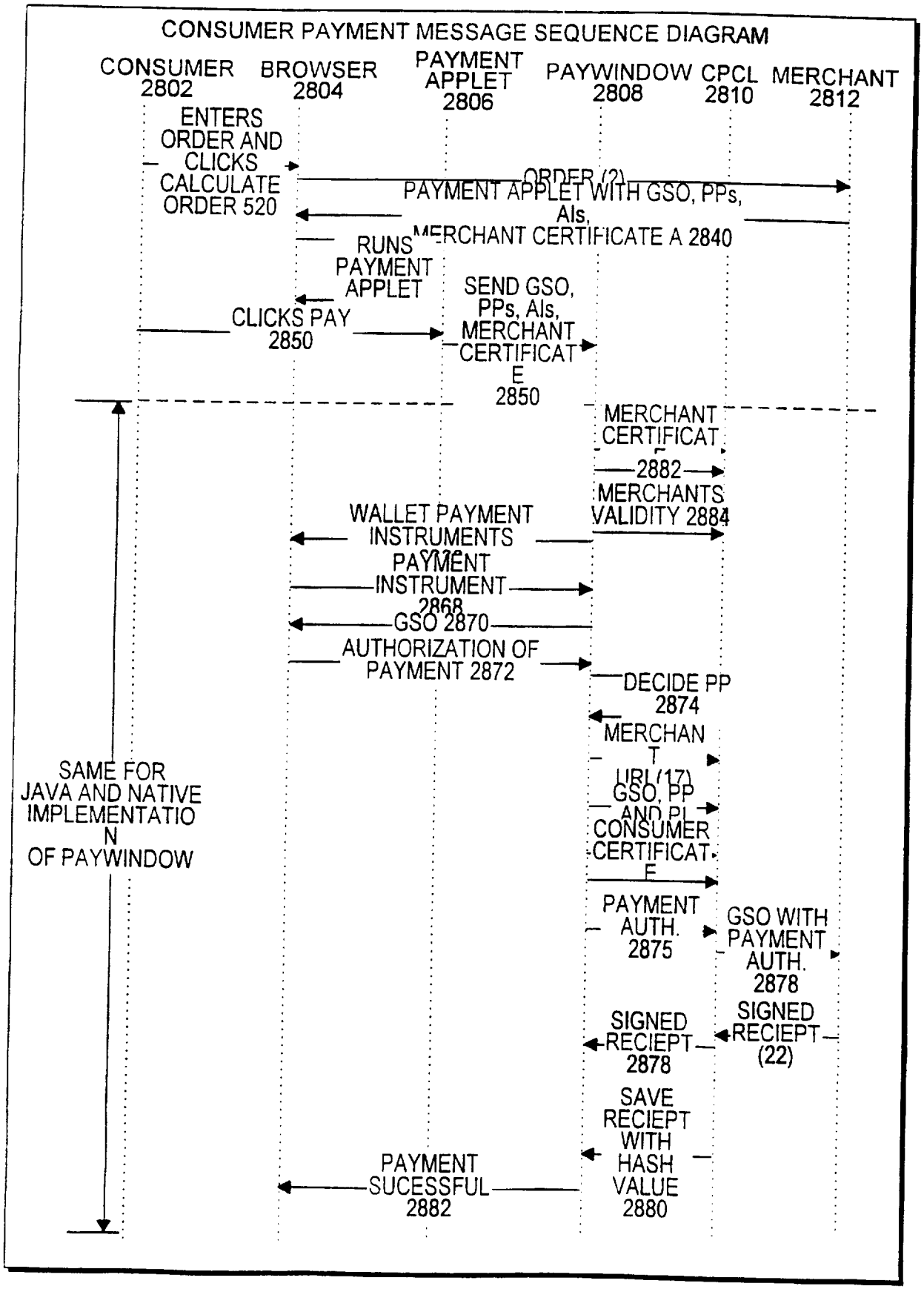
CONSUMER PAYMENT MESSAGE SEQUENCE DIAGRAM
CONSUMER 2802
BROWSER 2804
PAYMENT APPLET 2806
PAYWINDOW 2808
CPCL 2810
MERCHANT 2812
ENTERS ORDER AND CLICKS CALCULATE ORDER 520
ORDER (2)
PAYMENT APPLET WITH GSO, PPs, AIs, MERCHANT CERTIFICATE A 2840
RUNS PAYMENT APPLET
CLICKS PAY 2850
SEND GSO, PPs, AIs, MERCHANT CERTIFICATE 2850
MERCHANT CERTIFICATE 2882
MERCHANTS VALIDITY 2884
WALLET PAYMENT INSTRUMENTS
PAYMENT INSTRUMENT 2868
GSO 2870
AUTHORIZATION OF PAYMENT 2872
DECIDE PP 2874
MERCHANT URL (17)
GSO, PP AND PI
CONSUMER CERTIFICATE
PAYMENT AUTH. 2875
GSO WITH PAYMENT AUTH. 2878
SIGNED RECIEPT 2878
SIGNED RECIEPT (22)
SAVE RECIEPT WITH HASH VALUE 2880
PAYMENT SUCESSFUL 2882
SAME FOR JAVA AND NATIVE IMPLEMENTATION OF PAYWINDOW

FIG.-28

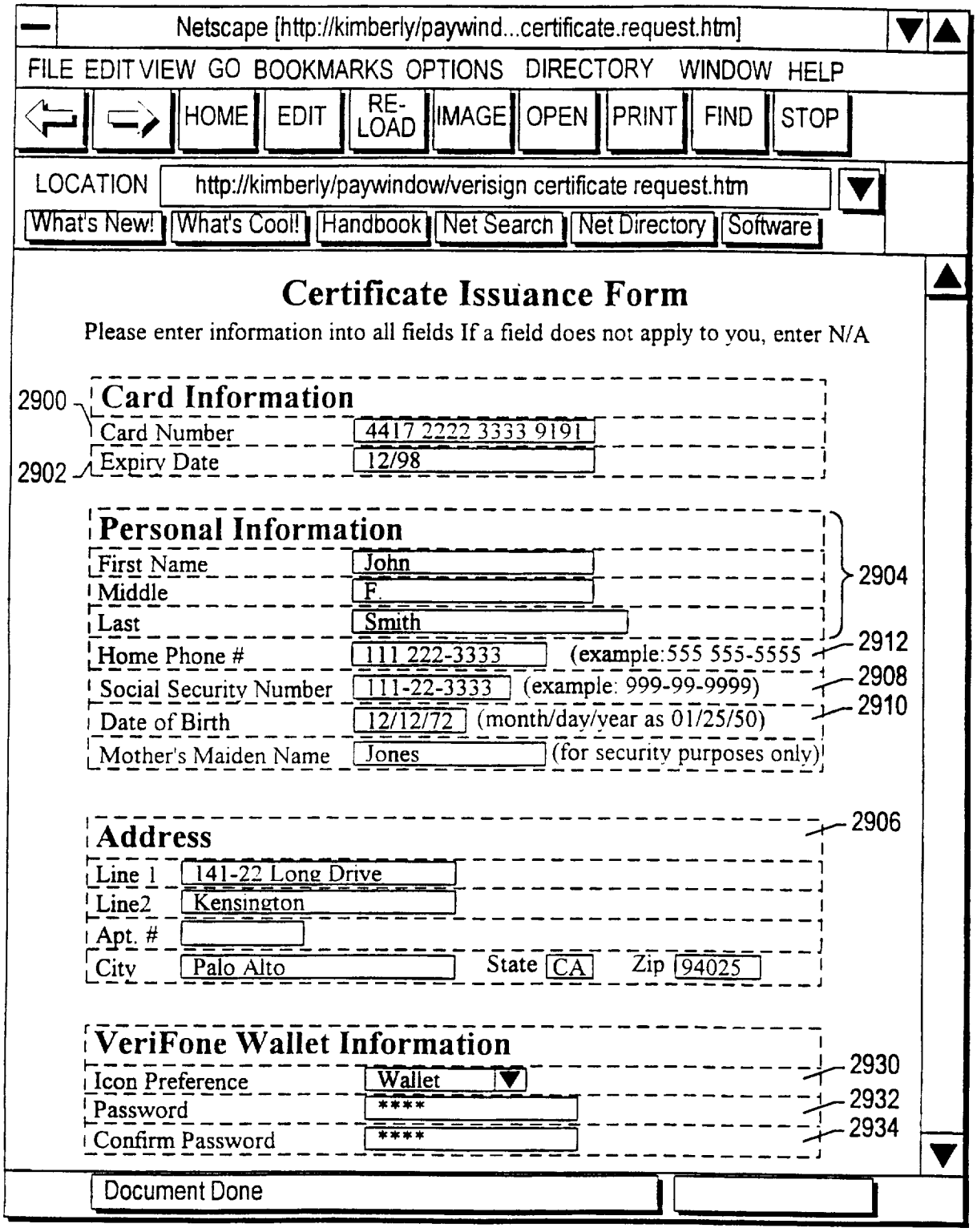
Netscape [http://kimberly/paywind...certificate.request.htm]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME EDIT RE-LOAD IMAGE OPEN PRINT FIND STOP
LOCATION http://kimberly/paywindow/verisign certificate request.htm
What's New! What's Cool! Handbook Net Search Net Directory Software
Certificate Issuance Form
Please enter information into all fields If a field does not apply to you, enter N/A
2900
Card Information
Card Number 4417 2222 3333 9191
2902
Expiry Date 12/98
Personal Information
First Name John
Middle F.
Last Smith
2904
Home Phone # 111 222-3333 (example:555 555-5555
2912
Social Security Number 111-22-3333 (example: 999-99-9999)
2908
Date of Birth 12/12/72 (month/day/year as 01/25/50)
2910
Mother's Maiden Name Jones (for security purposes only)
Address
2906
Line 1 141-22 Long Drive
Line2 Kensington
Apt. #
City Palo Alto State CA Zip 94025
VeriFone Wallet Information
Icon Preference Wallet
2930
Password ****
2932
Confirm Password ****
2934
Document Done

FIG.-29

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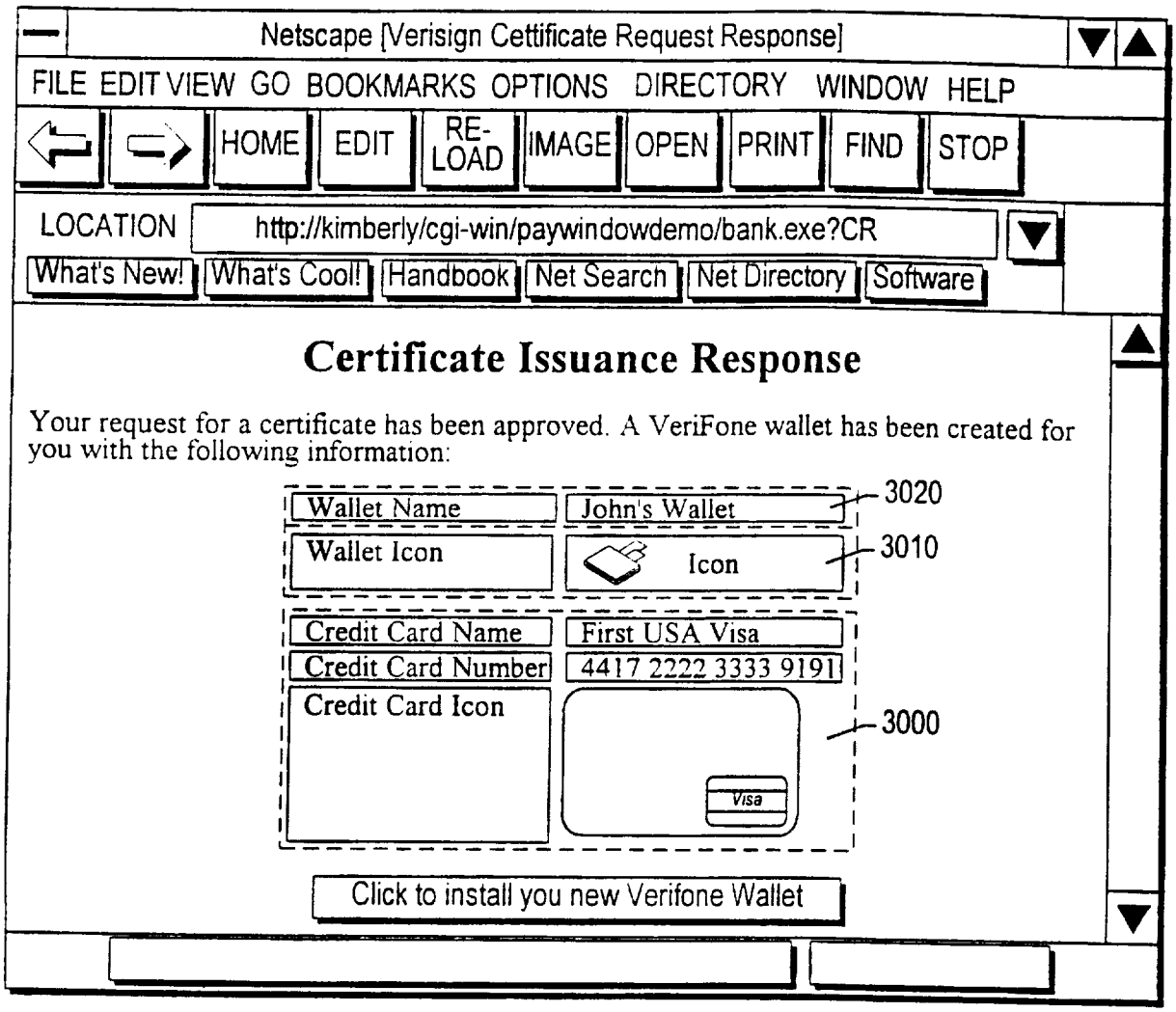
Netscape [Verisign Cettificate Request Response]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME
EDIT
RE-LOAD
IMAGE
OPEN
PRINT
FIND
STOP
LOCATION
http://kimberly/cgi-win/paywindowdemo/bank.exe?CR
What's New!
What's Cool!
Handbook
Net Search
Net Directory
Software
Certificate Issuance Response
Your request for a certificate has been approved. A VeriFone wallet has been created for you with the following information:
Wallet Name
John's Wallet
3020
Wallet Icon
Icon
3010
Credit Card Name
First USA Visa
Credit Card Number
4417 2222 3333 9191
Credit Card Icon
Visa
3000
Click to install you new Verifone Wallet

FIG.-30

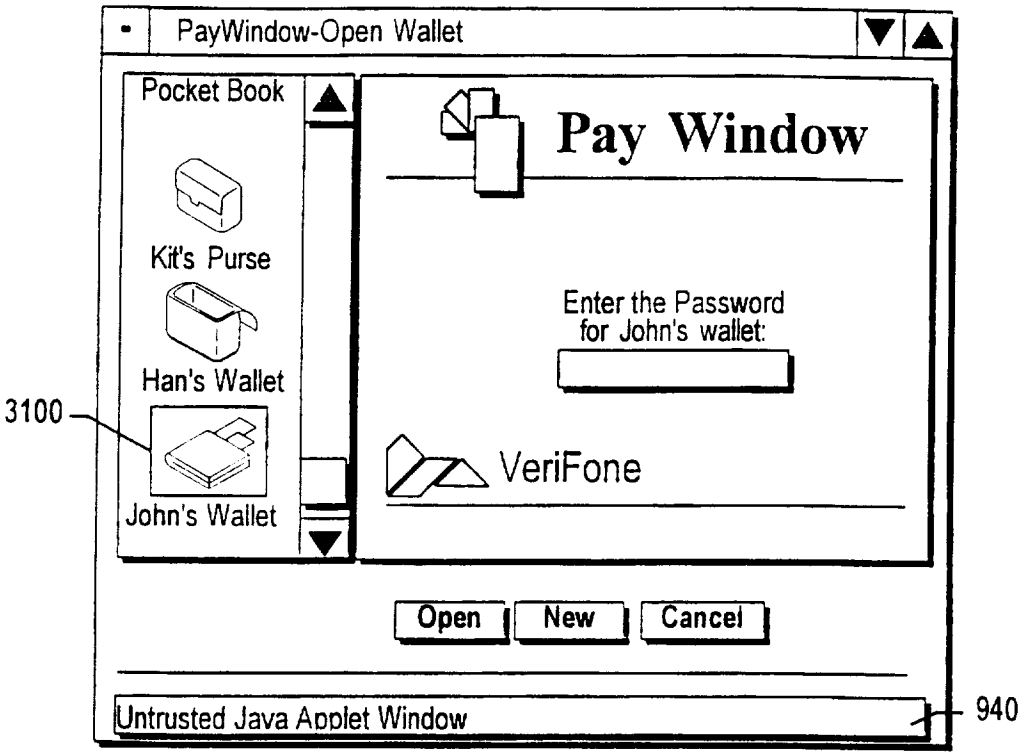
PayWindow-Open Wallet
Pocket Book
Kit's Purse
Han's Wallet
John's Wallet
3100
Pay Window
Enter the Password
for John's wallet:
VeriFone
Open
New
Cancel
Untrusted Java Applet Window
940

FIG.-31

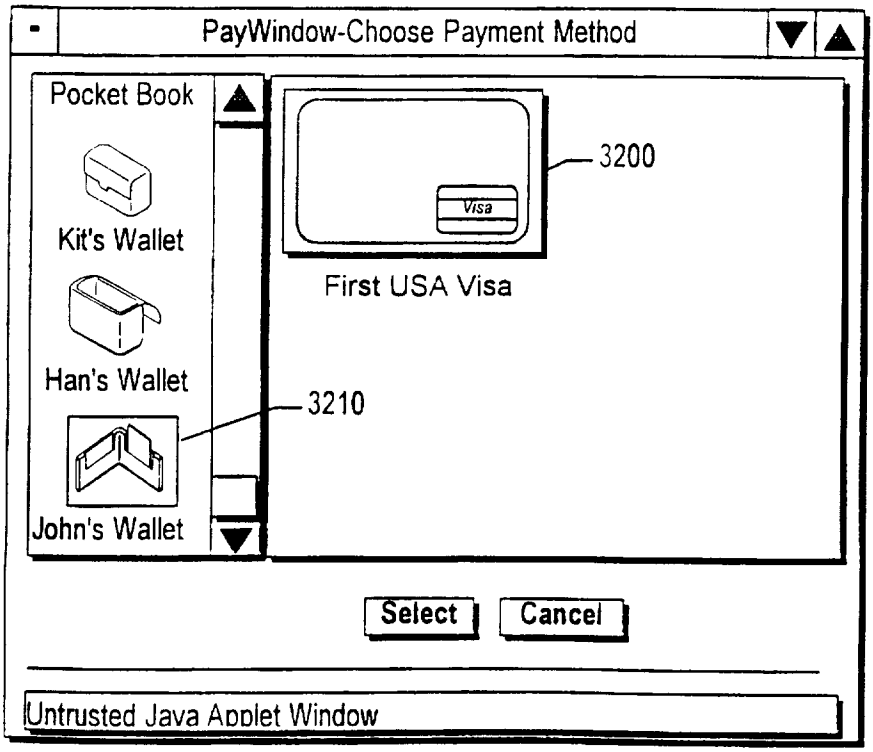
PayWindow-Choose Payment Method
Pocket Book
Kit's Wallet
Han's Wallet
John's Wallet
3210
3200
Visa
First USA Visa
Select
Cancel
Untrusted Java Applet Window

FIG.-32

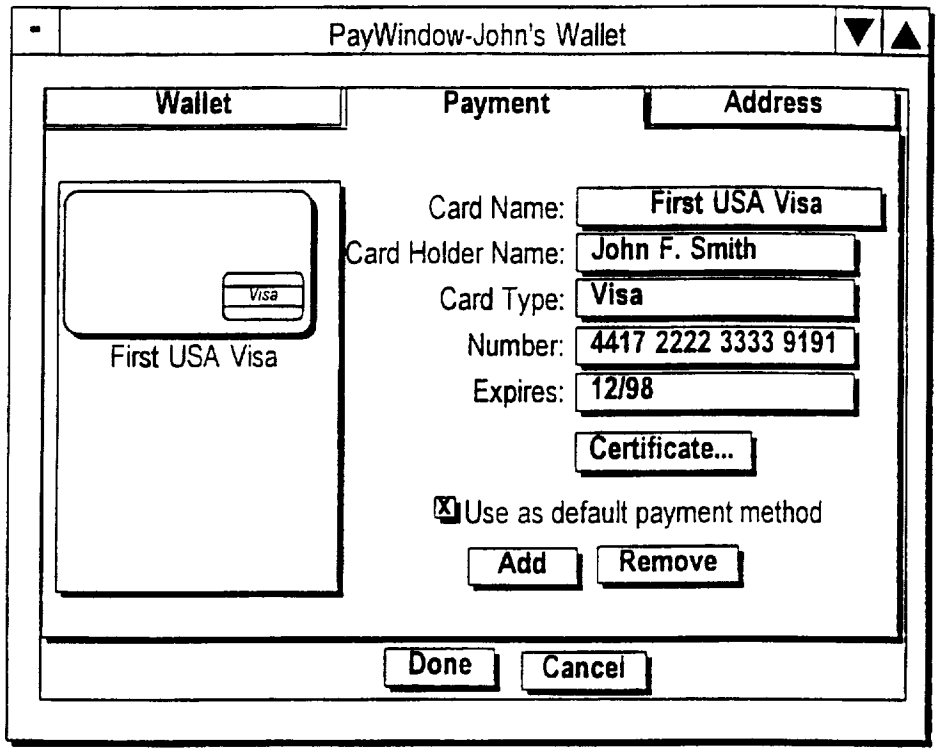
PayWindow-John's Wallet
Wallet
Payment
Address
Visa
First USA Visa
Card Name:
First USA Visa
Card Holder Name:
John F. Smith
Card Type:
Visa
Number:
4417 2222 3333 9191
Expires:
12/98
Certificate...
Use as default payment method
Add
Remove
Done
Cancel

FIG.-33

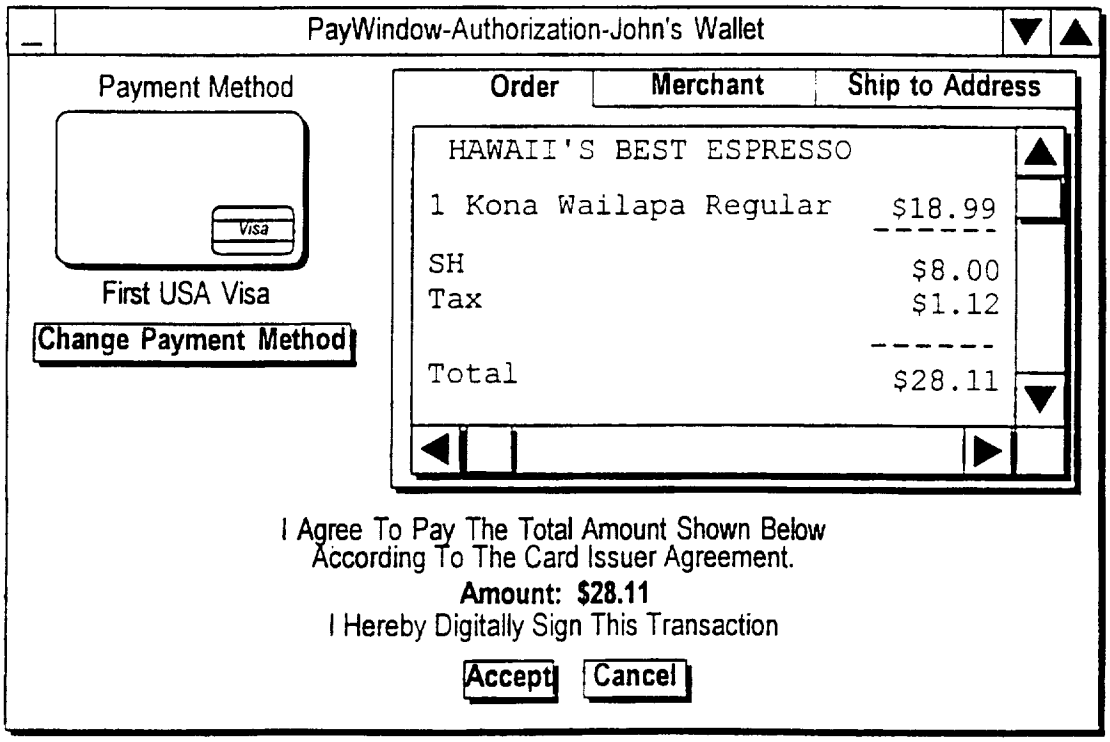
PayWindow-Authorization-John's Wallet
Payment Method
Visa
First USA Visa
Change Payment Method
Order
Merchant
Ship to Address
HAWAII'S BEST ESPRESSO
1 Kona Wailapa Regular $18.99
SH $8.00
Tax $1.12
Total $28.11
I Agree To Pay The Total Amount Shown Below
According To The Card Issuer Agreement.
Amount: $28.11
I Hereby Digitally Sign This Transaction
Accept
Cancel

FIG.-34

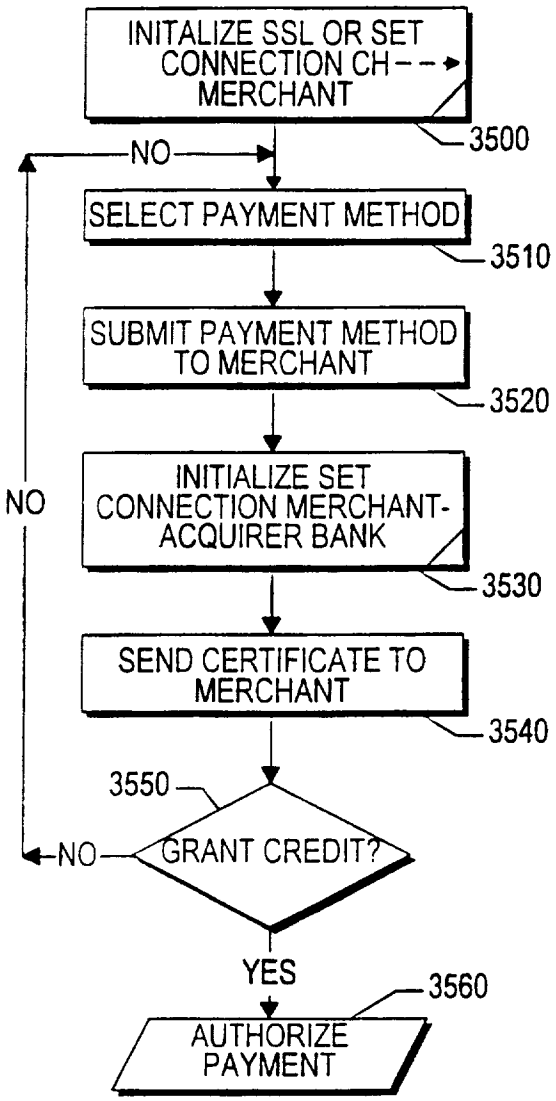
INITALIZE SSL OR SET CONNECTION CH - - → MERCHANT
3500
NO
SELECT PAYMENT METHOD
3510
SUBMIT PAYMENT METHOD TO MERCHANT
3520
INITIALIZE SET CONNECTION MERCHANT-ACQUIRER BANK
3530
NO
SEND CERTIFICATE TO MERCHANT
3540
3550
GRANT CREDIT?
NO
YES
3560
AUTHORIZE PAYMENT

FIG.-35

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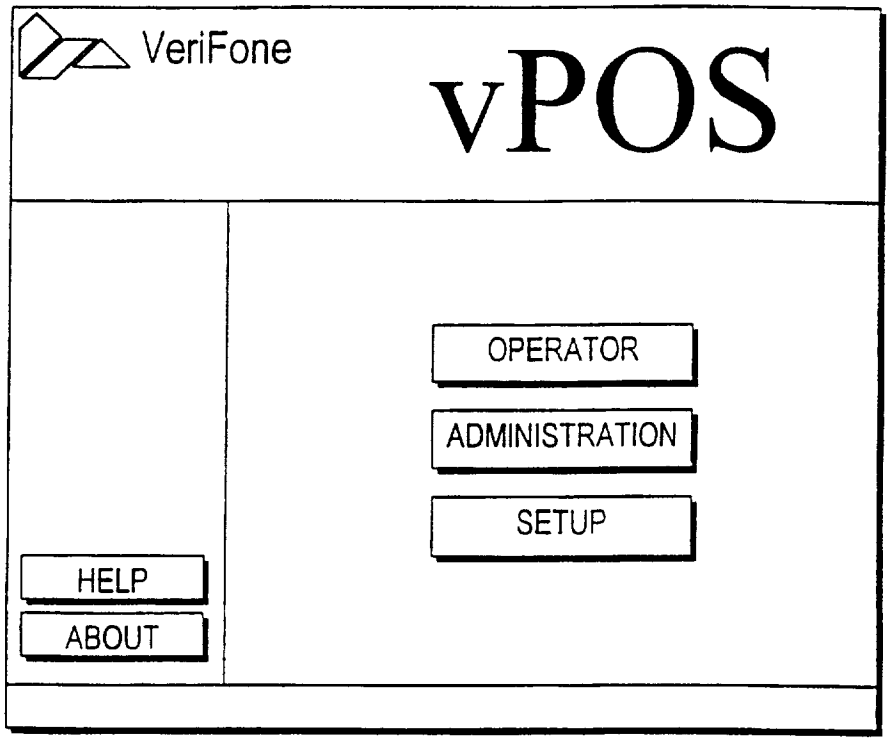

FIG.-36

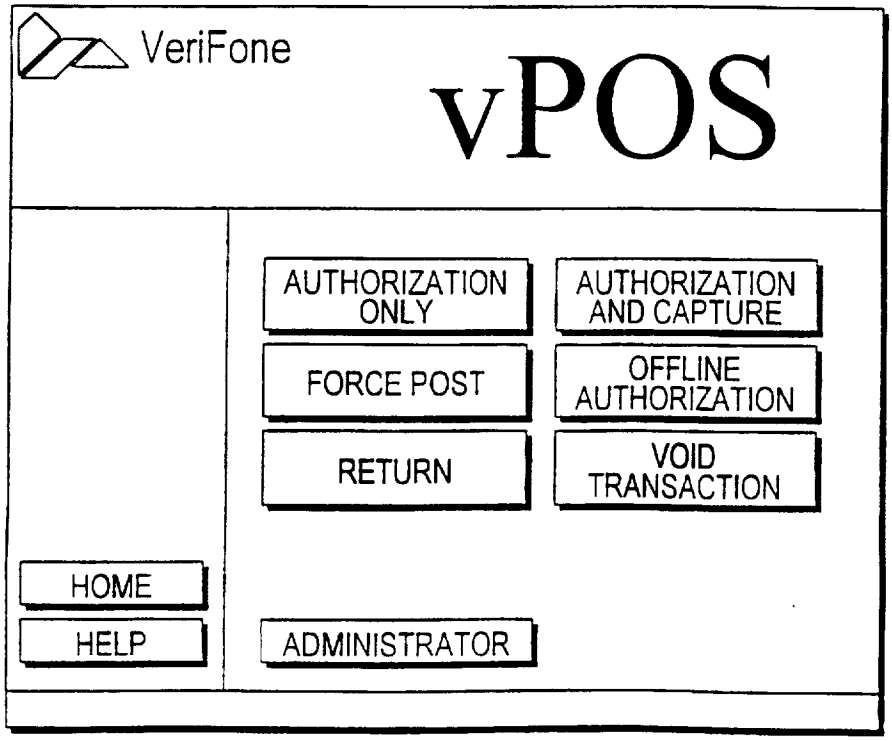

FIG.-37

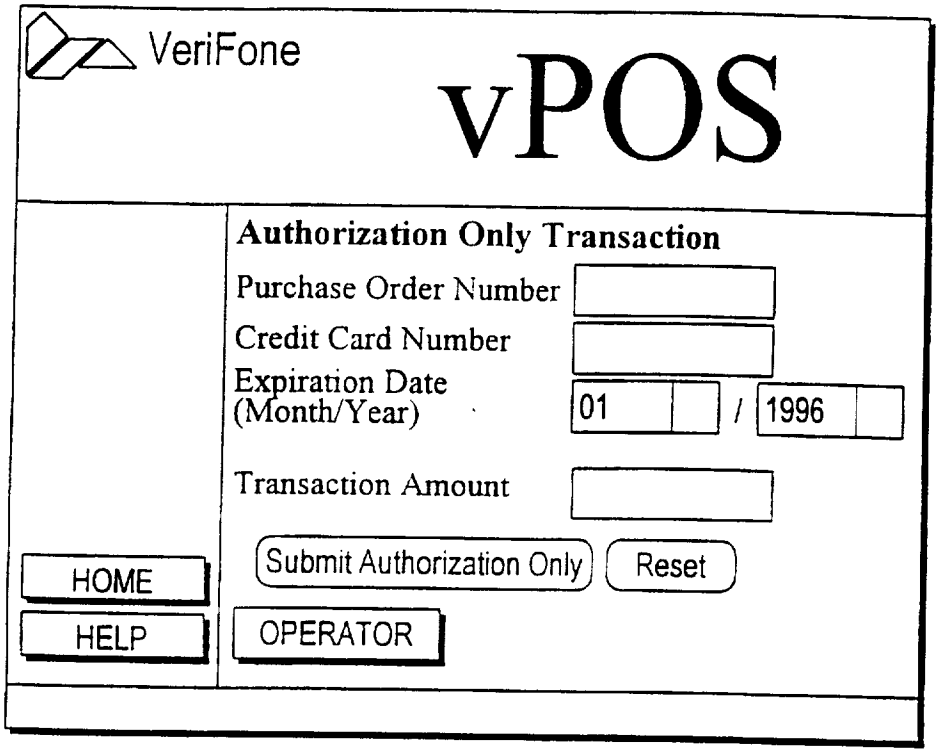
VeriFone
vPOS
Authorization Only Transaction
Purchase Order Number
Credit Card Number
Expiration Date (Month/Year)
01
/
1996
Transaction Amount
Submit Authorization Only
Reset
HOME
HELP
OPERATOR

FIG.-38

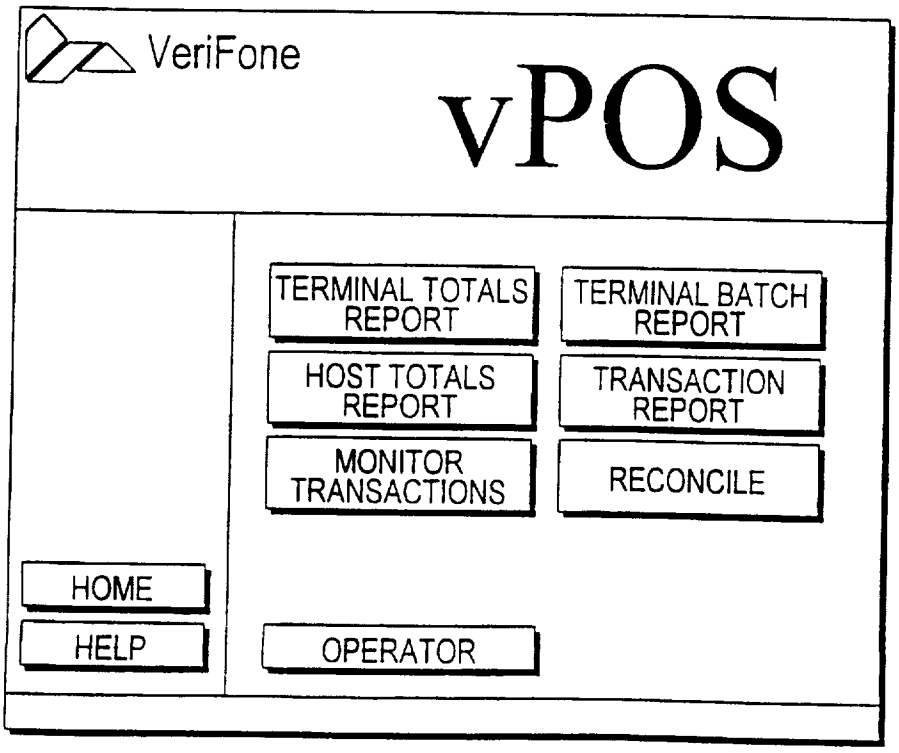
VeriFone
vPOS
TERMINAL TOTALS REPORT
TERMINAL BATCH REPORT
HOST TOTALS REPORT
TRANSACTION REPORT
MONITOR TRANSACTIONS
RECONCILE
HOME
HELP
OPERATOR

FIG.-39

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VeriFone vPOS

Terminal Totals Report

Note: The transaction is not currently implemented. The report below is a sample.

Overall Terminal Totals		
Sales	Trans. Count	25
	Amount	$6161.70
Credits	Trans. Count	5
	Amount	($11.70)
Net Sales		$6150.70

Visa Totals		
Sales	Num. of Trans.	5
	Amount	$1232.34
Credits	Num. of Trans.	1
	Amount	($2.34)
Net Sales		$1230.00

MasterCard Totals		
Sales	Trans. Count	5
	Amount	$1232.34
Credits	Trans. Count	1
	Amount	($2.34)
Net Sales		$1230.00

Discover Totals		
Sales	Num. of Trans.	5
	Amount	$1232.34
Credits	Num. of Trans.	1
	Amount	($2.34)
Net Sales		$1230.00

American Express Totals		
Sales	Num. of Trans.	5
	Amount	$1232.34
Credits	Num. of Trans.	1
	Amount	($2.34)
Net Sales		$1230.00

FIG.-40

JCB Totals		
Sales	Num. of Trans.	5
	Amount	$1232.34
Credits	Num. of Trans.	1
	Amount	($2.34)
Net Sales		$1230.00

ADMINISTRATOR

FIG.-41

VeriFone vPOS

Terminal Setup

Terminal Tables Configuration

Card(s) Definition Table	Review
Acquirer(s) Definition Table	Review
Merchant Configuration Table	Review

Help

FIG.-42

VeriFone vPOS

Terminal Type CDT List Update/Review

Cards acepted by the merchant

Visa

FIG.-43

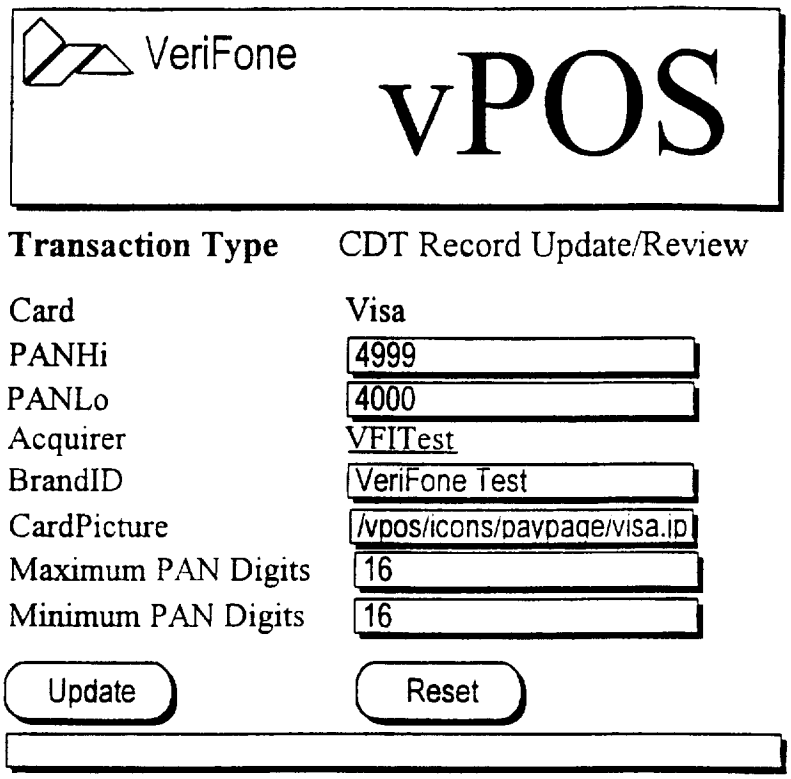
VeriFone
vPOS
Transaction Type
CDT Record Update/Review
Card
Visa
PANHi
4999
PANLo
4000
Acquirer
VFITest
BrandID
VeriFone Test
CardPicture
/vpos/icons/paypage/visa.ip
Maximum PAN Digits
16
Minimum PAN Digits
16
Update
Reset

FIG.-44

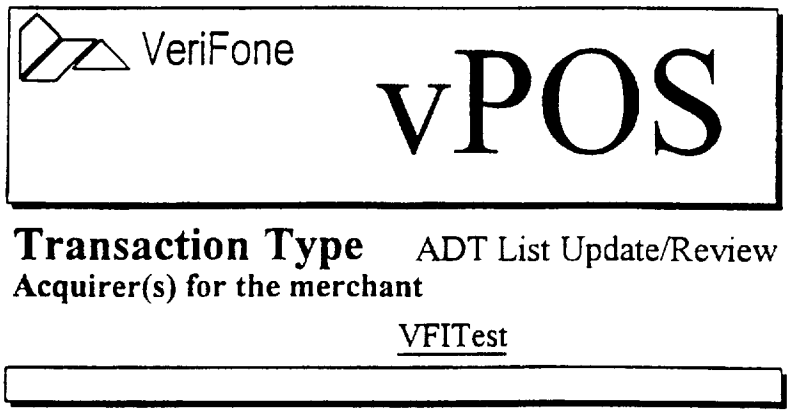
VeriFone
vPOS
Transaction Type
ADT List Update/Review
Acquirer(s) for the merchant
VFITest

FIG.-45

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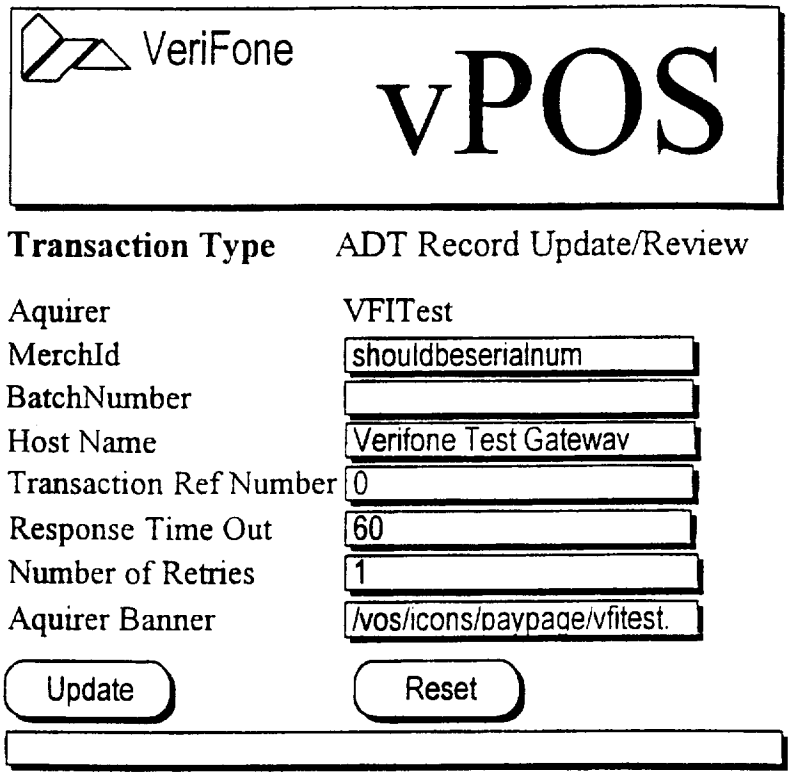

FIG.-46

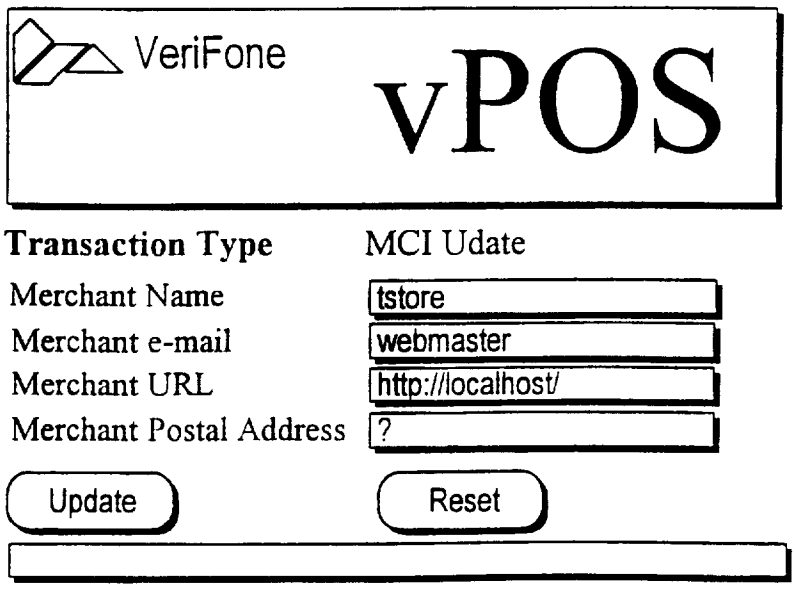

FIG.-47

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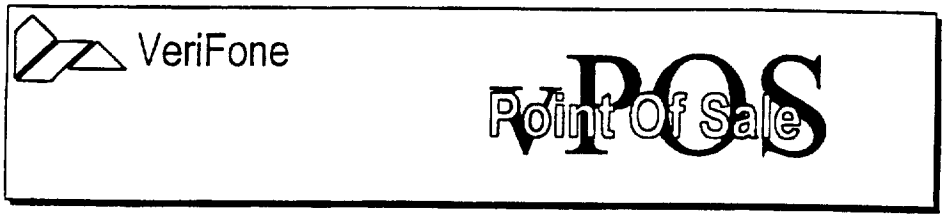

Order Number834100050

Bill To

Account Number VISA

Name on Card Good Through
Address Line 1
Address Line 2
City State/Province
Country Zip/Postal Code
Email Phone

If you wish to have billing defaults set in your browser, check this box

Total=$59.99

By pressing the PAY button I agree to pay the above total amount according to the card issuer agreement

RETURN TO SHOPPING PAY

FIG.-48

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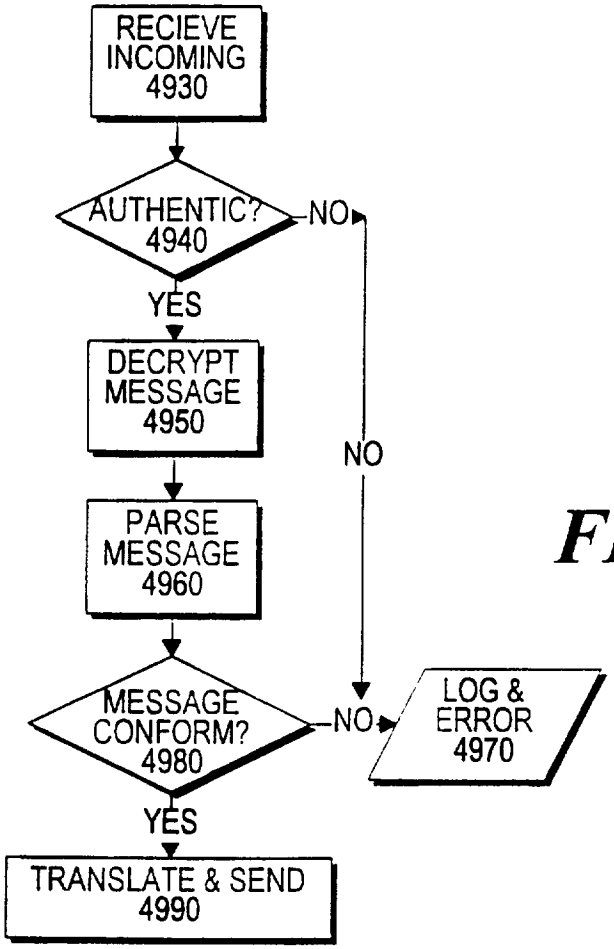

FIG.-49

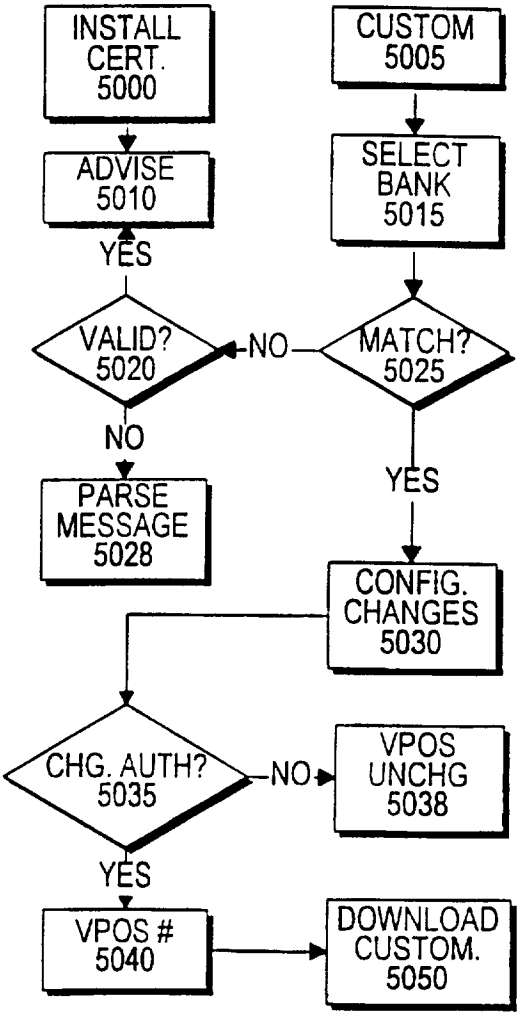

FIG.-50

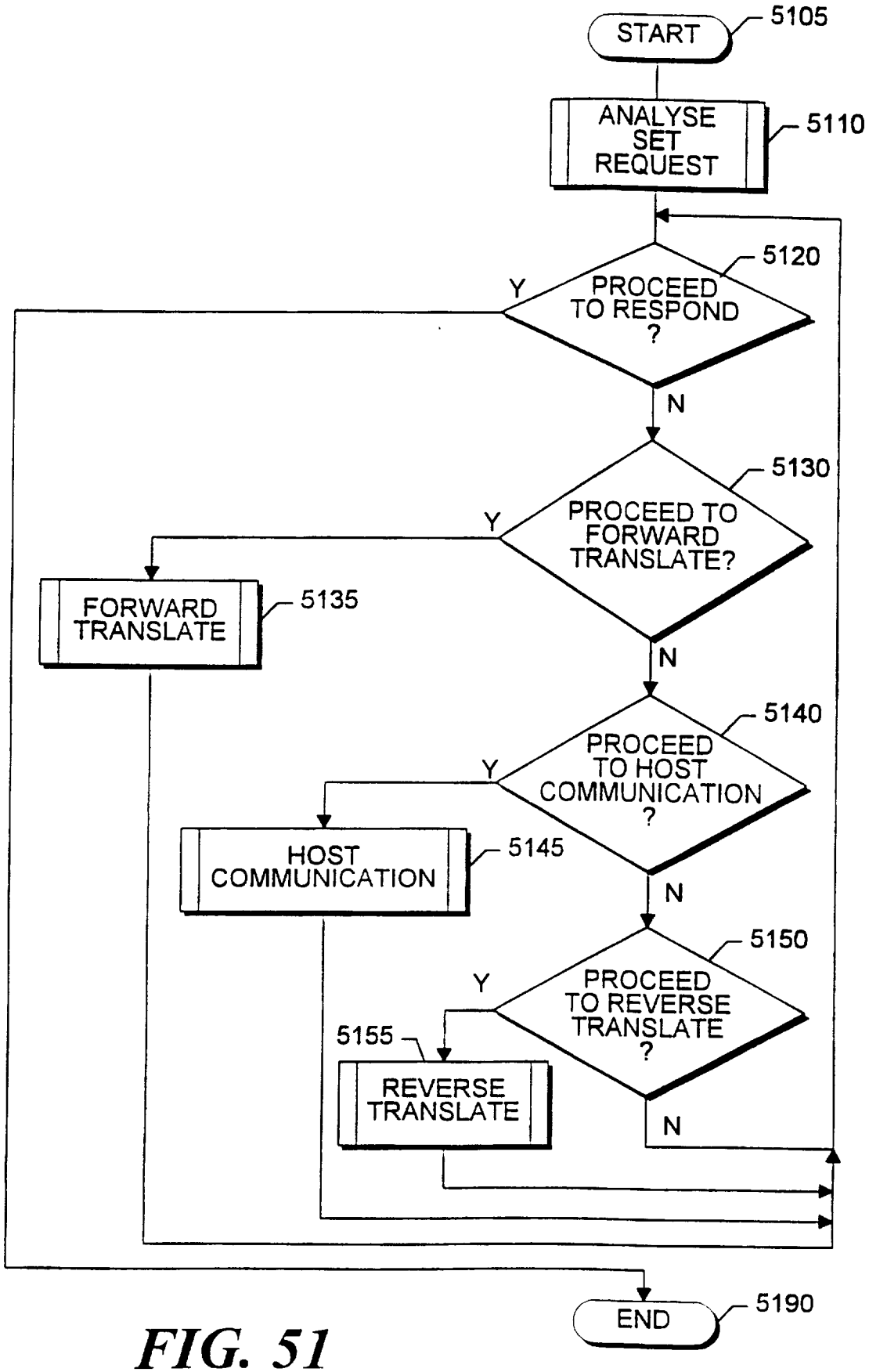
START
5105
ANALYSE SET REQUEST
5110
PROCEED TO RESPOND ?
5120
Y
N
PROCEED TO FORWARD TRANSLATE?
5130
Y
N
FORWARD TRANSLATE
5135
PROCEED TO HOST COMMUNICATION ?
5140
Y
N
HOST COMMUNICATION
5145
PROCEED TO REVERSE TRANSLATE ?
5150
Y
N
5155
REVERSE TRANSLATE
END
5190

FIG. 51

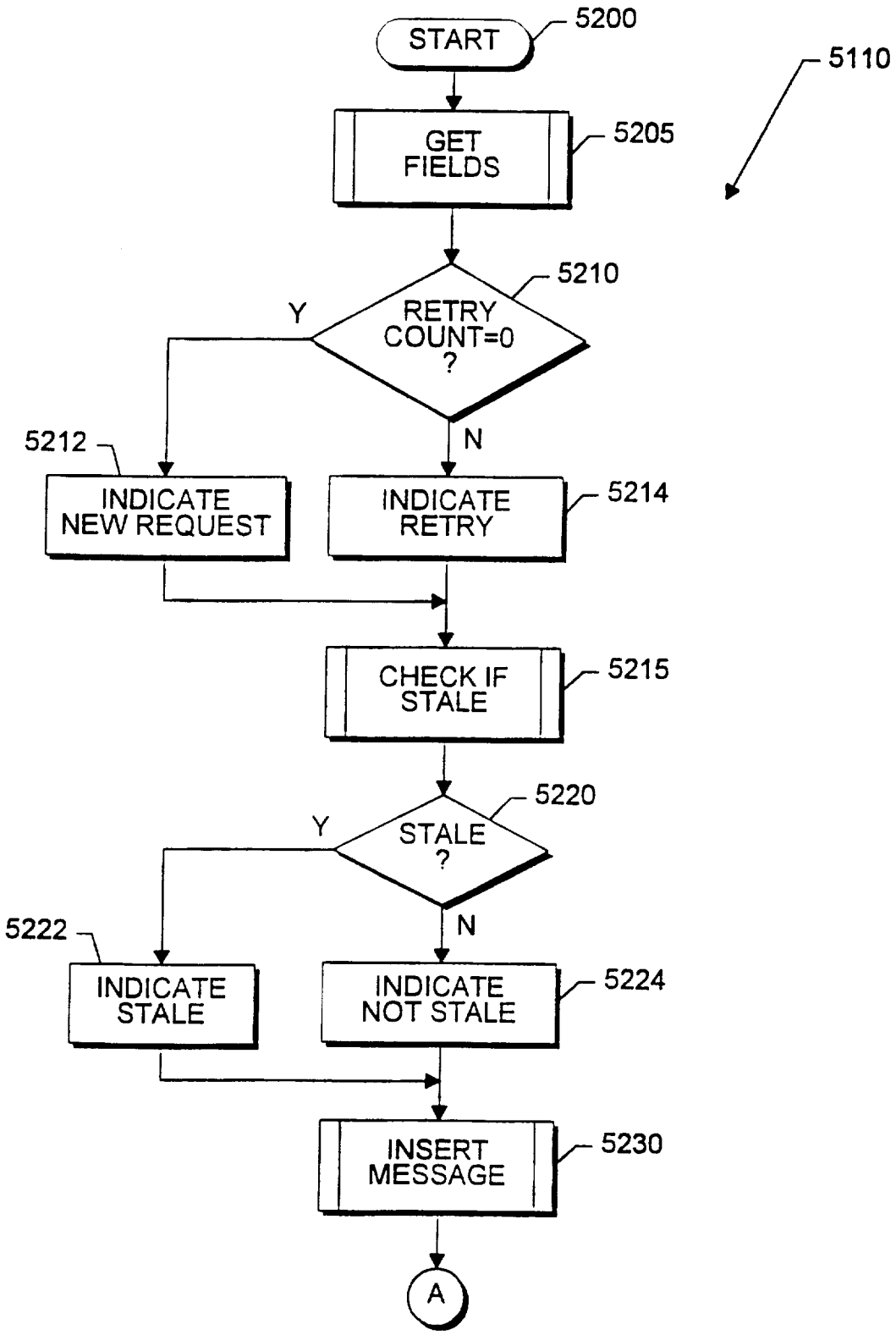
START
5200
5110
GET FIELDS
5205
RETRY COUNT=0 ?
5210
Y
N
5212
INDICATE NEW REQUEST
INDICATE RETRY
5214
CHECK IF STALE
5215
STALE ?
5220
Y
N
5222
INDICATE STALE
INDICATE NOT STALE
5224
INSERT MESSAGE
5230
A

FIG. 52A

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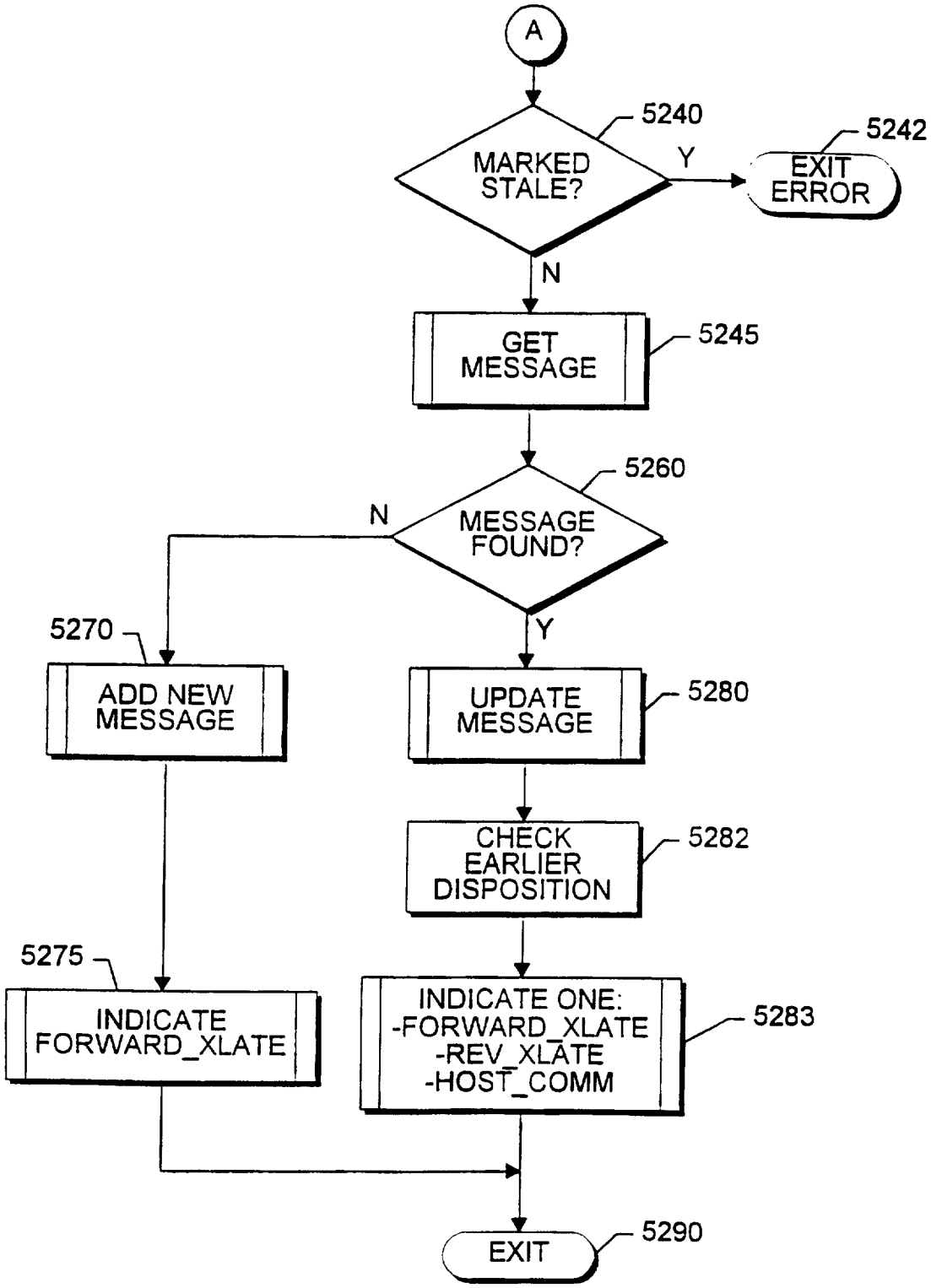
A
5240
MARKED STALE?
Y
5242
EXIT ERROR
N
GET MESSAGE
5245
5260
N
MESSAGE FOUND?
Y
5270
ADD NEW MESSAGE
UPDATE MESSAGE
5280
CHECK EARLIER DISPOSITION
5282
5275
INDICATE FORWARD_XLATE
INDICATE ONE:
-FORWARD_XLATE
-REV_XLATE
-HOST_COMM
5283
EXIT
5290

FIG. 52B

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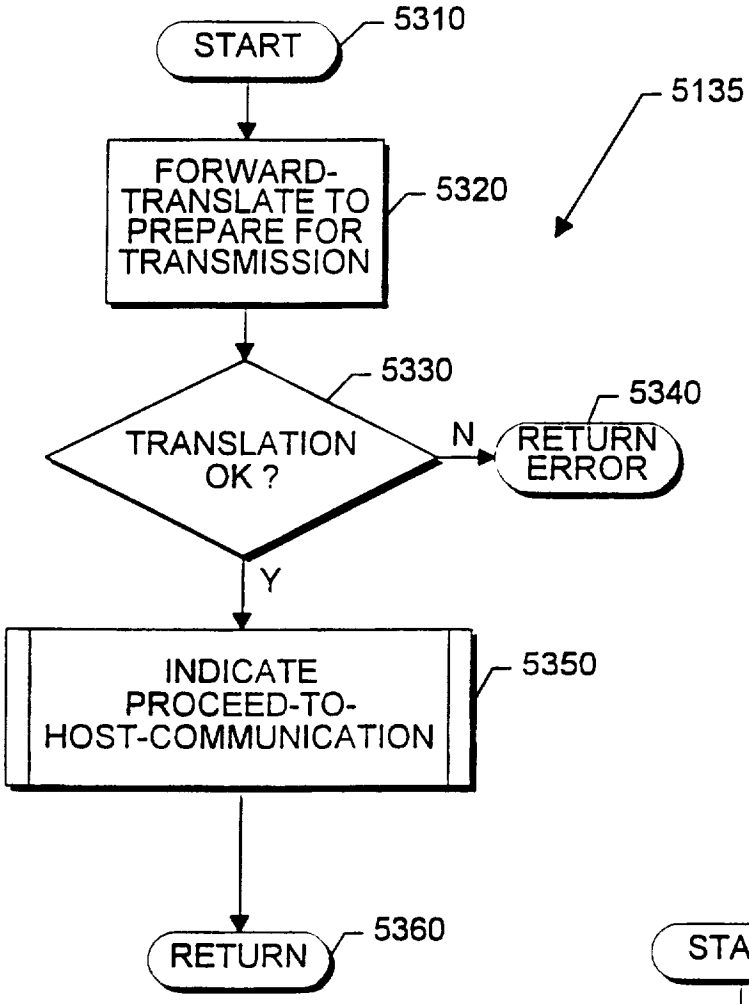

FIG. 53

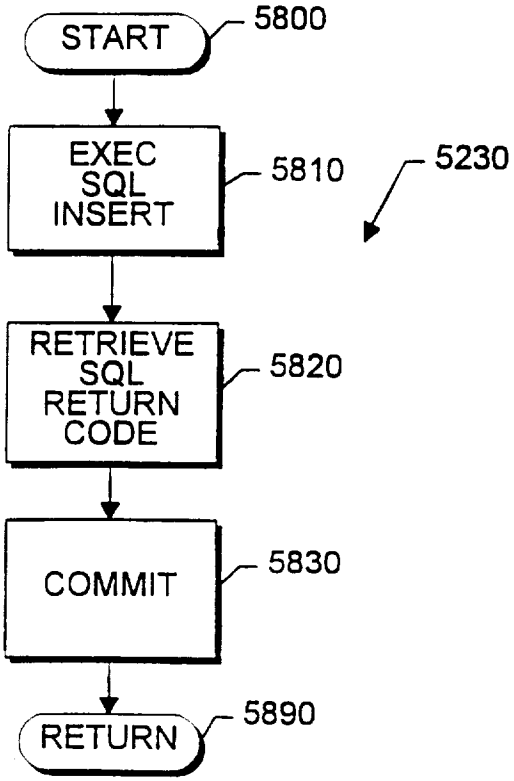

FIG. 58

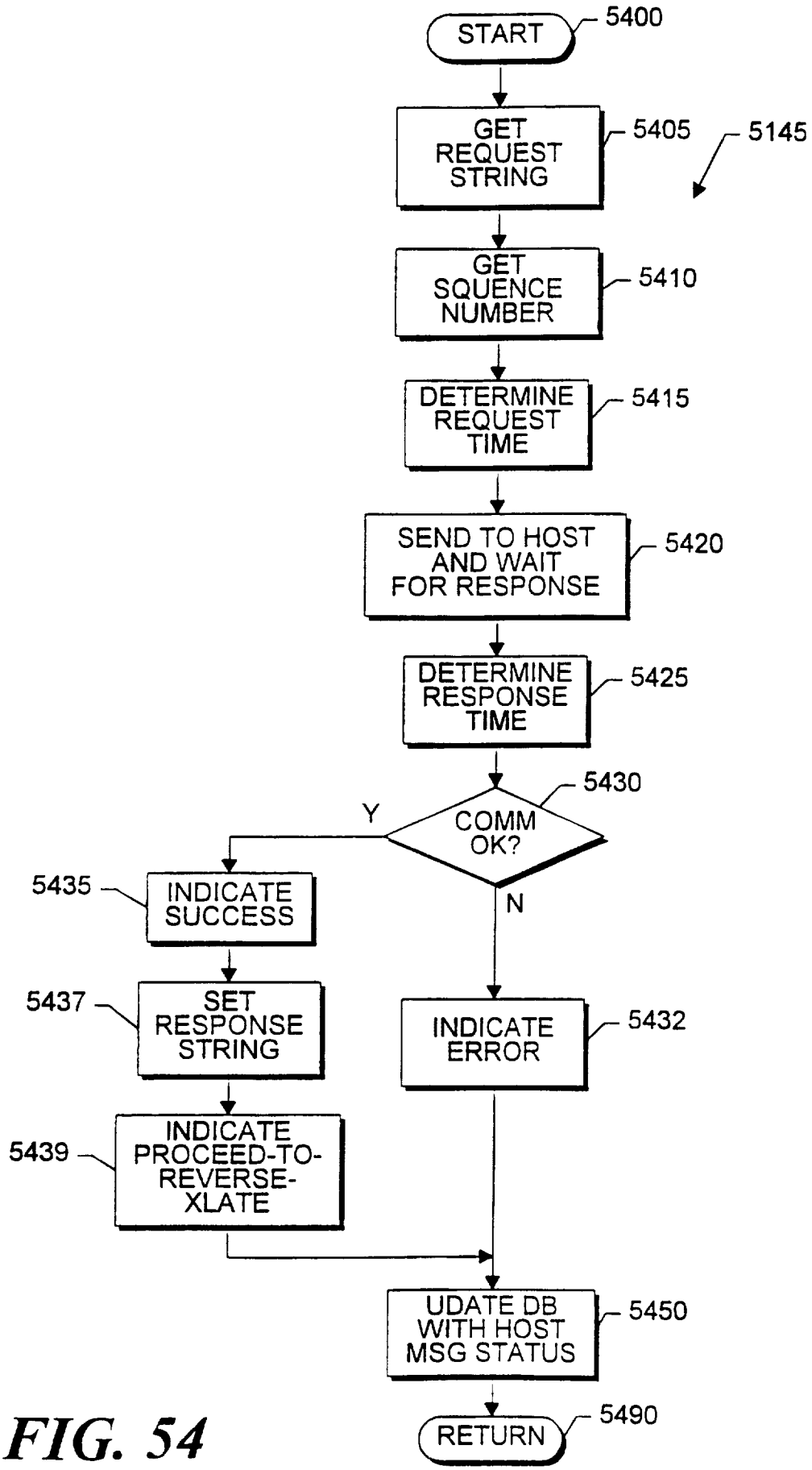
START
5400
GET REQUEST STRING
5405
5145
GET SQUENCE NUMBER
5410
DETERMINE REQUEST TIME
5415
SEND TO HOST AND WAIT FOR RESPONSE
5420
DETERMINE RESPONSE TIME
5425
COMM OK?
5430
Y
N
INDICATE SUCCESS
5435
SET RESPONSE STRING
5437
INDICATE PROCEED-TO-REVERSE-XLATE
5439
INDICATE ERROR
5432
UDATE DB WITH HOST MSG STATUS
5450
RETURN
5490

FIG. 54

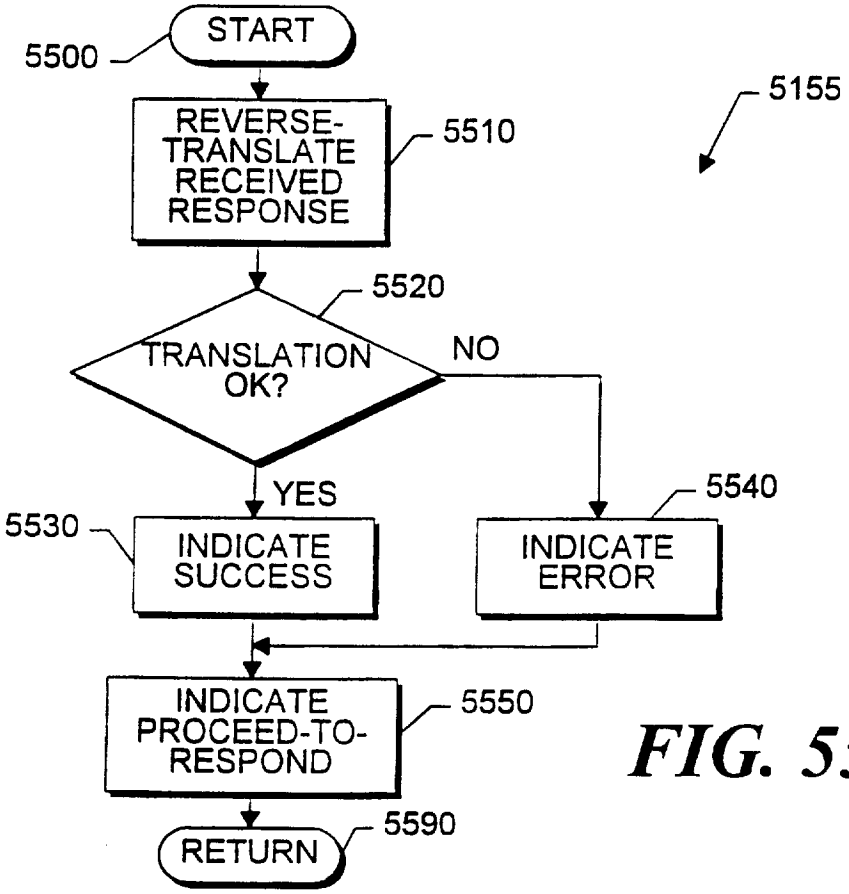
START
5500
REVERSE-TRANSLATE RECEIVED RESPONSE
5510
5155
5520
TRANSLATION OK?
NO
YES
5530
INDICATE SUCCESS
5540
INDICATE ERROR
INDICATE PROCEED-TO-RESPOND
5550
RETURN
5590

FIG. 55

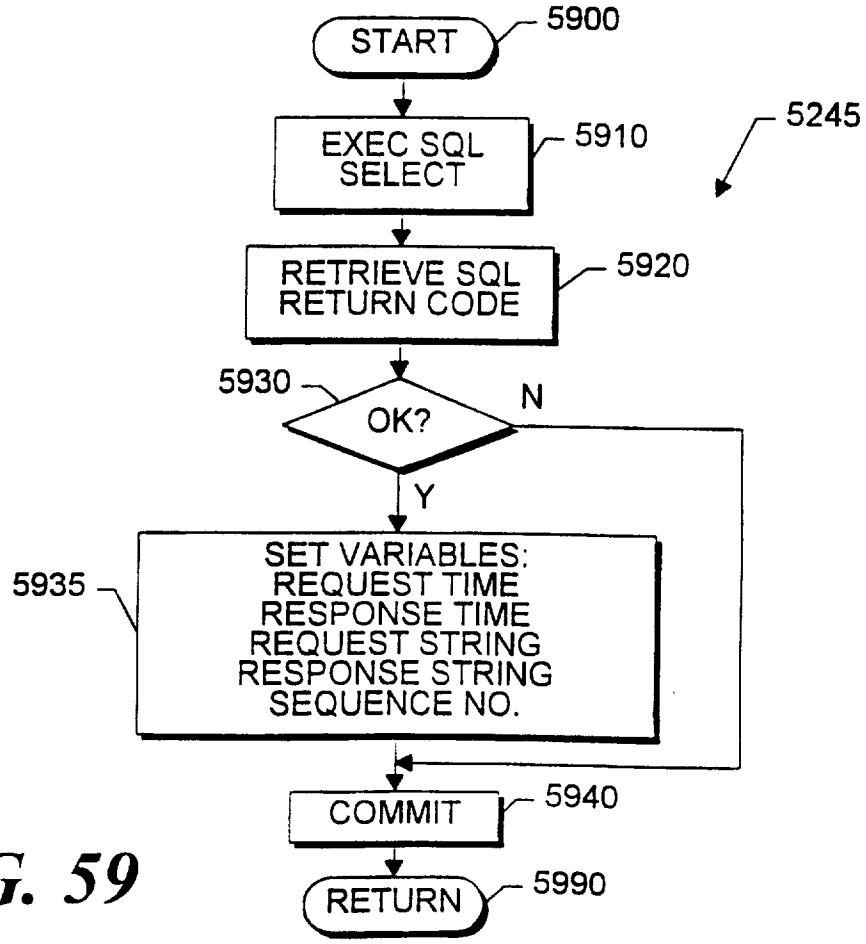
START
5900
EXEC SQL SELECT
5910
5245
RETRIEVE SQL RETURN CODE
5920
5930
OK?
N
Y
5935
SET VARIABLES:
REQUEST TIME
RESPONSE TIME
REQUEST STRING
RESPONSE STRING
SEQUENCE NO.
COMMIT
5940
RETURN
5990

FIG. 59

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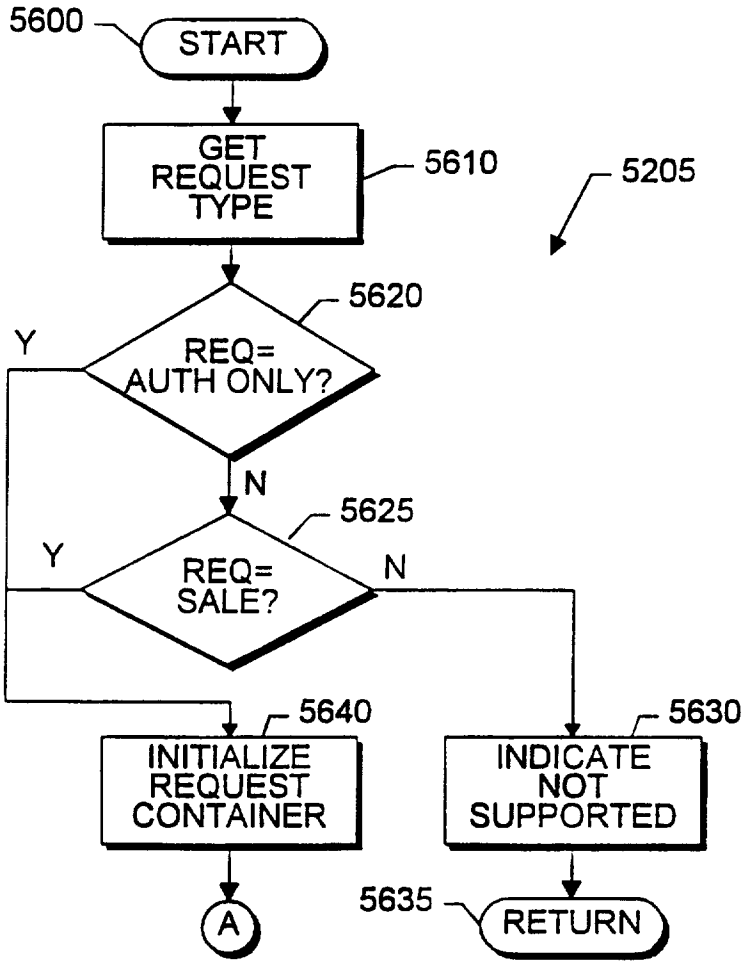

FIG. 56A

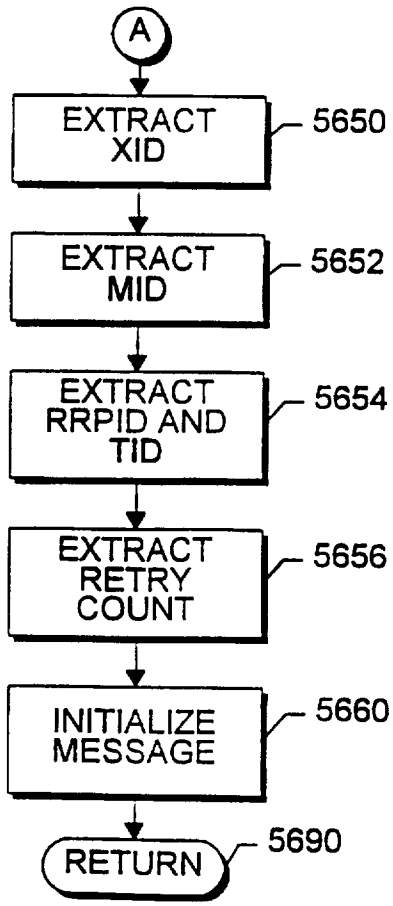

FIG. 56B

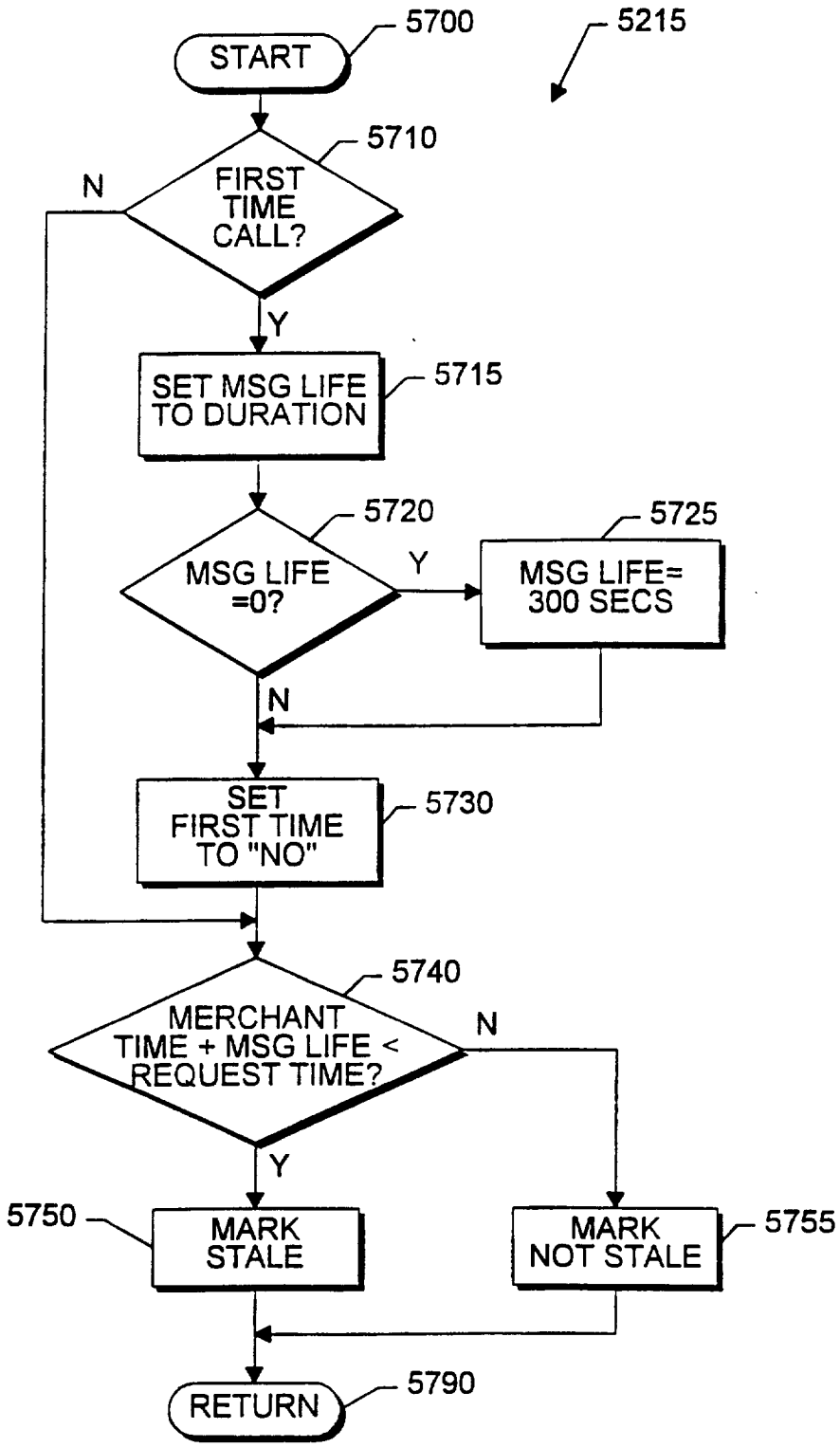
START
5700
5215
5710
FIRST TIME CALL?
N
Y
SET MSG LIFE TO DURATION
5715
5720
MSG LIFE =0?
Y
5725
MSG LIFE= 300 SECS
N
SET FIRST TIME TO "NO"
5730
5740
MERCHANT TIME + MSG LIFE < REQUEST TIME?
N
Y
5750
MARK STALE
MARK NOT STALE
5755
RETURN
5790

FIG. 57

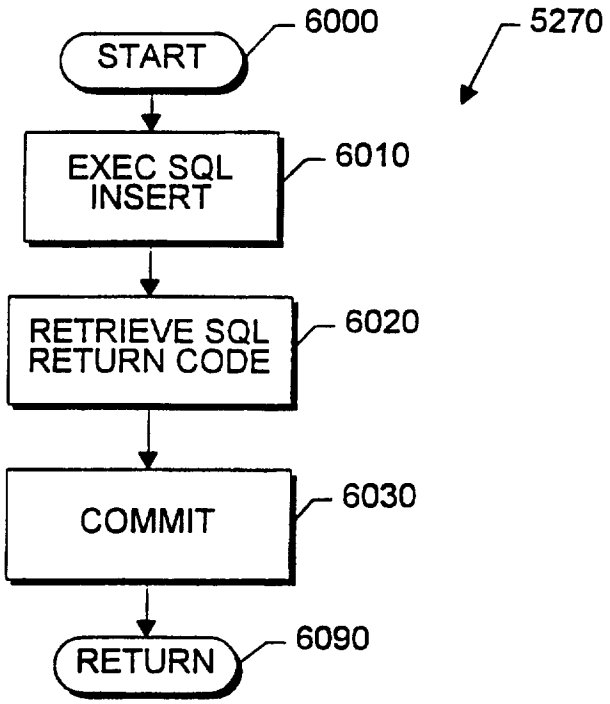
START
6000
5270
EXEC SQL INSERT
6010
RETRIEVE SQL RETURN CODE
6020
COMMIT
6030
RETURN
6090

FIG. 60

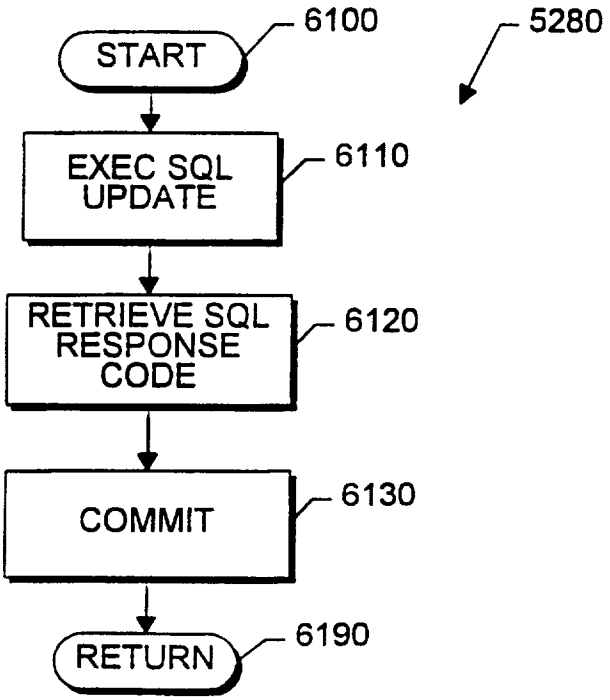
START
6100
5280
EXEC SQL UPDATE
6110
RETRIEVE SQL RESPONSE CODE
6120
COMMIT
6130
RETURN
6190

FIG. 61

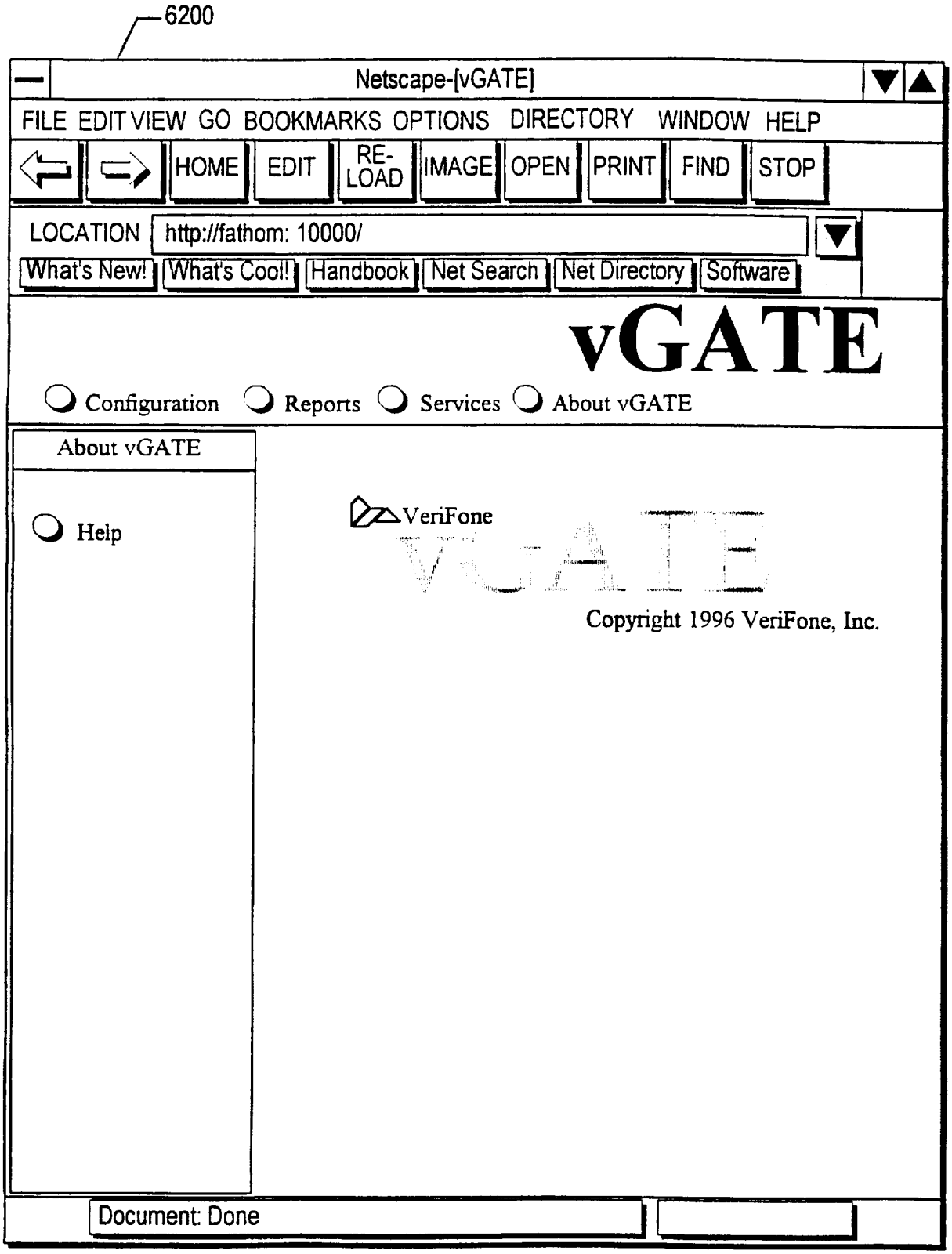
6200
Netscape-[vGATE]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME
EDIT
RE-LOAD
IMAGE
OPEN
PRINT
FIND
STOP
LOCATION
http://fathom: 10000/
What's New!
What's Cool!
Handbook
Net Search
Net Directory
Software
vGATE
Configuration
Reports
Services
About vGATE
About vGATE
Help
VeriFone
vGATE
Copyright 1996 VeriFone, Inc.
Document: Done

FIG.-62

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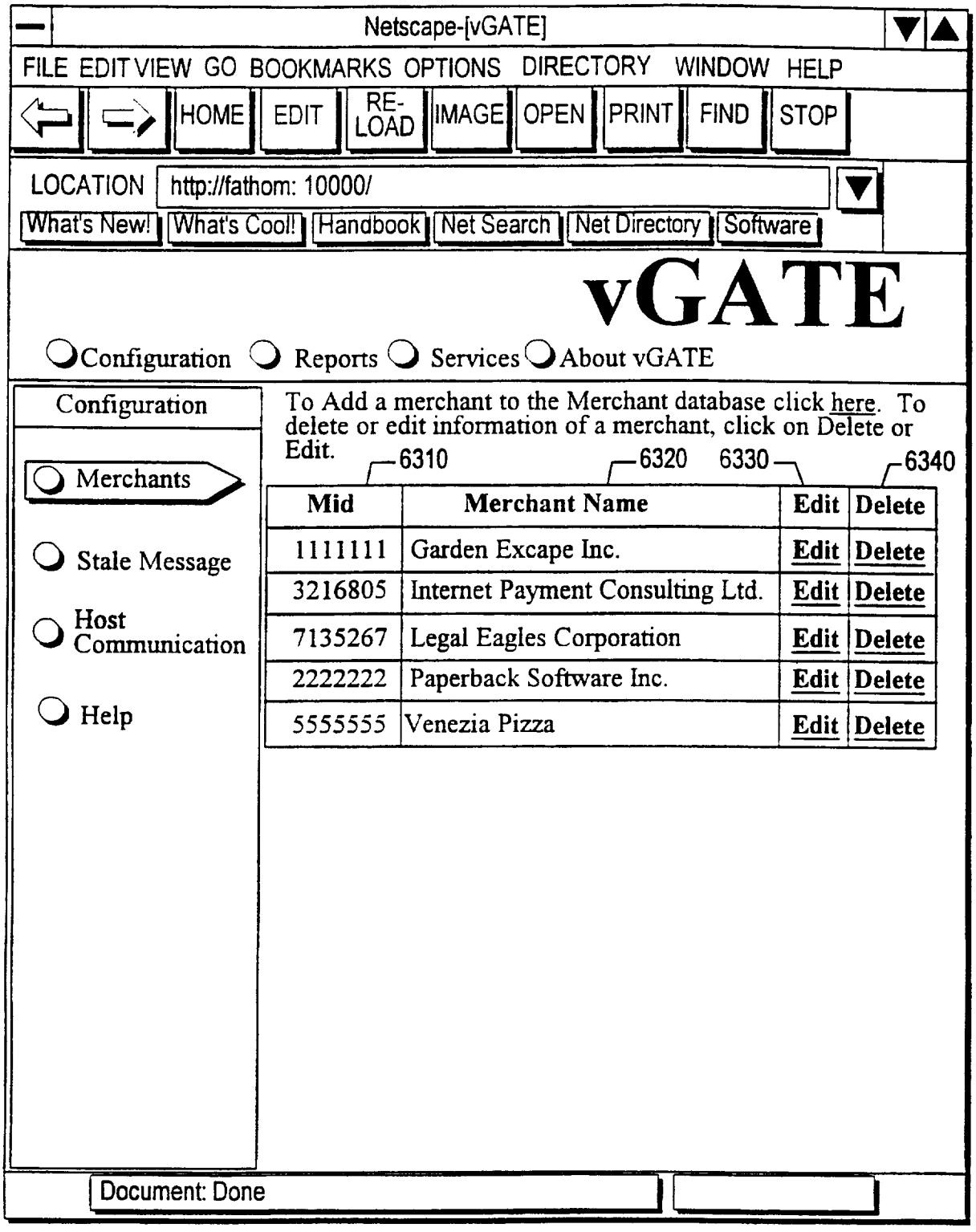
Netscape-[vGATE]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME
EDIT
RE-LOAD
IMAGE
OPEN
PRINT
FIND
STOP
LOCATION
http://fathom: 10000/
What's New!
What's Cool!
Handbook
Net Search
Net Directory
Software
vGATE
Configuration
Reports
Services
About vGATE
Configuration
Merchants
Stale Message
Host Communication
Help
To Add a merchant to the Merchant database click here. To delete or edit information of a merchant, click on Delete or Edit.
6310
6320
6330
6340
Mid
Merchant Name
Edit
Delete
1111111
Garden Excape Inc.
3216805
Internet Payment Consulting Ltd.
7135267
Legal Eagles Corporation
2222222
Paperback Software Inc.
5555555
Venezia Pizza
Document: Done

FIG.-63

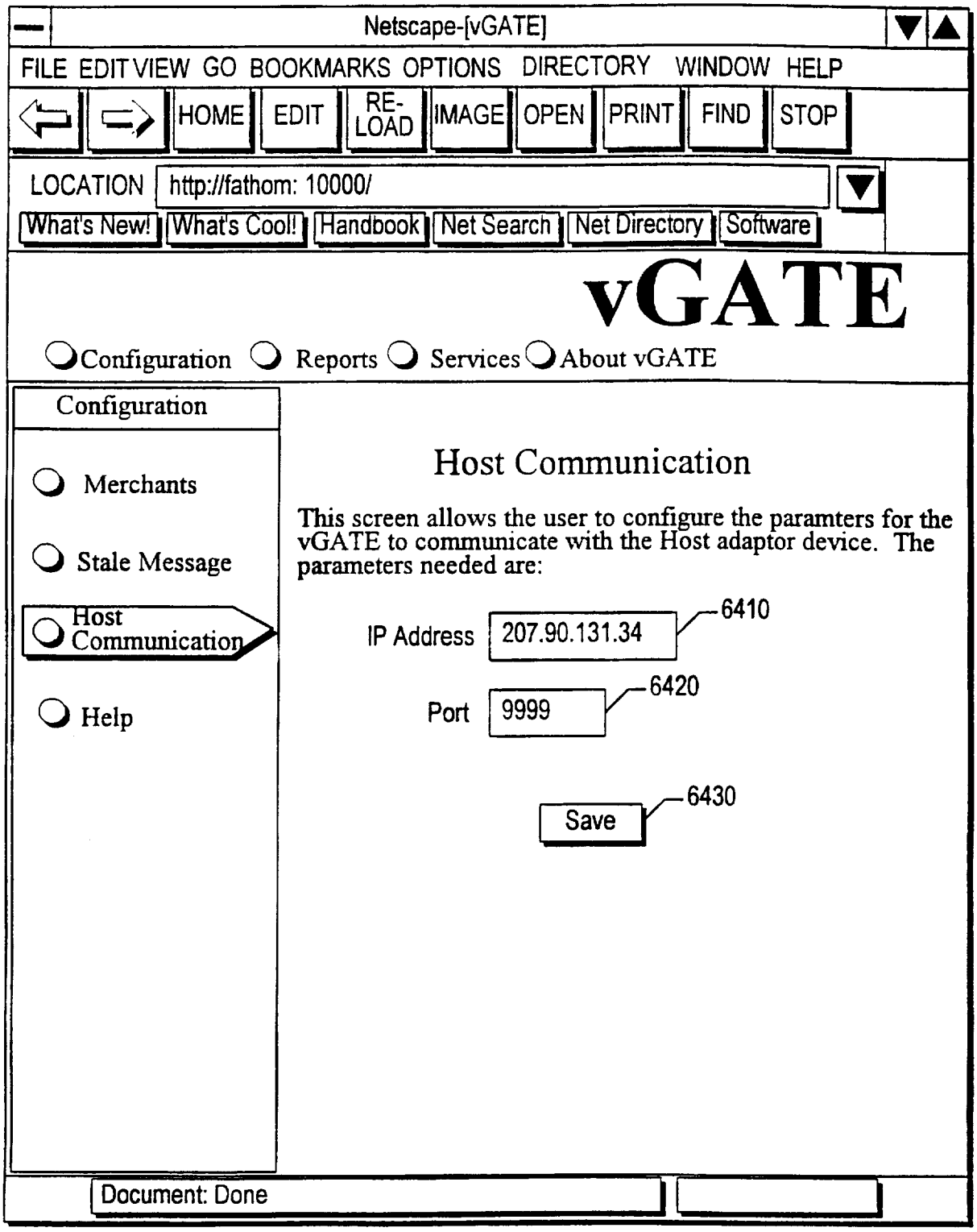
Netscape-[vGATE]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME
EDIT
RE-LOAD
IMAGE
OPEN
PRINT
FIND
STOP
LOCATION
http://fathom: 10000/
What's New!
What's Cool!
Handbook
Net Search
Net Directory
Software
vGATE
Configuration
Reports
Services
About vGATE
Configuration
Merchants
Stale Message
Host Communication
Help
Host Communication
This screen allows the user to configure the paramters for the vGATE to communicate with the Host adaptor device. The parameters needed are:
IP Address
207.90.131.34
6410
Port
9999
6420
Save
6430
Document: Done

FIG.-64

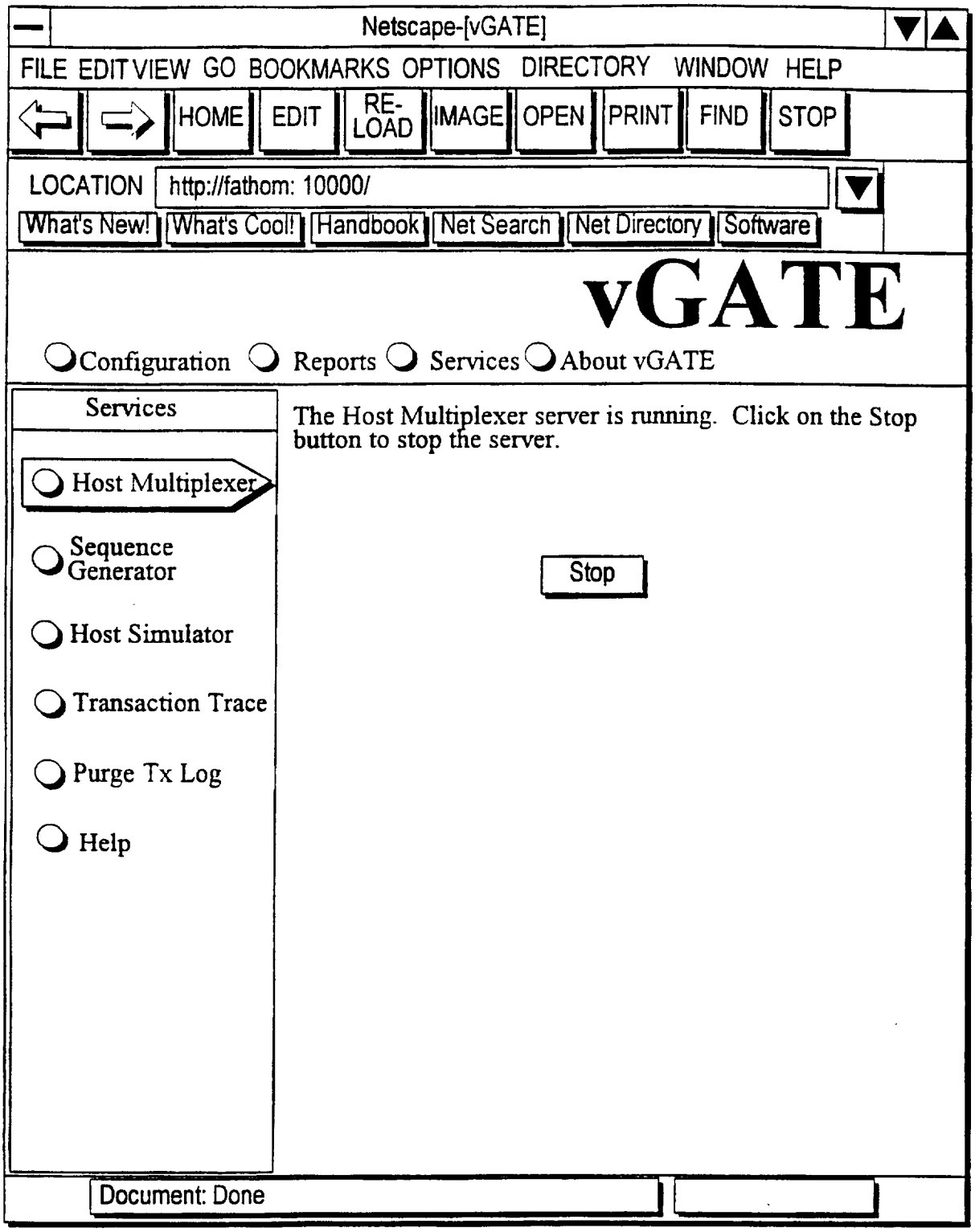
Netscape-[vGATE]
FILE EDIT VIEW GO BOOKMARKS OPTIONS DIRECTORY WINDOW HELP
HOME
EDIT
RE-LOAD
IMAGE
OPEN
PRINT
FIND
STOP
LOCATION
http://fathom: 10000/
What's New!
What's Cool!
Handbook
Net Search
Net Directory
Software
vGATE
Configuration
Reports
Services
About vGATE
Services
Host Multiplexer
Sequence Generator
Host Simulator
Transaction Trace
Purge Tx Log
Help
The Host Multiplexer server is running. Click on the Stop button to stop the server.
Stop
Document: Done

FIG.-65

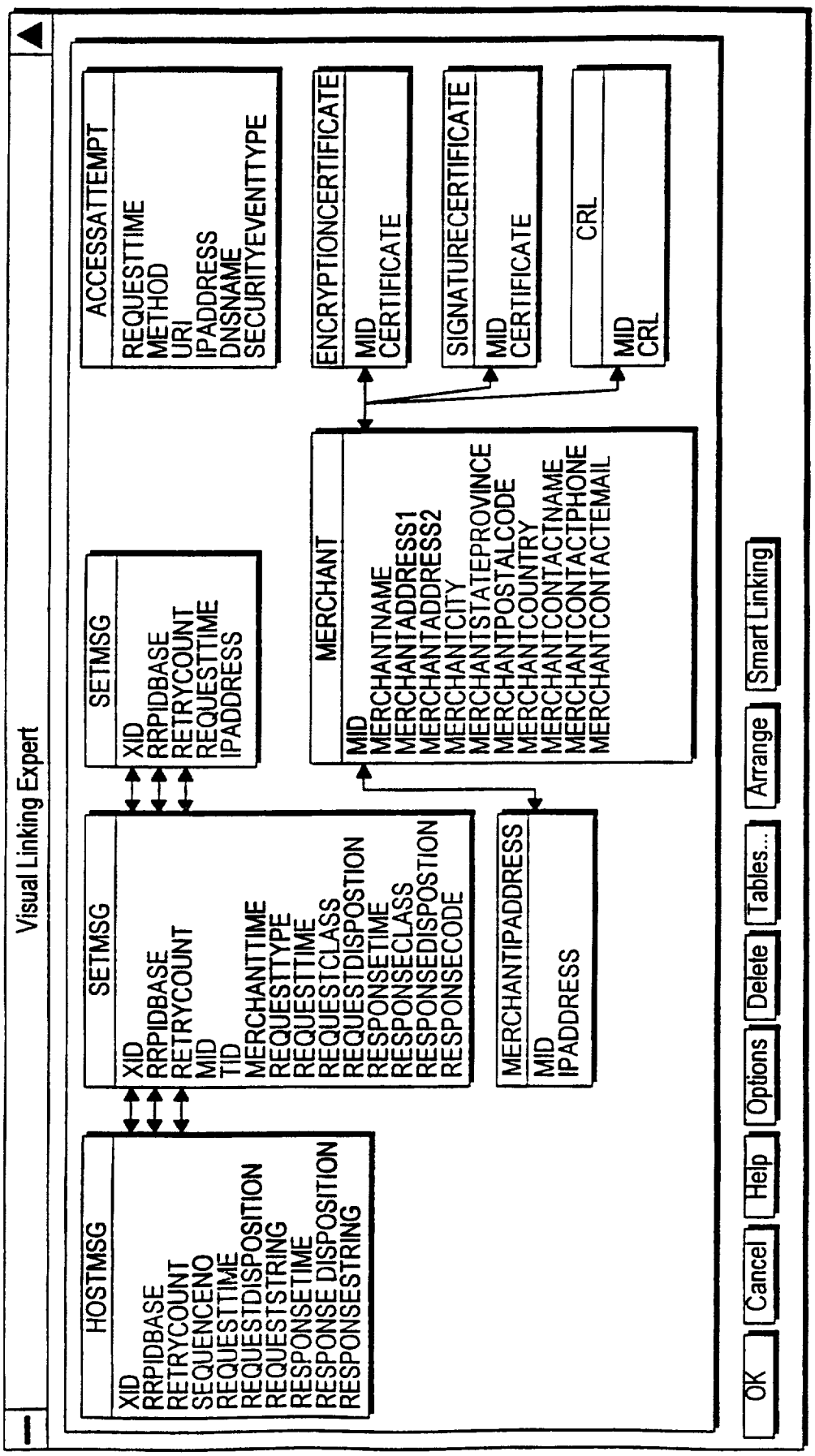
Visual Linking Expert
HOSTMSG
XID
RRPIDBASE
RETRYCOUNT
SEQUENCENO
REQUESTTIME
REQUESTDISPOSITION
REQUESTSTRING
RESPONSETIME
RESPONSE DISPOSITION
RESPONSESTRING
SETMSG
XID
RRPIDBASE
RETRYCOUNT
MID
TID
MERCHANTTIME
REQUESTTYPE
REQUESTTIME
REQUESTCLASS
REQUESTDISPOSTION
RESPONSETIME
RESPONSECLASS
RESPONSEDISPOSTION
RESPONSECODE
SETMSG
XID
RRPIDBASE
RETRYCOUNT
REQUESTTIME
IPADDRESS
MERCHANTIPADDRESS
MID
IPADDRESS
MERCHANT
MID
MERCHANTNAME
MERCHANTADDRESS1
MERCHANTADDRESS2
MERCHANTCITY
MERCHANTSTATEPROVINCE
MERCHANTPOSTALCODE
MERCHANTCOUNTRY
MERCHANTCONTACTNAME
MERCHANTCONTACTPHONE
MERCHANTCONTACTEMAIL
ACCESSATTEMPT
REQUESTTIME
METHOD
URI
IPADDRESS
DNSNAME
SECURITYEVENTTYPE
ENCRYPTIONCERTIFICATE
MID
CERTIFICATE
SIGNATURECERTIFICATE
MID
CERTIFICATE
CRL
MID
CRL
OK
Cancel
Help
Options
Delete
Tables...
Arrange
Smart Linking

FIG.-66