Submission to the Wallis Inquiry

from Price Waterhouse

September 1996

Submission

Introduction

Price Waterhouse provides professional services to over 100 institutions in the financial services industry.

The ultimate headquarters of our clients are varied; Europe, the Americas, Australia, and other parts of the world.

The size of our client base, and their diversity of activity and ownership provides us with a unique perspective of the challenges facing such institutions in Australia.

As auditors, we have a unique role in reporting to a variety of regulators, including the Reserve Bank, Australian Securities Commission, Australian Stock Exchange, Insurance and Superannuation Commission and others on aspects of compliance with rules and regulations applicable to organisations that fall within their jurisdiction.

We recognise that the various industry groupings are making submissions to the Committee addressing the Committee's terms of reference.

We have assisted certain of those groups and individual institutions in preparing their submissions. For that reason, we have decided that our own submission should be short.

Technology

We are aware of the Committee's particular interest in the impact of technology on the future of financial services.

To assist the Committee in that regard, we are pleased to enclose a copy of part of an international study prepared by the Price Waterhouse World Technology Centre in Menlo Park, California. The 700 page study is entitled Technology Forecast 1996, and is an annual review Price Waterhouse conducts of the impact of technology on business. A full copy is available to you is you wish to receive it.

To provide the Committee with a relevant perspective, the particular section we have included in our submission, just over 20 pages, is Section 6.4 entitled Electronic Commerce. This part involves commentary on items such as:

- means for payment
- approach to security

- electronic data interchange
- digital cash
- consumer orientated electronic commerce

We hope this future orientated study will assist the Committee in its deliberations.

A copy of the second publication entitled "Retail Financial Services, The Challenge of Virtual Banking in the New Millennium" is also enclosed for your information.

Minimising Duplication

In our role as auditors and business advisers to the financial services industry we are very conscious of the quantity of regulatory and statistical data that has to be provided to different regulatory bodies - Reserve Bank, ASC, ASX, ISC, Bureau of Statistics etc and on which we are asked to express our professional opinion.

Often the same information is required to be provided, sometimes it varies slightly in definition, requiring numbers to be rejigged.

We consider this duplication and redefinition adds to the cost of operations of a financial institution without a commensurate benefit in improved supervision.

We would recommend the Committee consider in its Report requiring that the appropriate regulatory bodies that are proposed to operate post the Inquiry liaise together initially to minimise duplication and unnecessary variation in definition of data supplied to them.

Further information

We would be pleased to provide additional assistance to the Inquiry in its deliberations.

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Attachment I - Price Waterhouse Technology Forecast 1996: Section 6.4 Electronic Commerce, published by the Price Waterhouse World Technology Centre Menlo Park, California USA.

Attachment II - Price Waterhouse Retail Financial Services, The Challenge of Virtual Banking in the New Millennium, published by the Price Waterhouse World Technology Centre Menlo Park, California USA

Extract From Technology Forecast 1996: Price Waterhouse World Technology Centre Menlo Park, California

6.4 Electronic Commerce

6.4.1 Executive Summary

The rise of electronic commerce (EC) is a worldwide phenomenon affecting business processes that reach into executive offices, shipping and receiving docks, and out to individual consumers. EC is reshaping marketplaces, trading relationships, and even international trading boundaries.

In EC, trading partners interact through electronic communications and automated computer systems. EC is used by businesses and governments to speed the exchange of information, gain improved service levels, and reduce operating costs.

Some form of EC has occurred among a significant number of large companies for almost two decades. In fact, the number of companies using electronic data interchange (EDI), the most common form of EC, is soaring. According to IDC, almost 121,000 companies worldwide used EDI in 1995, an increase of 50 percent in one year. As the number of EDI participants has reached critical mass, its ability to include trading partners in business process reengineering has made EDI even more compelling.

The recent rise of the Internet as a consumer technology has broadened the EC horizon. More than 30,000 companies have Internet addresses, and 2,000 companies have home pages on the Internet as of February 1995. Payment mechanisms are becoming more robust, and security and reliability concerns are being addressed by a host of existing transaction processors and startups that are offering solutions to protect transactions over the Internet. Although actual consumer transactions over public and private networks are small relative to the volumes conducted through traditional methods, the number is increasing dramatically.

The Internet's rise as a viable conduit for EC has initiated a reexamination of the contribution of value-added networks (VANs) that were previously relied upon for EDI and other transaction services. Remarkably lower transmission costs and the ubiquity of the Internet tempt many companies to consider it a viable alternative or supplement to services offered by the VAN providers. In response, VAN providers are broadening their product offerings to incorporate the Internet.

Meanwhile, the volume of traditional electronic funds transfers among financial institutions has continued to grow. Paperless transactions became more attractive with the June 1995 shortening of the five-day securities settlement process to three days in the U.S. Major banks face increasing competition from VAN as well as Internet providers. In response, Value-Added Banks (VABs) are now supporting the exchange of business settlement information that accompanies the standard payment. Banks are also extending their services over the Internet.

6.4.2 Business Background

The business community, governmental agencies, and individual consumers can all benefit from the growth in EC opportunities.

Electronic Commerce Drivers

The cost of doing business with paper-based systems and procedures has become increasingly high -- estimates range up to $100 to produce and process a paper invoice and payment, while the estimated cost of the electronic alternative ranges to less than $10. Electronically linking trading partners also reduces product development and production time, and can slash inventory carrying costs. Major automobile makers, computer companies, and other original equipment manufacturers (OEMs) that reengineer their business processes typically reduce their supplier ranks by 90 percent or more and require the few remaining vendors to interface with them electronically. Business process reengineering in all of its guises has been a primary driver behind the escalating interest in EC among corporations and governments.

Societal changes also are important to EC development. Two-income families have less time and energy to shop in the local mall. The proliferation of home computers has led many upper-middle and middle-income families with children to purchase access to on-line services. Although the volume of consumer-based on-line shopping is small -- $200 million in 1994, according to LINK Resources -- it is growing fast. CompuServe Inc. pioneered the concept of on-line direct marketing 11 years ago when it established the Electronic Mall. It claims average annual increases of 50 percent in orders and 78 percent in number of accesses during the past five years.

Government edict also is playing a role in the growth of EC. For example, in the U.S., the Clinton administration ordered federal agencies to shift all procurement of products and services for less than $25,000 to EDI by 1997. The North American Free Trade Agreement (NAFTA) requires the U.S. Internal Revenue Service to use electronic funds transfer (EFT) for approximately 94 percent of tax remittances by the year 2000, which will

mean a dramatic increase in electronic tax filings by corporations and individuals from the 3 percent rate of 1993. In addition, cost controls imposed by government and private health insurance payers is propelling the growth of EC between doctors, hospitals, and other health care institutions.

In Southeast Asia, many governments, including Singapore, Thailand, Hong Kong, and Australia, have been directly active in the development of national EDI strategies and the establishment of a national EDI infrastructure. For most countries with a focus on international trade, the outcome has been the establishment of an electronic community connecting the port authorities, shippers, agents, and customs to the importers and exporters. In international trade, the cost and time of processing documentation can represent a significant part of the value and transit time of goods. In order to address national priorities for trade facilitation, many customs administrations now mandate the use of EDI for the electronic clearance of goods for import and export as well as the use of EFT for the payment of duties and other charges.

As part of the Australian government's micro-economic reforms, Purchasing Australia (the Australian equivalent of the U.S. General Services Administration) requires all federal government departments and agencies to include EC initiatives in their annual business plans. Currently, the Australian government is establishing the Commonwealth Electronic Commerce System (CECS), with the intention that it may be used by any Commonwealth agency. At least a part of the system will be mandated for use by all Commonwealth agencies. It is expected that once established, use by other organizations, including government business enterprises, state governments, local governments, and certain non-government bodies, may also be required.

Another set of drivers of current EC trends are the builders of the national and global information infrastructures. These companies (such as AT&T Corp., BBN Communications Corp., PSInet, and MCI Communications Corp.) are expanding the industry by helping companies establish an EC presence. Internet service organizations provide World Wide Web servers with home page creation, data capture technology, security, and other infrastructure services such as transaction processing and financial settlement.

Components of EC Solutions

The various activities that come under the umbrella of EC are evolving. For example, *Putting the Information Infrastructure to Work*, published by the U.S. National Institute of Standards and Technology (NIST), begins with a quote from the Information Infrastructure Technology and Applications (IITA) Task Group:

Electronic Commerce integrates communications, data management, and security services to allow business applications within different organizations to automatically interchange information.

This definition makes no distinction between buying and selling electronically and the exchange of business information that accompanies traditional commerce. For example, using EDI to exchange catalog data, point-of-sale data, and inventory levels enables organizations to collaborate in the delivery of goods and services, and is clearly EC. This usage is different than providing access to a catalog on the Internet as a place to purchase goods or services, or the actual sale and delivery of information itself in electronic form. All are part of the evolving EC landscape. Table 6-7 gives some examples of types of EC.

Dimensions

Electronic commerce involves four significant dimensions: the nature of the transaction, the scope of operations, the means of payment, and the approach to security. Service providers offer products and services that address different levels of service in each of these dimensions.

Nature of the Transaction

Repetitive, high-volume or high-value, business-to-business transactions are great candidates for EDI. Consumer relationships require different systems altogether, with an emphasis on ease of use and visual appeal. Many transactions formerly handled by purchasing departments are now taking on retail characteristics.

In the past, purchasing departments bought supplies for departments within a corporation. Now, supplies can be acquired by departments directly. As an example, International Business Machines Corp.'s Electronic Market Services group has piloted an electronic procurement service for office supplies and equipment. Called the Electronic Purchasing Service, it front-ends EDI systems with graphical interfaces that can be browsed from an authorized individual's desktop. The Electronic Purchasing Service transmits the orders to suppliers and handles shipment notifications and other messages. IBM plans to make this service available through VANs, including IBM's Global Network.

Table 6-7: Attributes of Electronic Commerce

	Business/Retail	Business/Industrial	Government
Business Models	Storefront E-Catalog Computer Telephone Integration Interactive TV Bulletin Board System AutoTeller Machine Kiosks	Just-in-time (JIT) ordering Evaluated Receipt Settlement (ERS) Reference Model for Health care Automatic Replenishment Efficient Consumer Response (ECR)	Request for Quote procurement models of the Electronic Commerce Acquisition Program Management Office (ECAPMO) Electronic Tax Filing Economic Census Reporting
Security	Privacy Enhanced Mail Secure HyperText Transport Protocol (S-HTTP) Electronic Stamps Secure Socket Layer (SSL)	DES RSA X12.58	RSA Triple DES Key Escrow
Communication Infrastructure	Internet Cable Service Bureau	VAN VAB Internet Direct Connections	VAN VAB Internet
Data Management	Wide Area Information Server (WAIS) HyperText Markup Language (HTML) Info access to graphics, video, audio, text	EDIFACT ANSI ASC X12 UPC/EAN Industry Guides Info access to text	NIST ECAT Implementation Convention (IC) Info access to text

Scope of Operations

Companies launching EC initiatives take very different approaches to participating in the value chain. Some ventures choose to focus on narrow functions, such as offering smart cards; others plan more expansively and create new platforms, currencies, or environments, such as digital currency.

There are many ways to participate. On the front end, companies can define complete retail interfaces: front ends for commerce with virtual shopping baskets, aisles, and product-test and comparison tools.

On the back end, companies might run a server, run a service, or build an electronic mall. Servers can provide a gateway or switch to existing clearing-houses, banks, or transaction systems. Servers can present, validate, authenticate, or notarize. They can offer protection schemes for intellectual property such as metering and unique, traceable digital signatures. Metering systems monitor usage, accumulate charges, and submit them for payment when they cross a threshold.

Means of Payment

There are many mechanisms for payment in addition to EFT, including cash, credit card, debit card, traveler's checks, electronic bill payments, money orders, cashier's checks, IOUs, letters and lines of credit, and wire transfers. Each conventional payment option presents tradeoffs between transaction

speed, risk, and cost. Paper cash is immediate and almost risk-free, but its transport and storage are expensive. Debit cards withdraw money directly from customers' accounts, but the direct account access increases risk, so their use is more constrained than credit cards. Wire transfers are more immediate than checks, but they cost more.

Each payment scheme has a significantly different infrastructure. Some give rise to support systems to mitigate risk. Over time, EC offerings will likely develop their own diversity.

Most consumer-oriented EC efforts use the credit card system for payments. A few attempt to create their own local currencies in the form of tokens or vouchers for specific uses. Creating a currency is much more complex than passing transactions through to a conventional clearing system. It raises tax and float implications and questions of what happens if the system is compromised or if its guarantor fails. Therefore, credit-card payment systems are the default players for the near term.

Transferring value through EC requires trust. These consumer systems normally require that participants preregister, usually through non-electric media, such as over the phone. The person's credit-card account is proof of creditworthiness. Encryption technology addresses many other trust issues, such as whether the transmission medium is trustworthy and private.

Because individuals cannot electronically transfer monetary values amongst themselves, intermediaries play a necessary role. EC systems vary in the number of parties involved and the sequence of events. Transactions may have to pass through a centralized server for validation, then through a gateway to the credit-card system for approval. It may take many steps to complete a single transaction.

Approach to Security

Most EC initiatives require special software; some require special hardware. The simplest systems require that participants use a specific client application or encryption scheme. Because it can be hard to detect when passwords are compromised, software authentication tends to be less reliable than systems based on smart cards or other hardware. Hardware cards are also the best way to ensure that the person is actually present. Nevertheless, hardware-based systems are harder to establish due to the magnitude of the effort to get broad deployment and the associated costs.

Encryption technology makes most of the efforts described here possible. It enables people to send sensitive information securely over otherwise unsecured networks. Of the payment processes, described in "Digital Cash" in section 6.4.3, , only First Virtual Holdings Inc. uses encryption as part of the user transaction. CyberCash Inc. uses encryption, but is linked directly

to the credit-card system. Only DigiCash offers completely anonymous encrypted transactions.

Another issue is privacy, which arises from the public's concerns about how organizations that collect information on individuals, such as the government, banks, credit reporting and credit card companies, might use or redistribute that information. Most EC financial reporting schemes are linked to the major banks or credit-card processing systems. When a credit card is used for purchases, a complete record of behavior is left behind. (See Chapter 4.3, *Security*, .)

6.4.3 Technology Background

The technologies used for EC include electronic data interchange, electronic mail (interpersonal and integrated messaging), electronic bulletin board systems, electronic catalogs, electronic forms, finance and banking technologies, smart cards, funds transfer, and digital cash.

Electronic Data Interchange (EDI)

EDI is a means of communication being rapidly assimilated into everyday business practice. It consists of routine information exchanges between computer-based processes. Processes that exchange information through EDI are typically mirror-image business applications owned by two or more trading partners. The most common EDI partners are vendors and their customers. An example of a mirror-image process is the generation of orders by a customer's purchasing system for transmission to a vendor's sales-order-entry system. Another example is a vendor's billing system preparing invoices for a customer's accounts payable system.

The technology of EDI consists of three primary components:

- Translation
- Communications
- Value-Added Network (VAN) Services

Translation

EDI's primary tool is software that transforms data into the defined EDI standard formats. This computer-based process is referred to as translation. Examples of standard formats include the Accredited Standards Committee (ASC) X12 in the U.S. and the worldwide standard United Nations/Electronic Data Interchange For Administration Commerce and Transport (UN/EDIFACT).

EDI begins and ends with business applications that share data but may have different methods of viewing and processing that data internally. Buyers uses their firm's purchasing system to place an order, specifying part number, quantity, unit price, and delivery schedule. These data elements are received by the supplier's order entry system and used to identify the product being purchased, to coordinate delivery from inventory or schedule manufacturing, and then to begin the billing cycle after delivery is complete.

Although exactly the same data values appear in each application, the semantics and syntax vary based on the process. In effect, each application speaks a language of its own. Company A's purchasing system will require the data to be in a different format than Company B's purchasing system, unless both companies use the same software vendor. Reprogramming all applications in all companies to share a common view of data -- that is, establishing a common language used by all applications -- is unrealistic. EDI's solution is to translate everything into a common language that is used during data exchange.

The sender's originating application, such as purchasing, produces data in their standard format regardless of whether or not EDI is being used. When EDI is used, the purchase order data are sent to the translation process instead of the printer. The translator software accepts the purchasing system's data, applies a user-defined mapping, and converts the purchase order (PO) to a standard representation of the transaction.

The transaction is delivered through a communication process to the receiving vendor, who reverses the translation process. The standard EDI PO information is filtered through a mapping process and converted to the order entry system's format. The order entry system then processes the information just as though it had originated from a paper PO received through the supplier's mailroom and entered by a sales order clerk.

Translation software packages with varying degrees of sophistication exist for virtually every computer platform. Personal computer (PC)-based translators frequently include data entry and filing interfaces for small organizations that may not have other computer applications. These features permit small businesses to send and receive EDI transactions. Other common uses of PC translators are to provide large organizations with easy-to-implement pilot applications and to perform limited front-end services for applications on mainframe or midrange platforms. Midrange platforms (for example, AS/400 and VAX) as well as UNIX systems are used for EDI in medium-sized organizations where these computers support the core business applications. Most large organizations use translators running on the mainframes that centrally support all their firm's business applications.

As additional applications are selected for EDI support, new mappings and application data definitions are added to the central translator's libraries. New trading partners are put in the translator's profile tables, which associate the partner with the appropriate application and transaction type. Communication profiles are also established to direct the output of the translator to the correct delivery mechanism. Creating these maps and profiles replaces the more time-consuming activity of programming individual interfaces for each trading partner's view of each target application. Current-generation translation software provides integrated utilities with map- and profile-building capabilities to streamline this task.

Communications

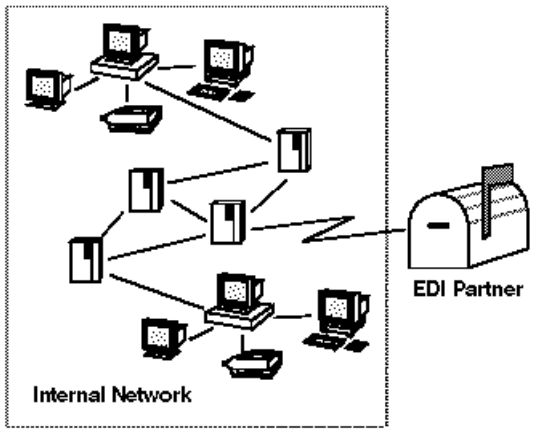
Communication is an extension of an organization's existing networking capabilities. The difference in communications for EDI is not the technology; rather, what is different is that the recipient of the communication is outside the organization's network environment. How that communication is accomplished depends upon the type of application being supported.

EDI exchanges most often occur in bursts of file transfer activity at the beginning and end of a company's batch production cycles, and can be done over a switched circuit. A dedicated circuit is only needed when transactions are volume- or time-sensitive, as is the case with just-in-time programs. In addition to dedicated or batch mode connectivity, an EDI user must decide whether to support direct communication with each trading partner or engage a VAN provider. For a fee, the VAN will collect and disseminate all of a company's EDI transactions, regardless of the number of partners involved.

Value-Added Network (VAN) Services

VANs are data communications networks that provide various services, such as mailboxing, scheduling, and communications protocol conversion. A VAN customer needs only a single connection between itself and the VAN's nearest point of presence, usually a local telephone call. The sender may communicate with the VAN at its convenience, and the VAN will deliver the sender's transactions to the appropriate electronic mailboxes. Each mailbox belongs to a specific recipient of transaction data, and transactions from multiple senders may be collected in the same mailbox. (See Figure 6-12.)

Figure 6-12: EDI Communications



At its convenience, the recipient of EDI data from a VAN establishes a communication session and requests delivery of all transactions stored in its mailbox. Since the sender's and recipient communication sessions are independent from one another, the VAN acts as a security buffer between the two organizations' networks. The fact that sender and recipient are not directly connected also means that a VAN user is not required to support multiple data communication protocols and speeds in order to connect to each of its trading partners.

Businesses have used VANs to establish purchasing arrangements as well. Electronic purchase orders, invoices, and settlements are all established through formal agreements. Consumer purchasing and selling through the Internet has generated much of the recent publicity. Buyers and sellers meet dynamically and affect a transaction with no formal, predefined agreements. These business transactions are exploding for both commercial and consumer users.

EDI Advantages

Businesses using EDI have many advantages over their non-EDI equivalents, including fewer personnel required to perform or manage processes, fewer errors, reduced redundant rekeying of data, and faster cycle times, resulting in more strategic business relationships for competitive advantage.

However, in many fields, EDI is moving from business advantage to business necessity, especially as large players in fields such as automotive manufacturing (like Ford Motor Co.) and retail (like Wal-Mart Stores Inc.) insist that their trading partners use EDI. Nonetheless, implementing an EDI capability can be a great leveler of competition, enabling a small supplier to compete with big ones.

Some of the alternative technologies described below offer cost savings over EDI, and easier implementations. EDI, however, provides a standardized approach to sharing information and facilitating communication among a

wide variety of trading partners. EDI also assures the security of transaction transmission.

One of the problems with EDI is that its implementation is too complex for some small to-midsized companies to justify. Integration of other technologies with EDI is smoothing the path for these smaller companies. For example, an extension has been made to the Group 3 facsimile standard to enable information to be faxed into EDI systems. Ford Motor and Sears, Roebuck and Co. are both using EDI interfaces that enable their smaller suppliers to exchange data using faxes or E-mail.

Electronic Mail (Interpersonal and Integrated Messaging)

Just as EDI is the standard technology for automated business-to-business information sharing, E-mail has become the standard for person-to-person communication. As desktop workstations have gained capabilities for creating different types of documents (from spreadsheets to multimedia presentations), users' demands for capabilities to attach these documents to their mail messages has also grown. E-mail accommodates many of these demands.

As the numbers of business partnerships and virtual corporations grow (with attendant growth in message volumes and the need for security and tracking), users are finding a greater need for E-mail to cross enterprise boundaries. Many companies are establishing Internet gateways for their internal mail systems and using the Internet to connect with their business partners. According to Gartner, the overlapping of functions between EDI networks and E-mail is likely to continue, with companies using VANs to transfer messages and manage gateways, and also using E-mail backbones based on X.400 to connect trading partners. (See Chapter 3.3, Network Services and Operating Systems, , for more information about X.400.)

As of mid-1995, business-to-business exchange of E-mail (which about 15 percent of large corporations now employ) usually is not coordinated as part of the IT mission. According to Gartner, however, this responsibility may change as the use of E-mail extends to the following:

- Distributing reports to trading partners
- Delivering electronic forms for collecting information from trading partners
- Transporting EDI transaction sets using extensions to mail protocols such as X.435, which transmits an EDI message as an X.400 mail attachment, or using the EDI features of the Multipurpose Internet Mail Extensions (MIME) structure

Electronic Bulletin Boards and FTP Servers

Many groups use electronic bulletin board systems (BBSs), the Internet, and File Transfer Protocol (FTP) servers to communicate with others in their industry, market, geographic region, or interest group. These systems can be used to post information, share E-mail and databases, or hold electronic conferences. These capabilities make them useful for customer and supplier interactions. Although not suited for business transactions, BBSs still form a part of EC strategies for information sharing. (See Chapter 6.3, The Internet and Information Publishing, .)

Electronic Catalogs

Electronic catalogs (E-catalogs) range from simple, text-based supply catalogs that support EDI relationships to complex, multimedia marketing extravaganzas with sound and video clips. One of their primary advantages is that they can be updated daily, ensuring that all customers and potential customers have access to the latest product and price information.

The most successful offerings give a business some extra value for using the catalog. For example, vendors that create E-catalogs that can be loaded into an on-line purchasing system greatly simplify the process of buying their goods. To complete the transaction, the user only has to fill out an electronic form with the item number, the quantity, and the department to be charged.

Several vendors now offer an electronic environment that a manufacturer can use to demonstrate a product. This approach is especially successful for software, stock photo, and font marketers, who can also use the electronic catalog as a distribution device. The user can view or test the merchandise on the computer, select the desired products, and purchase a software key to unlock the purchase.

Electronic Forms (E-forms)

Electronic mail vendors and BBS users are beginning to build electronic forms (E-form) capabilities into their products to facilitate on-line business transactions. E-form packages make it easy to route information within work groups or to forward messages for approval; they are intended to be used electronically rather than printed for paper-based processing. Although E-forms seem like an easy-to-use, inexpensive EDI replacement, EDI offers a degree of standardization and security that E-forms do not. Service bureaus and software are being developed to enable smaller trading partners to use E-forms with fax gateways to interact with EDI systems.

Finance and Banking Technologies

Financial institutions have been conducting business electronically for years. Through the use of special-purpose secure networks, transactions and

clearing activities among banks and other financial entities are carried out daily.

Companies that traditionally use EDI for supply chain management are now extending EDI to automate the payment and collection of funds as well. This process is financial EDI -- using EDI to communicate information related to payments as well to execute the payment. Any electronic payment process includes two components, funds transfer and remittance information. The funds transfer involves directing a financial institution to take money out of one account and send it to another account (that may be at another financial institution). The remittance information tells the trading partner the purpose of the funds that were transferred and how to apply the funds.

One way that financial EDI differs from traditional EDI is that other parties are now involved; in addition to the buyer and the seller, there are the buyer's bank and the seller's bank. Another complication is that electronic funds transfers (EFTs) are not ANSI ASC X12 or EDIFACT transactions, but banking industry transactions.

Electronic Funds Transfer (EFT)

Surging international monetary exchange and other forms of cross-border investing continue to spur growth of funds transfer around the world. By early 1995, the SWIFT global funds transfer organization network of 4,300 banks was transferring more than 2.2 million messages per day, representing more than $2 trillion. U.S. EFT volumes also were prodigious -- the automated clearing-houses reported that their volumes had more than doubled from 1988 to 1994, to 2 billion transactions per year, according to the National Automated Clearinghouse Association and the Federal Reserve Board.

The U.S. government's long-running campaign to use EFT reached a crucial landmark in 1995. More than half of the 1 billion payments made by various federal agencies last year were electronic, after more than a decade of persuading suppliers and recipients to use EFT. This is an important milestone in the U.S. toward the 1997 deadline for moving most government suppliers to EDI.

Surging EFT volumes worldwide has attracted competition. One new player is Ibos, founded in 1991 by the Royal Bank of Scotland and Banco Santander of Spain. Although its transaction volume is a small fraction of SWIFT's -- Ibos officials hope to capture 10 percent of the international payments flow by the year 2000 -- the impact has been significant. Several other companies, with backing from telephone and airline companies, also have begun to offer EFT services to banks. In response, SWIFT began reengineering its operations to be more economical and business-driven. It cut prices by 30 percent and began offering other services, such as EDI.

Consumer funds transfer via telephone and PC has become commonplace. More than 250,000 U.S. consumers transmitted $9 billion in electronic payments from their computers via the CheckFree link to the automated clearing houses in 1995. Discount securities broker Charles Schwab & Co. says that one-third of its 15,000 daily transactions is transmitted by a PC or a telephone keypad. Several banks took inspiration from Schwab's financial incentive program -- it offers a 10 percent discount for electronic transactions -- to encourage their customers to use less-expensive electronic transaction services. Last year, major banks such as Citicorp and First National Bank of Chicago began offering financial incentives for customers who used automated teller machines, PCs, and telephones, rather than human tellers, to conduct financial transactions.

Smart Cards

The smart card offers an integrated circuit chip in a package that is the size of the familiar, plastic magnetic-stripe card. The smart card, however, introduces significant additional capabilities at a lower per-transaction cost than the magnetic card. It offers security, communications management, and portable database functions that are not available with magnetic-stripe cards.

The term smart card refers to one of three kinds of packages. Traditionally, it is a conventional plastic financial transaction card into which a small chip has been embedded. A set of contacts on the card's surface provides an interface for the chip. The chip usually has three components: an 8-bit microprocessor, a program, and a working memory. Power is supplied through the card acceptor device or terminal. The microprocessor card may contain portable databases, security architecture, communications management, a programmable computer, business controls, and a transaction journal.

A second kind of smart card is a hand-held package with one or more integrated circuits and a communications interface. These cards range from devices that look like bank cards, with small memories of less than 1,000 bits, to multimillion-byte packages that are as thick as 7 bank cards. Other configurations look like plastic keys, injectable modules, or a variety of shapes. Small memory cards are used to replace coins in public telephones in more than 70 countries, including France and Germany. The larger memory cards, a type of PC Card, are designed for use in a variety of hand-held, portable information devices and subnotebook-class computers. (See Chapter 1.2, *Storage Devices,* , and Chapter 2.5, *Mobile Systems,* .)

A third category is the contactless smart card. These devices have an IC and at least one communications interface, and they are hand-held or window-mounted. They are read by radio-frequency signals. These cards can be used to collect tolls as cars drive through toll plaza and to allow passengers to enter mass transit systems without turnstiles.

One feature that differentiates smart cards from magnetic-striped cards is how validation using personal identification numbers (PINs) is performed. When the user enters a PIN, the magnetic card must rely on communication with the system's remote databases to validate the PIN. A smart card stores the PIN and does the comparison locally.

The smart card can provide other security features. The card's microprocessor can be programmed with a series of responses to attack from physical and electrical sources. It can be used for holder authentication and for card and terminal authentication. Other uses include certification (checking the authenticity of data registered in the card) and electronic signature (guaranteeing data origin and integrity).

Digital Cash

Rising consumer and retailer interest in EC has led to the growth of hardware and software alternatives to traditional payment mechanisms. A new generation of smart cards has offset some of the security concerns. Current-generation smart cards, essentially credit cards with a few embedded microcircuits instead of a magnetic stripe, store modest monetary value (typically less than $25) along with user identification.

In addition to the Mondex venture, described below, U.S. banks are looking at several other currency tokens. Citicorp is developing its Electronic Monetary System, which would have the functionality of a debit card. The two interbank services, Mastercard International Inc. and Visa International, also plan to launch similar cash card projects in early 1996, after jointly issuing a common standard in mid-1995.

National Semiconductor Corp. and other firms have developed a "smarter" smart card. It includes a microprocessor and enough memory to store monetary value, user identification information, third-party certification, and encryption. Furthermore, the new generation of smarter smart cards uses the same form factor and electrical interfaces as PC Cards. Use of the PC Card format enables the new generation of smart cards to take the role of an electronic wallet, holding a variety of credit cards, a driver's license, and other information. Although the $249 cost of National Semiconductors' PersonaCard appears steep, the price is expected to drop to $100 once it is in volume production. (See Chapter 2.5, Mobile Systems, , for more information about PC Cards.)

In 1994 and 1995, several startup companies introduced software-based electronic cash. These companies, including First Virtual Holdings, CyberCash, and DigiCash, provide Internet users with electronic cash, which can be used for on-line shopping. Essentially, these companies provide software that offers a medium of exchange for use on the Internet, and can be converted to real money via an interface to the existing payments

network. CyberCash has partnered with Wells Fargo Bank N.A. and CheckFree to transmit consumer electronic drafts to the payees via the automated clearing-house network. By mid-1995, these pioneering projects had attracted a lot of media attention, although actual transaction totals remain confidential. Officials are reporting extraordinary volumes -- First Virtual Holdings says that the number of transactions is increasing at the rate of 16 percent per week.

Mondex

Mondex, a joint venture between National Westminster Bank and Midland Bank, has a pilot smart card-based system in the U.K. The system allows value to pass from one card to another account. It eliminates the need to verify every transaction with a central credit-approval system. Small readers and electronic wallets will tell people how much value their cards have at any given time. Each card contains a microprocessor and other semiconductors, and its reader uses a liquid-crystal display to show the value of the card. Consumers can use the card to pay for goods and services in stores and by using specially equipped telephones.

The Mondex service was launched in July 1995. The sponsors predict that more than 40,000 cards will be in use within a year. Cash value can be downloaded via telephone or automated teller machine. A maximum of #500 (approximately $800) was allowed to be stored on the Mondex card for the trial run in Swindon, England. Canadian and U.S. banks, including Wells Fargo and Marine Midland Bank, also are considering participating in the Mondex trial.

First Virtual Holdings

First Virtual Holding's system is particularly appealing to information businesses that engage in small transactions and need the Internet to find viable audiences. The system is now in operation, using Electronic Data Systems (EDS) Inc.'s service. Sensitive information such as credit-card and bank-account numbers never travel over the Internet, nor is it stored on servers accessible to the Internet. In 1996, First Virtual Holdings is expected to announce a program for any bank worldwide to participate in its system.

First Virtual Holdings uses a model where merchants fulfill orders immediately; First Virtual sends confirmation separately over E-mail, then awaits buyers' authentication before charging their credit cards. Buyers may decline to pay, but First Virtual monitors purchase patterns and closes abusers' accounts. Enrolling as a First Virtual Holdings buyer or merchant is simple and does not require special software or hardware. In the long term, First Virtual Holdings may become one of several different commonly accepted electronic-payment schemes.

CyberCash

CyberCash seeks to offer technology that speeds the secure placement of orders and passes the information directly to the existing banking and credit-card payment infrastructure for authorization. CyberCash's first partner is Wells Fargo. Potential users of CyberCash must apply for an account and download special software that encrypts and transmits payment information. When buyers press a "pay" button on a WWW page, it activates a form that asks for the buyer's account information. The buyer's account is then debited for the amount due.

CyberCash is also working on a peer-to-peer electronic cash system that will allow any CyberCash account holder to exchange cash without intervention from a server. CyberCash expects this system to help launch a market for small electronic transactions, such as payments for publications or database searches.

DigiCash

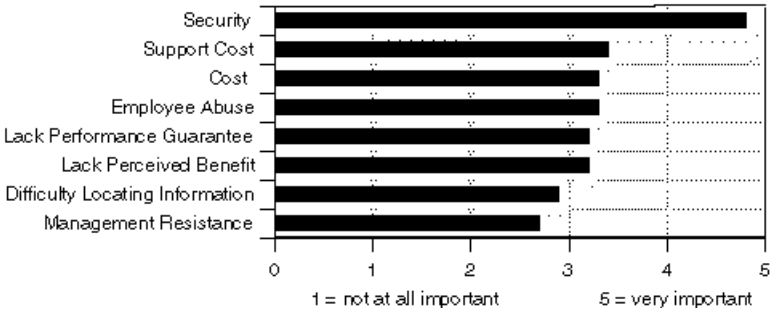
DigiCash has proposed a system that uses untraceable digital cash. Founder David Chaum, a long-time innovator in public-key cryptography, feels strongly that there should be a way for people to protect themselves from inappropriate use of their personal information. His answer is ecash, a system that uses "blind" digital signatures to certify that the digital payment units have value, without betraying the identity of their owner. In fact, one million dollars of ecash are in circulation now as part of DigiCash's first operational pilot project. That money is cleared by DigiCash's First Digital Bank.

An account holder submits a digitally signed withdrawal note to the bank with the note information encrypted. The bank verifies the customer's signature, then removes that signature and applies its own, which certifies that the resulting message now has transferable value. The note is then returned to the buyer, who forwards it to the seller. The bank cannot trace the note, however, and does not know where it is spent because of the blinding factors. DigiCash's technology operates on a minimal-need-to-know basis, with trusted virtual intermediaries that monitor the transaction and confirm its authority along the way. Value gets transferred and people are paid, but nobody knows who was involved in the transaction.

6.4.4 Security Issues

The Graphic Visualization Usability Center (affiliated with Georgia Tech's College of Computing) found in its third *WWW User Survey* that security is the primary objection to performing financial transactions over the Internet. More than 60 percent of the survey respondents, who could be considered experienced Internet users, said it would be "just plain foolish" to provide credit information on-line. Figure 6-13 illustrates the results of a Yankee Group survey of 200 IT managers at large organizations who listed security as the main reason for delaying Internet implementation.

Figure 6-13: Reasons for Delaying Internet Implementation



Source: Yankee Group, 1995

Transmitting sensitive account information, such as credit-card numbers, over the public Internet scares corporate treasurers and experienced IT managers, and many decline to extend the services offered on their Web sites beyond product catalogs to actual transactions. Headlines about hackers in *The Wall Street Journal* do nothing to assuage these fears. However, the rise of Web browsers and servers equipped with encryption software promise to reduce data security issues.

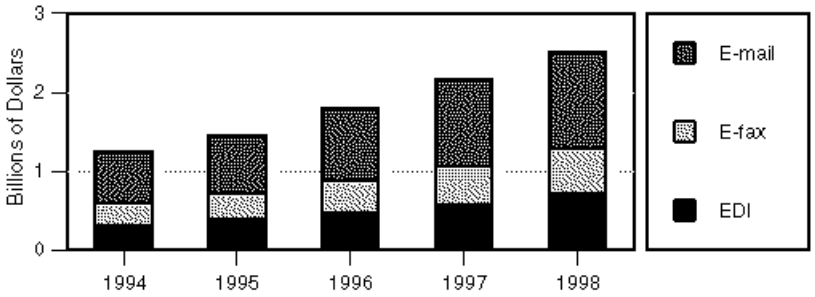
Public-key encryption concepts and algorithms developed and licensed by RSA Data Security Inc. became the de facto feature of commercial browsers. In 1994 and 1995, CompuServe, Netscape Communications Corp., MCI, and other EC infrastructure providers incorporated RSA's technology into their products.

6.4.5 Market Overview

Figure 6-14 shows that the total market for EC software and services revenue was around $1.5 billion in 1995, but is expected to increase 65 percent to $2.5 billion by 1998, according to IDC. However, other market observers insist that the total is far higher -- the EDI Group estimates North American EDI revenue at more than $2 billion, and predicts that it will exceed $3 billion by 1997. BIS Strategic Decisions pegged EC products and services as a $4.5 billion business in 1994. Others estimate that home

banking alone already generates nearly $1 billion in sales of software, communications services, and fees.

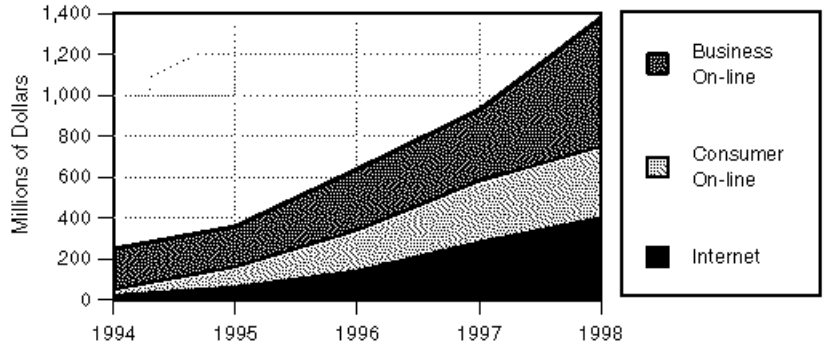
Figure 6-14: Worldwide EC Revenues of U.S.-Based Providers



Source: IDC, 1994

Interest in using the Internet for EC may have overtaken EDI penetration. A *Network World* survey in early 1995 found that one-third of the 522 respondents were already using the Internet for EC. Furthermore, half of the respondents predicted that they would be doing EC over the Internet by the end of 1995. Similarly, SIMBA Information projects that Internet-based sales will grow by more than 2,000 percent by the end of 1998. (See Figure 6-15.)

Figure 6-15: Electronic Marketplace Transaction Revenue

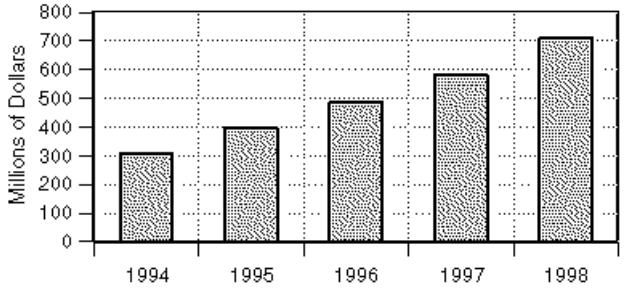


Source: SIMBA Information, 1995

Electronic Data Interchange (EDI)

IDC estimates that almost 121,000 companies used EDI in 1995, and predicts that the total will triple by 1998. The EDI Group estimates that the typical large OEM had 192 trading partners using EDI in 1993, but 261 by 1994, increasing its EDI usage from 17 percent of trading partners to more than 34 percent. These large companies are adding 100 additional trading partners or customers per year. IDC estimates that 86 percent of EDI revenues were generated in the U.S. in 1993, but that proportion is expected to fall to 68 percent by 1998 as more European and Asian firms and third parties expand their offerings. (See Figure 6-16.)

Figure 6-16: Worldwide EDI Revenues of U.S.-Based Providers



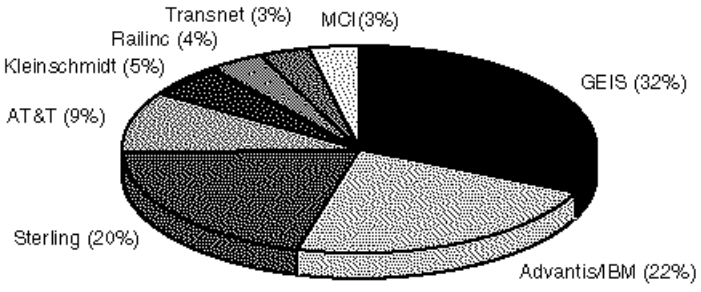
Source: IDC, 1994

More than a dozen EDI VANs, including General Electric Information Services (GEIS), Sterling Software Inc., Advantis, and EDS, are experiencing soaring revenues even as the Internet threatens to become a far lower cost-per-transaction conduit. Gartner estimates that the EDI VANs recorded $240 million in revenue in 1993, up 40 percent from 1992 sales. Furthermore, it predicts a 40 percent annual increase in revenue from 1994 to 1996, in part due to new government and health care EDI mandates; IDC predicts a 24 percent compound annual growth rare.

EDI VANs and software vendors responded to the rise in demand for UNIX-based software and hardware by reworking their products for that platform. The move to UNIX for EDI activities led to more widespread use of graphical user interfaces such as Motif.

Figure 6-17 shows that GEIS is considered the leading EDI VAN, with roughly 32 percent of the worldwide market, according to IDC. Advantis, developed by IBM and Sears, and Sterling each have at least 20 percent. Meanwhile, EDS is leveraging its EDI offerings, along with its services for General Motors Corp. and other large corporations, into a position as a leading transactions facilitator for EC over the Internet and its private network. Traditional network carriers AT&T, MCI, and Sprint Corp. also are enhancing their existing operations to offer EC services, including Internet linkages.

Figure 6-17: Worldwide EDI Revenues by Service Provider



Source: IDC, 1994

Continuing media exposure and the rapid growth of the Internet has forced existing VAN providers of EC services to improve the ease of use of their software. EDS, Sterling, GEIS, and others integrated their EDI offerings with the Internet in 1995. Furthermore, GEIS and other EDI VANs now offer electronic commerce services over the Microsoft Network. IBM plans to use Lotus Notes as the basis for an EC offering over its Global Network.

However, the cost of using EDI software and VANs to perform EC and the relative lack of security of the Internet has led many customers to try to combine the two approaches. In response, EDI software vendor Premenos Corp. announced the Templar suite of software and services in May 1995 to provide integrated EDI services over the Internet. A half-dozen companies, including electronics distributor Avex Electronics Inc. and networking gear maker Cisco Systems Inc., are already using Templar and have experienced a significant reduction in EDI costs. BIS Strategic Decisions estimates that the cost of EDI over the Internet is 10 percent to 30 percent the cost of VANs.

In September 1995, Lawrence Livermore National Laboratory and Bank of America announced a new Internet-based financial EDI pilot in which Livermore will issue EDI payment orders to Bank of America, which will then pay vendors. Livermore will send standard ANSI ASC X12 EDI transactions, using a Trusted Information Systems Inc.'s Privacy Enhanced Mail product.

Leading International EDI VANs and their Strategies

- **General Electric Information Services (GEIS)**

GEIS secured its position as a leading EC provider by various moves in 1994 and 1995. It joined the Microsoft Network to provide EDI services to the millions of small businesses expected to use the on-line service. It reworked its EDI software and service to provide simple transaction capabilities for small businesses who are required by their large customers to conduct business via EDI. GEIS is expected to expand the number of organizations participating in electronic commerce dramatically.

GEIS also joined the CommerceNet project, a nonprofit venture partially funded by the U.S. government to smooth out the security and infrastructure wrinkles in Internet-based EC. It also unveiled its Business Network bundle of EDI services and Internet access. With a $472 million investment by Ameritech Corp. in mid-1994, GEIS gained access to that Regional Bell Operating Company's operations in New Zealand, Norway, Poland, Hungary, and Switzerland. GEIS continues to enhance its extensive array of specialized services, such as supply chain management support, photo exchange services, and sales force automation.

- **Advantis**

Advantis, developed by IBM and Sears to combine their payment processing network, continues to grow into a thriving commercial venture, including EC-related services. Advantis announced a broad-based series of products and services designed to provide EC over the Internet in late 1994, after being the first VAN to join CommerceNet. Advantis began offering dial-up and leased line access to the Internet. In 1995, Advantis was combined with IBM's non-U.S. network to become the U.S. operating arm of IBM's Global Network. The acquisition of Lotus Development Corp. by IBM is expected to lead to the availability of the Lotus Notes groupware software on Global Network, as an enabler of electronic commerce.

- **Sterling**

Sterling has provided EDI services since 1975, primarily for IBM mainframes and minicomputers. In 1995, it introduced a Windows-based client for its EDI software, along with improved E-mail and EDI linkages. Recognizing the movement toward client/server environments, Sterling acquired the UNIX-based EDI vendor American Business Computer Inc. in 1995.

- **Electronic Data Systems (EDS)**

EDS' EC activities revolve around its role as a back-office transaction process for banks, retailers, and government-paid health care providers. It services more than 14.8 million credit-card accounts and 245,000 merchants. EDS has expanded its visibility as an EC player, joining CommerceNet and providing financing for one of the early Internet entrees, the First Virtual Holdings transaction service. It also invested in Ibos. Gartner predicts that EDS' EC activity will remain focused on back-office services for governments, banks, and its corporate parent, General Motors.

Consumer-Oriented Electronic Commerce

Consumer-oriented on-line services have matured as EC conduits, too. CompuServe reports soaring transaction volumes, up 50 percent per year during the past five years, though it was not specific about the dollar amounts or nominal unit volumes. Although less than 5 percent of U.S. retail, wholesale, and mail-order purchases were electronic in 1994, that figure is expected to triple by the year 2000, according to Killen & Associates. CompuServe announced that its 170-store Electronic Mall would be accessible via the Internet by the end of 1995, opening up a vast new customer base as well as creating a surge of transactions to be processed over its network; it also offers a private-label Visa card. Prodigy and America Online (AOL) Inc. also continued to expand and enhance their EC offerings.

By the end of 1995, however, AOL, CompuServe, and Prodigy are expected to be joined by a host of other on-line network providers offering EC and Internet access. Microsoft's Windows 95 operating system includes easy access to its Microsoft Network, which also includes Internet access. EC, especially on-line bill payments, is one of the primary goals of Microsoft's on-line service.

Major financial institutions are moving into commercial and consumer EC services as well. In mid-1995, 14 money center banks led by Bank of America, Chase Manhattan, Mellon Bank Corp., First Chicago, and NationsBank launched EDI Bank Alliance Network Exchange (EDIBANX). Essentially, EDIBANX combines the financial institutions' automated clearing-house capabilities with the VANs' EDI access to provide a broader base of more-integrated services. Dozens of banks announced alliances with personal finance software makers Intuit Inc., MECA Software Inc., and Microsoft in 1995. These alliances will enable consumers and small businesses to check balances, transfer funds, and perform other banking transactions with their PCs.

In the U.S., Microsoft's personal finance package, Microsoft Money, is being offered by more than a dozen large banks that will provide funds transfer and other services. Intuit also lined up dozens of banks that will offer on-line linkages between their accounts and Quicken personal finance software. Bank of America and NationsBank purchased the Managing Your Money software package from CompuServe parent H&R Block Inc., as part of their strategy to compete against Microsoft and its personal finance software and network.

Meanwhile, large and medium-sized banks are setting up home pages and EC services via the Internet. A few leading-edge banks, led by Marquette Banks, NationsBank, and Wells Fargo, offer a range of EC services, such as account balance information, transfers, and investments. Last year, other financial institutions, such as Smith Barney Inc. and American Express Co., offered account access via private networks such as Prodigy and AOL as well as Internet home pages. Although a transaction facility over the Internet from established financial services companies was rare in mid-1995, the firms have promised broader capabilities via the Internet in the future. Though market expansion is a primary spur to their actions, cost efficiency is almost as compelling -- providing transaction services without human intervention saves money.

6.4.6 Forecast

- As business process reengineering continues, more organizations will turn to EC, in traditional and new forms, to increase efficiency.

- A host of new Internet-based EC ventures will emerge and fade. More than a half-dozen electronic cash models have been proposed to facilitate Internet commerce. Some are in operation and use established payment mechanisms, such as the credit card, EDI VANs, and on-line services. The new names lack brand name recognition that provides confidence to leery customers. In addition, some of the new ventures have fragile and somewhat complicated infrastructures and lack economies of scale.

- As security issues are resolved on the Internet, consumers will move to the less-expensive, more information-rich Internet. This transition should occur by 1998.

- AOL, CompuServe, and Prodigy have the established brand names and infrastructure. As their Internet and EC services are fleshed out, they could become more competitive against the newcomers and dominate the consumer market.

- Advantis, GEIS, Sterling, and other EDI VANs will change into corporate Internet EDI providers. Their business models will be severely tested by the economics of the Internet.

- EDI networks and VANs will continue to grow for large-value EC between trading partners. The Internet will be increasingly used for small-value transactions for the next few years. As the Internet becomes more secure and reliable, its use may grow for business-to-business transactions.

- The credit-card companies, Visa and Mastercard, will adapt a single specification for EC, and will be a major processor of electronic transactions.

- RSA's algorithm will be utilized by most Internet-based systems due to its public- and private-key mechanisms.