e-Commerce

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1. History of e-Commerce

In this Chapter we will discuss

- The initial business data interchange efforts.
- Evolution of e-commerce concept.
- Advantages and Disadvantages of e-commerce.
- Development of internet as an e-commerce platform.
- Indian corporate hurdles in transition to e-commerce.

Structure of the chapter

1.1. Early Business Information Interchange Efforts

The emergence of large business organizations in the late 1800s and early 1900s triggered the need to create and maintain formal records of business transactions. In the 1950s, companies began to use computers to store and process internal transaction records, but the information flows between businesses continued to be on paper. Purchase orders, invoices, bills of lading, cheques, remittance advices, and other standard forms were used to document transactions.

The process of using a person or a computer to generate a paper form, mailing that form, and then having another person enter the data into the trading partner's computer was slow, inefficient, expensive, redundant, and unreliable. By the 1960s, businesses that engaged in large volumes of transactions had begun exchanging transaction information on punched cards or magnetic tape. Advances in data communications technology eventually allowed trading partners to transfer data over telephone lines instead of shipping punched cards or magnetic tapes to each other.

Although these information transfer agreements between trading partners increased efficiency and reduced errors, they were not an ideal solution. Since the translation programs that one trading partner wrote usually would not work for other trading partners, each company participating in this information exchange had to make a substantial investment in computing infrastructure. Only large trading partners could afford this investment, and even those companies had to have a significant number of transactions to justify the cost. Smaller-or lower-volume trading partners could not afford to participate in the benefits of these paper-free exchanges.

In 1968, a number of freight and shipping companies joined together to form the Transportation Data Coordinating Committee (TDCC), which was charged with exploring ways to reduce the paperwork burden that shippers and carriers faced. The TDCC created a standardized information set that included all the data elements that shippers commonly included in bills of lading, freight invoices, shipping manifests, and other paper forms. Instead of printing a paper form, shippers could transform information about shipments into a computer file that conformed to the TDCC standard format. The shipper could electronically transmit that computer file to any freight company that had adopted the TDCC format. The freight company translated the TDCC format into data it could use in its own information systems. The savings from not printing and handling forms, not entering the data twice, and not having to worry about error-correction procedures were significant for most shippers and freight carriers.

After a decade of fragmented attempts at setting broader EDI standards, a number of industry groups and several large companies decided to make a major effort to create a set of cross-industry standards for electronic components, mechanical equipment, and other widely used items. The American National Standards Institute (ANSI) has been the coordinating body for standards in the United States since 1918. ANSI does not set standards, though it creates procedures and organizational standards for the development of national standards and accredited committees that follow those procedures.

In 1979, ANSI chartered a new committee to develop uniform EDI standards. This committee is called the Accredited Standards Committee XI2 (ASC XI2). The committee meets three times a year to develop and maintain EDI standards. The committee and its subcommittees include information technology professionals from over 800 businesses and other organizations. Membership is open to organizations and individuals who have an interest in the standards. The ASC XI2 standard has benefitted from the participation of members from a wide variety of industries. This standard currently includes specifications for several hundred transaction sets, which are the names of the formats for specific business data interchanges.

In 1987, the United Nations published its first standards under the title EDI for Administration, Commerce, and Transport (EDIFACT, or UN/EDIFACT). As the Internet gained prominence as a tool for conducting business, the trading partners who had been using EDI began to view the Internet as a potential replacement for the expensive leased lines and dial-up connections they had been using. Companies that were unable to afford EDI began to look at the

Internet as an enabling technology that might get them back in the game of selling to a large number of customers who demanded EDI capabilities of their suppliers.

The major hurdles to conducting EDI over the Internet initially were general concerns about security and the Internet's general inability to provide audit logs and third-party verification of message transmission and delivery. The lack of third-party verification continues to be an issue, since the Internet has no built-in facility for that. Because EDI transactions are business contracts and often involve large amounts of money, the issue of non-repudiation causes significant concern.

1.2 History of e-Commerce

One of the most popular activities on the Web is shopping. It has much allure in it – you can shop at your leisure, anytime, and in your pajamas. Literally anyone can have their pages built to display their specific goods and services.

History of ecommerce dates back to the invention of the very old notion of “sell and buy”, electricity, cables, computers, modems, and the Internet. Ecommerce became possible in 1991 when the Internet was opened to commercial use. Since that date thousands of businesses have taken up residence at web sites.

At first, the term ecommerce meant the process of execution of commercial transactions electronically with the help of the leading technologies such as Electronic Data Interchange (EDI) and Electronic Funds Transfer (EFT) which gave an opportunity for users to exchange business information and do electronic transactions. The ability to use these technologies appeared in the late 1970s and allowed business companies and organizations to send commercial documentation electronically.

Although the Internet began to advance in popularity among the general public in 1994, it took approximately four years to develop the security protocols (for example, HTTP) and DSL which allowed rapid access and a persistent connection to the Internet. In 2000 a great number of business companies in the United States and Western Europe represented their services in the World Wide Web. At this time the meaning of the word ecommerce was changed. People began to define the term ecommerce as the process of purchasing of available goods and services over the Internet using secure connections and electronic payment services. Although the dot-com collapse in 2000 led to unfortunate results and many of ecommerce companies disappeared, the “brick and mortar” retailers recognized the advantages of electronic commerce and began to add such capabilities to their web sites (e.g., after the online grocery store Webvan came to ruin, two supermarket chains, Albertsons and Safeway, began to use ecommerce to enable their customers to buy groceries online). By the end of 2001, the largest form of ecommerce, Business-to-Business (B2B) model, had around $700 billion in transactions.

According to all available data, ecommerce sales continued to grow in the next few years and, by the end of 2007, ecommerce sales accounted for 3.4 percent of total sales.

e-commerce has a great deal of advantages over “brick and mortar” stores and mail order catalogs. Consumers can easily search through a large database of products and services. They can see actual prices, build an order over several days and email it as a “wish list” hoping that someone will pay for their selected goods. Customers can compare prices with a click of the mouse and buy the selected product at best prices.

Online vendors, in their turn, also get distinct advantages. The web and its search engines provide a way to be found by customers without expensive advertising campaign. Even small online shops can reach global markets. Web technology also allows to track customer preferences and to deliver individually-tailored marketing.

History of ecommerce is unthinkable without Amazon and Ebay which were among the first Internet companies to allow electronic transactions. Thanks to their founders we now have a handsome ecommerce sector and enjoy the buying and selling advantages of the Internet. Currently there are 5 largest and most famous worldwide Internet retailers: Amazon, Dell, Staples, Office Depot and Hewlett Packard. According to statistics, the most popular categories of products sold in the World Wide Web are music, books, computers, office supplies and other consumer electronics.

Amazon.com, Inc. is one of the most famous ecommerce companies and is located in Seattle, Washington (USA). It was founded in 1994 by Jeff Bezos and was one of the first American ecommerce companies to sell products over the Internet. After the dot-com collapse Amazon lost its position as a successful business model, however, in 2003 the company made its first annual profit which was the first step to the further development.

At the outset Amazon.com was considered as an online bookstore, but in time it extended a variety of goods by adding electronics, software, DVDs, video games, music CDs, MP3s, apparel, footwear, health products, etc. The original name of the company was Cadabra.com, but shortly after it become popular in the Internet Bezos decided to rename his business "Amazon" after the world's most voluminous river. In 1999 Jeff Bezos was entitled as the Person of the Year by Time Magazine in recognition of the company's success. Although the company's main headquarters is located in the USA, WA, Amazon has set up separate websites in other economically developed countries such as the United Kingdom, Canada, France, Germany, Japan, and China. The company supports and operates retail web sites for many famous businesses, including Marks & Spencer, Lacoste, the NBA, Bebe Stores, Target, etc.

Amazon is one of the first ecommerce businesses to establish an affiliate marketing program, and nowadays the company gets about 40% of its sales from affiliates and third party sellers who list and sell goods on the web site. In 2008 Amazon penetrated into the cinema and is currently sponsoring the film "The Stolen Child" with 20th Century Fox.

According to the research conducted in 2008, the domain Amazon.com attracted about 615 million customers every year. The most popular feature of the web site is the review system, i.e. the ability for visitors to submit their reviews and rate any product on a rating scale from one to five stars. Amazon.com is also well-known for its clear and user-friendly advanced search facility which enables visitors to search for keywords in the full text of many books in the database.

One more company which has contributed much to the process of ecommerce development is Dell Inc., an American company located in Texas, which stands third in computer sales within the industry behind Hewlett-Packard and Acer.

Launched in 1994 as a static page, Dell.com has made rapid strides, and by the end of 1997 was the first company to record a million dollars in online sales. The company's unique strategy of selling goods over the World Wide Web with no retail outlets and no middlemen has been admired by a lot of customers and imitated by a great number of ecommerce businesses. The key factor of Dell's success is that Dell.com enables customers to choose and to control, i.e. visitors can browse the site and assemble PCs piece by piece choosing each single component based on their budget and requirements. According to statistics, approximately half of the company's profit comes from the web site.

In 2007, Fortune magazine ranked Dell as the 34th-largest company in the Fortune 500 list and 8th on its annual Top 20 list of the most successful and admired companies in the USA in recognition of the company's business model.

History of ecommerce is a history of a new, virtual world which is evolving according to the customer advantage. It is a world which we are all building together brick by brick, laying a secure foundation for the future generations.

1. 3 Emergence of the Internet

The role of the Internet in the evolution of e-commerce has been so crucial that the history of e-commerce will remain incomplete without the inclusion of the history of the Internet.

In recent years, the Internet has allowed commercial enterprises to connect with one another and with customers. Today, all kinds of businesses provide information about their products and services on the Internet. Many of these businesses use the Internet to market and sell their products and services. The part of the Internet known as the World Wide Web, or, more simply, the Web, is a subset of the computers on the Internet that are connected to each other in a specific way that makes those computers and their contents easily accessible to each other. The most important thing about the Web is that it includes an easy-to-use standard interface. This interface makes it possible for people who are not computer experts to use the World Wide Web to access a variety of Internet resources.

In the early 1960s, the US Department of Defense became very much concerned about the possible effects of a nuclear attack on its computing facilities. The Defense Department realized the need for powerful computers for coordination and control. The powerful computers of that time were all large mainframe computers. So the Defense Department began examining ways to connect these computers to each other and also to weapon installations that were distributed all over the world. The Defense Department agency, charged with this task, hired many of the best communications technology researchers and funded research at leading universities and institutes to explore the task of creating a worldwide network that could remain operational even if parts of the network were destroyed by enemy military action or sabotage. These researchers worked to devise ways to build networks that could operate independently—that is, networks that would not require a central computer to control network operations.

The world's telephone companies were the early models for networked computers, because early networks of computers used leased telephone company lines for their connections. Telephone company systems of that time established a single connection between sender and receiver for each telephone call, and that connection carried all the data along a single path. When a company wanted to connect computers it owned at two different locations, it placed a telephone call to establish the connection and then connected one computer to each end of that single connection.

The Defense Department was concerned about the inherent risk of this single-channel method for connecting computers. So its researchers developed a different method of sending information through multiple channels. In this method, files and messages are broken into packets and labelled electronically with codes about their origin and destination. The packets travel from computer to computer along the network until they reach their destination. The destination computer collects the packets and reassembles the original data from the pieces in each packet. Each computer that an individual packet encounters on its trip through the network, determines the best way to move the packet forward to its destination.

In 1969, these Defense Department researchers used this network model to connect four computers—one each at the University of California at Los Angeles, SRI International, the University of California at Santa Barbara, and the University of Utah. During the subsequent years, many researchers in the academic community connected to this network and contributed to technological developments that increased the speed and efficiency with which the network operated. At the same time, researchers at other universities were creating their own networks using similar technologies.

The upshot was the Internet Protocol (IP), which enabled any number of computer networks to link up and act as one—and eventually it was given the name, the Internet.

Growth of the Internet

In 1991, the NSF further eased its restrictions on Internet commercial activity and began implementing plans to privatize the Internet. The privatization of the Internet was substantially completed in 1995, when the NSF turned over the operation of the main Internet connections to a group of privately owned companies. The new structure of the Internet was based on four Network Access Points (NAPs), each operated by a separate company. These companies, which are known as network-access providers, sell Internet access rights directly to larger customers and indirectly to smaller firms through other companies, called Internet Service Providers (ISPs).

The Internet was a phenomenon that truly sneaked into an unsuspecting world. The researchers who had been so involved in the creation and growth of the Internet just accepted it as a part of their working environment. People outside the research community were largely unaware of the potential offered by a large interconnected set of computer networks.

Within 30 years, the Internet became one of the most amazing technological and social accomplishments of the 20th century. Millions of people are using today this complex, inter-connected network of computers. These computers run thousands of different software packages. The computers are located in almost every country of the world. Every year, billions of dollars change hands over the Internet in exchange for all kinds of products and services. All of this activity occurs with no central coordination point or control, which is especially interesting, given that the Internet began as a way for the military to maintain control while under attack.

The opening of the Internet to business activities helped increase the Internet's growth dramatically; however, there was another development that worked hand in hand with the commercialization of the Internet to spur its growth. That development was the World Wide Web (WWW).

1.4 Advantages of E-commerce

Some of the key strengths of using the Internet for businesses include the following:

1. 24 x 7 operation:

Round-the-clock operation is an expensive proposition in the 'brick-and-mortar' world, while it is natural in the 'click-and-conquer' world.

2. Global reach:

The net being inherently global, reaching global customers is relatively easy on the net compared to the world of bricks.

3. Cost of acquiring, serving and retaining customers:

It is relatively cheaper to acquire new customers over the net; thanks to 24 x 7 operation and its global reach. Through innovative tools of 'push' technology, it is also possible to retain customers' loyalty with minimal investments.

4. An extended enterprise is easy to build:

In today's world every enterprise is part of the 'connected economy'; as such, you need to extend your enterprise all the way to your suppliers and business partners like distributors, retailers and ultimately your end-customers. The Internet provides an effective (often less expensive) way to extend your enterprise beyond the narrow confines of your own organization. Tools like enterprise resource planning (ERP), supply chain management (SCM) and customer relationship management (CRM), can easily be deployed over the Internet, permitting amazing efficiency in time needed to market, customer loyalty, on-time delivery and eventually profitability.

5. Disintermediation:

Using the Internet, one can directly approach the customers and suppliers, cutting down on the number of levels and in the process, cutting down the costs.

6. Improved customer service to your clients:

It results in higher satisfaction and more sales.

7. Power to provide the 'best of both the worlds:

It benefits the traditional business side-by-side with the Internet tools.

8. A technology-based customer interface:

In a brick- and-mortar business, customers conduct transactions either face-to-face or over the phone with store clerks, account managers, or other individuals. In contrast, the customer interface in the electronic environment is a 'screen-to-face' interaction. This includes PC based monitors, ATM machines, PDAs, or other electronic devices such as the DoCopMo iMode in Japan and the Nokia 7100 in Europe. Operationally, these types of interfaces place an enormous responsibility on the organization to capture and represent the customer experience because there is often no opportunity for direct human intervention during the encounter. If the interface is designed correctly, the customer will have no need for a simultaneous or follow-up phone conversation. Thus, the 'screen-to-customer' interface has the potential to both increase sales and decrease costs. In fact, a number of innovators are entering the e-commerce markets with solutions that reintroduce humans into the process, such as the service representatives available on demand for Web users at www.liveperson.com. When the interface does not work, not only is the revenue lost but the organization also incurs the technology costs. Thus, a poorly designed customer interface has both negative revenue and cost implications.

9. The customer controls the interaction:

At most websites, the customer is in control during screen-to-face interaction, in that the Web largely employs a 'self service' model for managing commerce or community-based interaction. The customer controls the search process, the time spent on various sites, the degree of price/product comparison, the people with whom he or she comes in contact, and the decision to buy. In a face-to-face interchange, the control can rest with either the buyer/seller or the community member. At a minimum, the seller attempts to influence the buying process by directing the potential buyer to different products or locations in the store, overcoming price objections and reacting in real item to competitive offering. The virtual store can attempt to shape the customer experience with uniquely targeted promotions, reconfiguration of storefronts to reflect past search behaviour, recommendations based on previous behaviour of other similar users, and access to proprietary information. However, the seller has much less power in the online environment due to the control and information flows that the online world puts in customer's hands.

10. Knowledge of customer behaviour:

While the customer controls the interaction, the firm has unprecedented access to observe and track individual consumer behaviour. Companies, through a third-party measurement firm such as Vividence and Accrue, can track a host of behaviours on websites visited, length of stays on a site, page views on a site, contents of wish lists and shopping carts, purchases, dollar amounts of purchases, repeat purchases behaviour, conversion rates of visitors who have completed transactions and other metrics. This level of customer behaviour tracking, in contrast with tracking consumer attitudes, knowledge or behavioural intentions, is not possible in the brick-and-mortar world. Armed with this information, companies can provide one-to-one customization of their offerings. In addition, companies can dynamically publish their storefronts on the Web to configure offerings to individual customers. In a tactical embellishment, electronic retailers can welcome a user back by name. In more strategic terms, an online business can actually position offers and merchandise in ways that uniquely appeal to specific customers.

11. Network economics:

In information intensive industries, a key competitive battleground centres on the emergence of industry-standard products, services, components, and or architecture. Network effects, as described by Metcalfe's law, can best be expressed as the situation where the value of a product or service rises as a function of the number of other users who are using the product. A classic example is the fax machine of other people who adopt the technology. A key characteristic of network's economic is positive feedback, that is, as the installed base grows, more and more users are likely to adopt the technology because of the installed base. Many commercial wares in the digital economy revolve around setting a standard, growing the installed base and attempting to 'lock-in* customers to the standard because of rising switching costs. This applies to both hardware (e.g. cable modems versus DSL lines) and software (e.g. MP3 versus streaming audio). A key result of network effects and positive feedback is 'increasing return' economies as compared to the traditional decreasing-retums model often associated with the brick-and-mortar world. It also means that the traditional realities of marketing such as the importance of word-of-mouth (WOM) among potential customers, become greatly magnified in this new environment. It is this turbocharged WOM phenomenon that makes viral marketing a reality for consumer-oriented e-commerce business such as ICQ in instant messaging system.

1.5 Disadvantages of E-commerce

Some business processes may never lend themselves to electronic commerce. For example, perishable foods, and high-cost items (such as jewellery, antiques, and the like), may be difficult to inspect from a remote location, regardless of any technologies that might be devised in the future. Most of the disadvantages of electronic commerce today, however, stem from the newness and rapidly developing pace of the underlying technologies. These disadvantages will disappear as e-commerce matures and becomes more and more available to and gets accepted by the general population. Many products and services require a critical mass of potential buyers who are well-equipped and willing to buy through the Internet.

Businesses often calculate the return-on-investment before committing to any new technology. This has been difficult to do with e-commerce, since the costs and benefits have been hard to quantify. Costs, which are a function of technology, can change dramatically even during short-lived e-commerce implementation projects, because the underlying technologies are changing rapidly. Many firms have had trouble in recruiting and retaining employees with technological, design, and business process skills needed to create an effective e-commerce atmosphere. Another problem facing firms that want to do business on the Internet is the difficulty of integrating existing databases and transaction-processing software designed for traditional commerce into a software that enables e-commerce.

In addition to technology and software issues, many businesses face cultural and legal obstacles in conducting e-commerce. Some consumers are still somewhat fearful of sending their credit card numbers over the Internet. Other consumers are simply resistant to change and are uncomfortable viewing merchandise on a computer screen rather than in person. The legal environment in which e-commerce is conducted is full of unclear and conflicting laws. In many cases, government regulators have not kept up with the trends in technologies.

1.6 E-transition Challenges for Indian Corporates

Some issues that Indian corporates face while e-transforming themselves are worth delving into, in the following manner:

1.6.1 Internal Resisting Issues

Bureaucratic wrangles:

With organizations e-transforming themselves, the old ways of doing things are being replaced by new ways which destabilize the existing power equations. The fear of this among the staff is a significant barrier to the organizational transformation.

Cultural changes:

The e-biz team spearheading the e-com initiatives in an organization, mostly consists of young, externally recruited, tech savvy populace who maintain a 'skunkwork' like culture. This open culture may be in direct conflict with the already established culture in the organization and may force the old-timers to oppose any change.

Not many are prepared:

A survey by the GIIC found out that only 20 per cent of the organizations covered under the CIO segment are trying to use e-commerce at least to some extent. Eighty per cent of the industry is in the process of gearing up for the show, such as banks and sectors like IT, courier, travel and transport.

Lack of skill and training:

Lack of skill and training within a company (28 per cent) and lack of funds (24 per cent) are other factors impeding the implementation of IT in companies. Most of these companies are from traditional businesses like manufacturing, travel, transport and education.

1.6.2 External Driving Factors

Sheer necessity:

No one will dispute the argument that any business will benefit if it cuts down the processing time for a transaction. E-commerce does exactly this—it increases process efficiency by reducing transaction time and this can have a significant impact on cash flows and the bottom line.

Big business, the driving factor:

Business entities will themselves be the key drivers. The big bosses of the industries will be the guiding and forcing factor for SMEs to adopt the Internet. A good example is that of Cisco which has mandated that it will deal with its suppliers, dealers and partners only if they are Web-enabled. The partners, whether they like it or not, have been forced to make the change. If the same happens in India and companies like HLL, Maruti, TELCO, Reliance Industries and other major players in their respective segments make it mandatory to have their dealers, suppliers and others linked to their supply chain on the Internet, one can imagine the stampede that will ensue. Sooner or later, these companies must have their supply chain e-driven, if they are to compete in the global market, and this again will lead to growth in the B2B segment.

Global market:

If you are looking at 'the world as your market', e-commerce will fit in neatly with your plans. Globalization is forcing organizations to achieve new competitive levels in order to enter the world market. So if we are late to react, we shall lose the early-entrant advantage and a whole lot of market share. It is imperative that we get on to the e-commerce bandwagon for the sheer efficiencies that it can generate.

Value for money:

Purely from the customer's perspective, e-commerce will be one of the'. key factors in propelling B2C growth in the Indian market. The driving factors for the B2C segment will be convenience, low cost to end-consumers and a wider choice. If you take a look at the products available on rediff.com, this point will be clear. Most products are available at discounts of 20-50 per cent over the price in the physical world. Besides, the opportunity of comparing prices on two different sites is just a click away and you will then avail the best option available.

No-entry barriers:

The good thing about the Internet is that one does not need deep pockets to be successful. The Internet is an upstart's paradise. Even if you have a flourishing business in the physical world, it will not take much resource or time for a new entrant to; compete with you. Remember how the innovative amazon.com grew from nothing to become the largest bookseller 'in the universe'. All this while, Barnes & Noble, the dominant player with huge financial resources, watched its market share being eroded by the upstart, forcing;

It finally to get on the e-commerce bandwagon. If this can happen with Barnes & Noble, it can happen with your business too. Alternatively, if ama7.on.com can give Barnes & Noble a run for its money, so can you to your established competitor.

Other factors:

With the private ISPs becoming aggressive and also looking at the huge cable market to provide Internet connections, it is only a matter of time before subscriber; numbers start looking up.

Now, we shall discuss some of the factors that could hinder the success of e-commerce.

1.6.3 Doubts and Difficulties

Households are shaky about buying over the Internet:

A very high proportion among PC owners and PC non-owners opine that they would not like to buy through the Internet. The reasons are they are not sure of the quality and the delivery of the products. They need to feel the products and bargain before they buy them. Many do not understand the new method of buying and selling in a digital environment. This reluctance among households prevents e-commerce from achieving the critical mass, and forces the corporates to adopt a 'wait and watch' policy.

Computers are not bought for browsing the Internet:

Browsing the Internet and purchasing through the Internet are among the least important perceived benefits of owning a computer. Business, learning (self) and education for children are so far given as the main reasons for purchasing a computer.

Lack of proper commercial and legal system:

Security, lack of proper and secure payment structures, legal issues: a clear fix on contracts and liabilities in the digital economy, and trust and assurance are the main concerns.

1.7 Summary

e-commerce is growing at rapid phase these days with the advances in the electronics. Internet helped e-commerce to move to a new heights. As discussed in this chapter, e-commerce will provide several advantages in parallel to some disadvantages. Several factors which resist the phase of transition from traditional commerce to e-commerce are also discussed in this chapter.

Problems

1. What are the key differences between traditional commerce and e-commerce?

2. Explain about emergence and growth of internet?

3. What are the advantages and disadvantages of

   e-commerce?

4. Write about the history of e-commerce?

5. Write about challenges that Indian industries need to face while transition from traditional commerce to e-commerce?

2. Business Models for E-commerce

In this Chapter we will discuss

- The business models used for e-commerce
- Models based on transaction parties
- Models based on transaction types

Structure of the chapter

2.1 Introduction

A business model is the method of doing business by which a company can sustain itself, that is, generate revenue. The business model spells out how a company makes money by specifying where it is positioned in the value chain.

Some models are quite simple. A company produces goods or services and sells it to customers. If all goes well, the revenues from sales exceed the cost of operation and the company realizes profit. Other models can be more intricately woven. Radio and television broadcasting is a good example. The broadcaster is part of a complex network of distributors, content creators, advertisers, and listeners or viewers. Who makes money and how much, it is not always clear at the outset. The bottom line depends on many competing factors.

However, a business model does not discuss how the business mission of the company will be realized. The marketing strategy of the company is needed to assess the commercial viability of a business model and to answer questions like the following: How is competitive advantage being built? What is the positioning? What is the marketing mix? Which product-market strategy is followed? and so forth.

For our understanding, e-commerce can be defined as any form of business transaction in which the parties interact electronically.[1] A transaction in an electronic market represents a number of interactions between parties. For instance, it could involve several trading steps, such as marketing, ordering, payment, and support for delivery. An electronic market allows the participating sellers and buyers to exchange goods and services with the aid of information technology. Electronic markets have three main functions such as: (i) matching buyers and sellers, (ii) facilitating commercial transactions, and (iii) providing legal infrastructure. Information technology permeates all the three functions and also helps to increase market efficiency and reduce transaction costs. The interaction between participants is supported by electronic trade processes that are basically search, valuation, payment and settlement, logistics, and authentication, as shown in Figure 2.1. The Internet and the World Wide Web allow companies to efficiently implement these key trading processes. For instance, many search services and brokers are available to help buyers find information, products, and merchants in electronic markets.

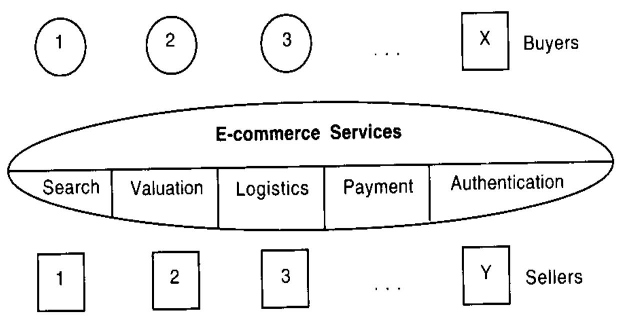

Fig. 2.1 Representation of an electronic market.

E-commerce can be formally defined as technology-mediated exchanges between parties (individuals, organizations, or both) as well as the electronically-based intra- or inter-organizational activities that facilitate such exchanges. It is global. It favours intangible things—ideas, information, and relationships. And it is intensely interlinked. These three attributes produce a new type of marketplace and society, one that is rooted in ubiquitous electronic networks.

The Birth of Portals

As the use of Internet accelerated beginning in 1994, the number of websites also proliferated. This self-reinforcing phenomenon led to a need for help with navigation. To that end, two types of sites, directories and search engines, came into being.

Directories were guides to the Web compiled by human editors and organized by categories like arts, business, news, health, etc. Users followed a hierarchy by headings and subheadings to locate the sought-after information. Search engines, on the other hand, compiled key words from Web pages and introduced them into databases that users could query. These search engines continually "crawled" the Web capturing, storing, and indexing the latest site information. The critical success factor for search engines was the number of Web pages indexed. The larger the index, the more likely it was that the search engine maintained a comprehensive record of the Web. Yet with large indexes new organizational challenges emerged, most notably, how do we give users *just* what they want? Examples of search engines included AltaVista, Excite, Infoseek, Lycos, Askjeeves, Google, etc.

Due to the need for navigational services, directories and search engines quickly grew to be among the most heavily trafficked sites on the Web, and prospered with a business model that monetized this traffic by selling advertising. Since ad revenue increased in direct proportion to the number of

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"eyeballs" delivered, these sites gradually shifted their strategies away from quickly linking users to destination sites; they began encouraging users to linger.

With that goal, directories and search engines sought to build user loyalty by adding content and "sticky" features such as e-mail and user chat rooms. Eventually, strategies to boost the frequency and duration of user visits caused searches to become a smaller percentage of total page views. At that point, industry observers began to refer to the original search and directory sites as "portals", a term coined in 1997 by Halsey Minor, the then CEO of CNET.

Though portals performed many different functions, their essence constituted five core elements: search, content, community building, commerce and personal-productivity applications:

- *Search services* included search engines, directories. Yellow Pages services for locating local businesses, "people finder" services for tracking down phone numbers and/or e-mail addresses, MP3 finders for locating downloadable music files, and "shopping bots" for locating merchandise and comparing the prices offered by different online retailers.

- *Content* comprised topical information such as news headlines, stock quotes, sports scores, weather forecasts, and local event listings; reference information such as maps and dictionaries; entertainment options including games and links to Internet radio stations; and third-party produced content in special interest areas (e.g. information about automobiles, travel destinations, or personal health).

- *Community-building features* included chat rooms, message boards instant-messaging services, online greeting cards, applications for exchanging digital photos, personal classifieds (e.g. "Single Male, 35, seeks...."), and free personal home pages.

- *Commerce offerings* included classified advertisements for jobs, cars, and homes;

  auctions; shopping malls aggregating small online retailers' websites; and links to external shopping sites nested within the relevant content categories.

- *Personal productivity applications* included Web-based e-mail, address books, calendars, file storage, and bill payment services.

Portal users spent about one-third of their time conducting searches, another one-third sending messages and participating in chat groups, and the balance one-third accessing other content.

None of the features described above were unique to portals. For example for search services. Yahoo! partnered with Google, the acknowledged search engine leader in terms of Web pages indexed. Also, for the most part, portals did not create the content they presented but rather obtained it through a variety of partnerships with online content providers. While portals offered access to online shopping, they themselves were not retailers. Portals did not make merchandising decisions, nor did they take title to goods or arranged for their shipment. Thus, a user could turn to stand-alone sites for most of the services offered by portals. The unique value proposition for portals was the convenience they offered to users by aggregating and organizing a vast array of content, commerce, and applications developed by others.

As the industry evolved, two types of portals emerged, delineated by the breadth of content and commerce offerings they aggregated. *Horizontal portals* directed the users to a broad range of content and commerce destinations; they tried to be "all things to all people." Examples of horizontal portals included AOL, Alta Vista, Excite@Home, Lycos, Yahoo!, and MSN. *Vertical portals,* on the other hand, directed the users to content and commerce offerings within a single thematic area such as personal finance, music, or sports. Examples of vertical portals included *CNET, iVillage, MarketWatch.com, and SportsLine.corn.*

The effectiveness of an e-commerce website is measured through the various parameters that constitute the Web usage analysis for e-commerce. The return on investment is a major cause of worry for the Web merchants. The Web channel provides new opportunities and challenges for analysis. It collects a large amount of detailed information on every user action. There is little experience and knowledge of the end-to-end process—from identifying what usage analysis is interesting to an organization, and what needs to be tracked down and measured, to acting on analysis for revising Web content, and updating advertising and promotion strategies.[4]

A company's business model is the way in which it conducts business in order to generate revenue. In the new economy, companies are creating new business models and reinventing old models. Reading the literature, we find business models categorized in different ways. Presently, there is no single, comprehensive and cogent taxonomy of Web business models that one can point to. Although there are many different ways to categorize e-business models, they can be broadly classified as follows:

1. E-business model based on the relationship of transaction parties
2. E-business model based on the relationship of transaction types
3. Classification by revenue model. A revenue model may comprise: (a) product sales model that charges customers directly for the products or services they buy;

(b) subscription model that charges a fixed monthly or annual rental for the service;

(c) transaction fee model that charges a service fee based on volume and value of the transactions offered; advertising support model that charges advertisers instead of charging users; and sponsorship model that provides sponsorship by companies for non-financial reasons.

4. Classification by distribution channel. A distribution channel may comprise: (a) direct marketing where manufacturers such as Dell, Nike, Lego or Sony market directly from company sites to individual customers; (b) pure play e-tailers who have no physical stores, only an online sales presence. *Amazon.com* is an example of such a model; and (c) click-and-mortar retailers who are traditional retailers with a supplementary website, like *Walmart.com.*

In Figure 2.2, many of the entities of these models have been assembled together and given the name e-commerce.

A business model can be defined as an architecture for product, service, and information flow, including a description of business players, their roles, and revenue sources. For example, some of the most popular revenue-generating models adopted by companies are: (i) charge fees for advertising, (ii) sell goods and services, (iii) sell digital contents, and (iv) charge for processing the transactions that occur between two parties on the Web. E-commerce models can be perceived in the form of relationship between two entities such as:

- Direct marketing versus indirect marketing
- Fully cybermarketing versus partial cybermarketing
- Electronic distributor versus electronic broker
- Electronic store versus shopping mall
- Generalized e-mails versus specialized e-mails
- Proactive versus strategic cybermarketing
- Global versus regional marketing

- Sales versus customer service.

And the list will go on. However, it is possible to classify e-business models according to this criteria.

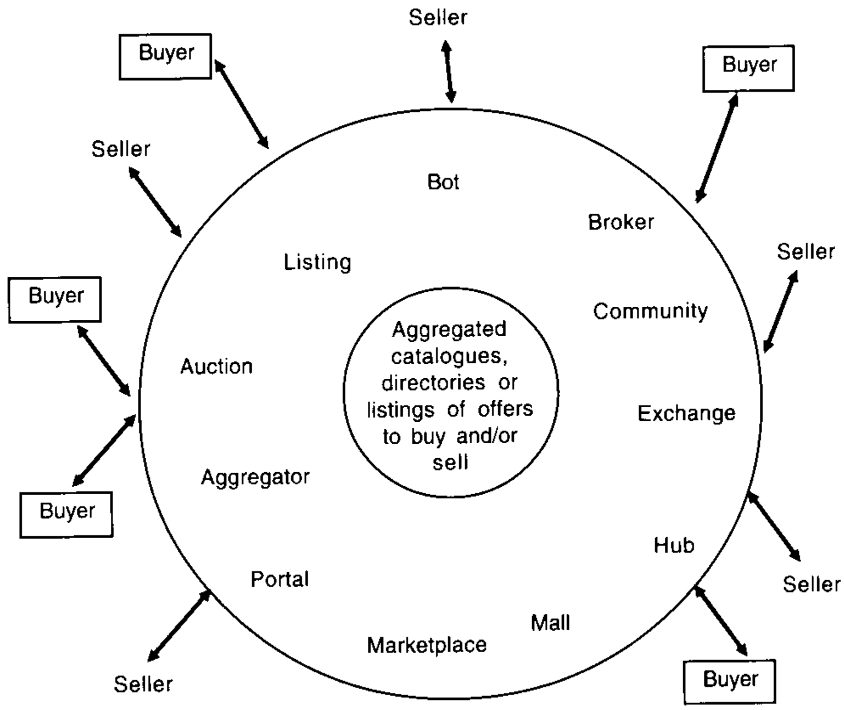

Fig. 2.2 **Representation of e-commerce marketplace.**

2.1 E-business Models Based on the Relationship of Transaction Parties

Electronic markets are emerging in various fields. Different industries have markets with different characteristics. For example, an information B2C market differs in many respects from the automotive B2B market. The former represents companies that sell digital information goods, such as news, articles, music, books, or digital videos. In the information B2C market, the electronic infrastructure not only helps match customers and sellers, but also acts as the distribution channel, delivering products to customers. In this case, the infrastructure, such as servers and networks, must support the delivery of large files, streaming media and other types of digital goods in an efficient way. This B2C market over the Internet can be viewed as an open system, where the number of participants is unknown. In the automotive B2B market, the products traded, such as parts and components of cars, have a high degree of specificity. The market infrastructure used is to be mainly based on Electronic Data Interchange (EDI) over expensive VAN services. EDI involves the exchange of standardized, structured information between organizations, permitting direct communication between computer systems. At the heart of B2B applications is the strong integration of different applications. Servers, networks, and software should provide the infrastructure to integrate Web-based applications with mainframe and legacy systems. B2B is also a closed market in the sense that the number of participants involved in trading is limited and known a priori.

Understanding the nature of the market's requirements is critical for creating the underlying e-business infrastructure. The relation between B2B and B2C models is clearly shown in Figure 2.3. B2B covers business transactions along the various interactions existing in the value chain from producers of raw materials to retailers and consumers including manufacturers and distributors. On the contrary, B2C reflects only the interactions between a customer and a retailer. Basically, B2C transactions include the following steps: (i) account acquisition, (ii) product discovery through search and browse, (iii) price negotiation, (iv) payment, and (v) product delivery. In some cases, dispute resolution and customer services may also exist.

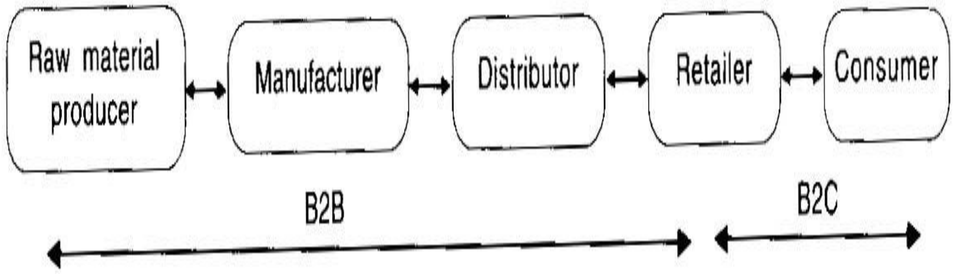

Fig. 2.3 Relation between B2B and B2C models.

E-commerce can be classified according to the transaction partners such as **business-to-consumer** (B2C), **business-to-business (B2B), business-to-government (B2G), consumer-to-consumer** (C2C), and **consumer-to-business (C2B).** Within these broad categories, there are a number of variations in the way the models are implemented. Table 2.1 summarizes some of the current e-business models. The contents of this table are illustrated in the form of a diagram in Figure 2.4.

Business-to-Consumer (B2C)

Consumers are increasingly going online to shop for and purchase products, arrange financing, arrange shipment or take delivery of digital products such as software, and get service after the sale. B2C e-business includes retail sales, often called e-retail (or e-tail), and other online purchases such as airline tickets, entertainment venue tickets, hotel rooms, and shares of stock.

Table 2.1

SUMMARY OF E-BUSINESS TRANSACTION MODELS

Model	*Description*	*Examples*
B2C	Sells products or services directly to consumers.	*amazon.com, autobytel.com, eDiets.com, Pets.com*
B2B	Sells products or services to other businesses or brings multiple buyers and sellers together in a central marketplace.	*MetalSite.com, VerticalNet.com, SHOP2gether.com*
B2G	Businesses selling to local, state, and federal agencies.	*iGov.com*
C2C	Consumers sell directly to other consumers.	*ebay.com, InfoRocket.com*
C2B	Consumers fix price on their own, which businesses accept or decline.	*Priceline.com*

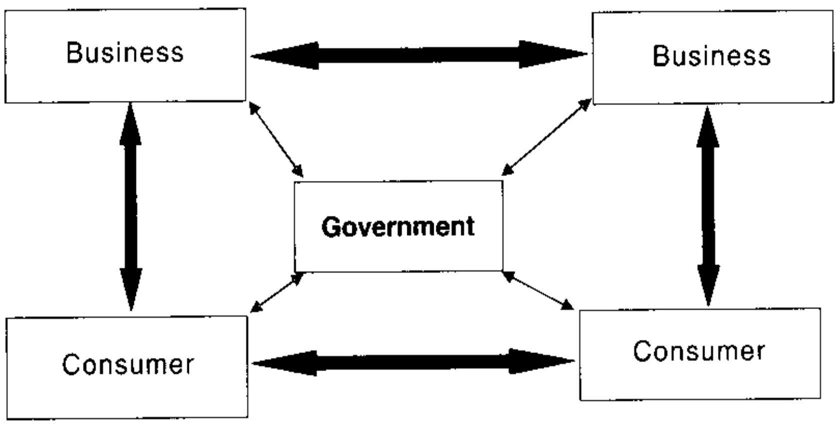

Fig. 2.4 **E-business transaction model.**

Many traditional brick-and-mortar retailers such as Barnes & Noble are now e-tailers with a Web storefront. These combined brick-and-mortar/online businesses are also known as *brick-and-click* companies.

Some B2C e-businesses provide high-value content to consumers for a subscription fee. Examples of e-business following this subscription model include the *Wall Street Journal* (financial news and articles). *Consumer Reports* (product reviews and evaluations), and *eDiets.com* (nutritional counselling).

B2C e-business models include virtual malls, which are websites that host many online merchants. Virtual malls typically charge setup, listing, or transaction fees to online merchants, and may include transaction handling services and marketing options. Examples of virtual malls include *excite.corn, choicemall, women.corn, networkweb.com, amazon.com. Zshops.com,* and *yahoo, corn.*

E-tailers that offer traditional or Web-specific products or services only over the Internet are sometimes called *virtual merchants,* and provide another variation on the B2C model. Examples of virtual merchants include *amazon.com* (books, electronics, toys, and music), *eToys.com* (children's books and toys), and *ashford.com* (personal accessories).

Some businesses supplement a successful traditional mail-order business with an online shopping site, or move completely to Web-based ordering. These businesses are sometimes called *catalogue merchants.* Examples include *avon.com* (cosmetics and fragrances), chefs (cookware and kitchen accessories), Omaha Steaks (premium steaks, meats, and other gourmet food), and Harry and David (gourmet food gifts).

Many people were very excited about the use of B2C on the Internet, because this new communication medium allowed businesses and consumers to get connected in entirely new ways. The opportunities and the challenges posed by the B2C e-commerce are enormous. A large amount of investment has gone into this and many sites have either come up or are coming up daily to tap this growing market.

Some of the reasons why one should opt for B2C are:

1. ***Inexpensive costs, big opportunities.*** Once on the Internet, opportunities are immense as companies can market their products to the whole world without much additional cost.

2. ***Globalization.*** Even being in a small company, the Web can make you appear to be a big player which simply means that the playing field has been levelled by e-business. The Internet is accessed by millions of people around the world, and definitely, they are all potential customers.

3. ***Reduced operational costs.*** Selling through the Web means cutting down on paper costs, customer support costs, advertising costs, and order processing costs.

4. ***Customer convenience.*** Searchable content, shopping carts, promotions, and interactive and user-friendly interfaces facilitate customer convenience, thus generating more business. Customers can also see order status, delivery status, and get their receipts online.

5. ***Knowledge management.*** Through database systems and information management, you can find out who visited your site, and how to create, better value for customers.

How Does B2C Work?

B2C e-commerce is more than just an online store. It really is about managing the entire process, but just using technology as a tool for order processing and customer support. Figure 2.5 depicts the processes in B2C. The B2C process is now explained in greater detail.

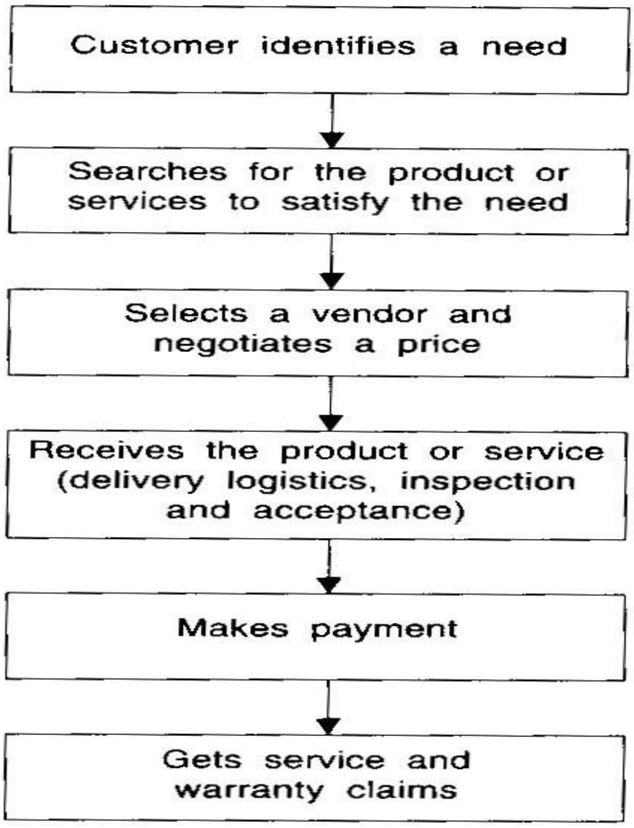

Fig. 2.5 Processes in B2C.

1. *Visiting the virtual mall.* The customer 'visits' the mall by browsing the online catalogue—a very organized manner of displaying products and their related information such as price, description, and availability. Finding the right product becomes easy by using a keyword search engine. Virtual malls may include a basic to an advanced search engine, product rating system, content management, customer support systems, bulletin boards, newsletters and other components which make shopping convenient for shoppers.

2. *Customer registers.* The customer has to register to become part of the site's shopper registry. This allows the customer to avail of the shop's complete services. The customer becomes a part of the company's growing database and can use the same for knowledge management and data mining.

3. *Customer buys products.* Through a shopping cart system, order details, shipping charges, taxes, additional charges and price totals are presented in an organized manner. The customer can even change the quantity of a certain product. Virtual malls have a very comprehensive shopping system, complete with check-out forms.

4. *Merchant processes the order.* The merchant then processes the order that is received from the previous stage and fills up the necessary forms.

5. *Credit card is processed.* The credit card of the customer is authenticated through a payment gateway or a bank. Other payment methods can be used as well, such as debit cards, prepaid cards, or bank-to-bank transfers.

6. *Operations management.* When the order is passed on to the logistics people, the traditional business operations will still be used. Things like inventory management, total quality management, warehousing, optimization and project management should still be incorporated even though it is an e-business. Getting the product to the customer is still the most important aspect of e-commerce.

7. *Shipment and delivery.* The product is then shipped to the customer. The customer can track the order/delivery as virtual malls have a delivery tracking module on the website which allows a customer to check the status of a particular order.

8. *Customer receives.* The product is received by the customer, and is verified. The system should then tell the firm that the order has been fulfilled.

9. *After-sales service.* After the sale has been made, the firm has to make sure that it maintains a good relationship with its customers. This is done through customer relationship management or **CRM.**

Business-to-Business (B2B)

B2B is that model of e-commerce whereby a company conducts its trading and other commercial activity through the Internet and the customer is another business itself. This essentially means commercial activity between companies through the Internet as a medium.

This is supposed to be a huge opportunity area on the Web. Companies have by and large computerized all the operations worldwide and now they need to go into the next stage by linking their customers and vendors. This is done by supply chain software, which is an integral part of your ERP application. Companies need to set up a backbone of B2B applications, which will support the customer requirements on the Web. Many B2B sites are company and industry specific, catering to a community of users, or are a combination of forward and backward integration. Companies have achieved huge savings in distribution-related costs due to their B2B applications.

Major Advantages of B2B

1. *Direct interaction with customers.* This is the greatest advantage of e-business. The unknown and faceless customer including other businesses, buying the products of a large MNC like say HLL or Procter & Gamble through distributors, channels, shops and the like, now has a name, face, and a profile. Large MNCs pay a fortune for this information on customer buying patterns.

2. *Focussed sales promotion.* This information gives authentic data about the likes, dislikes and preferences of clients and thus helps the company bring out focussed sales promotion drives which are aimed at the right audience.

3. *Building customer loyalty.* It has been observed that online customers can be more loyal than other customers if they are made to feel special and their distinct identity is recognized and their concerns about privacy are respected. It has also been found that once the customers develop a binding relationship with a site and its product, they do not like to shift loyalties to another site or product.

4. *Scalability.* This means that the Web is open and offers round-the-clock access. This provides an access never known before, to the customer. This access is across locations and time zones. Thus a company is able to handle many more customers on a much wider geographical spread if it uses an e-business model. The company can set up a generic parent site for all locations and make regional domains to suit such requirements. Microsoft is using this model very successfully. The additional cost of serving a larger segment of customers comes down drastically once a critical mass is reached.

5. *Savings in distribution costs.* A company can make huge savings in distribution, logistical and after-sales support costs by using e-business models. Typical examples are of computer companies, airlines, and telecom companies. This is because the e-business models involve the customer in the business interaction to such a level that companies are able to avoid setting up the huge backbone of sales and support force, which ordinarily would have to be set up.

Tools and Techniques at the Disposal of B2B Enterprises

It is important to know the right marketing strategies, which would be required to sell successfully and profitably over the Web. The Web as a medium provides you with a unique platform to enable various strategies, which would not have been possible to execute in a conventional scenario. Some of these are:

1. *Use of pricing as a tool.* There is a wealth of research on pricing used as a tool to generate sales on the Internet. The biggest e-tailer of them all, *amcn.on.com,* made it big by giving substantial discounts. Part of these heavy discounts is attributed to the distributor level commissions, which are now being passed on to the customer. Apart from this, companies have started giving things free on the Internet in order to get a critical mass of subscribers, which helps in getting advertising revenues. The best example is the Apple IMac computer machine being given free if the buyer agrees to make a certain amount of purchase using the Apple's e-commerce website.

2. *Use of application service provider model.* This is an old model of the 1970s, which was used among mainframes, and dumb terminals, and which is being revisited with a vengeance. Software companies are offering their packages not in CDs and boxes but through the Web. The customer can log in over the Internet and access the software from the web server of the company and need not download it into his PC. This goes one step further in the age of the networked PCs where one need not use even a hard disk and all critical application data is kept on the Web and can be accessed from anywhere in the world. These services (which are not products) are being offered at, say, $5 an hour.

3. *Use of generic models which are known for efficiency as well as personalized attention to various business customers.* The Web has given rise to a new partnership between brick-and-mortar manufacturers, e-tailers, and express delivery companies like FedEx. These organizations take care of the individual elements of the customer, the order fulfillment and the post sale complaints, if any.

4. *Use of comparison shopping.* The Internet has brought in a whole new concept of price matching and comparison-shopping. Today there are sites, which will take you to hundreds of sites to find the cheapest product to suit your specifications. This would never have been possible without the Internet.

Business activities between companies can be transacted over an extranet. An extranet consists of two or more intranets connected via the Internet, where participating companies can view each other's data and complete business transactions such as purchasing.

Like B2C models, B2B models take a variety of forms. There are basic B2B Internet storefronts, such as Staples and Office Depot, that provide business customers with purchase, order fulfillment, and other value added services. Another B2B model is a business trading community, also called a *vertical Web community,* that acts as a central source of information for a *vertical market.* A vertical market is a specific industry in which similar products or services are developed and sold using similar methods. Examples of broad vertical markets include insurance, real estate, banking, heavy manufacturing, and transportation. The information available at a vertical Web community can include buyer's guides, supplier and product directories, industry news and articles, schedules for industry trade shows and events, and classified advertisements. *MediSpeciality.com* (healthcare), *Hotel Resource* (hospitality), and *Net Possibilities* (building trades) are examples of virtual vertical marketspaces. B2B exchanges are websites that bring multiple buyers and sellers together in a virtual centralized marketspace. In this market space, buyers and sellers can buy from and sell to each other at dynamic prices determined by the exchange rules. Table 2.2 illustrates some common elements of B2B exchanges. B2B exchanges can be further categorized into several ways as aggregators, trading hubs, post and browse markets, auction markets, and fully automated exchanges.

B2B aggregators provide a single marketspace for company purchasing by providing many like-formatted supplier product cataloges in one place. Examples of B2B aggregators include *e-chemicals* (industrial chemicals), *Chemdex* (chemicals), *MetalSite* (steel and other metals), and *freightqu.ote.com* (shipping services).

COMMON ELEMENTS OF B2B EXCHANGES

Element	Benefit
Centralized marketspace	Neutral and nonaligned with either sel or buyers.
Standardized documentation	Users are prequalified and regulated.
Price quotes, price history, and after-the-sale information provided	Pricing mechanism is self-regulating.
Confidential transactions between businesses.	Clearing and settlement services provi(

or advertising. For example, there are e-companies that sell information about contract! to bid market intelligence and analysis, and jobs by industry.

5. *Auctions or dynamic pricing markets.* Auctions or dynamic pricing markets handle complex exchanges between buyers and sellers in B2B commerce. Auctions (e.g English, Dutch, Vickrey, Reverse) are dynamic and efficient mechanisms for mediating and brokering in complex marketplaces, like supply-chain and procurement systems Bundle auctions allow agents to bid for bundles of items and are useful for B2t applications such as automatic supply-chain or procurement.

In a fully automated B2B exchange, multiple buyers and sellers competitively bid 01 commodities or standardized products, and the buy and sell orders are matched automatically *PaperExchange.com* is a fully automated B2B exchange. A summary of B2B models is given in Table 2.3.

TABLE 2.3

B2B SUMMARY

Type	Description	Examples
B2B storefronts	Provide businesses with purchase, order fulfillment, and other value-added services	*Staples.com* *OfficeDepot.com*
B2B vertical markets	Provide a trading community for a specific industry	*HotelResource.com*
B2B aggregators	Provide a single marketspace for business purchasing from multiple suppliers	*MetalSite.com*
B2B trading hubs	Provide a marketspace for multiple vertical markets	*VerticalNet.com*
B2B post and browse markets	Provide a marketspace where participants post buy and sell opportunities	*CATEX.com* *CreditTrade.com* *TechEx.com*
B2B auction markets	Provide a marketspace for buyers and sellers to enter competitive bids on contracts	*e-STEEL.com* *HoustonStreet.com* *Altra.com* *FreeMarkets.com*
B2B fully automated exchanges	Provide a marketspace for the automatic matching of standardized buy and sell contracts	*PaperExchange.com*

Trading hubs are B2B sites that provide a marketspace for multiple vertical markets Horizontal trading hubs support buyers and sellers from many different industries. *VerticalNe,* is an example of a horizontal trading hub. A pioneer in providing virtual vertical market spaces, it maintains business trading communities for many different industries, including communications, energy, healthcare, food service, and manufacturing. Diagonal trading hub! support specific types of buyers or sellers, or specific types of products across multiplie industries. *SHOP2gether.com* is an example of a diagonal trading hub.

Post and browse markets such as *CATEX* (insurance, reinsurance, and risk management) *CreditTrade* (credit derivatives), and *TechEx* (life sciences intellectual property) enable participant to post buy or sell opportunities on an electronic bulletin board. Interested parties meet through the postings and negotiate transactions for themselves.

B2B auction markets enable multiple buyers or sellers to enter competitive bids on contract. Examples of B2B auction markets include *e-STEEL* (steel and other metals;

Hou.stonStrect.com (energy), *Altra* (energy), and *Manheim Online* (auto dealer auctions;

Auction markets may include reverse auctions or "name your price" auctions. In a reverse auction, a product's selling price continues to decline until the product is purchased. "Nam your price" auctions, which allow buyers to enter a bid for a product or service that a seller can then provide at the bid price, are also called reverse auctions. *Free Markets* is an example of a B2B site conducting reverse auctions.

Business-to-Business Transactions and Models

B2B interactions involve much more complexity than B2C. For instance, typical B2B transaction include, among others, the following steps: (i) review catalogues, (ii) identify specification (iii) define requirements, (iv) post request for proposals (REP), (v) review vendor reputation (vi) select vendor, (vii) fill out purchase orders (PO), (viii) send PO to vendor, (ix) prepare invoice, (x) make payment, (xi) arrange shipment, and (xii) organize product inspection an reception. Due to the large number of transactions involved, business-to-business operation can be too risky if e-business sites cannot guarantee adequate quality of service in terms of performance, availability, and security.

Several models and classifications have been proposed for B2B commerce. Figure 2.

Electronic Marketplace

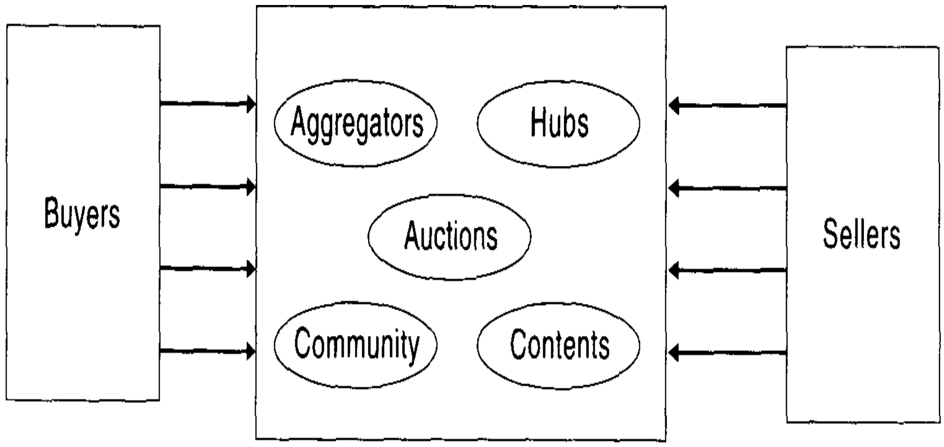

Fig. 2.6 Business-to-Business (B2B) marketplace.

illustrates an electronic marketplace for B2B trading. The model could be oriented to a vertical market (e.g. wholesale trade, chemicals, construction, and electronics) or to a horizontal approach (e.g. office supply, and logistics). The models can now be described as follows:

1. *Aggregators.* In the aggregation model, one company aggregates buyers to form a virtual buying entity and/or aggregates suppliers to constitute a virtual distributor. For example, in the science marketplace, one company became the central buying location for thousands of buyers to implement their own purchasing rules and obtain volume discounts. The aggregator takes the responsibility for selection and fulfillment, pricing, and marketing segmentation. Another example is an electronic company that offers a total home buying service, from search to financing, under one site.

2. *Hubs or process integration.* Hubs or process integration focusses on producing a highly integrated value proposition through a managed process. Hubs have been defined as *neutral Internet-based intermediaries* that focus on a specific industry or a specific business process. Hubs host electronic markets and create value by reducing the costs of transactions between sellers and buyers. There are examples of vertical hubs that serve a vertical market or a specific industry, such as energy, steel, telecommunications, and plastic. On the contrary, functional hubs specialize in horizontal markets across different industries. Functional hubs focus on business processes such as project management and MRO (Maintenance, Repair and Operating, and procurement). An electronic business company that provides office supplies to many industries is a good example of a functional hub in B2B commerce.

3. *Community or alliance.* In the community model, alliances are used to achieve high value integration without hierarchical control. Members and end-users play key roles as contributors and customers. Basically, communities produce knowledge with economic value, such as Linux, MP3, and Open Source.

4. *Content.* Content is the end product of this model of B2B commerce. It has the purpose of facilitating trading. Revenue can be generated from subscriptions, membership,

Another business model similar to the B2B exchange model is the business-to-government, or B2G procurement model. B2G e-businesses such as *eFed.eral.com* and *Gov.com* in the US are hoping to tap the $18 billion per year market for government procurements that do not require a bid.

Not only do businesses sell directly to consumers and other businesses online, but consumers are now interacting with each other to buy, sell, or trade products, personal services, or information.

Consumer-to-Consumer (C2C)

With the C2C e-business model, consumers sell directly to other consumers via online classified ads and auctions, or by selling personal services or expertise online. Examples of consumers selling directly to consumers are *ebay.com* (auction) and *Tra.derOnline.com* (classified ads).

There are also a number of new consumer-to-consumer expert information exchanges that are expected to generate $6 billion in revenue by 2005. Some of these exchanges, such as *AskMe.com* and abuzz, are free, and some allow their experts to negotiate fees with clients. *InfoRocket.com,* one of the first question-and-answer marketplaces, is driven by a person-to-person auction format. The *InfoRocket.com* bidding system allows a person who submits a question to review the profiles of the "experts" who offer to answer the question. When the person asking the question accepts an "expert" offer, *InfoRocket.com* bills the person's credit card, delivers the answer, and takes a 20 per cent commission.

Consumer-to-Business (C2B)

The C2B model, also called a *reverse auction* or *demand collection model,* enables buyers to name their own price, often binding, for a specific good or service generating demand. The website collects the "demand bids" and then offers the bids to the participating sellers. *Reverse Auction-com* (travel, autos, consumer electronics) and *priceline. corn* (travel, telephone, mortgages) are examples of C2B e-business models.

2.3 E-business Models Based on the Relationship of Transaction Types

This business model is essentially ruled by the following two parameters:

On the basis of value addition. Value addition is the addition of value to a product or service because of the opportunities that it offers on the Web.

On the basis of control. At the high end of control there is hierarchical control and at the low end there is no control, so that it is self-organizing. Normally, the control is done through the policies of the website.

Based on these, nine types of transactions can be identified as listed below:

NOTES

- Brokerage
- Aggregator
- Info-mediary
- Community
- Value Chain
- Subscription
- Manufacturer
- Advertising
- Affiliate

2.4 Summary

This chapter deals with the business models used for E-commerce. Criteria used to classify BM's is presented followed by in-depth discussion on models based on the relationship of transaction parties (B2C,B2B,C2C,C2B). Brief listing was given related to business models based on the relationship of transaction types.

Questions

1. Write briefly about business models for e-commerce?
2. Write about E-business Models Based on the Relationship of Transaction Parties
3. List the E-business Models Based on the Relationship of Transaction Types

3. Enabling Technologies of the World Wide Web

In this Chapter we will discuss

- Technologies behind the WWW
- Client server applications
- The way to connect computers
- Search engines
- Software agents
- Internet service providers in India

Structure of the chapter

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3.1 Introduction

The World Wide Web (abbreviated Web, WWW, or W3) is a system of Internet servers that supports hypertext to access several Internet protocols on a single interface. Almost every protocol type available on the Internet is accessible on the

Web. This includes e-mail, File Transfer Protocol (FTP), Gopher, Telnet, and the like. In addition to these, the World Wide Web has its own protocol, the HyperText Transfer Protocol (HTTP).

The World Wide Web provides a single interface for accessing all these protocols. This creates a convenient and a user-friendly environment. It is no longer necessary to be conversant with these protocols within separate, command level environments. The Web gathers together these protocols into a single system. Because of this feature, and because of the Web's ability to work with multimedia and advanced programming languages, the World Wide Web is the fastest growing component of the Internet.

The operation of the Web relies primarily on hypertext as its means of information retrieval. HyperText is a document containing words that connect to other documents. These words are called *links,* and open on a single click. A single hypertext document can contain links to many documents. In the context of the Web, words or graphics may serve as links to other documents, images, video and sound. Links may or may not follow a logical path and it depends on how the source document is programmed. On the whole, the WWW contains a complex virtual web of connections among a vast number of documents, graphics, videos, and sounds.

HyperText for the Web is created by documents written in HyperText Markup Language (HTML) or its various offshoots. With HTML, tags are placed within the text to accomplish document formatting such as font size, font style, and visual features like images, animations and creation of hypertext links. The World Wide Web consists of files, called pages, created in HTML and opened with any program which can read the language. Generally, it is comprised of a home page which links to other pages accessed with just a mouse-click.

The Web provides a vast array of experiences including multimedia presentations, real-time collaborations, interactive pages, radio and television broadcasts, and the automatic 'push' of information to a client computer. New programming languages such as Java and JavaScript are expanding these capabilities of the Web.

3.2 Internet Client-Server Applications

The users of the Internet interact through one of the several client-server applications. As the name suggests, in a client-server application there are two major classes of software— the client software, which usually exists on an end-user's desktop and provides navigation and display. The other software is the server software, which usually exists on a workstation or a server-class machine and provides back-end data access services, where the data can be something simple like a file or complex like a relational database. The most widely used client-server applications are listed in Table 3.1.

TABLE 3.1

CLIENT-SERVER APPLICATIONS

Application	*Protocol*	*Purpose*
World Wide Web	HyperText Transport Protocol (HTTP)	Offers access to hypertext documents, executable programs, and other Internet resources.
E-mail	Simple Mail Transport Protocol (SMTP)	Allows the transmission of text messages and binary attachments across the Internet.
	Post Office Protocol version 3 (POP3)	
	Multipurpose Internet Mail Extensions (MIME)	
File Transfer	File Transfer Protocol (FTP)	Enables files to be uploaded and downloaded across the Internet.
Chat	Internet Relay Chat Protocol (IRC)	Provides a way for users to talk to one another in real-time over the Internet. The real-time chat groups are called channels.
Use Net Newsgroups	Network News Transfer Protocol (NNTP)	Discussions forums where users can asynchronously post messages and read messages posted by others.

E-mail allows computer users to exchange messages worldwide. Each user of e-mail has a mailbox address or user account identity, with which all main transactions are done. Messages sent via e-mail reach their destination within a matter of seconds. A powerful aspect of e-mail is the option to send electronic files to a person's e-mail address. Non-ASCII files, known as binary files, may be attached to e-mail messages. For example, a document created in Microsoft Word can be attached to an e-mail message and retrieved by the recipient in any e-mail program such as Pine, Netscape messenger or Outlook Express.

Telnet

Telnet is a program that allows you to log into computers on the Internet and use online databases, library catalogs, chat services and more. To Telnet to a computer, you must know its address. This can consist of words *(www.yahoo.com)* or numbers (204.71.200.67). Some services may require connection to a specific port on a remote computer. In this case, type the port number after the Internet address, for example *telnet dte.vsnl.net.in* to access your Web server. Probably the most common Web-based resource available through telnet are library catalogs. A link to a telnet resource may look like any other link, but it will launch a telnet session to make the connection. A telnet program must be installed on your local computer and configured to your Web browser in order to work.

File Transfer Protocol (FTP)

This is both a program and a method used to transfer files between computers on the Internet. Anonymous FTP is an option that allows users to transfer files from thousands of host computers on the Internet to their personal computer account. File transfer is quite rapid. FTP sites contain books, articles, software, games, images, sounds, multimedia, course work, data sets, and more. FTP transfers can be performed on the World Wide Web even without a special software. In this case, the Web browser will suffice. You can retrieve FTP files via search engines such as FAST FTP Search, located at http://ftpsearch.lycos.com/. This option is convenient because you do not need to know FTP program commands.

Chat on the Web

For the most part, businesses have ignored the potential economic payoff from online communications. Except for e-mail, the Internet and the Web have been treated as a medium with information flowing in only one direction—either pulled by or pushed to the end user. Most recently, businesses have begun to recognize that the Internet and the Web offer the ability to engage customers in a dialogue and create virtual communities where customers can also communicate with one another.

Chat programs are now common on the Web. They are sometimes included as a feature of a website, where users can log into the "chat room" to exchange comments and information about the topics addressed on the site. Chat may take other, more wide-ranging forms. For example, America Online is well known for sponsoring a number of topical chat rooms.

A variation of chat is the phenomenon of instant messaging. With instant messaging, a user on the Web can contact another user currently logged in and type a conversation. The most famous is America Online's Instant Messenger.

IRC

IRC is the Internet Relay Chat service in which participants around the world can "talk" to each other in real-time on hundreds of channels. These channels are usually based on a particular topic. While many topics are frivolous, substantive conversations also take place. To have access to IRC, you must use an IRC software program. This program connects you to an IRC server and allows you to visit IRC channels. The largest nets are EFnet (the original IRC net, often having more than 32,000 people at once), Undemet, IRCnet, DALnet, and NewNet.

Generally, the user (such as you) runs a program (called a "client") to connect to a server on one of the IRC nets. The server relays information to and from other servers on the same net. Some of the recommended clients are:

UNIX/shell: **ircll**
Windows: mIRC or PIRCH
Macintosh: Ircle

Once connected to an IRC server on an IRC network, you will usually join one or more "channels" and converse with others. On EFnet, often there are more than 12,000 channels, each devoted to a different topic. Conversations may be public (where everyone in a channel can see what you type) or private (messages between only two people, who may or may not be on the same channel).

ICQ

As the name implies, ICQ or 'I Seek You' is simply a smart way of getting in touch with people. This small program takes up the complicated work of finding friends, colleagues and people with similar interests across the globe, people who could be communicating by e-mail, chat, SMS, phone or pager, and makes it as straightforward as calling across a room and starting a friendly conversation. The most popular method of communication on ICQ is instant messaging, enabling you to send a message that immediately pops up on an online contact's screen. ICQ also lets you chat, send e-mails, SMS and wireless-pager messages, as well as transfer files and URLs. ICQ phone incorporates IP telephony functions enabling you to engage in PC-to-PC and PC-to-phone calls. Used in multiple-user mode, groups can conduct conferences or play games with ICQ. In fact, ICQ supports a variety of popular

Internet applications and serves as a Universal Platform from which you can launch peer-to-peer applications.

ICQ brings together the most widely used methods of communication in the simplest way. ICQ is also a global community that puts you in touch with friends you already know and friends you have not met yet. Just as search engines help you find information, ICQ helps you find people. The ICQ Community can connect you to people with similar interests, beliefs and passions.

ICQ has acquired over 120 million users in more than 245 countries since its launch in November 1996. Whatever the topic or time of the day, you can be rest assured that there would be people discussing things on ICQ. ICQ hosts an exciting range of community features including Message Boards, Chat Rooms, Interest Groups, ICQ Match, User Lists, Game Partners and White pages (people search), and alerts you when friends sign in or off.

Identifying Data Types with Multipurpose Internet Mail Extensions (MIME)

Using HTTP, you can transfer full-motion video sequences, stereo sound tracks and even high-resolution images. The standard that makes this possible is MIME. HTTP utilizes MIME to identify the type of object being transferred across the Internet. Object types are identified in a header field that comes before the actual data for the object. Under HTTP, this header field is the Content-Type header field. By identifying the type of object in a header field, the client receiving the object can appropriately handle it. For example, if the object is a Graphic Interface (GIF) image, the image will be identified by the MIME type as image/GIF. When the client receiving the object of type image/GIF can handle the object type directly, it will display the object. When the client receiving the object of type image/ GIF cannot handle the object directly, it will check a configuration table to see whether an application is configured to handle an object of this MIME type. If such an application is configured for use and is available with the client, it will display the GIF image. Otherwise, it will flash an error message on the screen. MIME typing is extremely useful not only to HTTP, but also to other protocols. MIME typing was originally developed to allow e-mail messages to have multiple parts with different types of data in each part and thus attach any type of file to an e-mail message.

3.3 Networks and Internets

A computer network consists of two or more computers that are connected to each other using cables and other network devices that handle the flow of data. When you connect two or more computers together, you form a network. Later, if you connect one network to another, you form an Internetwork or an Internet, for short. Network technology enables employees to use resources located in computers of different networks, without being influenced by the technology difference behind each of these networks. Figure 3.1 shows the relationship between networks and Internetworks (Internets).

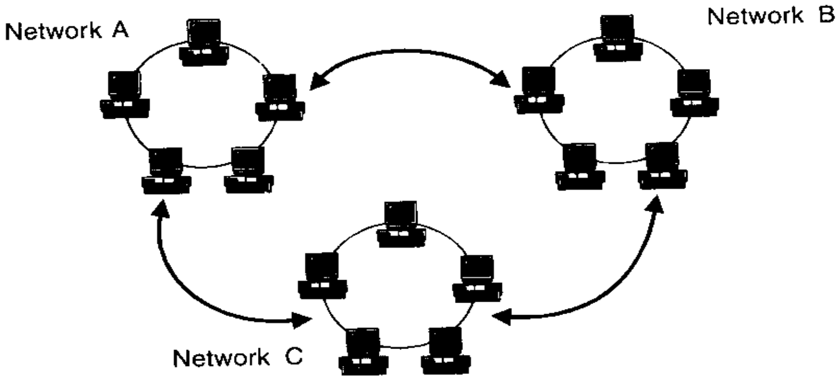


Fig. 3.1 Relationship between networks and internets.

Communication Switching

Through the use of communication switching, computer networks allow computers to transfer data using shared lines of communication such as a cable. Communication switching works similar to telephone switching networks. A telephone switching network eliminates the need to connect a wire between your telephone and every telephone you may ever call. Instead, the phone company connects your phone (and everyone else's phone) to a set of switches. When you place a phone call, the switches create the connection between the two phones. Without a telephone switching network, if you needed to call 1000 different people, you would need to connect 1000 lines to your phone. In a similar way, computer networks rely on communication switches. Networks use two common methods of communication switching to transfer data—circuit switching and packet switching. In circuit switching, the switches create a single, unbroken path between devices that want to communicate.

Most computer networks, including the Internet, do not use circuit switching. They use a technique called **packet switching.** In a typical terminal-to-host data connection, the line remains idle for most of the time. Thus, with data connections, a circuit-switched approach is inefficient. In a circuit-switched network, the connection provides for transmission at a constant data rate. Thus, each of the two devices that are connected must transmit and receive at the same data rate as the other. This limits the utility of the network in interconnecting host computers and terminals.

In packet switching, data are transmitted in short packets. A typical upper limit on packet length is 1 kilobyte. If a source has a longer message to send, the message is broken up into a series of packets. Each packet contains a portion (or all for a short message) of the user's data, plus some control information. The control information, at a minimum, includes the information that the network requires in order to be able to route the packet through the network and deliver it to the intended destination. At each node on the route, the packet is received, stored briefly, and passed on to the next node. In packet switching, programs break data into small pieces, called *packets,* and then transmit the packets between computers. Packets are pieces of data that adhere to a standard set of rules (protocols) that define their size and format. Unlike circuit switching, in a packet-switched network, data can flow along multiple paths, as shown in Figure 3.2.

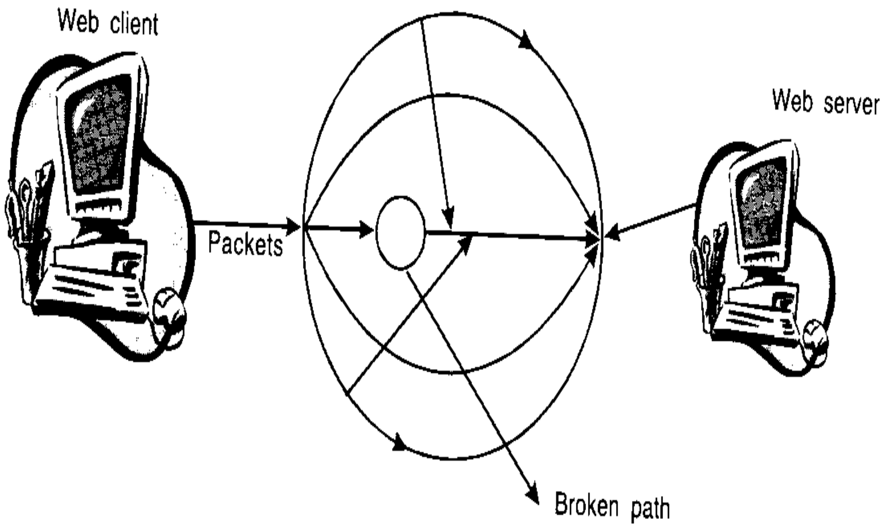


Fig. 3.2 A packet switching network with a broken path.

In packet-switched networks, breaking one path does not prevent the data from reaching its destination. The packet will simply find a different path. Each packet must contain its destination address. As the packet travels from one computer to another, each computer examines the packet's address and routes the packet to its next intermediate hop or directly to the destination. The Internet is a packet-switched network. Think of a packet in a packet-switched network as a traveller flying from New Delhi to Mumbai. Depending on the available flights, the traveller may be able to fly non-stop (if the packet is lucky enough to get a direct connection). In most cases, however, the traveller must stop at airports along the way (possibly in Ahmedabad or Jaipur). In a similar way, a packet may visit several computers as it travels across the Internet. As signals travel through network media (cables and wires), they become weak. Engineers refer to this weakening of signals as attenuation. To overcome this, the network designers use special networking devices called *repeaters* which amplify network data.

Developments in Transmission

Today, the Internet is measured by the capacity of its cables to carry information bits to users; this carrying capacity is called *bandwidth.* Universities and corporations typically connect directly to the Internet with dedicated leased lines of either 1,544,000 or 45,000,000 bits per second (bps). Each of these lines must support hundreds or even thousands of simultaneous users. In contrast, most home users dial into Internet through the telephone network, at *narrowband* rates. The modems on their computers are connected to a "twisted pair" of copper phone wires that can transmit at the rate of 14,000 to 56,000 bps. At such speeds, the text scrolls quickly down the screen, but a large image can take several minutes to appear.

The Internet can also be accessed at *midband* speeds of 128,000 bps or more. At midband speeds, still images open on the screen quickly, and it becomes possible to transmit moving pictures too, though still fuzzier and jerky.

Two of the midband technologies—Asymmetrical Digital Subscriber Line (ADSL) and Integrated Services Digital Network (ISDN)—use wires to connect users to the Internet through a telephone system. Another competing technology brings the Internet to home PCs, using the coaxial cables of cable television. Currently, cable television systems waste most of their bandwidth transmitting up to 75 television channels simultaneously in analog, whether a user wants them or not. Using digital switching, however, coaxial cables can carry perhaps 27,000,000 bps of Internet data alongside the regular cable programming. Unlike phone signals, which are sent to specific homes, cable signals are shared by entire neighbourhoods, Under normal conditions, each cable modem in a neighbourhood can get the equivalent of a midband connection. Broadband data will be processed by an infrastructure that uses Asynchronous Transfer Mode (ATM) to transmit data at 622,000,000 bps or more, and a technique called Quality of Service (QoS) that guarantees the smooth delivery of audio or video for a fee.

Network Routers

Network designers use routers to transfer or route data between networks that use different network technologies. Since the Internet is comprised of various networks that use many different network technologies, routers are an integral part of the Internet. A router has an address on the network. Using the addressing capability of routers, the nodes on a network can send packets destined for another network to a router. The router, in turn, will transfer the packet to the other network. To manage network traffic, network designers also use routers to segment large sections of a Local Area Network (LAN) to smaller segments, called *subnets.* To route data, routers commonly use routing tables, which are similar to a lookup database. Using a routing table, routers can look up the correct path (or the best route) from the packet's current location to any destination on the network. Depending on the network's requirements, a designer can implement routing tables as static or dynamic. With a static routing table, the network administrator must manually update the table. Network software automatically updates the dynamic routing tables. The advantage of dynamic routing tables is that, should a part of the network get bogged down with a lot of traffic, the network software can update the routing tables to route packets around the current bottleneck.

Connectionless versus Connection-oriented Protocols

Connectionless protocols differ from connection-oriented protocols in the way requests and responses to requests are handled. With a connectionless protocol, clients connect to the server, make a request, get a response, and then disconnect. With a connection-oriented protocol, clients connect to the server, make a request, get a response, and then maintain the connection to service future requests.

An example of a connection-oriented protocol is FTP. When you connect to an FTP server, the connection remains open after you download a file. The maintenance of this connection requires system resources. A server with too many open connections quickly gets bogged down. Consequently, many FTP servers are configured to allow only 250 open connections at one time, that is, only 250 users can access the FTP server at once. Additionally, processes that are not disconnected cleanly can cause problems on the server. The worst of these processes is running out of control, using system resources, and eventually crashing the server. The best of these processes simply eat up system resources. In contrast, HTTP is a connectionless protocol. When clients connect to the server, they make a request, get a response, and then disconnect. Since the connection is not maintained, no system resource is used after the transaction is completed. Consequently, HTTP servers are only limited to active connections and can generally do thousands of transactions with low system overhead. The drawback to connectionless protocols is that when the same client requests additional data, the connection must be re-established. To the Web users, this means a waste of time and energy.

Signal Bandwidth

The primary limit on any communications channel is its bandwidth. Bandwidth merely specifies a range of frequencies, from the lowest to the highest, that a channel can carry or that are present in the signal. Bandwidth is expressed in a different way for analog and digital circuits. In analog technology, the bandwidth of a circuit is the difference between the lowest and the highest frequencies that can pass through the channel. Engineers measure analog bandwidth in kilohertz or megahertz. In a digital circuit, the bandwidth is the amount of information that can pass through a channel. Engineers measure digital bandwidth in bits, kilobits, or megabits per second.

Channel Bandwidth

The bandwidth of a communications channel defines the frequency limits of the signals that they carry. This channel bandwidth may be physically limited to the medium used by the channel or artificially limited by communications standards. The bandwidths of radio transmissions, for example, are artificially limited, by law to allow more different modulated carriers to share the air waves at the same time while preventing interference between them.

In wire-based communications channels, bandwidth is often limited by the wires. Certain physical characteristics of wires cause degradations in their high frequency transmission capabilities. The capacitance between conductors in a cable pair, for instance, increasingly degrades signals as their frequencies rise, until it reaches a point at which a high frequency signal might not be able to traverse more than a few centimetres of wire. Amplifiers or repeaters, which boost signals so that they can travel longer distances, often cannot handle very low or very high frequencies.

Most of the telephone channels have an artificial bandwidth limitation imposed by the telephone company. To get the greatest financial potential from the capacity of their transmission cables, microwave systems, and satellites, telephone carriers normally limit the bandwidth of telephone signals. One reason why bandwidth is limited is that many separate telephone conversations can be stacked atop one another through multiplexing techniques, which allow a single pair of wires to carry hundreds of simultaneous conversations.

Uniform or Universal Resource Locators (URLs)

The URLs provide a uniform way of identifying resources that are available using Internet protocols (IP). To understand the concept of URLs, you need to know about URL schemes and formats, how URLs are defined, and how to use escape codes in URLs. The basic mechanism that makes URLs so versatile is the standard naming scheme. The URL schemes name the protocol that the client will use to access and transfer the file. Web clients use the name of the protocol to determine the format for the information that follows the protocol name. The protocol name is generally followed by a colon and two forward slashes. The colon is a separator. The double slash marks indicate that the protocol uses the format defined by the Common Internet Scheme Syntax (CISS). The CISS is a common syntax for URL schemes that involve the direct use of IP-based protocols. These protocols specify a particular host on the Internet by a unique numeric identifier called an IP address or by a unique name that can be resolved into the IP address. The information after the double slashes follows a format that is dependent on the protocol type referenced in the URL. Here are two general formats:

1. protocol ://hostname:port/path_to_resource

2. protocol://username:password@hostname:port/path_to_resource

If you use a DOS/Windows-based system, you normally type a backslash to change directories and manoeuvre around the system. Consequently, you might have to remind yourself that the Web follows the UNIX syntax for slashes, and the slashes you type for URLs should be forward slashes.

Hostname information used in URLs identifies the address of a host and is broken down into two or more parts separated by periods. The periods are used to separate domain information from the hostname. The common domain names for Web servers begin with www, such as *www.xlri.com,* which identifies the Web server called *xiri* in the commercial domain. Domains you can specify in your URLs include:

corn — Commercial sites

edu — Educational sites

gov — Nonmilitary government sites

mil — Military sites

net — Network sites (developers. Internet Service Providers, and so on)

org — Organizational sites

Dynamic IP Addressing vs Static IP Addressing

In assigning IP addresses to machines, you have two choices. You can either go around typing in the individual address on each machine or you can set up one machine to assign IP addresses to the others. The second one, called dynamic addressing, is preferred for three reasons. First, it makes the job of administering the network, such as adding new clients, avoiding IP clashes, and so on, a lot easier. And second, since only those machines that are switched on will need an IP address, you could potentially have more machines on your network with dynamic addressing, than you could with static addressing. You do dynamic addressing with Dynamic Host Configuration Protocol (DHCP). To make DHCP work on your network, you have to set up a DHCP server.

Next Generation IP

The current version of IP is version 4 (IPv4). Under this version, the Internet addresses an 32 bits long and written as four sets of numbers separated by periods, e.g. 130.211.100.5 This format is also called dotted quad addressing. You may be familiar with addresses like *www.yahoo.com.* Behind each one of these character addresses is a 32-bit numerica address.

With IPv4, the maximum number of available addresses is slightly over 4 billion (2^{32}). This is a large number but because of the block assignments of IP numbers to individual organizations, these numbers may run out over the next few years. For this reason, the various Internet Society boards began to craft in the early 1990s the Next Generation Internet Protocol (Ipng). This protocol which was renamed IP version 6 (IPv6) has just begun to be adopted and it utilizes 128-bit addresses.

IPv6

The main changes from IPv4 to IPv6 can be summarized as follows:

About 1 billion people would be using the Internet by the end of the year 2005. One critical problem is the lack of address space. IPv4 which uses 32-bit addressing, theoretically has more than 4 billion addresses. But because of IP class implementation, it is not possible to use all of them. The solution is IPv6 which has 128-bit addressing space. It is expected that IPv6 will be implemented from 2005 onwards.

The address size for IPv6 has been increased to 128 bits. This solves the problem of the limited address space of IPv4 and offers a deeper addressing hierarchy and simpler configuration. There will come a day when you will hardly remember how it felt to have only 32 bits in an IP address. Network administrators will love the auto configuration mechanisms built into the protocol. Multicast routing has been improved, with the multicast address being extended by a scope field. And a new address type has been introduced, called Any cast address, which can send a message to the nearest single member of a group.

The 6 Bone

The 6 Bone started out as a network of IPv6 islands working over the existing IPv4 infrastructure of the Internet by tunneling IPv6 packets through IPv4 packets. The 6 Bone became a reality in early 1996 as a result of an initiative of several research institutes in France, Denmark, and Japan.

The Structure of the IPv6 Protocol

The IPv6 header has a fixed length of 40 bytes. This actually accommodates only an 8 byte header plus two 16 byte IP addresses (source address and destination address). See Figure 3.4. Some fields of the IPv4 header have been removed or have become optional. This way, packets can be handled faster with lower processing costs.

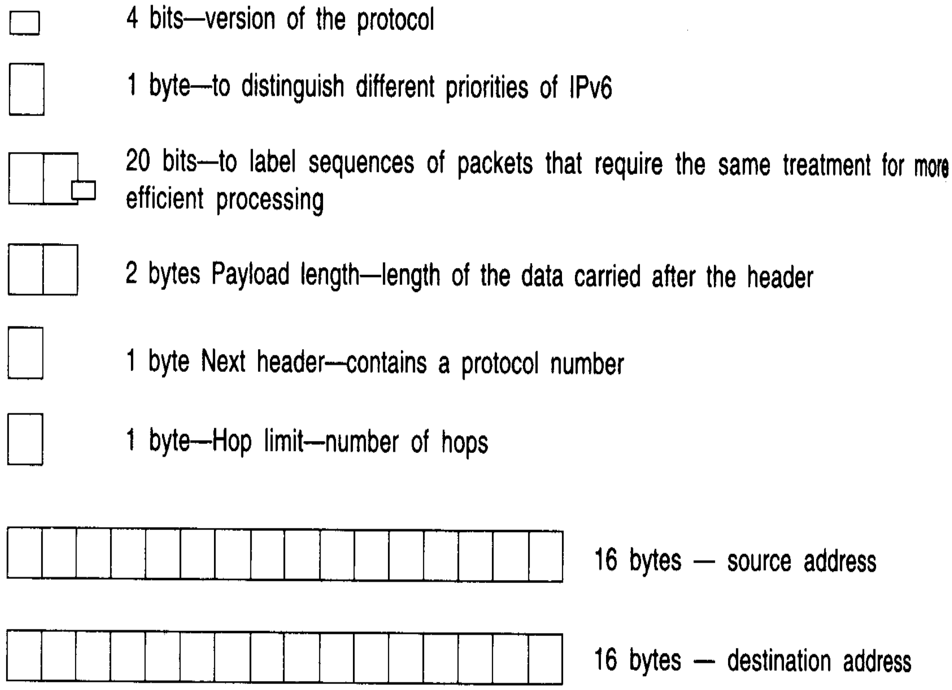


Fig. 3.4 General header structure of IPv6.

In IPv6, five fields from the IPv4 header have been removed:

- Header Length
- Identification
- Flags
- Fragment Offset
- Header Checksum

Version (4 **bits).** This is a 4-bit field and contains the version of the protocol. In the case of IPv6, the number 5 could not be used because it had already been assigned an experimental stream protocol.

Traffic class (1 byte). This field replaces the Type of Service field in IPv4. This field facilitates the handling of real-time data and any other data that requires special handling, This field can be used by sending nodes and forwarding routers to identify and distinguish between classes or priorities of IPv6 packets.

Flow label (20 **bits).** This field distinguishes packets that require the same treatment, in order to facilitate the handling of real-time traffic. A sending host can label sequences of packets with a set of options, routers keep track of flows and can process packets belonging to the same flow more efficiently because they do not have to reprocess each packet's header. A flow is uniquely identified by the flow label and the address of the source node.

Payload length (2 **bytes).** This field specifies the payload, i.e. the length of data carried after the IP header. The calculation in IPv6 is different from the one in IPv4. The Length Field in IPv4 includes the length of the IPv4 header, whereas the Payload Length field in IPv6 contains only the data following the IPv6 header. Extension headers are considered part of the payload and are therefore included in the calculation.

Next header (1 **byte).** In IPv4, this field is the Protocol Type field. It was renamed in IPv6 to reflect the new organization of IP packets. If the Next header is UDP or TCP, this field will contain the same protocol numbers as in IPv4, for example, protocol number 6 for TCP or 17 for UDP.

Hop limit (1 **byte).** This field is analogous to the TTL field in IPv4. The TTL field contains the number of seconds, indicating how long a packet can remain in the network before being destroyed. Most routers simply decremented this value by one at each hop. This field was renamed to Hop limit in IPv6. The value in this field now expresses the number of hops and not the number of seconds. Every forwarding node decrements the number by one.

Source address (16 bytes). This field contains the IP address of the originator of the packet.

Destination address (16 bytes). This field contains the IP address of the intended recipient of the packet. With IPv4, this field always contains the address of the ultimate destination of the packet. With IPv6, this field might not contain the IP address of the ultimate destination if a Routing header is present.

Extension headers

The IPv4 header can be extended from a minimum of 20 bytes to 60 bytes in order to specify options such as Security Options, Source Routing, or Timestamping. This capacity has rarely been used because it causes a performance hit.

The simpler a packet header, the faster the processing. IPv6 has a new way to deal with options, that has substantially improved processing. It handles options in additional headers called Extension headers.

The current IPv6 specification defines six Extension headers:

- Hop-by-Hop Options header
- Routing header
- Fragment header
- Destination Options header
- Authentication header
- Encrypted Security Payload header

Transmission Control Protocol (TCP)

The Internet uses packet switching hardware that can become overrun with datagrams. Since this necessitates an additional communication software, the TCP has been invented. All computers that connect to the Internet, run TCP/IP software.

TCP solves several problems that can occur in a packet switching system. If a router becomes overrun with datagrams, it must discard them. As a result, a datagram can be lost in its trip through the Internet. TCP automatically checks for lost datagrams and handles the problem. The Internet has a complex structure with multiple paths that datagrams can travel. When the hardware in a router fails or a network fails, the other routers start sending datagrams along a new path, analogous to the way cars detour around a barricade on a road. As a result of the change in routes, some datagrams can arrive at the destination in a different order than they were actually sent in. TCP automatically checks the incoming datagrams and puts the data back in order. Network hardware failures sometimes result in duplication of datagrams. TCP automatically checks for duplicate datagrams and accepts only the first copy of data that arrives. TCP software makes it possible for two computer programs to communicate across the Internet in a manner similar to the way humans use a telephone. Once the programs establish a connection, they can exchange arbitrary amounts of data and then terminate communication.

Although TCP and IP can be used separately, they were designed at the same time to work as part of a unified system, and were engineered to cooperate and to complement each other. TCP provides a connection-oriented, reliable, byte stream service. The term connection-oriented means that the two applications using TCP (normally considered a client and a server) must establish a TCP connection with each other before they can exchange data. There are exactly two end points communicating with each other on a TCP connection. TCP provides reliability by doing the following:

1. The application data is broken into what TCP considers the best sized chunks to send. The unit of information thus passed by TCP to IP is called a *segment.*

2. When TCP sends a segment it maintains a timer, waiting for the other end to acknowledge the

reception of the segment. If an acknowledgment is not received in time, the segment is retransmitted.

3. When TCP receives data from the other end of the connection, it sends an acknowledgement.

4. TCP maintains a checksum on its header and data. This is an end-to-end checksum whose purpose is to detect any modification of the data in transit. If a segment arrives with an invalid checksum, TCP discards it and does not acknowledge receiving it.

5. Since TCP segments are transmitted as IP datagrams, and since IP datagrams can arrive out of order, TCP segments can arrive out of order. A receiving TCP resequences the data if necessary, passing the received data in the correct order to the application.

6. Since IP datagrams can get duplicated, a receiving TCP must discard duplicate data.

7. TCP also provides flow control. Each end of a TCP connection has a finite amount of buffer space. A receiving TCP only allows the other end to send as much data as the receiver has buffers for. This prevents a fast host from taking all the buffers on a slower host.

IP Datagrams

IP is the workhorse protocol of the TCP/IP protocol suite. All TCP data gets transmitted as IP datagrams. IP provides an unreliable, connectionless datagram delivery service. By unreliable, it is meant that there are no guarantees that an IP datagram successfully reaches its destination. The term connectionless means that IP does not maintain any state information about successive datagrams. Each datagram is handled independently from all other datagrams. This also means that IP datagrams can get delivered out of order. If a source sends two consecutive datagrams (first A, then B) to the same destination, each is routed independently and can take different routes, with B arriving before A.

TCP/IP Protocol Suite Architecture

A protocol suite, such as TCP/IP, is the combination of different protocols at various layers. TCP/IP is normally considered to be a four layer system as shown in Figure 3.5.

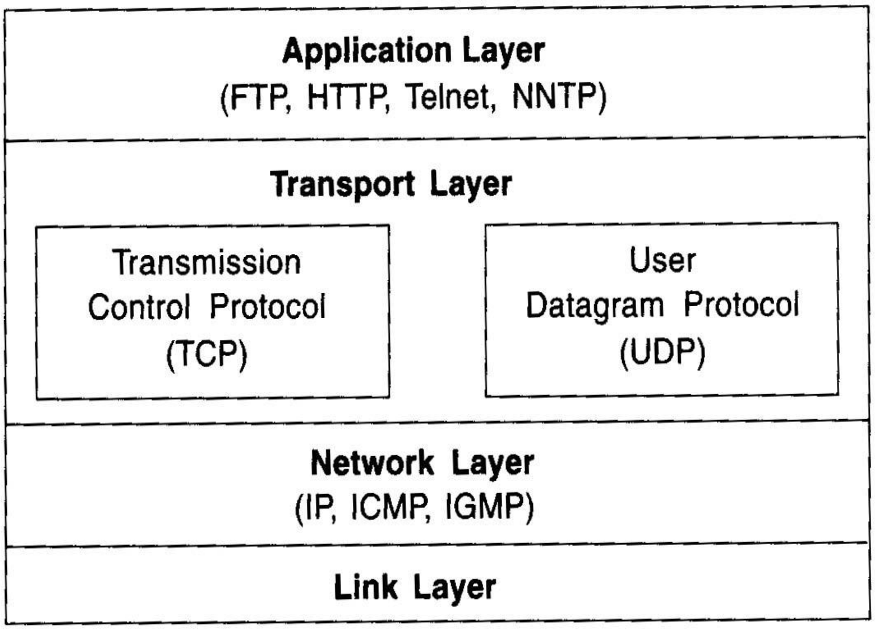


Fig. 3.5 Layering of TCP/IP.

Each layer has a different responsibility, listed as follows:

1. The link layer, sometimes called the data-link layer or network interface layer, normally includes the device driver in the operating system and the corresponding network interface card in the computer. Together they handle all the hardware details of physically interfacing with the cable.

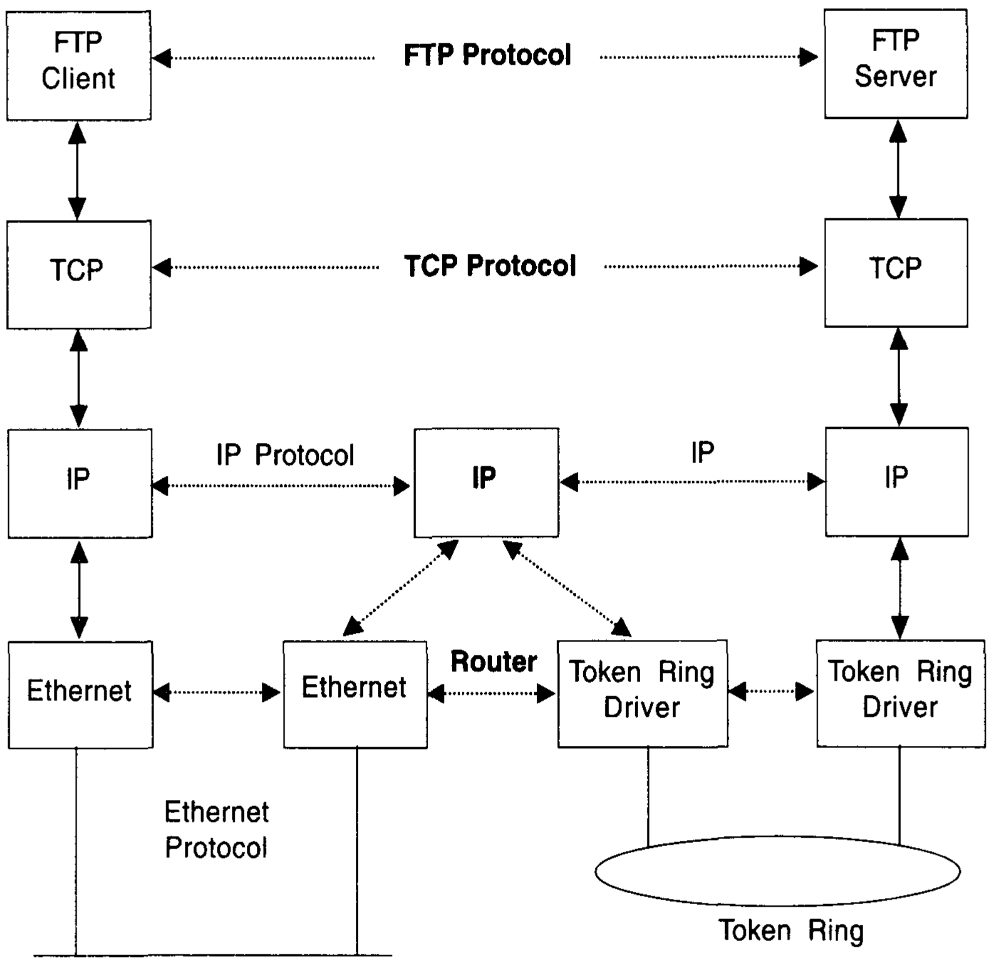
2. The network layer (also called the Internet layer) handles the movement of packets around the network.

Routing of packets, for example, takes place here. Internet Protocol provides the network layer in the TCP/IP protocol suite.

3. The transport layer provides a flow of data between two hosts, for the application layer above. In the TCP/IP protocol suite, there are two vastly different protocols: TCP and User Datagram Protocol (UDP).

The application layer handles the details of the particular application. One application box is labelled the FTP client and the other, the FTP server. Each layer has one or more protocols for communicating with its peer at the same layer. One protocol, for example, allows the two TCP layers to communicate, and another protocol lets the two IP layers communicate. The application layer is a user process, while the lower three layers are usually implemented in the kernel (the operating system). There is another critical difference between the top layer and the lower three layers. The application layer is concerned with the details of the application and not with the movement of data across the network. The lower three layers know nothing about the application but handle all the communication details.

The purpose of the network interface layer and the application layer are obvious: the former handles the details of the communication media while the latter handles the one specific user application. To understand the difference between the network layer and the transport layer, we connect two or more networks with a router. Figure 3.6 shows two networks connected with a router—an Ethernet and a token ring. The application layer and the transport layer use end-to-end protocols. The network layer, however, provides a hop-by-hop protocol and is used on the two end systems and an every intermediate system. A router, by definition, has two or more network interface layers (since it connects two or more networks). A system with multiple interfaces is called *multi-homed.*



Ethernet Fig. 3.6 Two networks connected with a router.

Encapsulation

Encapsulation is the packaging of attributes and functionality to create an object, essentially the one whose internal structure remains private, though accessible by other objects through a clearly defined interface. Encapsulation ensures security (see Figure 3.7).

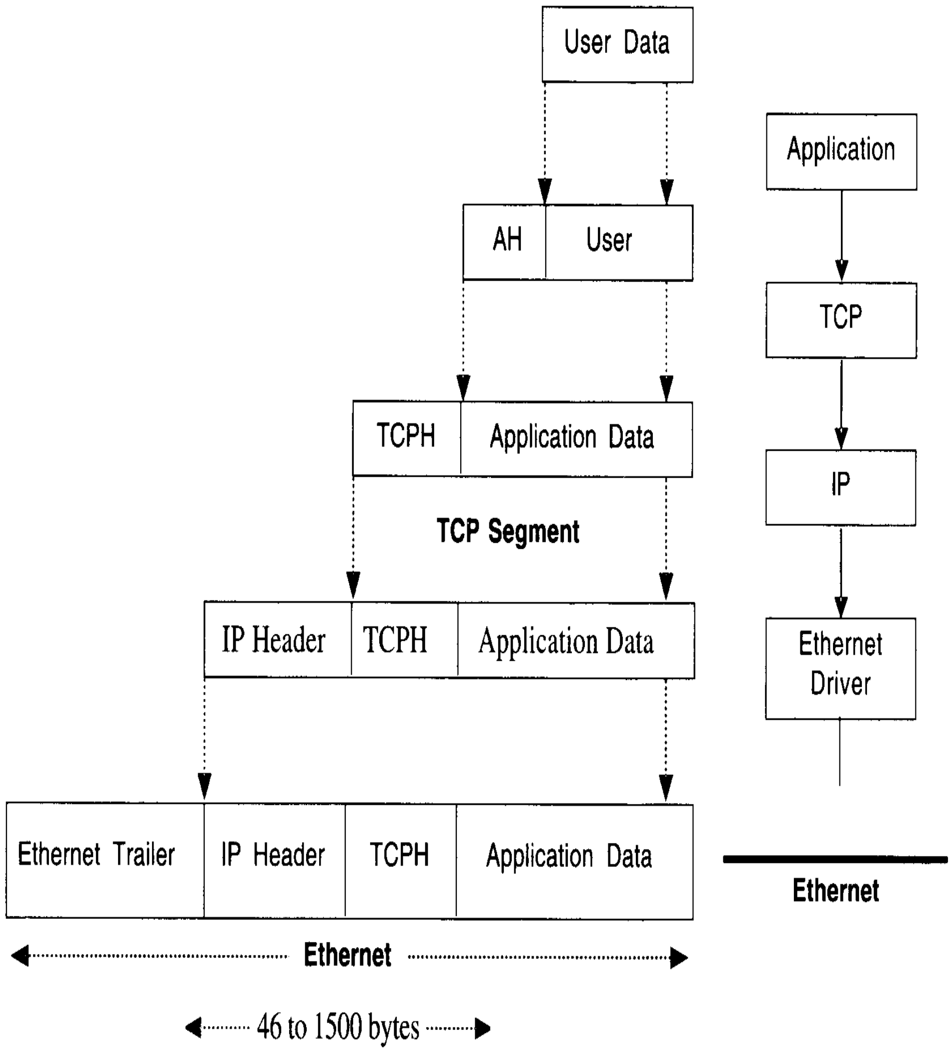


Fig. 3.7 Encapsulation.

AH in the given figure stands for Application Header and TCPH stands for TCP Header. The unit of data that TCP sends to IP is called a TCP segment. The unit of data that IP sends to the network interface is called an IP datagram. The stream of bits that flows across the Ethernet is called a *frame.*

Protocol Interfaces

Each layer in the TCP/IP protocol suite interacts with its immediate adjacent layers. At the source, the process layer makes use of the services of the host-to-host layer and provides data down to that layer. A similar relationship exists at the interface of the host-to-host and Internet layers and at the interface of the network access layers. At the destination, each layer delivers data up to the next higher layer. This use of each individual layer is not required by the architecture (see Figure 3.8).

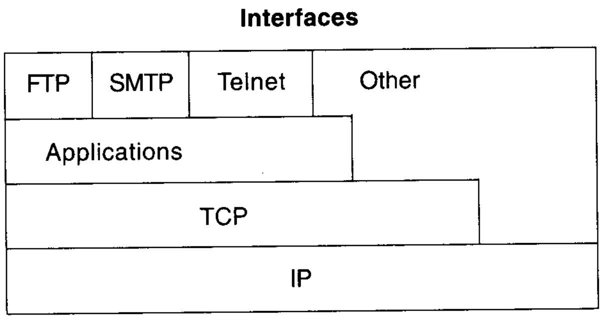


Fig. 3.8 TCP/IP Protocol suite.

As the figure suggests, it is possible to develop applications that directly invoke the services of any one of the layers. Most applications require a reliable end-to-end protocol and thus make use of TCP. Some special-purpose applications, such as the simple network management protocol (SNMP), use an alternative host-to-host protocol known as the user datagram protocol (UDP); others may make use of IP directly. Applications that do not involve internetworking and that do not need TCP, have been developed to invoke the network access layer directly.

3.4 Search Engines

The Internet today contains billions of websites, which is analogous to a library having billions of books. This list of websites is getting longer every second. In such a situation, if one has to search for a particular topic, it becomes almost impossible to find it, as one is aware of possibly a few hundred sites. It is at this point that the search engines come to our rescue; or rather they help us in finding the proverbial needle in this immense haystack (or a tiny fly in the web). We may use two basic approaches. The first one is by a search engine and the second, by a subject guide such as Yahoo, Snap, Looksmart, and Magellan. Subject guides are for browsing general topics. For specific information, one should use a search engine.

History of the Search Engines

The first of all search engines was Archie, created in 1990 by Alan Emtage, a student at McGill University in Montreal. The author originally wanted to call the program "archives", but had to shorten it to comply with the Unix world standard of assigning programs and files short, cryptic names.

In 1990, there was no World Wide Web. Nonetheless, there was still an Internet, and many files were scattered all over the vast network. The primary method of storing and retrieving files was via the FTP. This was (and still is) a system that specified a common way for computers to exchange files over the Internet. Initially, anyone who wanted to share a file had to set up an FTP server in order to make the file available to others. Later, anonymous FTP sites became repositories for files, allowing all users to post and retrieve them.

Even with archive sites, many important files were still scattered on small FTP servers. Unfortunately, these files could be located only by the Internet equivalent of word of mouth, i.e. somebody would post an e-mail to a message list or a discussion forum announcing the availability of a file.

Archie changed all that. It combined a script-based data gatherer, which fetched site listings of anonymous FTP files, with a regular expression matcher for retrieving file names matching a user query. In other words, Archie's gatherer scoured FTP sites across the Internet and indexed all the files it found. Its regular expression matcher provided users with access to its database.

How Do the Search Engines Work

All search engines have what are called 'robots' or 'spiders', which spend their time going from link to link across the Internet. When they find a new site or an updated site, they will copy some information about the site back to their home database. It is this database, which is interrogated when you run a search. People can register their Web pages with search engines, which means that they usually get listed much more quickly than waiting for the spiders to come across them. They may have the ability to search by some or all of the following search methods:

- Keyword searching
- Concept-based searching
- Refining the search
- Relevancy ranking
- Meta tags

Keyword Searching

This is the most common form of text search on the Web. Most search engines do their text query and retrieval using keywords. Essentially, this means that the search engine pull out the pages containing the words it finds matching the query, and are significant. Words that are mentioned on the top of a document and words that are repeated several times throughout the document are more likely to be deemed important.

Concept-based Searching

Unlike keyword search systems, the concept-based search systems try to determine what you mean, not just what you say. In the best circumstances, a concept-based search returns hits on documents that are about the subject/theme you are exploring, even if the words in the document do not precisely match the words you enter into the query.

Excite is currently the best-known general-purpose search engine site on the Web that relies on concept-based searching. This is also known as clustering—which essentially means that words are examined in relation to other words found nearby.

For example, the word 'heart', when used in the medical/health context, is likely to appear with such words as coronary, artery, lung, stroke, cholesterol, pump, blood, attack, and arteriosclerosis. If the word 'heart' appears in a document with other words such as flowers, candy, love, passion, and valentine, a very different context is established, and the search engine returns links for the pages on the subject of romance.

Refining the Search

Most sites offer two different types of searches—"basic" and "advanced". In a "basic" search, you just enter a keyword without sifting through any pull-down menus of additional options. Depending on the engine though, "basic" searches can be quite complex.

Advanced search refining options differ from one search engine to another, but some of the possibilities include the ability to search on more than one word, to give more weight to one search term than you give to another, and to exclude words that may give wrong results. You may also be able to search on proper names, on phrases, and on words that are in close proximity to other search terms.

Many, but not all search engines allow you to use Boolean operators to refine your search. These are the logical terms AND, OR, NOT, and the so-called proximal locators, NEAR and FOLLOWED BY.

Boolean AND.

This means that all the terms you specify must appear in the documents, i.e. "heart" AND "attack". You can use AND if you want to avoid other common irrelevant search results for your query.

Boolean OR.

This means that at least one of the terms you specify must appear in the documents, i.e. bronchitis, "acute" OR "chronic". You can use OR if you do not want to miss any relevant search result.

Boolean NOT.

This means that at least one of the terms you specify must not appear in the documents. You can use NOT if you anticipate results that would be totally off-base, i.e. nirvana AND Buddhism, NOT Cobain.

Capitalization.

This is essential for searching on proper names of people, companies or products. Unfortunately, many words in English are used both as proper and common nouns—Bill, bill. Gates, gates, Oracle, oracle, Lotus, lotus. Digital, digital—the list is endless.

3.5 Software Agents

E-commerce is changing the way business is being done in the Information Age. To gain a competitive edge, businesses are in need of new computational models and infrastructure. To address this need, businesses are developing a model of inter-organizational e-commerce. According to this model, different users are represented by autonomous software agents interconnected via the Internet. The agents act on behalf of their human users/organizations to perform information gathering tasks, such as locating and accessing information from various sources, filtering unwanted information, and providing decision support.

Information Overload

The information overload can be illustrated with the example of Sun Microsystems which reports that employees receive on an average over 100 e-mail messages a day. For

Sun, that is a million and a quarter messages a day. The content of the Web grows by an estimated 170,000 pages daily. Also, surveys of data warehouse projects reveal that a number of the larger retail and telecommunications companies have multiple terabyte databases.

The Web has provided end users with 'point-and-click' applications that enable them to browse and navigate through gigabytes and terabytes of data to their heart's content. Unfortunately, end users are often overwhelmed. They spend most of their time navigating and sorting through the data, spending little time interpreting and even less time actually doing something about what they find. The end result is that much of the data we gather goes unused.

Value of Software Agents in a Networked World

An agent can be defined as one that acts or exerts power. It can be an autonomous, (preferably) intelligent, collaborative, adaptive, computational entity. Here, intelligence is the ability to infer and execute needed actions, and seek and incorporate relevant information, given certain goals.

Intelligent Agent (IA) is an agent, which has the capability to deal with new and trying situations. IA must have autonomous and rational properties. Intelligent Agent is a software program that uses agent communication protocols to exchange information for automatic problem solving. IA might have services capabilities, ability for autonomous decision, and commitments features. Some other criteria such as cooperation, negotiation, and conflict resolution make IA more personalized.

The range of firms and universities actively pursuing agent technology is quite broad, and the list is ever-growing. It includes small non-household names (e.g. Icon, Edify and Verity), medium-size organizations (e.g. Carnegie Mellon University (CMU), General Magic, Massachusetts Institute of Technology (MIT), the University of London), and the real big multinationals (e.g. Alcatel, Apple, AT&T, BT, Daimler-Benz, HP, IBM, Microsoft, Oracle, Sharp). Clearly, these companies are by no means completely homogeneous, especially if others such as Reuters and Dow Jones are appended to this list.

Software agents have synonyms including knowbots (i.e. knowledge-based robots), softbots (software robots), taskbots (task-based robots), userbots, robots, personal agents, autonomous agents, and personal assistants. There are some good reasons for having such synonyms. Firstly, the agents come in many physical guises: for example, those that inhabit the physical world, for example, a factory, are called robots; those that inhabit vast computer networks are sometimes referred to as softbots; those that perform specific tasks are sometimes called taskbots; and autonomous agents refer typically to mobile agents or robots which operate in dynamic and uncertain environments. Secondly, agents can play many roles, say, personal assistants or knowbots, which have expert knowledge in some specific domain. Furthermore, due to the multiplicity of roles that agents can play, there is now a plethora of adjectives which precede the word agent: search agents, report agents, presentation agents, navigation agents, role-playing agents, management agents, search and retrieval agents, domain-specific agents, development agents, analysis and design agents, testing agents, packaging agents, and help agents.

A major advantage of employing software agents with intranet, the Internet, and extranet applications is that they are able to assist in locating and filtering all the data. They save time by making decisions about what is relevant to the user. They are able to sort through the network and the various databases effortlessly and with unswerving attention to detail to extract the best data. They are not limited to hard (quantitative) data, but can also be useful in obtaining soft data about new trends that may cause unanticipated changes and opportunities in local or even global markets. With an agent at work, the competent user's decision-making ability is enhanced with information rather than paralyzed by too much input. Agents are Artificial Intelligence's answer to a need created by internetworked computers.

Information access and navigation are today's major applications of software agents in the intranet, the Internet, and the extranet worlds, but there are other reasons why this technology is expected to grow rapidly.

1. *Mundane personal activity:*

In a fast-paced society, time-strapped people need new ways to minimize the time spent on routine personal tasks such as shopping for groceries or travel planning, so that they can devote more time to professional activities.

2. *Search and retrieval:*

It is not possible to directly manipulate a distributed database system in an e-commerce setting with millions of data objects. Users will have to relegate the task of searching and cost comparison to agents. These agents will perform the cumbersome, time-consuming tasks of searching databases, retrieving and filtering information, and delivering it back to the user.

3. *Repetitive office activity:*

There is a pressing need to automate tasks performed by administrative and clerical personnel in functions such as sales or customer support, to reduce labor costs and increase office productivity. Today, labor costs are estimated to be as much as 60 per cent of the total cost of information delivery.

4. *Decision support:*

There is a need for increased support for tasks performed by knowledge workers, especially in the decision-making area. Timely and knowledgeable decisions made by these professionals, greatly increase their effectiveness and the success of their business in the marketplace.

5. *Domain experts:*

It is advisable to model costly expertise and make it widely available. Examples of expert software agents could be models of real-world agents such as translators, lawyers, diplomats, union negotiators, and stockbrokers.

To date, the list of tasks to which commercially available agents and research prototypes have been applied includes advising, alerting, broadcasting, browsing, critiquing, distributing, enlisting, empowering, explaining, filtering, guiding, identifying, matching, monitoring, navigating, negotiating, organizing, presenting, querying, reminding, reporting, retrieving, scheduling, searching, securing, soliciting, sorting, storing, suggesting, summarizing, teaching, translating, and watching.

On the whole, the software agents make the networked world less forbidding, save time by reducing the effort required to locate and retrieve data, and improve productivity by off-loading a variety of mundane, tedious and mindless tasks.

A Typology of Agents

Firstly, the agents may be classified by their mobility, i.e. by their ability to move around some networks. They can thus be called *static* or *mobile* agents.

Secondly, they may be classed as either *deliberative* or *reactive.* Deliberative agents derive from the deliberative thinking paradigm: the agents possess an internal, symbolic, reasoning model and they engage in planning and negotiation in order to achieve coordination with other agents.

Thirdly, agents may be classified along several ideal and primary attributes which they need to exhibit. Some of them are: autonomy, learning and cooperation. We appreciate that any such list would be contentious. Hence, we are not claiming that this is a necessary or a sufficient set. *Autonomy* refers to the principle that agents can operate on their own without any need for human guidance, even though this would sometimes be invaluable. Hence, agents have individual internal states and goals, and they act in such a manner as to meet its goals on behalf of its user. A key element of their autonomy is their proactiveness, i.e. their ability to take the initiative rather than act simply in response to their environment. Cooperation with other agents is of great importance because it is the reason for having multiple agents in the first place in contrast to having just one. In order to cooperate, agents need to possess a social ability, i.e. the ability to interact with other agents and possibly humans via some communication language. Having said this, it is not possible for agents to coordinate their actions without cooperation. Lastly, for agent systems to be truly smart, they would have to *learn* as they react and/or interact with their external environment. In our view, agents are (or should be) disembodied bits of intelligence. Though we will not attempt to define what intelligence is, we maintain that a key attribute of any intelligent being is its ability to learn. Learning may also take the form of increased performance over time. We use these three minimal characteristics in Figure 3.9 to derive four types of agents to include in our typology: *collaborative agents, collaborative learning agents, interface agents* and *truly smart agents.*

A Panoramic Overview of the Different Agent Types

Let us now have an overview of the different agent types in Figure 3.10.

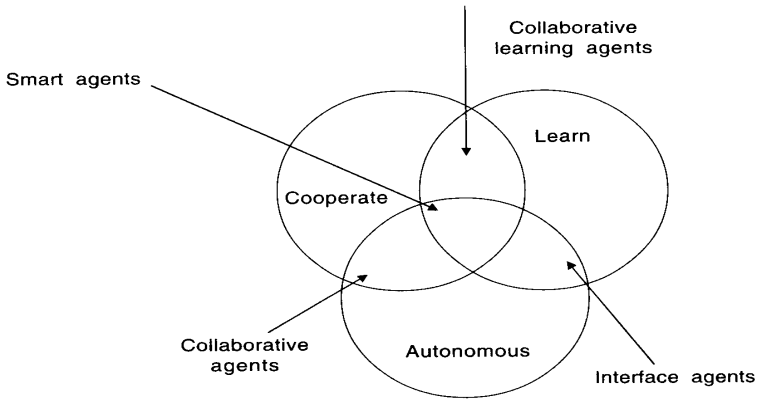


Fig. 3.9 A partial view of agent typology

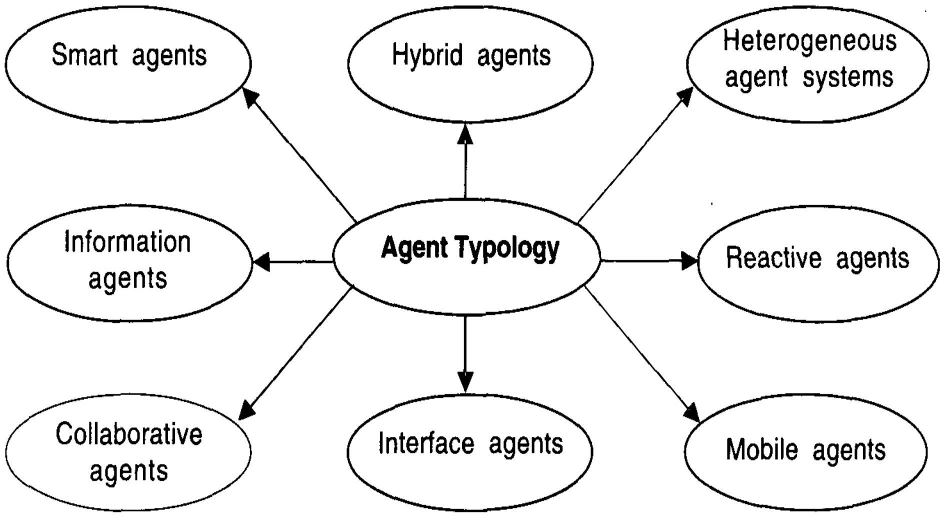


Fig. 3.10 Classification of software agents.

Collaborative Agents

Collaborative agents emphasize autonomy and cooperation (with other agents) in order to perform tasks for their owners. They may leam, but this aspect is not typically a major emphasis of their operation. In order to have a coordinated set-up of collaborative agents, they may have to negotiate and reach mutually acceptable agreements on some matters.

In brief, the general characteristics of these agents include autonomy, social ability, responsiveness and proactiveness. Hence, they are able to act rationally and autonomously in an open and time-constrained multi-agent environment. They tend to be static, large, coarse-grained agents. They may be benevolent, rational, truthful, or some combination of these, or none. Typically, most recently implemented collaborative agents do not perform any complex learning, though they may or may not perform limited parametric or rote learning. The motivation for having collaborative agent systems may include one or several of the following:

1. To solve problems that are too large for a centralized single agent to do due to resource limitations or the sheer risk of having one centralized system

2. To allow interconnecting and interoperation of multiple existing legacy systems, e.g. expert systems, decision support systems, and so forth

3. To provide solutions to inherently distributed problems, e.g. distributed sensor networks or air-traffic control

4. To provide solutions in the form of distributed information sources, e.g. for distributed online information sources, it is natural to adopt a distributed and collaborative agent approach

5. To provide solutions where the expertise is distributed, e.g. in healthcare provisioning

6. To enhance modularity (which reduces complexity), speed (due to parallelism), reliability (due to redundancy), flexibility (i.e. new tasks are composed more easily due to the more modular organization) and reusability at the knowledge level (hence shareability of resources)

7. To research into other issues, e.g. understanding interactions among human societies.

Interface Agents

Interface agents emphasize autonomy and learning in order to perform tasks for their owners. The key metaphor underlying interface agents is that of a personal assistant who is collaborating with the user in the same work environment. Note the subtle emphasis and distinction between collaborating with the user and collaborating with other agents as is the case with collaborative agents. Collaborating with a user may not require an explicit agent communication language as is required when collaborating with other agents.

The user's agent acts as an autonomous personal assistant which cooperates with the user in accomplishing some task in the application. As for learning, an interface agent leams typically to assist its user better in four ways: by observing and imitating the user (i.e. learning from the user); receiving positive and negative feedback from the user (learning from the user); receiving explicit instructions from the user (learning from the user); and asking other agents for advice (i.e. learning from peers).

Mobile Agents

Mobile agents are computational software processes capable of roaming Wide Area Networks (WANs) such as the WWW, interacting with foreign hosts, gathering information on behalf of their owners, and coming back home, having performed the duties set by their users. These duties may range from flight reservation to managing a telecommunications network. However, mobility is neither a necessary nor a sufficient condition for agenthood. Mobile agents are autonomous and cooperate, albeit differently from collaborative agents. For example, they may cooperate or communicate with one agent making the location of some of its internal objects and methods known to other agents. By doing this, an agent exchanges data or information with other agents without necessarily giving all its information away. The need for mobile agents includes the following anticipated benefits:

1. *Reduced communication costs.* There may be a lot of raw information that needs to be examined to determine its relevance. Transferring this raw information can be very time-consuming and may even clog the networks. Imagine having to transfer many images just to pick out one. It is much more natural to get your agents to "go" to that location, do a local search/pruning and transfer only the chosen compressed image back across the network. It obviates the need for costly network connections between remote computers as required in Remote Procedure Calls (RPC). It provides a much cheaper alternative as we pay increasingly for network bandwidth and time, such as CompuServe users already do. In the future, we would almost certainly be charged by bytes for bandwidth, though others maintain that the bandwidth would be free.

2. *Limited local resources.* The processing power and storage on the local machine may be very limited (perhaps only for processing and storing the results of a search), thereby necessitating the use of mobile agents.

3. *Easier coordination.* It may be simpler to coordinate a number of remote and independent requests and just locally collate all the results.

4. *Asynchronous computing.* You can set off your mobile agents and do something else and the results will be back in your mailbox, say, at some later time. They may operate when you are not even connected.

5. *Natural development environment.* It provides a natural development environment for implementing free market trading services. New services can come and go dynamically and much more flexible services may co-exist with inferior ones, providing more choices for consumers.

6. *A flexible distributed computing architecture.* Mobile agents provide a unique distributed computing architecture which functions differently from the static setups. It provides for an innovative way of doing distributed computation.

7. *Rethinking on design process.* Mobile agents represent an opportunity for a radical and an attractive rethinking of the design process in general. Following on from the latter, it turns the conventional design process on its head, and some truly innovative products should/would emerge out of mobile agent technology.

Information/Internet Agents

Information agents have come about because of the sheer demand for tools to help us manage the explosive growth of information we are currently experiencing, and which we will continue to experience henceforth. Information agents perform the role of managing, manipulating or collating information from many distributed sources.

Interface or collaborative agents started out quite distinct, but with the explosion of the WWW and their applicability to this vast WAN, there is now a significant degree of overlapping. This is inevitable, especially since information or Internet agents are defined using different criteria. They are defined by what 'they do', in contrast to collaborative or interface agents which are defined by what 'they are'. Many of the interface agents built at the MIT Media Labs, for example, are autonomous and learned, but they have been employed in WWW-based roles; hence, they are in a sense, information agents.

Similarly, it is also true that we are drowning in data, being at the same time, starved of information. The underlying hypothesis of information agents is that, somehow they can ameliorate, but certainly not eliminate, this specific problem of information overload and the general issue of information management in this information era.

The motivation for developing information/Internet agents is at least twofold. First, there is simply a yearning need/demand for tools to manage such information explosion. Everyone on the WWW would benefit from them in just the same way as they benefit from search engines such as Google, Spiders, Lycos, or Webcrawlers.

Second, there are vast financial benefits to be gained. Recall that Netscape Corporation grew from relative obscurity to a billion dollar company almost overnight—and a Netscape or Internet Explorer client generally offers browsing capabilities, albeit with a few add-ons.

Information agents have varying characteristics: they may be static or mobile; they may be non-cooperative or social; and they may or may not learn. Hence, there is no standard mode to their operation. Internet agents could be mobile, i.e. they may be able to traverse the WWW, gather information and report what they retrieve to a home location. However, this is not the norm as yet. Information agents may be associated with some particular indexer(s), e.g. a Spider. A Spider is an indexer, able to search in depth, the WWW, and store the topology of the WWW in a database management system (DBMS) and the full index of URLs in the WAIS. Other search/indexing engines or spiders such as Lycos or Webcrawler can be used similarly to build up the index. Indeed, there are currently more than twenty spiders on the WWW.

The user information agent, which has been requested to collate information on some subject, issues various search requests to one or several URL search engines to meet the request. Some of this search may even be done locally if it has a local cache. The information is collated and sent back to the user.

Reactive Software Agents

Reactive agents represent a special category of agents which do not possess internal, symbolic models of their environments; instead they act/respond in a stimulus-response manner to the present state of the environment in which they are embedded. However, the most important points to be noted about the reactive agents are not these (i.e. languages, theories or architectures), but the fact that the agents are relatively simple and they interact with other agents in basic ways. Nevertheless, complex patterns of behaviour emerge from these interactions when the ensemble of agents is viewed globally.

Traditional Artificial Intelligence (AI) has staked most of its bets on the latter, which holds that the necessary and sufficient condition for a physical system to demonstrate intelligent action is that it is a physical symbol system. On the contrary, the physical grounding hypothesis challenges this long-held view, arguing that it is flawed fundamentally, and that it imposes severe limitations on symbolic AI-based systems. This new hypothesis states that in order to build a system that is intelligent, it is necessary to have representations grounded in the physical world.

The key benefit which motivates the reactive agents is the hope that they would be more robust and fault tolerant than other agent-based systems, e.g. an agent may be lost but without any catastrophic effects. Other benefits include flexibility and adaptability, in contrast to the inflexibility, slow response times and brittleness of classical AI systems. Another benefit, it is hoped, is that this type of work would address the frame problem which has so far proved intractable with traditional AI techniques such as non-monotonic reasoning.

Other challenges include the following:

1. Expanding the range and number of applications based on reactive agents

2. Yearning need for a clearer methodology to facilitate the development of reactive software agent applications. This may or may not require the development of more associated theories, architectures and languages. Much of the current approaches are on the basis of trial and error

3. Issues such as scalability and performance need to be addressed, though these are unlikely to be important until clearer methodologies are developed and evaluated.

Hybrid Agents

So far, we have reviewed five types of agents: collaborative, interface, mobile. Internet and reactive agents. The debates as to which of them is better are rather academic, and frankly, sterile, rather too early to get into. Since each type has (or promises) its own strengths and deficiencies, the trick (as always) is to maximize the strengths and minimize the deficiencies of the most relevant technique for your particular purpose. Frequently, one way of doing this is to adopt a hybrid approach which brings together the strengths of both the deliberative and reactive paradigms. Hence, hybrid agents refer to those whose constitution is a combination of two or more agent philosophies within a singular agent. These philosophies include a mobile philosophy, an interface agent philosophy and collaborative agent philosophy.

Hybrid agent architectures are still relatively few in number but the cause for having them is overwhelming. There are usually three typical criticisms of hybrid architectures in general. Firstly, hybridism usually translates to ad hoc or unprincipled designs with all its related problems. Secondly, many hybrid architectures tend to be very application-specific. Thirdly, the theory which undermines the hybrid systems is not usually specified. Therefore, we see the challenges for hybrid agents research quite similar to those identified for reactive agents. In addition to these, we would also expect to see the hybrids of philosophies other than those of reactive/deliberative ones. For example, there is scope for more hybrids within a singular agent: combining the interface agent and mobile agent philosophies, which would enable mobile agents to be able to harness features of typical interface agents; or some other combination.

Heterogeneous Agent Systems

Heterogeneous agent systems, unlike hybrid systems described in the preceding section, refer to an integrated set-up of at least two or more agents which belong to two or more different agent classes. A heterogeneous agent system may also contain one or more hybrid agents.

The essential argument is that the world abounds with a rich diversity of software products, providing a wide range of services for a similarly wide range of domains. Though these programs work in isolation, there is an increasing demand to have them interoperate— hopefully, in such a manner that they provide added value as an ensemble than they do individually. The hypothesis is that this is plausible. Indeed, a new domain called agent-based software engineering has been invented in order to facilitate the interoperation of miscellaneous software agents. A key requirement for interoperation amongst heterogeneous agents is having an Agent Communication Language (ACL) through which the different software agents can communicate with each other. The potential benefits for having the heterogeneous agent technology are as follows:

1. Standalone applications can be made to provide value-added services in order to participate and interoperate in cooperative heterogeneous set-ups.

2. The software legacy problem may be ameliorated since it could obviate the need for costly software rewrites, as they are given new leases of life by their interoperation with other systems. At the very least, the heterogeneous agent technology may lessen the blow or effect of routine software maintenance, upgrades or rewrites.

3. Agent-based software engineering provides a radical new approach to software design, implementation and maintenance in general, and software interoperability in particular. Its ramifications (e.g. moving from passive modules in traditional software engineering to proactive agent-controlled ones) would only be clear as this methodology and its tools become clearer.

Smart Agents

Smart agents are those agents which can leam, cooperate, and are autonomous. In a way, all agents are smart. But for our understanding, when these three qualities are combined in an agent, we call it smart.

Software Agents at Work

Auction watchers, comparison shoppers, personal web spiders, newshounds, site recommenders, and portfolio assistants are some of the agents operating in today's e-commerce world. It does not stop with these. The pace at which existing and experimental agent technologies are being applied to the virtual world has quickened. This is evident from the papers presented in conferences on software agents. A good place to monitor new applications of software agents and to keep an eye on both their immediate and long-term future is the Bot Spot website *(www.botspot.com).*

The use of the Internet has accelerated at an unprecedented pace. However, its effective use by humans or decision support machine systems has been hampered by some dominant characteristics of the Infosphere. First, information available from the Internet is unorganized, multi-modal, and distributed on server sites all over the world. Second, the number and variety of data sources and services is dramatically increasing every day. Furthermore, the availability, type and reliability of information services are constantly changing. Third, the same piece of information can be accessed from a variety of different information sources. Fourth, information is ambiguous and possibly erroneous due to the dynamic nature of the information sources and potential information updating and maintenance problems. Therefore, information is becoming increasingly more difficult for a person or machine system to collect, filter, evaluate, and use in problem solving. As a result, the problem of locating information sources, accessing, filtering, and integrating information in support of decision making, as well as coordinating information retrieval and problem solving efforts of information sources and decision-making systems has become a very critical task. Intelligent Software Agents are being used to address these challenges.

Most of the current agent-oriented approaches have focused on what we call *interface agents,* which is a single agent with simple knowledge and problem solving capabilities, whose main task is information filtering to alleviate the user's cognitive overload. Another type of agent is the *SoftBot,* a single agent with general knowledge that performs a wide range of user-delegated information-finding tasks. Unless the agent has beyond the state-of-the-art learning capabilities, it would need considerable reprogramming to deal with the appearance of new agents and information sources in the environment. Because of the complexity of the information finding and filtering task, and the large amount of information, the required processing would overwhelm a single agent. So a proposed solution is to use multi-agent computer systems to access, filter, evaluate, and integrate this information. Such multi-agent systems can compartmentalize specialized task knowledge, organize themselves to avoid processing bottlenecks, and can be built expressly to deal with dynamic changes in the agent and information-source landscape. In addition. Multiple Intelligent Coordinating Agents are ideally suited to the predominant characteristics of the Infosphere, such as the heterogeneity of the information sources, and the presence of multiple users with related information needs.

3.6 ISPs in India

Internet access, in a sense, came into India in the early 1990s. ERNet, a division of Department of Electronics (DoE), and NICNet (Department of Statistics) made the initial inroads in this field. Both ERNet and NICNet are government projects, but with very different charters and growth histories.

The ERNet (Educational and Research Network) project was designed to provide Internet connectivity to the premier educational and research institutions of India, while NICNet was assigned the provision of Internet services primarily to government departments and organizations.

NICNet was designed to provide V-SAT and dial-up Internet access primarily to government departments. It began with shell-only access, at 2400 bps, but now provides high speed TCP/IP access through 64 kbps V-SAT links.

ERNet and NICNet are thus India's first ISPs, though their operations have been shackled by the restrictions imposed on them by the government in the form of regulations and policies of the DoT. Despite this, they were doing quite well in providing essential Internet services to an Internet-starved India, until the advent of VSNL Internet services and the restrictive clampdown that followed.

Another provider of Internet services that preceded Videsh Sanchar Nigam Limited (VSNL) is the Software Technology Parks of India (STPI) Internet service. Again, this service was permitted only to a restricted audience, essentially the software exporters who fall under the STP scheme of the DoE. STPI has been providing high-end Internet services through leased lines and dial-up links, in and around several parts of the country, through the respective SoftNET networks.

On 15th August 1995, VSNL launched the **Gateway Internet** Access Service, for providing public Internet access. Starting with only dial-up shell and PPP access in the 4 metros, VSNL followed with leased-line access to subscribers, followed by the setting up of points of presence (POP) in Bangalore and Pune. VSNL has, since the inception of GIAS, portrayed itself in the press as India's only legitimate ISP, while forcing many restrictions on the other ISPs through DoT regulations and the telecom policy.

Terms Related to ISPs

There are some terms exclusive for ISPs. Let us discuss them now.

Shell Access

Internet access supporting only textual interfaces, with Unix or Unix-like operating system commands. This requires "logging in" to a Unix-type user account, and then operating via textual commands or text-based menu systems. Shell access does not use the TCP/IP network protocols between the user (client) end and the servers. Therefore, applications like Netscape, NFS file sharing, and Internet telephony cannot be used.

Dial-up Modem

As opposed to leased-line modems, this device is connected between a computer or a Data Terminal Equipment (DTE) and a conventional POTS analog telephone line. This is used to dial in to a corresponding modem at the service provider, and connect to the Internet or other services (e.g. INET X.25 network).

Serial Line Internet Protocol (SLIP)

SLIP is one of the popular protocols for IP access over dial-up and analog leased lines. Now commonly superseded by Point-to-Point Protocol (PPP), it is still used by some ISPs. SLIP and PPP are two similar methods of encapsulating TCP packets to go over a modem line. PPP is simpler to set up, as compared to SLIP, and can handle more types of traffic. These two enable the PCs to become part of the Internet.

Very Small Aperture Terminal (V-SAT)

V-SAT is a satellite-based digital communication system usually consisting of 1.8 metre diameter satellite dishes establishing point-to-point connections, often via a V-SAT hub, a central switching system. Bandwidths can be from 2400 bps to 256 kbps. Communication delay is high, due to the two satellite hops between end points, and hub latency.

Types of Broadband Technologies

Broadband technology refers to the means by which access can be made speedier. There are several such technologies, each of which can be discussed in the following manner:

Digital Subscriber Line (DSL)

Faced with the limitations of their cable infrastructure, the telecommunications industry needed a technology that could deliver high-bandwidth Internet access over existing phone wiring. Integrated Services Digital Network (ISDN) was offered in the mid 1990s with moderate success. However, the telephone companies soon found their switched voice networks saturated with data traffic. DSL has gained wide success. It is comprised of two basic pans: a head-end device, called a Digital Subscriber Line Access Multiplexer, and a DSL modem/router, which is found at the subscriber location. The human ear can detect sonic waves up to a frequency of about 20 kHz. DSL essentially modulates binary data into sonic frequencies above 20 kHz. Thus data can "ride" the phone lines alongside an active voice transmission, undetected by the caller.

Cable Modems

Faced with competition as well as an increasing number of customers who are switching to digital satellite service, cable Multiple Service Operators (MSOs) needed to quickly adopt value added services to capture and retain their customer base. One of these services is highspeed Internet access via a cable modem.

Cable modem technology utilizes the Hybrid Fibre Coax (HFC) or the all-coaxial infrastructure of the local cable provider. Cable modems and cable head-end devices usually adhere to the Data Over Cable Service Interface System (DOCSIS) initiative. This system consists of a head-end device located at the MSO and a cable modem located on the customer's premises. The cable modem provides an Ethernet port for connectivity to the customer's PC or network.

Bandwidth capabilities have undergone several evolutions, from 500 kbps to 4 mbps, then to 10 mbps, and finally to 30 mbps. Manufacturers are now promising even further bandwidth increases. However, while bandwidth on this scale may be adequate for today's applications, it will suffer serious scalability issues in the future.

Passive Optical Networks (PON)

Passive Optical Networks are access networks in which fiber trunks are fed towards end points and split into multipoint trees along the way, until reaching a termination of the fiber run. A PON consists of Optical Line Termination (OLT) and Optical Network Unit (ONU) equipment. It is deemed "passive" because the physical connection between the OLT and ONUs, referred to as the Optical Distribution Network (ODN), consists only of passive components such as optical fibers, connectors, splitters, combiners, and splice points. One OLT typically supports up to 32 ONUs; the ITU recommendation states a desired support for up to 64 ONUs.

Wireless LAN and LMDS

Local Multipoint Distribution Service (LMDS) and IEEE 802.11 represent a growing popularity of non-terrestrial network systems. While they both employ the use of radio frequencies, they are vastly different in both intent and deployment.

Early in 1998, the FCC held an auction of the wireless spectrums in the range of 28-31 GHz, which were to be utilized for LMDS implementations. This accomplished two things—generating over a half-billion dollars of revenue for the FCC, and opening up real competition in the local loop. While LMDS is not specifically being deployed for local broadband services to date, it is conceivable that it will be in the near future.

The major applications being considered for the future of LMDS are wireless consumer video and wireless Internet access. Some providers are placing fixed antennae throughout metropolitan areas, offering wireless service to the Internet through LMDS. Currently deployed bandwidth of these systems is comparable to the sub 300 kbps DSL service that ILECs are providing. However, the frequency band utilized is so large that the bandwidth could be scaled much higher.

Asynchronous Transfer Mode (ATM)

ATM emerged in the early to mid-1990s as a telecommunication grown technology that was being pushed to the enterprise LAN. Simply explained, ATM is a Layer 2 technology that establishes connection-oriented Virtual Circuits (VC) across the network. VCs can either be manually configured, using permanent virtual circuits (PVCs), or set up and torn down dynamically as needed, using Switched Virtual Circuits (SVCs). Once a connection is established, data packets are segmented into 53-byte cells. These cells are transmitted across the VC to the egress ATM switch, reassembled into the original packet, and delivered to the intended destination. This process is called segmentation and reassembly.

Since ATM is a protocol unto itself and switches at Layer 2, it is unbiased to whatever is sent over it. Data, voice, video, or virtually anything else can be sent across an ATM network. All data packets are converted into an ATM cell for transport, and then reassembled for end-node delivery.

While ATM has been very successful in the telecommunications carrier space, the enterprises have refused to adopt it. One of the ATM's best arguments is its ability to implement end-to-end Quality of Service (QoS) throughout the network. While this makes it possible to give preferred service to applications that have stringent requirements regarding delay or bandwidth, the number of applications that can signal for the required service level is not significant enough to balance out the ATM's faults. Huge costs and complex technology prevent the majority of network managers from implementing ATM. Now, in the local loop broadband market, technologies built upon ATM technology, such as PON, are trying to find a home. Ethernet and its associated standards surpassed ATM in speed, cost-efficiency and other features in the enterprise. Once again, ATM is fighting a losing battle in the broadband access space.

10/100/1000 Mbps Ethernet

Ethernet has enjoyed phenomenal success in enterprise LANs since its inception in the early 1980s. Today, well over 90 per cent of deployed networks are based on this solid and standardized technology. It has grown from a shared 10 mbps technology, where all users on the network contend for the same pool of bandwidth, into a switched technology providing dedicated bandwidth to each subscriber at up to a full gigabyte of throughput. Thousands of Ethernet devices are available to handle everything from small, home-based networks, to wiring closets and even Fortune 500 backbones. World-wide shipments of Ethernet devices measure in tens of millions of interfaces.

The IEEE 802.3 committee, which is responsible for the Ethernet standard, is broken into sub-committees based on different versions of Ethernet. The following are the specific committees:

IEEE 802.3—Ethernet (10 Mbps)

IEEE 802.3u—Fast Ethernet (100 Mbps)

IEEE 802.3z—Gigabyte Ethernet (1000 Mbps)

IEEE 802.3ae—10 Gbps Ethernet (10 Gbps): standard under development.

Hypertext

Hypertext allows the visual blurring of boundaries, renaming whole nodes and links to bring all the texts you receive into an indistinguishable aggregate of nodes and links. There would be no one central individual text with the others relegated to comments on, yet the whole could also be read as an integrated, communal discourse not co-authored in the traditional way, but conjoined by the editor's activities. The natural mode of hypertext is compilation rather than linear creation. Hypertext documents are chiefly made up of links to other documents, or other lists of links. Every file, site, movie or sound file, or anything on the Web has a unique URL to identify in which computer it is located, where it is within that computer, and its specific file name. Every Hypertext link on every Web page in the world contains one of the URLs. When a link on a Web page is clicked, a request is sent to retrieve the unique document on some computer in the world that is uniquely identified by that URL. A whole cluster of internationally accepted standards (such as TCP/IP and HTML) make possible this global information retrieval phenomenon that transcends all political and language boundaries.

Hyper Text Markup Language (HTML) is a powerful document-processing language. HTML is not a programming language; thus, you do not have to be a programmer to create HTML documents. Instead, using HTML, you simply embed special symbols (tags), which have specific meaning to your browser, within your documents. HTML documents are plain ASCII text files. Unlike a word processor, which focuses on the format of a document, HTML focuses primarily on the content. To create an HTML document, you need a text editor. To view an HTML document, you can use any browser like the Internet explorer.

3.7 SUMMARY

The technologies on which the www depend are discussed in this chapter. The way of working of internet client-server applications is discussed. Working of internets and the networking concepts are given focus. Apart from these topics, the concept of software agents which now a days is being used in the e-commerce domain, search engines and internet service providers are also discussed.

EXERCISES

1. Describe the physical structure of the Internet.
2. What is a protocol and which protocols handle Internet communications?
3. List the client-server protocols of the Internet.
4. How does the Internet survive without a governing body? How is a dispute currently solved?
5. Try to log on to Sahara airline's site. What will happen if you type airsahara.com?
6. Why is IPv6 needed?
7. What is an intelligent agent?
8. Give the history of hypertext and hypermedia.
9. Why is google.com a big success? How do they make profit? What is special about google's search engine?

5. *E-security*

In this Chapter we will discuss

- Security risks of networks and web
- E-business risk management issues

Structure of the chapter

5.1 Introduction

Any business, whether it is a traditional brick-and-mortar business, a brick-and-click e-business, or a pure-play e-business, needs to be concerned about network security. The Internet is a public network consisting of thousands of private computer networks connected together. This means that a private computer network system is exposed to potential threats from anywhere on the public network. Protection against these threats requires businesses to have stringent security measures in place. In the physical world, crimes often leave evidence—fingerprints, footprints, witnesses, video on security cameras, and so on. Online, a cyber crime also leaves physical and electronic evidence, but unless good security measures are taken, it may be difficult to trace the source of a cyber crime.

E-Commerce is growing fast, as may be inferred from the revenues shown in Table 5.1. In this context, e-security becomes a major concern for all involved.

Region	*Total*
North America	$3.5 trillion
Asia Pacific	$1.6 trillion
Western Europe	$1.5 trillion
Latin America	$81.8 billion
Rest of World	$68.6 billion

TABLE 5.1 TOTAL WORLDWIDE E-COMMERCE REVENUES, 2004 (B2B & B2C)

Additionally, e-businesses must protect against the unknown. New methods of attacking networks and websites and new network security holes are being discovered with disturbing frequency. By carefully planning its network and website security system, an e-business can protect itself against many known and as yet unknown threats. An e-business must always be prepared for network and website attacks, or risk the loss of assets.

Another very important reason to protect an e-business' network and a website is to maintain the e-business' relationships with its customers. Many Internet users perceive that there is a large risk to their privacy and security when they buy products and services or submit personal information online. Although the perception of risk may be greater than the actual risk, it is still a cause for concern. An e-business must address customers' perceived risks just as much as any actual risks.

An e-business cannot expect perfect security to be obtained for its network and website. The important issue for an e-business is to have adequate security to protect its assets, revenue stream, customer privacy, and its own reputation. Determining adequate security depends on an individual e-business' situation. For example, a website providing information on flavours of dog food may not require the same level of security as an online banking website. An e-business must determine its security needs according to the risks involved, the value of the assets at risk, and the cost of implementing a security system.

How does an e-business identify the security issues to be addressed? First, the e-business must thoroughly understand its business and how all its systems, not just its Web servers, are used. Several aspects of e-business computer systems' security need to be addressed.

Security has become one of the primary concerns when an organization connects its private network to the Internet. Regardless of the business, an increasing number of users on private networks are demanding access to Internet services such as the World Wide Web (WWW), Internet mail, Telnet, and File Transfer Protocol (FTP). In addition, there are corporations which offer Web home pages and FTP servers for public access on the Internet.

Security on the Internet

Looking at Table 5.2, one can see the amount of money being spent on security of computer systems.

TABLE 5.2

GLOBAL SPENDING ON INTERNET SECURITY SOFTWARE 1998-2003

Year	*Revenues (in billion)*
1998	\$3.2
1999	\$4.4
2003	\$8.3

Network administrators have increasing concerns about the security of their networks when they expose their organization's private data and networking infrastructure to Internet crackers. To provide the required level of protection, an organization needs a security policy to prevent unauthorized users from accessing resources on the private network and to protect against the unauthorized export of private information. Even if an organization is not connected to the Internet, it may still want to establish an internal security policy to manage user access to certain portions of the network and protect sensitive or secret information.

The fundamental problem may be that the Internet was not designed to be very secure, i.e. open access for the purposes of research was the prime consideration at the time the Internet was implemented. However, the phenomenal success of the Internet, combined with the introduction of different types of users, including unethical users, has aggravated existing security deficiencies to the extent that wide-open Internet sites risk inevitable break-ins and resultant damages. Other factors include the following:

1. ***Vulnerable TCP/IP services.*** *A* number of the TCP/IP services are not secure and can be compromised by knowledgeable intruders; services used in the local area networking environment for improving network management are especially vulnerable.

2. ***Ease of spying and spoofing.*** A majority of Internet traffic is unencrypted; e-mail, passwords, and file transfers can be monitored and captured using readily-available software. Intruders can then reuse passwords to break into systems.

3. ***Lack of policy.*** Many sites are configured unintentionally for wide-open Internet access, without regard for the potential for abuse from the Internet; many sites permit more TCP/IP services than they require for their operations, and do not attempt to limit access to information about their computers that could prove valuable to intruders.

4. ***Complexity of configuration.*** Host security access controls are often complex to configure and monitor; controls that are accidentally misconfigured often result in unauthorized access.

Sites that ignore these problems face some significant risk that they will be attacked by intruders and that they may provide intruders with a staging ground for attacks on other networks. Even sites that do observe good security practices, face problems with new vulnerabilities in networking software and the persistence of some intruders.

Some of the problems with Internet security are the result of inherent vulnerabilities in the services (and the protocols that the services implement), while others are a result of host configuration and access controls that are poorly implemented or overly complex to administer. This is further aggravated by the tremendous growth of the Internet and the way it is used. Businesses and agencies now depend on the Internet for communications and research, and thus have much more to lose if their sites are attacked. The following sections describe the problems on the Internet and the factors that contribute to these problems:

1. *How secure is the server software?* Security should be in place to prevent any unauthorized remote logon to the system. It should be extremely difficult to make changes to the server software. The servers themselves should be physically located in a secure environment.

2. *How secure are communications?* Customer credit card information and other sensitive data that is being transmitted across the Internet must be protected.

3. How is the data protected once it is delivered to the e-business? Is it stored in unencrypted text files at the website? Is it moved to offline storage?

4. *How are credit card transactions authenticated and authorized?* Credit card transactions must be authenticated and authorized, so as to make it more secure for the users.

Besides implementing secure technologies, an e-business should develop security policies and procedures. Everyone working in an e-business should understand his or her responsibilities for keeping the business secure. Also, a plan of action should be ready to deal with any potential security problem.

The biggest potential security problem in an e-business is of human, rather than of electronic origin. The weakest link in any security system is the people using it. The employees of an e-business may not understand the security policy. Sometimes, the security policy is so burdensome that the employees are not able to follow it, or refuse to follow it because it makes it difficult for them to get their work done. For example, employees may get annoyed at having to make frequent changes to logon passwords. At times, they may not understand the importance of security measures. Educating employees about the need for security and their role in the security processes is essential. Table 5.3 summarizes the general security issues that e-businesses must consider.

TABLE 5.3

GENERAL SECURITY ISSUES

Issue	*Comment*
Connection to the Internet	Private computer networks are at risk from potential threats from anywhere on the public Internet network.
Unknown risks	New security holes and methods of attacking networks are being discovered with alarming frequency.
Customer privacy and security of customer information	Not only must steps be taken to protect the privacy of customer information, but also customers must be made aware of those steps and have confidence in them.
Security consciousness	Management and employees must understand the importance of security policies and procedures.

Security risks associated with a network and a website can be addressed in some ways as follows:

5.2 Network and Website Security Risks

As part of planning a startup e-business' security, management should become familiar with network and web server security risk terminology. Originally, hacker was a term used to describe gifted software programmers. Today, hacker is a slang term used to refer to someone who deliberately gains unauthorized access to individual computers or computer networks. Ethical hackers use their skills to find weaknesses in computer systems and make them known, without regard for personal gain. Malicious hackers, also called crackers, gain access to steal valuable information such as credit card numbers, attempt to disrupt service, or cause any other damage. Since there is a wide press coverage of computer system security breaches, the terms "hacker" and "cracker" are now generally used interchangeably for those involved in malicious, unauthorized computer system access.

An e-business must protect itself against unauthorized access to its computer network, denial-of-service traffic overloads, and the intrusion of destructive viruses.

Denial-of-Service Attacks

A Denial-of-Service or DoS attack is an attack on a network that is designed to disable the network by flooding it with useless traffic or activity. A distributed denial-of-service, or DDoS, attack uses multiple computers to launch a DoS attack. While a DoS attack does not do any technical damage, it can do substantial financial damage to an e-business, because every second an e-business's network or a website is down, it may result in lost revenues.

The attacker first breaks into hundreds or thousands of random, insecure computers on the Internet and installs an attack program. Then he coordinates them all to attack the target simultaneously. Thereafter, the target is attacked from many places at once; the traditional defences just do not work, and the system crashes.

These attacks are incredibly difficult, if not impossible, to defend against. In a traditional denial-of-service attack, the victim's computer might be able to figure out where the attack is coming from and shut down those connections. But in a distributed attack, there is no single source. The computer should shut down all connections except the ones it knows to be trustworthy, but that does not work for a public Internet site.

So far, these attacks are strictly denial-of-service. They do not affect the data on the websites. These attacks cannot steal credit card numbers or proprietary information. They cannot transfer money out of your bank account to trade stocks in your name. Attackers cannot gain financially from these attacks. Still, they are very serious. For most big corporations, the biggest risk of a security breach is loss of income or loss of reputation, either of which is achieved by a conspicuous denial-of-service attack. The real problem is that there are hundreds of thousands, possibly millions, of innocent, naive computer users who are vulnerable to attack. They are using DSL or cable modems, they're always on the Internet with static IP addresses, and they can be taken over and used as launching pads for these attacks.

Viruses

Viruses are the most common security risk faced by e-businesses today. A virus is a small program that inserts itself into other program files that then become "infected", just as a virus in nature embeds itself in normal human cells. The virus is spread when an infected program is executed, and this further infects other programs. Examples of virus effects include inability to boot, deletion of files or entire hard drives, inability to create or save files, and thousands of other possibilities. A logic bomb is a virus whose attack is triggered by some event such as the date on a computer's system clock. A logic bomb may simply release a virus or it may be a virus itself. Viruses are generally introduced into a computer system via e-mail or by unauthorized network access. Virus examples include Stoned, Michelangelo, and AutoStart 9805.

Trojan horse

This takes its name from a story in Homer's Iliad, and is a special type of virus that emulates a benign application. It appears to do something useful or entertaining but actually does something else as well, such as destroying files or creating a "back door" entry point to give an intruder access to the system. A Trojan horse may be an e-mail in the form of attachment or a downloaded program. Trojan horse examples include BackOrifice, VBS/Freelink, and BackDoor-G.

Worm

This is a special type of virus that does not directly alter program files. Instead, a worm replaces a document or an application with its own code and then uses that code to position itself. Worms are often not noticed until their uncontrolled replication consumes system resources and slows down or stops the system. Worm examples include VBS/Loveletter, a VBS/Godzilla.worm, and Happy99.

A macro is a short program written in an application such as Microsoft Word or Excel to accomplish a series of keystrokes. A macro virus is a virus that infects Microsoft Word or Excel macros. Macro viruses can be introduced into a computer system as part of a Word or an Excel document received as an e-mail attachment, or as a file on disk. Opening the e-mail attachment or file triggers the macro virus.

Some viruses are, however, just hoaxes. Several antivirus software vendors maintain up-to-date information such as the Virus Information Library at *McAfee.com,* the Anti Viral Pro Virus Encyclopedia on viruses, worms, Trojan horses, and hoaxes. E-businesses also face other security issues related to doing business on the Web, such as website defacement, information theft, and data spills.

How Are Sites Hacked?

Distributed systems based on the client/server model have become common. In recent months, we can see an increase in the development and the use of distributed sniffers, scanners, and denial-of-service tools. Attacks using these tools can involve a large number of sites simultaneously and focus to attack one or more victim hosts or networks.

In a typical distributed attack system, the 'intruder' controls a small number of 'masters', which in turn control a large number of 'daemons'. These daemons can be used to launch packet flooding or other attacks against the 'victims' targeted by the intruder.

In the incidents that have occurred so far, daemons were installed on several hundred sites, typically through the exploitation of well-known vulnerabilities that lead to root privileges on the compromised machines. Though some implementations of the daemon program do not require root privileges to launch attacks, in practice most of the daemons are concealed by the installation of 'root kits' designed to hide evidence of intrusion. There are indications that the processes for discovering vulnerable sites, compromising them, stalling daemons, and concealing the intrusion are largely automated, with each step being informed in 'batch' mode against many machines in one session. Daemons have been discovered on a variety of operating systems with varying levels of security and system management.

Once installed and operated, the daemon announces its presence to several (usually three or four) predefined masters and waits for further commands. The master program records that the daemon is ready to receive commands in an internal list, which can be retrieved by the intruder. Masters can cause daemons in the list to launch attacks, shut down gracefully, or even announce themselves to a new master server. Intruders have used cryptographic techniques to conceal the information recorded by the master and daemons.

At the command from an intruder, the master can issue attack requests to the daemons in its list. These requests contain information about the requested attack such as the address of the victim, the duration, and other parameters. The master programs frequently operate as ordinary user programs on compromised hosts, where their activity can easily be hidden.

Security Incidents on the Internet

As an evidence of the above, three problems have occurred within a short period of time. In the first, persistent vulnerabilities in the UNIX sendmail program were discovered. Sites which had not corrected their sendmail programs, were forced to scramble to correct the programs before their vulnerabilities were attacked. However, due to the complexity of the sendmail program and networking software in general, three subsequent versions of sendmail were found to still contain significant vulnerabilities. The sendmail program is used widely, and sites without firewalls to limit access to sendmail are forced to react quickly whenever problems are found and vulnerabilities revealed.

In the second, a version of a popular and a free FTP server was found to contain a Trojan horse that permitted privileged access to the server. Sites using this FTP server, but not necessarily the contaminated version, were again forced to react very carefully and quickly to this situation. Many sites rely on the wealth of free software available on the Internet, especially security-related software that adds capability for logging, access control, and integrity checking that vendors often do not provide as part of the operating system. While the software is often of high quality, sites may have little recourse other than to rely on the authors of the software if it is found to have vulnerabilities and other problems.

The third problem has the strongest implications: intruders had broken into potentially thousands of systems throughout the Internet, including gateways between major networks, and installed sniffer programs to monitor network traffic for user names and static passwords typed in by users to connect to networked systems. The intruders had used various known techniques for breaking into systems, as well as using passwords that had been "sniffed". One of the implications of this incident is that static or reusable passwords are obsolete for protecting access to user accounts. In fact, a user connecting to a remote system across the Internet may be unintentionally placing that system at the risk of attack by intruders who could be monitoring the network traffic to the remote system.

Weak Authentication

Security handling teams estimate that many incidents stem from the use of weak, static passwords. Passwords on the Internet can be "cracked" in a number of different ways. However, the two most common methods are by cracking the encrypted form of the password and by monitoring communications channels for password packets. The UNIX operating system usually stores an encrypted form of passwords in a file that can be read by normal users. The password file can be obtained by simply copying it. It can also be obtained by a number of other intruder methods. Once the file is on hand, an intruder can run readily-available password cracking programs against the passwords. If the passwords are weak, e.g. less than 8 characters, and so on, they could be cracked and used to gain access into the system.

Ease of Spying

It is important to note that when a user connects to her account on a remote host using Telnet or FTP, the user's password travels across the Internet unencrypted or in plain text. Thus, another method for breaking into systems is to monitor connections for IP packets bearing a username and a password, and then using them on the system for normal login. If the captured password is to an administrator's account, then the job of obtaining privileged access is made much easier. As noted previously, hundreds and possibly thousands of systems across the Internet have been penetrated as a result of monitoring for usemames and passwords. E-mail, as well as the contents of Telnet and FTP sessions, can be monitored and used to learn information about a site and its business transactions. Most users do not encrypt e-mail, since they assume that e-mail is secure and thus safe for transmitting sensitive information.

Ease of Spoofing

The IP address of a host is presumed to be valid and is therefore trusted by TCP and UDP services. A problem is that, using IP source routing, an attacker's host can masquerade as a trusted host or a client. Briefly, IP source routing is an option that can be used to specify a direct route to a destination and return path back to the origin. The route can involve the use of other routers or hosts that normally would not be used to forward packets to the destination. An example of how this can be used such that an attacker's system could masquerade as the trusted client of a particular server is as follows:

1. The attacker would change her host's IP address to match that of the trusted client.

2. The attacker would then construct a source route to the server, that specifies the direct path the IP packets should take to the server and should take from the server back to the attacker's host, using the trusted client as the last hop in the route to the server.

3. The attacker sends a client request to the server using the source route.

4. The server accepts the client's request as if it came directly from the trusted client, and returns a reply to the trusted client.

5. The trusted client, using the source route, forwards the packet on to the attacker's host.

Many UNIX hosts accept source routed packets and will pass them on as the source route indicates. Many routers will accept source routed packets as well, whereas some routers can be configured to block source routed packets.

E-mail on the Internet is particularly easy to spoof and, without enhancements such as digital signatures, generally cannot be trusted. As a brief example, consider the exchange that takes place when Internet hosts exchange mail. The exchange takes place using a simple protocol consisting of ASCII-character commands. An intruder could easily enter these commands on Telnet to connect directly to a system's Simple Mail Transfer Protocol (SMTP) port. The receiving host trusts this sending host, and thus the origin of the mail is spoofed easily by entering a sender address that is different from the true address. As a result, any user, without privileges, can falsify or spoof e-mail.

Other services, such as Domain Name Service (DNS), can be spoofed, but with more difficulty than e-mail. These services still represent a threat that needs to be considered when using them.

How Vulnerable Are The Internet Sites?

The Internet, while being a useful and a vital network, is at the same time vulnerable to attacks. Sites that are connected to the Internet face significant risk in some form by intruders. The following factors would influence the level of risk:

- Number of systems connected to the site
- Services utilized by the site
- Interconnectivity of the site to the Internet
- Site's profile, or how well-known the site is
- Site's readiness to handle computer security incidents.

The more the number of systems that are connected, obviously the harder it is to control their security. Equally, if a site is connected to the Internet at several points, it is •likely to be more vulnerable to attacks than a site with a single gateway. At the same time, though, how well prepared a site is, and the degree to which the site relies on the Internet, can increase or decrease the risk. A site's high profile could attract more potential intruders who wish to do some harm to the site's image. It should be mentioned though, that "quiet", less-frequently used sites are also attractive to intruders since they can more easily hide their activity.

Sites that use recommended procedures and controls for increasing computer security have significantly lower risks of attack. Firewalls, combined with one-time passwords that are immune from monitoring or guessing, can increase greatly a site's overall level of security and make using the Internet quite safe.

Website Defacement

Website vandalism or defacement can be the result of a hacker breaking into a network, accessing the website files, and modifying the HTML to physically change Web pages. Not only do website defacements embarrass an e-business, but some website defacements can have serious financial repercussions. Aastrom Biosciences. Inc., a Michigan based medical products company, experienced a serious defacement created to manipulate its stock price. In February 2000, a bogus news release announcing a merger with a California biopharmaceutical company, Geron Corporation, was posted on Aastrom's website. Stock prices for both companies rose: Aastrom shares rose from $4 to $4.41 and Geron shares rose from $47.19 to $51. After discovering the defacement, Aastrom notified Geron, and representatives of both companies advised officials with the NASDAQ index, where both stocks are traded, that there was no merger.

Electronic Industrial Espionage

It is a major risk and a big dollar issue that most companies are reluctant to discuss openly— electronic industrial espionage. Often, e-businesses that have been hacked and had business secrets stolen are too embarrassed to admit the break-in. However, in late October 2000, one very high-profile company, Microsoft, found itself scrambling to deal with first rumours and then published reports of a serious hacking incident with industrial espionage overtones. The apparent culprit was a Trojan horse virus named QAZ Trojan that was first identified in mid-July in China. The QAZ Trojan virus infects a computer system when a user opens an e-mail attachment containing the virus. Then the virus replaces the system's Notepad text editor with its own code, searches for other shared hard drives to infect, and sends the IP addresses of infected computers to an outside e-mail address. This creates a "back door" a hacker can use to enter a system, search for passwords, and install software programs to allow remote control of the computer. Although by August 2000, all major antivirus software makers had included the QAZ Trojan information in their downloadable virus updates, somehow the QAZ Trojan virus was used to create a "back door" in Microsoft.

Credit Card Fraud and Theft of Customer Data

Almost all B2C purchase transactions involve credit cards. An e- business that accepts credit cards in payment for goods and services, must secure the credit card information in transit to its website, and it must secure stored credit card information. Also systems must be in place for credit card transaction authentication and credit card authorization.

A hacker can break into a database server and steal thousands of credit card numbers and other information in a matter of moments, and an e-business might not even recognize that the hacker was there. For example, one of the largest reported cases of stolen credit card information took place in January 1999 (but was not reported until much later) when information on 485,000 credit cards, including card numbers, expiration dates, names, and addresses, was stolen from an e-business website and stored at a US government agency's website, where the agency's website administrator discovered the data. There was no reported evidence of fraudulent use, and some of the accounts were not active. But this event highlights the risk to a vulnerable e-business of the theft of sensitive information.

Security and E-Mail

E-mail users who desire confidentiality and sender authentication use encryption. Encryption is simply intended to keep personal thoughts personal. There are two good programs to encrypt e-mails and they are: Pretty Good Privacy (PGP), and Privacy Enhanced Mail (PEM).

E-mail is typically encrypted for the reason that all network correspondence is open for eavesdropping. Internet e-mail is obviously far less secure than the postal system, where envelopes protect correspondence from casual snooping. In contrast, the header area of any e-mail message will show that it has passed through a number of nodes on its way to you. Each of these nodes presents the opportunity for snooping.

Privacy Enhanced Mail Standard

PEM is the Internet Privacy Enhanced Mail standard, designed, proposed, but not yet officially adopted by the Internet Activities Board, to provide secure electronic mail over the Internet. Designed to work with current Internet e-mail formats, PEM includes encryption, authentication, and key management, and allows use of both public-key and secret-key crypto-systems. The system supports multiple cryptographic tools: for each mail message, the specific encryption algorithm, digital signature algorithm, hash function and so on, are specified in the header. PEM explicitly supports only a few cryptographic algorithms;

others may be added later. It uses the DES algorithm for encryption and the RSA algorithm for sender authentication and key management. PEM also provides support for non-repudiation, which allows the third-party recipient of a forwarded message to verify the identity of the message originator (not just the message forwarder) and to verify whether any of the original text has been altered.

Pretty Good Privacy (PGP)

Pretty Good Privacy (PGP) is the implementation of public-key cryptography based on RSA. It is a free software package developed by Phillip Zimmerman, that encrypts e-mail. Since being published in US as freeware in June 1991, PGP has spread rapidly and has since become the de facto worldwide standard for encryption of e-mail. It is freely available for DOS, Macintosh, UNIX, Amiga, VMS, Atari, and OS/2 systems. PGP provides secure encryption of documents and data files that even advanced supercomputers are hard pressed to "crack". The process is so simple that anyone with a PC can do it with almost no effort. For authentication, PGP employs the RSA public-key encryption scheme and the MD5 (Message Digest version 5) developed by Rivest, a one-way hash function to form a digital signature that assures the receiver that an incoming message is authentic (that it comes from the alleged sender and that it has not been altered).

Network and Website Security

The best way to recognize when a hacker is attempting unauthorized network access is to monitor network performance. Setting up, logging, and monitoring established network reference points, called benchmarks, can alert an e-business to security problems. A skilled system administrator and other well-trained technicians, who use these benchmarks to monitor and manage the network and servers, are critical. Other tools such as passwords, firewalls, intrusion detection systems, and virus scanning software should be used to protect an e-business' network and website.

A password is a code, or more often a common word, used to gain access to a computer network. Passwords are only effective when used properly. Often a computer user chooses a bad password, such as a short, common word—a name, or birthday—so that the user can remember the password easily. One way hackers penetrate network security is by using software that "guesses" a password by trying millions of common words until one of the words is accepted. Passwords that require a minimum length of six characters in a mix of letters and numbers increase the number of potential passwords into billions and make it more difficult for a hacker to guess them. A computer user should also change passwords regularly. If a user has access to multiple systems, it is a good idea to have different passwords on each system.

A firewall is a software or a hardware used to isolate and protect a private system or a network from the public network. A firewall provides an easy-to-manage entry point to multiple systems behind it. Firewalls can control the type of information that is allowed to pass from the public network to the private network, as well as what services inside the firewall are accessible from the outside. Firewalls can also log activity, to provide an audit trail in case the network is penetrated.

Intrusion detection is the ability to analyze real-time data to detect, log, and stop unauthorized network access as it happens. Businesses can install intrusion detection systems that monitor the network for real-time intrusions and respond to intrusions in a variety of user-detected ways. An intrusion detection system can defend a website against DoS attacks by adding more servers to increase the traffic the website can handle, by using filters and routers to manage traffic, and by having a backup plan to reroute legitimate traffic during an attack. Cisco's Secure Intrusion Detection System, and Network ICE'S ICEpac Security Suite are two examples of intrusion detection systems.

Virus scanning software, including e-mail virus scanning, should be installed on all network computers. Antivirus software should be kept updated. Communication ports should be used to allow data to enter and exit the network. The system administrator should close all unused communication ports. Up-to-date security patches for operating systems should be installed as soon as the patches are available, to prevent hackers from exploiting built-in system weaknesses.

Transaction Security and Data Protection

Transaction security, especially for credit card transactions, and the protection of customer data are as important as website and network security. Tools to protect transaction data and customer data include:

- Using a predefined key to encrypt and decrypt the data during transmission;
- Using the Secure Sockets Layer (SSL) protocol to protect data transmitted over the Internet. SSL provides encryption of data between the browser on the customer's computer and the software on the Web server, allowing data such as credit card information to be transmitted securely. SSL uses digital certificates so that a Web browser can authenticate the server it is connected to, making sure that credit card data is going to the appropriate server;
- Moving sensitive customer information such as credit card numbers offline, or encrypting the information if it is to be stored online;
- Removing all files and data from storage devices, including disk drives and tapes, before getting rid of the devices; and
- Shredding all hard-copy documents containing sensitive information before trashing them.

Of course, an e-business's security solutions are only as strong as its weakest link— often its employees. An e-business must maintain a security-oriented culture, starting at the top, in order for employees to take security seriously. An e-business should also consider having its security systems tested or audited.

Security Audits and Penetration Testing

Security audits can provide an overall assessment of an e-business' systems and security issues by checking for vulnerabilities in those systems and providing recommendations for fixing those vulnerabilities. Security consultants such as DefendNet Solutions Inc., Internet Security Systems, and Pinkerton Systems Integration offer security auditing services.

Accounting firms, such as Ernest & Young, also offer security auditing services. Some of the Big Five international accounting firms use the American Institute of Certified Public Accountants (AICPA) WebTrust seal and audit criteria. The WebTrust seal indicates to customers that the website is verified as being safe and secure by the AICPA. The AICPA audit criteria cover best business practices, site security, and customer information privacy. Some accounting firms use their own audit seal instead of, or in addition to, the AICPA WebTrust seal.

When evaluating security consultants who will perform the penetration testing, there are several factors to consider. They can be listed as follows:

1. Get evidence that the security consultants have insurance to protect against accidental system damage or down time.

2. Have everyone on the consultant's penetration team sign a non-disclosure agreement.

3. Consider requiring a third-party background check on each member of the consultant's penetration team.

4. Decide whether it makes sense to use a security consultant who employs former hackers.
5. Determine if the consultant's team is going to use packaged security scanning software that could be employed by the in-house staff, or if they are using custom tools.
6. Develop a clear scope for the penetration test and a workable time frame.
7. Determine whether to have a DoS attack done, and if so, when to schedule it to least disrupt customer access.
8. Make sure the final report from the consultant includes an accounting of all attacks attempted and whether or not they were successful, a return of all the paper or electronic information gathered by the consultant, and recommendations on how to fix up any problems discovered during the tests.

Individual PC Security Risks

Often managers in an e-business use stand-alone personal computer during the start up phase, until funds are available to build and operate a network or until the e-business can outsource its IT operations. Additionally, some e-businesses offer their employees the opportunity to telecommute—allowing an employee to use his or her home computer, or installing a business-owned personal computer in the employee's home. Certainly, business employees often work on business files at home. Due to these factors, it is important for an e-business to understand that individual PCs are also at risk from hackers.

5.3 E-business Risk Management Issues

An e-business should manage its e-business risks as a business issue, not just as a technology issue. An e-business must consider the direct financial impact of immediate loss of revenue, compensatory payments, and future revenue loss from e-business risks such as:

1. Business interruptions caused by website defacement or denial-of-service attacks;
2. Litigation and settlement costs over employees' inappropriate use of e-mail and the Internet;
3. Product or service claims against items advertised and sold via a website;
4. Web-related copyright, trademark, and patent infringement lawsuits; and
5. Natural or weather-related disasters.

An e-business should put in place an effective risk management program that includes the following:

- Network and website security and intruder detection programs
- Antivirus protection
- Firewalls
- Sound security policies and procedures
- Employee education.

Another important component of a risk management program is the transfer of risk via insurance. Table 5.4 illustrates some of the different kinds of insurance coverage an e-business should consider when developing an effective risk management program. It is a good idea for an e-business's management to consult with a commercial insurance broker that offers e-risk management services, to help develop a risk management plan including insurance coverage.

TABLE 5.4

E-RISK INSURANCE

E-risk insurance	*Coverage*
Computer Virus Transmission	Protects against losses that occur when employees open infected e-mail attachments or download virus-laden software.
Extortion and Reward	Responds to Internet extortion demands and/or pays rewards to help capture saboteurs.
Unauthorized Access/ Unauthorized Use	Covers failure to protect against third-party access to data and transactions.
Specialized Network Security	Responds to breach of network security and resulting losses.
Media Liability	Protects against intellectual property infringement losses.
Patent Infringement	Covers defensive and offensive costs when battling over patent infringement issues.
Computer Server and Services Errors & Omissions	Protects e-businesses against liability for errors and omissions when their professional advice causes a client's financial loss.

The Firewall Concept

An Internet firewall is a system or group of systems that enforces a security policy between an organization's network and the Internet. The firewall determines which inside services may be accessed from the outside, which outsiders are permitted access to the permitted inside services, and which outside services may be accessed by insiders. For a firewall to be effective, all traffic to and from the Internet must pass through the firewall, where it can be inspected. The firewall must permit only authorized traffic to pass, and the firewall itself must be immune to penetration. Unfortunately, a firewall system cannot offer any protection once an attacker has got through or around the firewall.

It is important to note that an Internet firewall is not just a router, a bastion host, or a combination of devices that provides security for a network. The firewall is part of an overall security policy that creates a perimeter defence designed to protect the information resources of the organization. This security policy must include published security guidelines to inform users of their responsibilities; corporate policies defining network access, service access, local and remote user authentication, dial-in and dial-out, disk and data encryption, and virus protection measures and employee training. All potential points of network attack must be protected with the same level of network security. Setting up an Internet firewall without a comprehensive security policy is like placing a steel door on a tent.

A firewall is an approach to security. It helps implement a larger security policy that defines the services and access to be permitted, and it is an implementation of that policy in terms of a network configuration, one or more host systems and routers, and other security measures such as advanced authentication in place of static passwords. The main purpose of a firewall system is to control access to or from a protected network, i.e. a site. It implements a network access policy by forcing connections to pass through the firewall, where they can be examined and evaluated.

A firewall system can be a router, a personal computer, a host, or a collection of hosts, set up specifically to shield a site or a subnet from protocols and services that can be abused from hosts outside the subnet. A firewall system is usually located at a higher-level gateway, such as a site's connection to the Internet. However, firewall systems can be located at lower-level gateways to provide protection for some smaller collection of hosts or subnets.

Why Firewalls?

The general reasoning behind firewall usage is that without a firewall, a subnet's systems expose themselves to inherently insecure services, and to probes and attacks from hosts elsewhere on the network. In a firewall-less environment, network security relies totally on host security and all hosts must, in a sense, cooperate to achieve a uniformly higher level of security. The larger the subnet, the less manageable it is to maintain all hosts at the same level of security. As mistakes and lapses in security become more common, break-ins occur not as the result of complex attacks, but because of simple errors in configuration and inadequate passwords.

A firewall approach provides numerous advantages to sites by helping to increase overall host security. The following sections summarize the primary benefits of using a firewall.

Protection of Vulnerable Services

A firewall can greatly improve network security and reduce risks to hosts on the subnet by filtering inherently insecure services. As a result, the subnet network environment is exposed to fewer risks, since only selected protocols will be able to pass through the firewall.

For example, a firewall could prohibit certain vulnerable services such as Network File System (NFS) from entering or leaving a protected subnet. This provides the benefit of preventing the services from being exploited by outside attackers, but at the same time permits the use of these services with greatly reduced risk of exploitation.

Firewalls can also provide protection from routing-based attacks, such as source routing, and attempts to redirect routing paths to compromised sites via Internet Control Message Protocol or ICMP redirects. A firewall could reject all source-routed packets and ICMP redirects and then inform administrators of the incidents.

Concentrated Security

A firewall can actually be less expensive for an organization in that all or most modified software and additional security software could be located on the firewall systems as opposed to being distributed on many hosts. In particular, one-time password systems and other add-on authentication software could be located at the firewall as opposed to each system that needed to be accessed from the Internet.

Enhanced Privacy

Privacy is of great concern to certain sites, since what would normally be considered innocuous information, might actually contain clues that would be useful to an attacker. Using a firewall, some sites wish to block services such as finger and Domain Name Service. Finger displays information about users, such as their last login time, whether they have read mail, and other items. But, finger could leak information to attackers about how often a system is used, whether the system has active users connected, and whether the system could be attacked without drawing attention.

Firewalls can also be used to block DNS information about site systems; thus, the names and IP addresses of site systems would not be available to Internet hosts. Some sites feel that by blocking this information, they are hiding information that would otherwise be useful to attackers.

Need for Usage Statistics on Network

If all access to and from the Internet passes through a firewall, the firewall can log accesses and provide valuable statistics about network usage. A firewall, with appropriate alarms that sound when suspicious activity occurs, can also provide details on whether the firewall and network are being probed or attacked.

It is important to collect statistics about network usage and evidence of probing for a number of reasons. Of primary importance is, knowing whether the firewall is withstanding probes and attacks, and determining whether the controls on the firewall are adequate. Network usage statistics are also important as input into network requirements studies and risk analysis activities.

Policy Enforcement

Lastly, but perhaps most importantly, a firewall provides the means for implementing and enforcing a network access policy. In effect, a firewall provides access control to users and services. Thus, a network access policy can be enforced by a firewall, whereas without a firewall, such a policy depends entirely on the cooperation of the users. A site may be able to depend on its own users for their cooperation. However, it cannot or it should not depend on the Internet users in general.

Firewall Components

The primary components (or aspects) of a firewall are:

1. Network policy
2. Advanced authentication mechanisms
3. Packet filtering
4. Application gateways.

The following sections describe each of these components in detail.

Network Policy

There are two levels of network policy that directly influence the design, installation and use of a firewall system. The higher-level policy is an issue-specific network access policy that defines those services which will be allowed or explicitly denied from the restricted network, how these services will be used, and the conditions for exceptions to this policy. The lower-level policy describes how the firewall will actually go about restricting the access and filtering the services that were defined in the higher level policy. The following sections describe these policies in brief.

Service access policy

The service access policy should focus on Internet-specific use issues as defined above, and perhaps all outside network access (i.e., dial-in policy, and SLIP and PPP connections) as well. This policy should be an extension of an overall organizational policy regarding the protection of information resources in the organization. For a firewall to be successful, the service access policy must be realistic and sound, and should be drafted before implementing a firewall. A realistic policy is one that provides a balance between protecting the network from known risks, while still providing users access to network resources. If a firewall system denies or restricts services, it usually requires the strength of the service access policy to prevent the firewall's access controls from being modified on an ad hoc basis. Only a management-backed sound policy can provide this.

A firewall can implement a number of service access policies. However, a typical policy may be to allow no access to a site from the Internet, but allow access from the site to the Internet. Another typical policy would be to allow some access from the Internet, but perhaps only to selected systems such as information servers and e-mail servers. Firewalls often implement service access policies that allow some user access from the Internet to selected internal hosts, but this access would be granted only if necessary and only if it could be combined with advanced authentication.

Firewall design policy

The firewall design policy is specific to the firewall. It defines the rules used to implement the service access policy. One cannot design this policy in a vacuum isolated from understanding issues such as firewall capabilities and limitations, and threats and vulnerabilities associated with TCP/IP. Firewalls generally implement one of the following two basic design policies:

1. Permit any service unless it is expressly denied
2. Deny any service unless it is expressly permitted.

A firewall that implements the first policy allows all services to pass into the site by default, with the exception of those services that the service access policy has identified as disallowed. A firewall that implements the second policy denies all services by default, but passes those services that have been identified as allowed. This second policy follows the classic access model used in all areas of information security.

The first policy is less desirable, since it offers more avenues for getting around the firewall, i.e. users could access new services currently not denied by the policy (or even addressed by the policy) or run denied services at non-standard TCP/UDP ports that are not denied by the policy. Certain services such as X Windows, FTP, Archie, and RPC cannot be filtered easily and are better accommodated by a firewall that implements the first policy. The second policy is stronger and safer, but is more difficult to implement and may impact users in that certain services such as those just mentioned may have to be blocked or restricted.

The relationship between the high-level service access policy and its lower level counterpart is reflected in the discussion above. This relationship exists because the implementation of the service access policy is heavily dependent upon the capabilities and limitations of the firewall system, as well as upon the inherent security problems associated with the wanted Internet services. For example, wanted services defined in the service access policy may have to be denied if the inherent security problems in these services cannot be effectively controlled by the lower level policy and if the security of the network takes precedence over other factors. On the other hand, an organization that is heavily dependent on these services to meet its mission may have to accept higher risk and allow access to these services. This relationship between the service access policy and its lower-level counterpart allows for an iterative process in defining both, thus producing the realistic and sound policy initially described.

The service access policy is the most significant component of the four described here. The other three components are used to implement and enforce the policy. (And as noted above, the service access policy should be a reflection of a strong overall organization security policy.) The effectiveness of the firewall system in protecting the network depends on the type of firewall implementation used, the use of proper firewall procedures, and the service access policy.

Advanced Authentication

Security lapses on the identity of Internet users have occurred in part due to the weaknesses associated with traditional passwords. For years, users have been advised to choose passwords that would be difficult to guess, or not to reveal their passwords. However, even if users follow this advice (and many do not), the fact that intruders can and do monitor the Internet for passwords that are transmitted in the clear has rendered traditional passwords obsolete.

Advanced authentication measures such as smartcards, authentication tokens, biometrics, and software-based mechanisms are designed to counter the weaknesses of traditional passwords. While the authentication techniques vary, they are indeed similar in one aspect. The passwords generated by advanced authentication devices cannot be reused by an attacker who has monitored a connection. Given the inherent problems with passwords on the Internet, an Internet-accessible firewall that does not use or does not contain the hooks to use advanced authentication makes little sense.

Some of the more popular advanced authentication devices in use today are called one-time password systems. A smartcard or authentication token, for example, generates a response that the host system can use in place of a traditional password. The token or card works in conjunction with software or hardware on the host, and therefore, the generated response is unique for every login. The result is a one-time password which, if monitored, cannot be reused by an intruder to gain access to an account.

Since firewalls can centralize and control site access, the firewall is the logical place for the advanced authentication software or hardware to be located. Although advanced authentication measures could be used at each host, it is more practical and manageable to centralize the measures at the firewall. Figure 5.1 illustrates that a site without a firewall using advanced authentication permits unauthenticated application traffic, such as Telnet or FTP, directly to site systems. If the hosts do not use advanced authentication, then intruders could attempt to crack passwords or could monitor the network for login sessions that would include the passwords. The figure also shows a site with a firewall using advanced authentication, such that Telnet or FTP sessions originating from the Internet to site systems must pass the advanced authentication before being permitted to the site systems. The site systems may still require static passwords before permitting access. However, these passwords would be protected against exploitation, even if the passwords are monitored, as long as the advanced authentication measures and other firewall components prevent intruders from penetrating or bypassing the firewall.

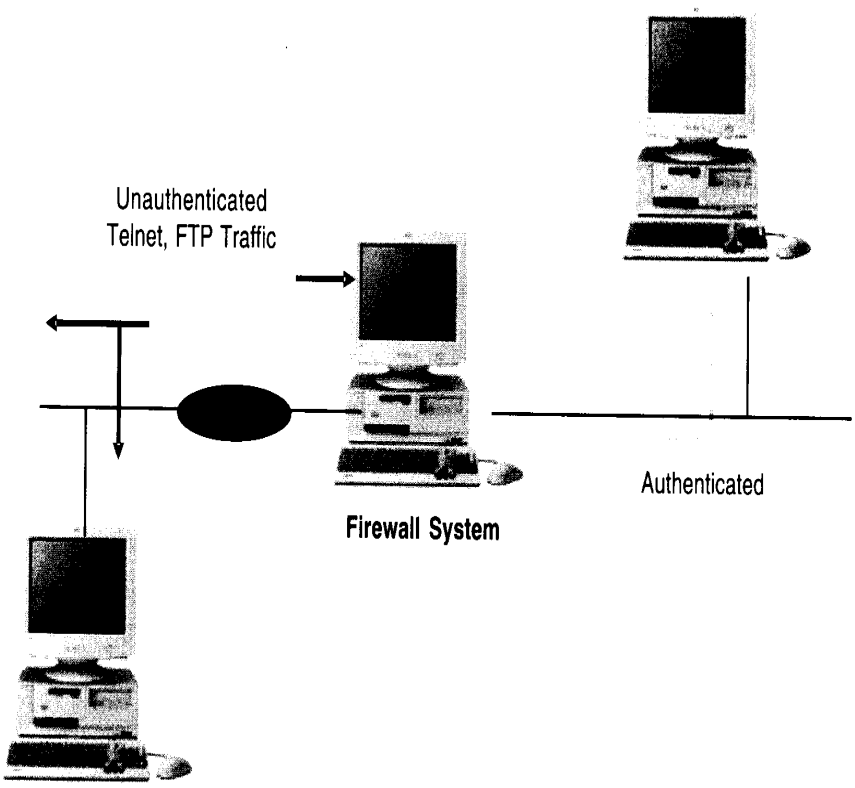


Fig. 5.1 Advanced authentication on a firewall to pre-authenticate Telnet, FTP traffic.

Packet Filtering

IP packet filtering is done, usually, using a packet filtering router designed for filtering packets, as they pass between the router's interfaces. A packet filtering router usually can filter IP packets based on some or all of the following fields:

1. Source IP address
2. Destination IP address
3. TCP/UDP source port
4. TCP/UDP destination port.

Not all packet filtering routers currently filter the source TCP/UDP port, though vendors have now started incorporating this capability. Some routers examine the router's network interfaces in which a packet arrives, and then use this as an additional filtering criterion. Some UNIX hosts provide packet filtering capability, although most do not.

Filtering can be used in a variety of ways to block connections from or to specific hosts or networks, and to block connections to specific ports. A site might wish to block connections from certain addresses, such as from hosts or sites that it considers to be hostile or untrustworthy. Alternatively, a site may wish to block connections from all addresses external to the site (with certain exceptions, such as SMTP for receiving e-mail) (see Figure 5.2).

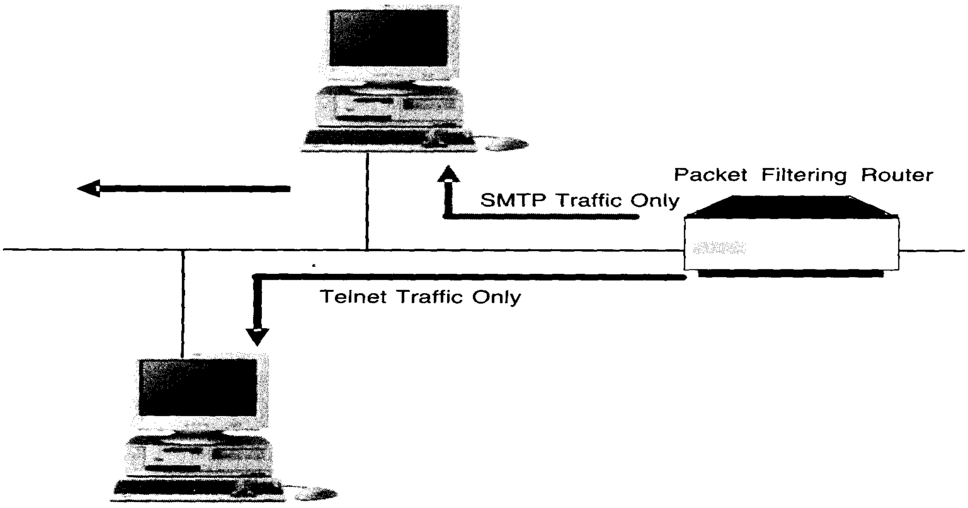


Fig. 5.2 Representation of packet filtering on Telnet and SMTP.

As an example of packet filtering, consider a policy to allow only certain connections to a network of address 123.4.*.*. Telnet connections will be allowed to only one host, 123.4.5.6, which may be the site's Telnet application gateway, and SMTP connections will be allowed to two hosts, 123.4.5.7 and 123.4.5.8, which may be the site's two electronic mail gateways. NNTP (Network News Transfer Protocol) is allowed only from the site's NNTP feed system, 129.6.48.254, and only to the site's NNTP server, 123.4.5.9, and NTP (Network Time Protocol) is allowed to all hosts. All other services and packets are to be blocked. An example of the rule-set is in Table 5.5.

TABLE 5.5

PACKET FILTERING TABLE

Type	*Source address*	*Destination address*	*Source port*	*Destination port*	*Action*
TCP	*	123.4.5.6	>1023	23	permit
TCP	*	123.4.5.6	>1023	25	permit
TCP	*	123.4.5.6	>1023	2	permit
TCP	129.6.58.254	123.4.5.6	>1023	119	permit
UDP	*	123.4.*.*	>1023	123	permit
*	*	*	*	*	deny

The first rule allows TCP packets from any source address and port greater than 1023 on the Internet to the destination address of 123.4.5.6 and port of 23 at the site. Port 23 is the port associated with the Telnet server, and all Telnet clients should have unprivileged source ports of 1024 or higher. The second and third rules work in a similar fashion, except packets to destination addresses 123.4.5.7 and 123.4.5.8, and port 25 for SMTP, are permitted.

The fourth rule permits packets to the site's NNTP server, but only from source address 129.6.48.254 to destination address 123.4.5.9 and port 119 (129.6.48.254 is the only NNTP server that the site should receive news from, thus access to the site for NNTP is restricted to only that system). The fifth rule permits NTP traffic, which uses UDP as opposed to TCP, from any source to any destination address at the site. Finally, the sixth rule denies all other packets—if this rule is not present, the router may or may not deny all subsequent packets. This is a very basic example of packet filtering. Actual rules permit more complex filtering and greater flexibility.

While some of these services such as Telnet or FTP are inherently risky, blocking access to these services completely may be too drastic a step for many sites. Not all systems generally require access to all services. For example, restricting Telnet or FTP access from the Internet to only those systems that require the access can improve the security of users at no cost. Services such as NNTP may seem to pose little threat, but restricting these services to only those systems that need them helps to create a cleaner network environment and reduces the likelihood of exploitation from yet-to-be-discovered vulnerabilities and threats.

Application Gateways

To counter some of the weaknesses associated with packet filtering routers, firewalls need to use software applications to forward and filter connections for services such as Telnet and FTP. Such an application is referred to as a proxy service, while the host running the proxy service is referred to as an application gateway. Application gateways and packet filtering routers can be combined to provide higher levels of security and flexibility than if either were used alone.

What Should a Firewall Contain?

Once the decision is made to use firewall technology to implement an organization's security policy, the next step is to procure a firewall that provides the appropriate level of protection and is cost-effective. However, what features should a firewall have, at a minimum, to provide effective protection? One cannot answer this question entirely with specifics, but it is possible to recommend that, in general, a firewall should have the following significant features or attributes.

1. Be able to support a "deny all services except those specifically permitted" design policy, even if that is not the policy used;

2. Support your security policy, not impose one;

3. Be flexible and able to accommodate new services and needs if the security policy of the organization changes;

4. Contain advanced authentication measures, or should contain the hooks for installing advanced authentication measures;

5. Employ filtering techniques to permit or deny services to specified host systems, as needed;

6. Use proxy services for services such as FTP and Telnet, so that advanced authentication measures can be employed and centralized at the firewall. If services such as NNTP, http, or gopher are required, the firewall should contain the corresponding proxy services;

7. Contain the ability to centralize SMTP access, to reduce direct SMTP connections between site and remote

systems. This results in centralized handling of site e-mail;

8. Accommodate public access to the site, such that public information servers can be protected by the firewall but can be segregated from site systems that do not require the public access;

9. Contain the ability to concentrate and filter dial-in access;

10. Contain mechanisms for logging traffic and suspicious activity, and also mechanisms for log reduction so that logs are readable and understandable;

11. Be developed in a manner that its strength and correctness is verifiable. It should be simple in design so that it can be understood and maintained;

12. Be updated with patches and other bug fixes, at regular time intervals.

If the firewall requires an operating system such as UNIX, a secured version of the operating system should be a part of the firewall, with other security tools as necessary to ensure firewall host integrity. The operating system should have all patches installed.

The IP filtering language should be flexible, user-friendly to program, and should filter on as many attributes as possible, including source and destination IP address, protocol type, source and destination TCP/UDP port, and inbound and outbound interface.

There are undoubtably more issues and requirements, however many of them will be specific to each site's own needs. A thorough requirements definition and high-level risk assessment will identify most issues and requirements; however it should be emphasized that the Internet is a constantly changing network. New vulnerabilities can arise, and new services and enhancements to other services may represent potential difficulties for any firewall installation. Therefore, flexibility to adapt to changing needs is an important consideration.

Benefits of an Internet Firewall

Internet firewalls manage access between the Internet and an organization's private network. Without a firewall, each host system on the private network is exposed to attacks from other hosts on the Internet. This means that the security of the private network would depend on the "hardness" of each host's security features and would be only as secure as the weakest system.

Internet firewalls allow the network administrator to define a centralized "choke point" that keeps unauthorized users such as hackers, crackers, vandals, and spies, out of the protected network, prohibits potentially vulnerable services from entering or leaving the protected network, and provides protection from various types of routing attacks. An Internet firewall simplifies security management, since network security is consolidated on the firewall systems rather than being distributed to every host in the entire private network.

Firewalls offer a convenient point where Internet security can be monitored and alarms generated. It should be noted that for organizations that have connections to the Internet, the question is not whether attacks will occur but, when do they occur? Network administrators must audit and log all significant traffic through the firewall. If the network administrator does not take the time to respond to each alarm and examine logs on a regular basis, there is no need for the firewall, since the network administrator will never know if the firewall has been successfully attacked!

For the past few years, the Internet has been experiencing an address space crisis that has made registered IP addresses a scarce resource. This means that organizations wanting to connect to the Internet may not be able to obtain enough registered IP addresses to meet the demands of their user population. An Internet firewall is a logical place to deploy a Network Address Translator (NAT) that can help alleviate the address space shortage and eliminate the need to renumber when an organization changes its ISPs.

An Internet firewall is the perfect point to audit or log Internet usage. This permits the network administrator to justify the expense of the Internet connection to management, pinpoint potential bandwidth bottlenecks, and provide a method for departmental charge-backs if this fits the organization's financial model.

An Internet firewall can also offer a central point of contact for information delivery service to customers. The Internet firewall is the ideal location for deploying World Wide Web and FTP servers. The firewall can be configured to allow Internet access to these services, while prohibiting external access to other systems on the protected network.

Finally, some might argue that the deployment of an Internet firewall creates a single point of failure. It should be emphasized that if the connection to the Internet fails, the organization's private network will still continue to operate though the Internet access is lost. If there are multiple points of access, each one becomes a potential point of attack that the network administrator must firewall and monitor regularly.

By adequately securing little corners of cyberspace, you can instil and maintain the right levels of trustworthiness that your customers both demand and deserve. We have seen that e-security requires a holistic approach. It is as much a set of behaviours as it is a bundle of software tools and network sniffers which, by themselves, might leave us with a false sense of security. Analogies abound in our everyday lives. We buy expensive alarm systems for our homes, move around elite communities, opt for a German Shepherd or a Doberman Pinscher, and yet we know that these are only partial solutions.

True security requires that you educate your staff, develop manageable security policies and procedures, and create a secure organization (whether it be one or many employees) that enforces those policies. It requires that you properly configure your network for your organization, without assuming that off-the-shelf configurations are right for you. It also means investing in the tools and expertise that you deem necessary to evaluate and monitor your network in order to detect intrusions before they actually happen, as well as develop a clear strategy for dealing with an intrusion when it inevitably happens. Finally, a secure network calls for constant vigilance. This means keeping up with the technological changes around you by reading trade journals and periodicals, joining user groups that discuss security issues and disseminate the latest security information, and attending conferences, seminars, and any relevant training that will keep you abreast of evolving security needs.

Defining an Enterprise-wide Security Framework

Traditionally, organizations have relied on policies to communicate high-level directives from the management. These documents, once issued, provide a top-down influence for everyone in the company—from business units to departments to individual employees. Furthermore, these policies typically were developed at one time in the organization's evolution to capture the current environment. One of the major challenges for an organization in this area is the continued growth and adaptation of the policies to mirror the transformation within the organization. The fastest area of growth and change within an organization is Information Systems. With the rapid development and push towards new technologies, organizations find themselves striving to maintain current technical environments with outdated policies. Secondly, with the emergence of new technology strategies such as Intranets and Extranets, security and protection of informational assets has become paramount.

The first step is an enterprise-wide Information Systems security policy that is consistently enforced even as business needs change. Unfortunately, most companies have only bits and pieces of security scattered throughout the organization.

These may make some departments or individuals feel safe, but they do little to protect the enterprise as a whole. A security policy should include People, Policy, and Technology. The security process is a mixture of these three elements. Each element depends in some manner on the other elements. Also, issues receive greater coverage when the elements are combined. The controls environment is greatly enhanced when these three elements work in concert. A simple diagram will suffice to illustrate this (see Figure 5.3). This diagram shows the basic elements and also the coverage areas.

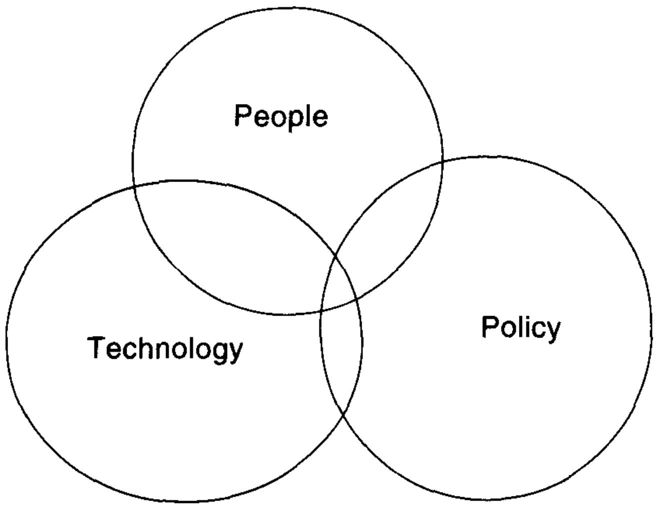


Fig. 5.3 People, policy and technology model.

As you move towards the union of these elements, the controls environment increases-there is greater coverage. Let us understand these three elements individually.

People. This core element is the most important. The people element comprises the people and various roles and responsibilities within the organization. These are the people that are put in place to execute and support the process. A few key roles include senior management, security administrators, system and IT administrators, end users, and auditors.

Policy. This element comprises the security vision statement, security policy and standards, and the control documentation. This is basically the written security environment—the bible that the security process will refer to for direction and guidance.

Technology. This element includes tools, methods, and mechanisms in place to support the process. These are core technologies—the operating systems, the databases, the applications, the security tools—embraced by the organization. The technology then is the enforcement, monitoring, and operational tools that will facilitate the process.

The concept is that each core element could be measured for effectiveness and coverage. Also, issues can be measured against the model to determine what controls coverage for that issue. The objective then is to move issues into the intersecting areas of the elements, with the final objective of moving the issue into the middle area of greatest coverage. As risk issues are identified, each step to manage the risk will fall into one of the core elements of people, policy, or technology. If the issue is resolved with one of the elements, addressing one of the other elements can enhance this resolution. As the core elements are added to the controls environment and utilized in concert, the issue is then resolved on several fronts— the controls coverage is greater.

The People, Policy, Technology (PPT) Model

The PPT model can be illustrated with a few simple examples. Figure 5.4 shows the PPT model with regards to Internet usage and misuse. Users are educated on the proper usage of the Internet. The controls environment relies solely on the user. An Internet usage policy is written to document proper use of the Internet and the consequences of misuse. The controls environment now is supported by two of the three core elements.

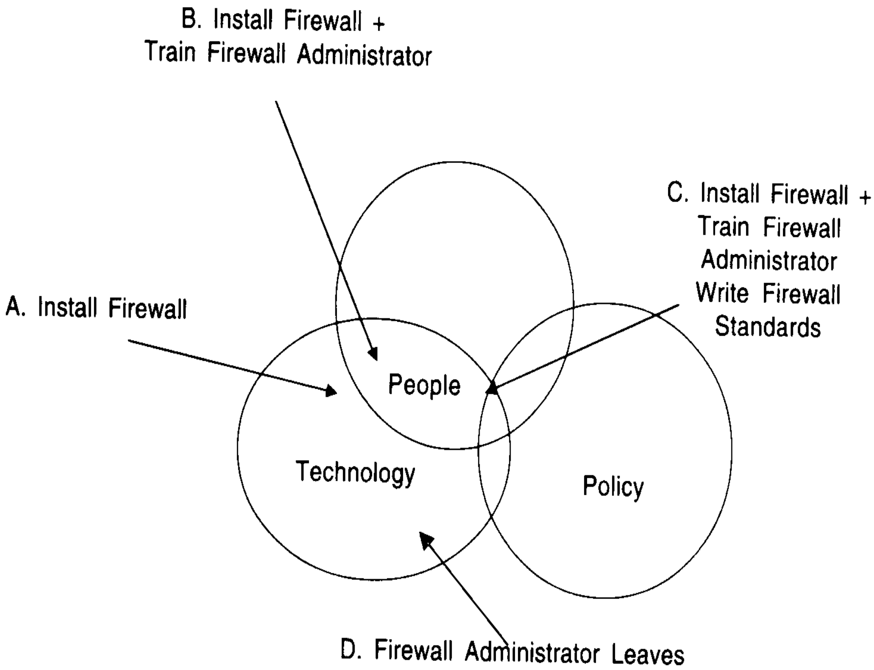


Fig. 5.4 Internet connection: coverage by three elements.

The PPT model is simply the analysis of a risk issue. If the issue is broken down into the three core elements, action items can be determined for each core element. In this manner, control coverage can be moved from one element to two, and ultimately to coverage by all of the elements.

Understanding the Security Framework

Key elements, also referred to as the "Four Pillars" to Information Security, include:

- Solid Senior Management Commitment
- An overall Security Vision and Strategy
- A comprehensive Training and Awareness Program
- A solid Information Security Management Structure including key skill sets and documented responsibilities as depicted in Figure 5.5.

Within the four "pillars" of the program, several phases are included.

The first is the Decision Driver Phase, which contains factors determining the business drivers of security. These include Technology Strategy and Usage, Business Initiatives and Processes, and Threats, Vulnerabilities and Risk. All these combine to form a unique "Security Profile" of the organization. The "profile" needs to be reflected in the Security Policies and Technical Controls.

The next facet of the Information Security Framework includes the design of the security environment, also called the Design Phase. This is the stage where the organization documents its security policy, the control environment and deals with controls on the technology level. A key element in this process is not only the clear definition of security policy and technical control information, but also the "Security Model" of the enterprise. Information Classifications and Risk Assessment methods fall under this component. These processes allow the organization to manage risk appropriately and identify the risks and value of information assets.

The final facet of the Information Security Framework is the Implementation Phase. This begins by documenting the Administrative and End-User guidelines and procedures. These guidelines must be succinct and flexible for the changing environment. Enforcement, Monitoring, and Recovery processes are then layered on for the operational support of the security program. These processes are "where the rubber hits the road". All the benefits of the Security Program design and documentation are diminished if it is not put into effect on an operational day-to-day basis.

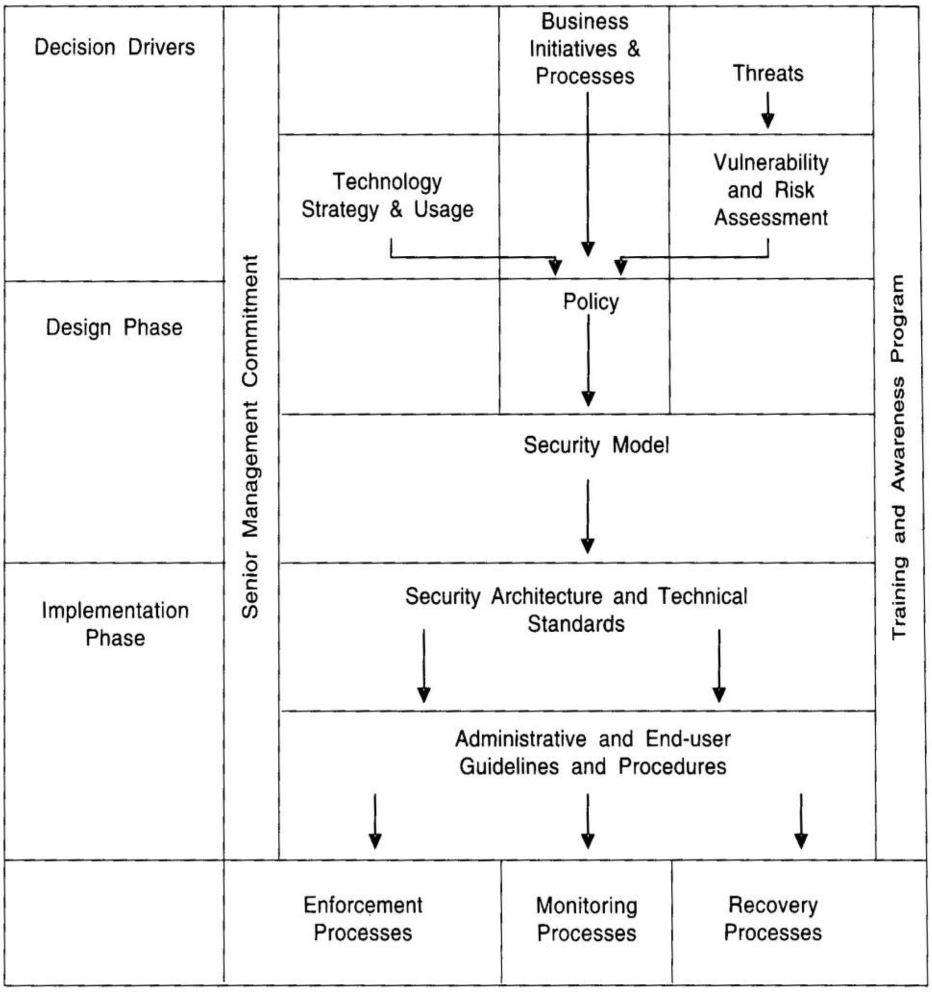


Fig. 5.5 Information Security Management Structure.

Secure Physical Infrastructure

All of us are concerned about physical and environmental security. We may not always do a formal risk assessment exercise, but intuitively, we try to ensure that we are secure. BS 7799 is very explicit about the requirements of this domain, which is applicable to the business premises and business information processing facilities. Design, implementation and monitoring of many controls for this domain will have to be jointly done with the physical security department.

Security can be best achieved by ensuring multiple layers of security and not depending on a single measure. This principle is very evident here. The controls for physical and environmental security are defined in three areas:

- Security of the premises
- Security of the equipment
- Secure behaviour

Security of the Premises

Physical security perimeter. We begin by defining the boundary of the premises and examining the security requirement, based on the risk assessment. The best way to do this will be to walk around the premises and 'case the joint.' Evaluate all the entry points through which an intruder could come in. Take help of a security agency to do this. Do not depend on your skills as an armchair detective. The classical approach to securing the premises is to create multiple barriers.

Start with the outermost perimeter. How much resistance this perimeter is expected to provide? Based on risk assessment, you need to decide all the physical specifications like height, width for the protective wall. Next, consider all the entry points. Are the doors strong enough? Are the door frames strong enough? Are the windows, ventilators, air-conditioning firmly secured with grills? Do the physical barriers extend from real floor to real ceiling, or is there a gap between false ceiling and real ceiling through which somebody could crawl in? We need to detect the weakest link while assessing the perimeter defence. How are the access points guarded? Are they controlled through card-controlled entry gates? Are watchmen, guards or receptionist monitoring the entry points?

Physical entry controls. Only the authorized persons should be allowed access to the secure areas. This objective could be achieved by having a clear access control policy defining the access rights. Based on this policy, appropriate measures should be in place. These measures may take the form of access control devices like swipe card controlled doors, logging information about visitors and visible identification badges.

Securing offices, rooms and facilities. Location of the secure office within the physically secure perimeter should be chosen with care. All the risks pertaining to fire, flood, explosion, civil unrest and other forms of natural or man-made disaster should be considered. There could also be threat from neighbouring premises, caused by leakage of water, spreading of fire, or storage of toxic/inflammable/explosive material. Even bulk supplies like stationery should not be stored within the secure premises.

The secure location should not be publicized in any manner. No display board, banners, signs to indicate the presence of any important information processing activity. Even the internal telephone directories should not be readily accessible to outsiders.

Support facilities like photocopier, fax machines, which are constantly accessed by everyone, should be located away from the secure area. Suitable intrusion detection systems like CCTV, motion sensors etc. should be installed and regularly tested.

Working in secure areas. Security equipment like CCTV and swipe-card controlled gates are of no use if the persons working in these locations are not trustworthy, or are incompetent, or simply lack awareness of their responsibility. They should be hand-picked and trained for these operations. They should not brag about their nature of work or location. Also, information should be provided on need-to-know basis. Segregation of duties should be scrupulously followed with strict supervision. Third-party personnel should be granted restricted access. No photographic, video, audio or other recording equipment must be allowed inside the premises, unless authorized.

Isolated delivery and loading areas. We have taken care of every aspect of physical security in the above paragraphs, but do we know how canteen facilities get into secured premises? How the trash is taken out? How the courier delivers the parcels? In industrial premises, there could be constant movement of incoming and outgoing material. All this traffic needs to be isolated from the secure office area, so that it does not pose a threat.

Security of the Equipment

Equipment setting and protection. Our next concern is the appropriate security of the equipment. Information processing equipment needs to be handled carefully. The first level of equipment protection depends on physical location. The location should minimize the need for unnecessary access, as well as prevent snooping. It should be such as to minimize the risk of theft as well as the risk from natural disasters like fire, flood, chemicals etc. Also, consider risks like electrical and electromagnetic interference, humidity etc.

Power supplies. Information processing will come to halt in the absence of a suitable power supply. This could be the worst type of a denial-of-service attack. A thorough business risks assessment is necessary to understand the impact on non-availability of power for certain durations. Based on the evaluation, appropriate measures need to be taken. These could be:

1. Taking power from multiple feeds of electric supply.
2. In case all the electric supplies fail simultaneously, you need to have an uninterruptible power supply (UPS) with adequate battery capacity capable of sustaining the initial load.
3. The UPS could in-turn be supported by backup generator sets.
4. The backup generator would require adequate supply of fuel, which also needs to be stored with replenishment, assured by the suppliers.

5. Proper installation of emergency lights should also be planned; lightning protection should be provided to the power installation and the communication lines.

Cabling security. We really need to remember every detail, including the proverbial last nail. Do we know the physical layout of power cables and communication cables in our premises? The first step will be to obtain wiring diagrams and update them. Then, do a physical inspection and assess the protection needs against damage, interference or interception. Establish the best practices for laying the network cables as well as power cables, and ensure that these are actually implemented. The next step is to decide on additional security protection required for the network. This could be expensive for an old installation. Safety measures like use of armoured conduit cables, underground ducts, or fibre optic cabling will require huge investment and need to be justified based on risk assessment. But simple measures like providing locks to the communication cable patch board, which are often over-looked, should be immediately implemented.

Equipment maintenance. It is normally expected that due care is taken for equipment maintenance, and proper records are maintained. From a security angle, two more measures are required. One is to maintain record of faults that were noticed, and the second step is to maintain records of all equipment sent off the premises for maintenance.

Security of equipment off premises. Shrinking size of computers and expanding wide area networks have made the computer equipment extremely mobile. Processing as well as storage capacity of mobile devices has been following Moore's law of doubling every 18 months. Securing these devices is as important as securing the data centre. Various controls that should be considered are: administrative controls like permissions and corporate policy on use of mobile computers in places like airplanes, physical controls like securing the devices with security chains, alarms, and storing them at non-obvious places, using access control devices like USB tokens, and finally taking adequate insurance cover.

Secure disposal or reuse of equipment. Storage devices have long memory, unless specifically destroyed. Mere deletion is not enough. This becomes important when an old computer equipment is disposed off or transferred to another location. Equipment sent for repair are equally susceptible to reading of data from the 'deleted' storage devices. Every such device should be subjected to a thorough erasing and overwriting to destroy the data.

Since some reports claim that the data could be recovered even after multiple overwriting and formatting, it may be desirable to physically destroy the media containing top secret information.

Secure Behaviour

Clear desk and clear screen policy. Our concern for information security should not stop at securing the premises and equipment. Sensitive information could be accessible in many forms, and it is necessary to identify and protect the information in all its incarnations. Classification of information will help to identify the sensitivity, but having an organizational "clear desk and clear screen policy" could ensure actual protection. In brief, it means keep everything under lock and key and do not allow anybody to snoop. The following guidelines should be issued:

- Lock up all documents and media when not being used.
- Protect the computers and terminals through use of key locks, passwords, and screen savers.
- Fax and telex machines used for confidential information should not be left unattended.
- Access to photocopiers and scanners is restricted after office hours.

- Printing of classified information should be supervised and all printouts must be removed immediately.

Removal of property. Any movement of equipment, information or software should be only with proper authorization. All these movements should be logged and records maintained for all outgoing and incoming items. In these days of storage media capable of containing gigabytes of information, this procedure becomes very important. Employees should be made aware that spot checks would be carried out to ensure full compliance.

Security is being paranoid about threats. Physical security is very demonstrative about this paranoia. But, it also sets the tone about the organization's concern about information security.

5.4 Summary

Internet is the network of computers. All are connected to all other's. There is lot of opportunity for the people connected to internet to turn e-business to a risky one. This chapter deals with the way the sites are hacked and the modes of risks that an e-commerce based company has to fight with. The available options to provide security for web based company are discussed with a special attention towards firewalls.

EXERCISES

1. Describe how online website operations can be protected from hackers?
2. What is the role of a firewall?
3. Outside firewalls, what are the major technologies used to ensure Internet security?
4. What is the use of a proxy server?
5. What is a denial-of-service attack and how does it affect a business organization?

6. Which is easier to maintain—default deny or default permit?
7. Why should a firm care about IP spoofing attacks that originate from its site but do not pose a threat to its own computer security?
8. What are the necessary components for an organization's security policy?
9. Why should a firewall be able to support a 'deny all services, except those specifically permitted', if this is not the policy expected to be used?
10. Discuss the relative merits of developing firewalls in-house or buying commercial firewall software?
11. What are some of the potentially dangerous internet services, and why?

UNIT - III

6. E-payment Systems

In this Chapter we will discuss

- The concept of money in financial transaction
- Recent trends in payments
- Mobile payments
- Risks involved in online payments
- Security mechanisms for online payments

Structure of the chapter

6.1 Introduction

The growth of e-commerce is dependent, among other factors, on the existence of secure, user-friendly and cost-effective payment systems. Handling payments is a costly process that has been a central part of bank business for the past century. However, it is now being transformed by technological developments, and in particular, the Internet. Conceptually, the alternative means of payment available for e-commerce may be classified as either electronic money (e-money), or electronic access products. The difference between them is that where as electronic access products basically provide Internet access to traditional products (credit card payments, bank transfers, and the like), e-money is a new concept, and in particular is considered to be "private money not depending on central bank reserves."

Consolidated methods of payment used for distance selling mostly at national level, such as cheque, cash-on-delivery and credit-transfer mechanisms, have proven easy to adapt to electronic transactions. The credit card system has to date been the usual payments instrument for goods ordered over the Internet. This is despite security concerns and relatively higher transaction cost. Nevertheless, the lack of a widely accepted e-payment system is not considered to be a major barrier for the gearing up of e-commerce. The most important factors are undoubtedly user trust and user confidence.

E-payment systems are becoming central to e-commerce as companies look for ways to serve customers faster and at lower cost. Emerging innovations in the payment for goods and services in electronic commerce promise to offer a wide range of new business opportunities. The current state of online electronic payments is in many ways reminiscent of the medieval ages. The merchants of Asia and Europe faced a similar problem while trying to unlock the commercial potential of the expanding marketplace. Those ancient traders faced a number of obstacles, such as conflicting local laws and customs regarding commercial practices, and incompatible and nonconvertible currencies that restricted trade. To circumvent some of these problems, traders invented various forms of payment instruments, such as promissory notes, bills of exchange, gold coins, and barter. The merchants also developed commercial law surrounding the use of these instruments, that proved to be one of the turning points in the history of trade and commerce. We are on the verge of a similar sort of development today with regard to e-payment systems.

Everyone agrees that the payment and settlement process is a potential bottleneck in the fast-moving electronic commerce environment, if we rely on conventional payment methods such as cash, cheques, bank drafts, or bills of exchange. Electronic replicas of these conventional instruments are not well-suited for the speed required in e-commerce purchase processing. For instance, payments of small denominations (micropayments) for bits and pieces of information must be accepted by vendors in real time. Conventional instruments are too slow for micropayments, and the high transaction costs involved in processing them add greatly to the overhead. Therefore, new methods of payment are needed to meet the emerging demands of e-commerce. These new payment instruments must be secure, have a low processing cost, and be accepted widely as global currency tender.

6.2 Evolution of the concept of money

The development of money is not dependent solely on objective characteristics. Subjective valuations play a critical role. Ultimately consumers determine what form of money is most desirable—people simply substitute cheaper and more convenient forms of money for expensive and inconvenient forms. It is ultimately through this substitution in use that new money forms embed themselves in the marketplace.

Up until that time, it was assumed that money and payment systems had been invented and imposed by the state. Money is a social phenomenon, with its roots in the barter economy; payment systems evolved out of the barter economy—and empowered buyers and sellers—with the development of money as a medium of exchange. Buyers and sellers recognized that doing business became much more efficient if everyone used a commonly accepted form of payment.

The notion of money continues to evolve, driven by overwhelming marketplace preference for increased convenience and efficiency, and decreasing risk and costs. The modem payment card system is an excellent example of this organic, socially-driven growth—the creation of new forms of exchange that continue to make life easier and more efficient. So long as the human condition continues to change, payment systems will continue to evolve, driven by those powerful market forces.

Digital Payment Requirements

For any digital payment system to succeed, the criteria given in Table 6.1 ought to be satisfied.

DIGITAL PAYMENT REQUIREMENTS

Criteria	*Need for the criteria*
Acceptability	Payment infrastructure needs to be widely accepted.
Anonymity	Identity of the customers should be protected.
Convertibility	Digital money should be convertible to any type of fund.
Efficiency	Cost per transaction should be near zero.
Integration	Interfaces should be created to support the existing system.
Scalability	Infrastructure should not breakdown if new customers and merchants join.
Security	Should allow financial transactions over open networks.
Reliability	Should avoid single points of failure.
Usability	Payment should be as easy as in the real world.

Table 6.1

Online Payment Categories

Online payments can be broadly divided into three categories as shown in Table 6.2.

ONLINE PAYMENT CATEGORIES

Category	*Description*
Micropayment	Transaction value less than 5 euros or dollars. Transaction costs are nearly zero.
Consumer payments	Transaction value between 5 and 500 euros or dollars. Payments are executed by credit card transactions.
Business payments	Transaction value more than 500 euros or dollars. Debit cards or invoices are appropriate solutions in this system.

TABLE 6.2

E-payment systems are proliferating in banking, retail, healthcare, online markets, and even in government in fact, anywhere money needs to change hands. Organizations are motivated by the need to deliver products and services more cost-effectively and to provide a higher quality of service to customers. Research into e-payment systems for consumers can be traced back to the 1940s, and the first applications, the credit cards, appeared soon after. In the early 1970s, the emerging electronic payment technology was labelled electronic funds transfer (EFT). EFT is defined as: any transfer of funds initiated through an electronic terminal, telephonic instrument, or computer or magnetic tape so as to order, instruct, or authorise a fine new institution to debit or credit an account.

EFT utilizes computer and telecommunication components, both to supply and to transfer money or financial assets. Transfer is information-based and intangible. Thus EFT stands in marked contrast to conventional money and payment modes that rely on physical delivery of cash or cheques (or other paper orders to pay) by truck, train, or airplane.

Digital Token-based E-payment Systems

The introduction of charge cards in the early 1900s, beginning with western union in 1914, represented a breakthrough in payments. But while these cards enhanced customer loyalty and stimulated repeat behaviour, they were generally limited to the local market, or in store use.

In 1958, Bank of America took a major step forward, introducing what eventually became the modem credit card. Based on extensive test marketing in Fresno, California, it became clear there was a large market for a general purpose bank card featuring a revolving credit facility and wide acceptance. With the launch of Bank of America's card, the consumer was not tied to one merchant or product, but was now free to make credit purchases at a wide range of outlets. As the adoption of the bank card grew, the potential size of the market for transactions expanded geometrically. It was a profound turning point in the history of money.

The development of the modem electronic payment network took an important step forward in the mid-1970s, with the creation of a global joint venture that would eventually be known as visa. Through shared investments, the visa association created a global system to authorize transactions, clear and settle electronic payments, codify operating regulations to protect consumers and merchants alike, and set interoperability standards to ensure that, unlike cash and cheques, a visa card could be used anywhere in the world.

Two developments in the 1990s further broadened the utility of electronic payments.

Debit cards, a popular "pay now" product, allowed consumers to access funds in a demand deposit account to conduct transaction at the point of sale; and e-commerce emerged as mainstream business channel, both relying on and stimulating electronic payments.

The rapid adoption of these relatively recent developments demonstrate the speed at which the payments landscape is changing. Looking forward, there is broad experimentation in ways to migrate electronic payment functions into consumer devices such as mobile phones, PDAs, and other popular electronic products. This process is well underway in some European and Asian markets where mobile phones are nearly as ubiquitous as payment cards. Visa describes this new range of payment choices as "u-commerce," or universal commerce— the ability to conduct commerce anywhere, anytime, or any way.

This shift in consumer preference is driving major changes in personal consumer expenditures (PCE). The growth in card usage as a share of PCE continues to expand relative to cash and cheques.

Also, in most markets around the world, the use of cash and cheques is declining—a trend that is likely to continue. The trend away from cash and cheques is driven by well established benefits of electronic payments to all parties.

Benefits to Buyers

- Convenience of global acceptance, a wide range of payment options, and enhanced financial management tools.
- Enhanced security and reduced liability for stolen or misused cards.
- Consumer protection through an established system of dispute resolution.
- Convenient and immediate access to funds on deposit via debit cards.
- Accessibility to immediate credit. Intuitively, the comparative cost of arranging for a consumer loan

relative to the ability to obtain credit at the point of sale is substantial in considering both the direct processing costs as well as the implicit opportunity costs to borrower and lender.

Benefits to Sellers

- Speed and security of the transaction processing chain from verification and authorization to clearing and settlement.
- Freedom from more costly labour, materials and accounting services that are required in paper-based processing.
- Better management of cash flow, inventory and financial planning due to swift bank payment.
- Incremental purchasing power on the part of the consumer.
- Cost and risk savings by eliminating the need to run an in-house credit facility.

A dramatic example of the efficiencies created by electronic payments can be seen in the public sector, where governments have used innovations such as purchasing card to reduce paperwork, enhance financial controls, and create more robust accounting and financial data.

Convenience

Anyone who has searched through pockets for exact change for parking, fumbled with foreign currency, paid exorbitant foreign exchange commissions, tried to cash a cheque in another country or been concerned about carrying a large roll of banknotes can appreciate the convenience of payment cards.

Fundamental to this convenience is the virtually ubiquitous acceptance and utility, whether it is an apparel store in Paris or a crafts shop in Nepal. Payment cards work in brick and mortar environments, over the phone, on the Internet, and through the post. Applications are underway that support new uses such as recurring payments, insurance and payroll disbursements, rent and utility bills, and small ticket transactions such a vending machines and car parks. Consumers place an enormous value on convenience, although this paper has not attempted to measure it. The sheer convenience of being able to access cash at an ATM or conduct a transaction directly at the point of sale with a credit or debit card clearly has had an impact on economic growth.

None of the banking or retailing payment methods in their present form are completely adequate for the consumer-oriented e-commerce environment. Their deficiency is their assumption that the parties will, at some time or other, be in each other's physical presence or that there will be a sufficient delay in the payment process for frauds, overdrafts, and other undesirables to be identified and corrected. These assumptions may not hold good for e-commerce and so, many of these payment mechanisms are being modified and adapted for the conduct of business over networks.

Entirely new forms of financial instruments are also being developed. One such new financial instrument is electronic tokens, which are available in the form of electronic cash/ money or cheques. Electronic tokens are designed as electronic analogues of various forms of payment backed by a bank or a financial institution. Simply stated, electronic tokens are equivalent to cash that is backed by a bank.

6.3 Credit Cards as E-payment Systems

Without doubt, the basic means of payment used and initiated via the Internet for consumer transactions till date is the credit card. Credit cards have proved popular for a number of reasons as the following:

1. The system is familiar to users and was widely used before the advent of e-commerce, thus bolstering the users' confidence.

2. Transaction costs are hidden from users (i.e. basically met by sellers, and passed on to all customers, not just credit card users).

3. Payment is simple anywhere and in any currency, thus matching the global reach of the Internet.

4. The credit-issuing company shares the transaction risk; helping overcome consumers' fear and reluctance to buy goods they have not actually seen, from sellers they do not know (in the physical world this function was important because it enabled sellers to take payment from buyers they do not know; online this trust relationship is needed in both directions).

The disadvantages of credit cards for e-commerce include the fact that they cannot be used directly for small value payments or peer-to-peer transactions.

Disadvantages of Credit Cards

Credit cards have their own disadvantages. First, the relatively high transaction cost makes them impractical for small-value payments. Second, they cannot be used directly by individuals to make payments to other individuals (peer-to-peer transactions). Third, protecting the security of transactions is vital, especially in the virtual world where there is no payment guarantee to the merchant by a bank. Users' fears about security issues seem to be a consequence of the newness and relative unfamiliarity of the medium, rather than the real risks involved in the system.

Security Issue and Encryption

What has proven to be a problem from the security point of view is not interception, but authentication. Some of the most serious cases of online fraud seem to be involved with the use of details of cards used in traditional ways (e.g.

payments slips collected from among paper wastes). Having collected the card numbers, by some means, fraudsters exploit the anonymity of the Internet to use the details and make untraceable purchases (when making cross-border purchases, they may be further aided by the fact that the address-verification system used by merchants to compare billing and delivery information in the US is useless overseas). In response to this threat, credit-issuing companies are planning to implement measures such as the use of smart cards to improve authentication. Also in the US, Visa and MasterCard and others have joined forces to develop the Secure Electronic Transactions (SET) standard for online payments; a single technical specification for safeguarding payment card purchases made over open networks. It includes digital signatures and digital certificates for all parties involved: customers, merchants, and financial institutions. SET combines a range of cryptographic means, using algorithms based on DES (Data Encryption Standard) and RSA (the encryption algorithm invented by Rivest, Shamir and Adieman in 1976).

Encryption and Credit Cards

Encryption is instantiated when credit card information is entered into a browser or other e-commerce device and sent securely over the network from a buyer to a seller as an encrypted message. This practice however, does not meet the important requirements of an adequate financial system, such as non-refutability, speed, safety, privacy, and security. To make a credit card transaction truly secure and non-refutable, the following sequence of steps must occur before actual goods, services, or funds flow:

1. A customer presents his or her credit card information (along with an authenticity signature, or other information such as mother's maiden name) securely to the merchant.

2. The merchant validates the customer's identity as the owner of the card account.

3. The merchant relays the credit card charge information and signature to its bank or online credit card processors.

4. The bank or processing party relays the information to the customer's bank for authorization approval.

5. The customer's bank returns the credit card data, charge authentication, and authorization to the merchant.

In this scheme, each consumer and each vendor generates a public key and a secret key. The public key is sent to the credit card company and put on its public key server. The secret key is re-encrypted with a password, and the unencrypted version is erased. To steal a credit card number, a thief would have to get access to both a consumer's encrypted secret key and password. The credit card company sends the consumer a credit card number and a credit limit. To buy something from vendor X, the consumer sends vendor X the message, "It is now time T. I am paying Y dollars to X for item Z." Then the consumer uses his or her password to sign the message with the public key. The vendor will then sign the message with its own secret key and send it to the credit card company, which will bill the consumer for Y dollars and give the same amount (less the fee) to X.

Nobody can cheat in this system. The consumer cannot claim that he did not agree to the transaction, because he has signed on it (as in everyday life). The vendor cannot levy fake charges, because he does not have access to the consumer's key. He cannot impose the same charge twice, because the consumer has included the precise time in the message. To become more useful, credit card systems will have to develop distributed key servers and card checkers. Otherwise, a concentrated attack on these sites could bring the system to a halt.

Support for Privacy Enhanced Mail (PEM) and Pretty Good Privacy (PGP) encryption has been built into several browsers. Both of these schemes can be substantially bolstered with the addition of encryption to defeat snooping attacks.

Unfortunately, whether existing credit card companies will accept digital signatures as replacements for real signature is not clear. And so, vendors will have a difficult time when customers dispute the charges made using encrypted credit card numbers over the Internet. When credit card companies do decide to accept digital signatures, they also need to maintain a public server with all the public keys. This method assumes that the credit card company will keep the vendor honest, as is the case with traditional credit card transactions. E-payment processing is not an inexpensive proposition, however. But neither is it fradulent. If e-commerce takes off and small transactions increase without a fully encrypted system in place, fraud will become expensive all the more.

Providing credit card processing service for numerous half-dollar and one-dollar transactions may not be financially attractive, compared to the average credit card transaction of about $60. If this process is extended to all of the micropayment services that are ultimately available over the Internet (e.g. 20-cent file transfers and $1 video game rentals), the overall processing load on key system components are likely to become unmanageable or commercially non-viable unless a significant amount of automation takes place. To solve this problem, third-party payment processors can be undertaken.

Business Pros and Cons of Credit Card-based Payment

Third-party processing for credit cards entails a number of pros and cons. These companies are chartered to give credit accounts to individuals and act as bill collecting agencies for businesses. Consumers use credit by presenting them for payment and then paying an aggregate bill every month. Consumers pay either by flat fee or individual transaction charge service. Merchants get paid for the credit card drafts that they submit to the credit card company. Businesses get charged a transaction charge ranging between 1 per cent to 3 per cent for each draft submitted.

Credit cards have advantages over cheques in that, the credit card company assumes a larger share of financial risk on both the buyer and the seller in a transaction. Buyers can sometimes dispute a charge retroactively and have the credit card company act on their behalf. Sellers are ensured that they will be paid for all their sales and they need not worry about the fraud. This becomes a convenience for the buyer in that, the credit card transactions are usually quicker and easier than cheque (and sometimes even cash) transactions. One disadvantage to credit cards is that their transactions are not anonymous, and credit card companies do in fact compile valuable data about spending habits.

Record keeping with credit cards is one of the features consumers value most, because of disputes and mistakes in billing. Disputes may arise because different services may have different policies. For example, an information provider might charge for partial delivery of a file (the user may have abandoned the session after reading a part of the file), and a movie distributor might charge depending on how much of the video had been downloaded. The cause of interrupted delivery needs to be considered while resolving disputes. In general, implementing payment policies will be simpler when payment is made by credit card rather than by cash.

The complexity of credit card processing takes place in the verification phase, a potential bottleneck. If there is a lapse in time between the charging and the delivery of goods or services (for example, when an airline ticket is purchased well in advance of the date of travel), the customer verification process is simple because it does not have to be done in real time. In fact, all the relaying and authorizations occur after the customer-merchant transaction is completed, unless the authorization request is denied. However, if the customer wants a report (or even a digital airline ticket) to be downloaded into a PC or other information appliance immediately at the time of purchase, many message relays and authorizations take place in real time, while the customer waits. Such exchanges may require many sequence-specific operations, such as staged encryption and decryption and exchanges of cryptographic keys.

6.4 The Mobile Payments

The biggest wildcard in the e-commerce and e-payment field at the moment is the way mobile Internet access develops. Already schemes such as Internet access via SMS (short message service), and pre-paid re-loadable cards are in place, allowing payment to be made via a mobile phone. The use of the SIM card in the user's mobile phone as part of a payment system implies a shift in the roles of both banks and telephone operators.

Classification of New Payment Systems

For the time being, the New Payment Systems can be roughly divided into 2 groups: one, using smart cards, and the other using the Internet. Traditional payment instruments such as cash, cheques, credit cards, EFT/POS, and account transfer have strong points—convenience and ease of circulation—but they are weak due to their high handling costs. The New Payment Systems are an experiment to augment payment instruments with the use of networks and electronics, while maintaining the strength of the older systems. The methods to be used by the New Payment Systems as in Table 6.3 can be classified in the following manner:

1. Cash substitution
2. Cheque substitution
3. Credit card substitution
4. Account transfer substitution systems.

Smart Card Cash Payment System

We will first look at the smart card-based cash payment system. In the early 1990s, a payment system for low value amounts using smart cards was first introduced in Europe.

GROUPS AND EXAMPLES OF THE NEW PAYMENT SYSTEMS

Technology	*Substitution*	*Circulation within the banking system*	*Circulation outside the banking system*
Smart Card	Cash	Visa International: Visa Cash Electronic Payment Services: SmartCash	Mondex International: Mondex
	Cash	CyberCash: CyberCoin	Digicash: e-cash
	Cheque	Checkfree: CheckFree Payment Services FSTC: Electronic Check	
Internet	Credit Card	CyberCash: Credit Card Service First Virtual Holdings: Internet Payment System	
	EFT	Intuit: Quicken Microsoft: Money Meca Software: Managing Your Money Cardinal Bancshares; Security First Network Bank	

TABLE 6.3

Most of these methods are known as stored value cards or electronic purse system. Units of prepayment or currency value are electronically stored on an IC chip imbedded in these cards. When purchases are made, the payment is effected through these units of electronic value.

Smart cards are credit and debit cards and other card products enhanced with microprocessors, capable of holding more information than the traditional magnetic stripe. The chip, at its current state of development, can store significantly greater amounts of data, estimated to be 80 times more than a magnetic stripe.

The smart card technology is widely used in countries such as France, Germany, Japan and Singapore to pay for public phone calls, transportation, and shopper loyalty programmes. The idea has taken longer to catch on in the United States, since a highly reliable and fairly inexpensive telecommunications system has favoured the use of credit and debit cards.

Smart cards are basically of two types: relationship-based smart credit cards and electronic purses. Electronic purses, which replace money, are also known as debit cards and electronic money.

The benefits of smart cards will rely on the ubiquity of devices called smart card readers that can communicate with the chip in a smart card. In addition to reading from and writing to smart cards, these devices can also support a variety of key management methods. Some smart-card readers combine elements of a personal computer, a point-of-sale terminal, and a phone to allow consumers to quickly conduct financial transactions without leaving their homes.

In the simplest form, the card reader features a two-line with a 16-character display that can show both the prompt and the response entered by the user. Efficiency is further enhanced by colour-coded function keys, which can be programmed to perform the most frequently used operations in a single key stroke. It can communicate via an RS-232 serial interface with the full range of transaction automation systems, including PCs and Electronic Cash Registers (ECRs).

Card readers in the form of screen phones are becoming more prominent. Proponents of screen phone applications have long stated that consumers, familiarity with phones gives screen phones an entry that computers cannot match. Some screen-based phones feature a four-line screen, a magnetic stripe card reader, and a phone keypad that folds away to reveal a keyboard for use in complex transactions. The phone prompts the users for transactions, using menus patterned on those found on automated teller machines.

Smart card readers can be customized for specific environments. The operating environment allows programmers to use the C programming language to create and modify applications without compromising the device's security functions. The development system for most card readers even comes with pre-coded modules for accelerated application development. To promote smart card usage, the Smart Card Forum—a group of about 130 businesses and government agencies—is drawing up common specifications to promote the use of multiple application smart cards useable for every kind of payments.

Micropayment Systems

VISA Cash of Visa International

Visa International, the world's largest credit card company, introduced their own stored value card (VISA Cash) in 1995 under license from and incorporation of the technology developed by Danmont in Denmark.

In the system of VISA Cash, the transaction is made on an existing financial network of Visa, where large value payments are also transacted. The level of security is quite high. However, as all transaction data go through the data centers' of Visa International, anonymity could be jeopardized. The transactions handled here are different from transactions by credit card. The user's identification and authentication are not required at the time of payment. Each bank does clearing of units of prepayment and deposit; thus the person concerned cannot be identified. In this manner, it provides anonymity. The operational cost is relatively high, since all transactions pass through the network for settlement at banks.

Mondex of Mondex International

We will now explore the system of Mondex which has been developed by National Westminster Bank (hereafter, NatWest Bank), a major commercial bank in Britain.

In December 1993, NatWest Bank announced an electronic low value payment system called Mondex. Mondex can be classified as a cash substitution system using smart cards, which in a sense is the same as VISA Cash, but the concept is notably different. In the Mondex system, there is one issuing body—the originator of electronic value in the currency of the country. This originator basically serves as an issuing bank in the Mondex system and issues to the Mondex member banks, the equivalent amount of electronic Mondex Value in exchange for prime negotiable instruments or cash. Consumers as cardholders load Mondex value on their card from a bank ATM, or a Mondex telephone. It can then be used as cash for shopping. Using a wallet, which resembles a pocket calculator, customers can also exchange electronic value between individuals. Therefore, once the electronic value has been drawn from a bank, only the person involved in the transaction knows the history of the monetary movement. No one else can trace it. In addition, using a private or a public telephone connected to the Mondex system, the electronic value can be withdrawn, deposited, or sent to a person at a remote location over the telephone network. By adding reader/writer functions to a personal computer, it will also be possible to send money over the Internet.

6.5 Electronic Cash (E-cash)

There are many ways of implementing an e-cash system. Specifically, e-cash must have the following four properties: monetary value, interoperability, retrievability, and security.

E-cash must have a monetary value; it must be backed by either cash (currency), a bank-authorized credit, or a bank-certified cashier's cheque. When e-cash created by one bank is accepted by others, reconciliation must occur without any problems. Stated another way, e-cash without proper bank certification carries the risk that when deposited, it might be returned for insufficient funds.

E-cash must be interoperable, that is, exchangeable as payment for other e-cash, paper cash, goods or services, lines of credit, deposits in banking accounts, bank notes or obligations, electronic benefits transfers, and the like. Most e-cash proposals use a single bank. In practice, multiple banks are required with an international clearing house that handles the exchange ability issues because all customers are not going to use the same bank or even be in the same country.

E-cash must be storable and retrievable. Remote storage and retrieval (e.g. from a telephone or a personal communications device) would allow users to exchange e-cash (e.g. withdraw from and deposit into banking accounts), from home or office or while travelling. The cash could be stored on a remote computer's memory, in smart cards, or in other easily transported standard or special-purpose devices. Since it is easy to create counterfeit cash that is stored in a computer, it is preferable that cash is stored on a dedicated device that cannot be altered. This device should have a suitable interface to facilitate personal authentication using passwords or other means and a display so that the user can view the card's contents. One example of a device that can store e-cash is the Mondex card—a pocket-sized electronic wallet.

E-cash should not be easy to copy or tamper with while being exchanged. This includes preventing or detecting duplication and double-spending. Counterfeiting poses a particular problem, since a counterfeiter may, in the Internet environment, be anywhere in the world and consequently be difficult to catch without appropriate international agreements. Detection is essential in order to audit whether prevention is working or not. Then there is the tricky issue of double spending. For instance, you could use your e-cash simultaneously to buy something in Japan, India, and England. Preventing double-spending from occurring is extremely difficult if multiple banks are involved in the transaction. For this reason, most systems rely on post-fact detection and punishment.

E-cash in Action

E-cash is based on cryptographic systems called digital signatures. This method involves pair of numeric keys (very large integers or numbers) that work in tandem: one for locking (or encoding), and the other for unlocking (or decoding). Messages encoded with one numeric key can only be decoded with the other numeric key and none other. The encoding key is kept private and the decoding key is made public.

By supplying all customers (buyers and sellers) with its public key, a bank enables customers to decode any message (or currency) encoded with the bank's private key. If decoding by a customer yields a recognizable message, the customer can be fairly confident that only the bank could have encoded it. These digital signatures are as secure as the mathematics involved and have proved over the past two decades to be more resistant to forgery than handwritten signatures. Before e-cash can be used to buy products or services, it must be procured from a currency server.

Purchasing E-cash from Currency Servers

The purchase of e-cash from an online currency server (or bank) involves two steps:

(i) establishment of an account, and (ii) maintaining enough money in the account to back the purchase. Some customers might prefer to purchase e-cash with paper currency, either to maintain anonymity or because they do not have a bank account. Currently, in most e-cash trials, all customers must have an account with a central online bank. This is too restrictive for international use and multicurrency transactions, for customers should be able to access and pay for foreign services as well as local services. To support this access, e-cash must be available in multiple currencies backed by several banks. A service provider in one country could then accept tokens of various currencies from users in many different countries, redeem them with their issuers, and have the funds transferred back to banks in the local country. A possible solution is to use an association of digital banks similar to organizations like VISA to serve as a clearing house for many credit card issuing banks.

And finally, consumers use the e-cash software on the computer to generate a random number, which serves as the "note". In exchange for money debited from the customer's account, the bank uses its private key to digitally sign the note for the amount requested, and transmits the note back to the customer. The network currency server, in effect, is issuing a "bank note" with a serial number and a dollar amount. By digitally signing it, the bank is committing itself to back that note with its face value in real dollars.

This method of 'note' generation is very secure, as neither the customer (payer) nor the merchant (payee) can counterfeit the bank's digital signature (analogous to the watermark in paper currency). Payer and payee can verify the validity of the payment since each knows the bank's public key. The bank is protected against forgery, the payee against the bank's refusal to honor a legitimate note, and the user against false accusations and invasion of privacy.

How does this process work in practice? In the case of DigiCash, every person using e-cash has an e-cash account at a digital bank (First Digital Bank) on the Internet. Using that account, people can withdraw and deposit e-cash. When an e-cash withdrawal is made, the PC of the e-cash user calculates how many digital coins and of what denominations are needed to withdraw the requested amount. Next, random serial numbers for those coins will be generated and the blinding (random number) factor will be included. The result of these calculations will be sent to the digital bank. The bank will encode the blinded numbers with its secret key (digital signature) and at the same time debit the account of the client for the same amount. The authenticated coins are sent back to the user and finally the user will take out the blinding factor that he or she introduced earlier. The serial numbers plus their signatures are now digital coins whose value is guaranteed by the bank.

E-cash can be completely anonymous. Anonymity allows freedom of usage to buy illegal products, such as drugs or pornographic material, or to buy legal products and services. This is accomplished in the following manner. When the e-cash software generates a note, it masks the original number or "blinds" the note using a random number and transmits it to a bank. The "blinding" carried out by the customer's software makes it impossible for anyone to link the payment to the payer. Even the bank cannot compare the signature with that of the payment, since the customer's original note number was blinded when it was signed. In other words, it is a way of creating anonymous, untraceable currency. What makes it even more interesting is that the users can prove unequivocally that they did or did not make a particular payment. This allows the bank to sign the "note" without even actually knowing how the issued currency will be used.

Using the Digital Currency

Once the tokens are purchased, the e-cash software on the customer's PC stores digital money undersigned by a bank. The user can spend the digital money at any shop accepting e-cash, without having to open an account there or having to transmit credit card numbers. As soon as the customer wants to make a payment, the software collects the necessary amount from the stored tokens.

Two types of transactions are possible: bilateral and trilateral. Typically, transactions involving cash are bilateral or two-party (buyer and seller) transactions, whereby the merchant checks the veracity of the note's digital signature by using the bank's public key. If satisfied with the payment, the merchant stores the digital currency on his machine and deposits it later in the bank to redeem the face value of the note. Transactions involving financial instruments other than cash are usually trilateral or three-party (buyer, seller, and bank) transactions, whereby the "notes" are sent to the merchant, who immediately sends them directly to the digital bank. The bank verifies the validity of these "notes" and that they have not been spent before. The account of the merchant is credited. In this case, every "note" can be used only once.

In many business situations, the bilateral transaction is not feasible because of the potential for double spending, which is equivalent to bouncing a cheque. Double spending becomes possible because it is very easy to make copies of the e-cash, forcing banks and merchants to take extra precautions.

To uncover double spending, banks must compare the notes passed on to it by the merchant against a database of spent notes. Just as paper currency is identified with a unique serial number, digital cash can also be protected. The ability to detect double-spending has to involve some form of registration so that all "notes" issued globally can be uniquely identified. However, this method of matching notes with a central registry has problems in the online world. For most systems which handle high volumes of micropayments, this method would simply be too expensive. In addition, the problem of double-spending means that banks have to carry added overhead because of the constant checking and auditing of logs.

Double spending would not be a major problem if the need for anonymity is realized. In such situations, when the consumer is issued a bank note, it is issued to that person's unique license. When he or she gives it to someone else, it is transferred specifically to that other person's license. Each time the money changes hands, the previous owner adds a tiny bit of information to the bank note, based on the bank note's serial number and his or her license. If somebody attempts to spend money twice, the bank will now be able to use the two bank notes to determine who the cheater is. Even if the bank notes pass through many different people's hands, the culprit will get caught, and none of the other people will ever come to know of it. The downside is that the bank can tell precisely what your buying habits are since it can check the numbers on the e-cash and the various merchant accounts that are being credited. Many people feel uncomfortable, letting others know this personal information.

One drawback of e-cash is its inability to be easily divided into smaller amounts. It is often necessary to get small denomination change in business transactions. A number of variations have been developed for dealing with the "change" problem. For the bank to issue users with enough electronic "coins" of various denominations is cumbersome in communication and storage. To overcome this problem, customers are issued a single number called an "open cheque", that contains multiple denomination values sufficient for transactions up to a prescribed limit. At payment time, the e-cash software on the client's computer would create a note of the transaction value from the "open cheque".

Operational Risk and E-cash

Operational risk associated with e-cash can be mitigated by imposing constraints, such as limits on (i) the time over which a given electronic money is valid, (ii) the amount than can be stored on and transferred by electronic money, (iii) the number of exchanges that can take place before money needs to be re-deposited with a bank or a financial institution, and (iv) the number of such transactions that can be made during a given period of time.

Legal Issues and E-cash

Electronic cash will force bankers and regulators to make tough choices that will shape the form of lawful commercial activity related to e-commerce. As a result of the very features that make it so attractive to many, cash has occupied an unstable and an uncomfortable place within the existing taxation and law enforcement systems.

Anonymous and virtually untraceable cash transactions today occupy a place in a kind of underground economy. This underground economy is generally confined to relatively small-scale transactions because paper money in large quantities is cumbersome to use and manipulate, organized crime being the obvious exception. As long as the transactions are small in monetary value, they are tolerated by the government as an unfortunate but largely insignificant by-product of the modem commercial state. As transactions get larger, the government becomes more suspicious and enlists the aid of the banks through the various currency reporting laws in reporting large disbursements of cash, so that additional oversight can be ordered.

Consider the impact of e-cash on taxation. Transaction-based taxes (e.g. sales taxes) account for a significant portion of state and local government revenue. But if e-cash really is made to function the way that paper money does, payments we would never think of making in cash—to buy a new car, or as a down payment on a house—could be made in this new form of currency, because there would be no problem of bulk and no risk of robbery. The threat to the government's revenue flow is a very real one, and officials in government have started to take cognizance of this development and prepare their responses.

To prevent an underdeveloped economy, the government through law, may prevent a truly anonymous and untraceable e-cash system from developing. Just as powerful encryption schemes permit the design of untraceable e-cash systems, so too, do powerful electronic record-keeping tools permit the design of traceable systems—systems in which all financial transactions are duly recorded in some database, allowing those with access to know more about an individual than anyone could know today.

Anything that makes cash substantially easier to use in a broader range of transactions, holds the potential to expand this underground economy to proportions posing ever more serious threats to the existing legal order. Under the most ambitious visions of e-cash, we can see a new form of currency that could be freely passed off from one computer to another with no record, yet incapable of being forged. A consumer can draw such e-cash electronically from his or her bank. The bank has a record of that transaction, just as a withdrawal or a cheque is recorded now. But after that, the encrypted e-cash file could be handed off without the knowledge of anyone but the parties involved in the transaction.

However, as politics and business play their role, technology is forcing legal issues to be reconsidered. The question e-cash poses is not, "Should the law take notice of this development?" but rather, "How can it not?" By impacting revenue-raising capabilities, e-cash cannot escape government scrutiny and regulation; but it is going to take some serious thinking to design a regulatory scheme that balances personal privacy, speed of execution, and ease of use. Without a functioning system, what the government will do, remains a mystery. Moreover, it is not even clear yet that the markets as a whole will adopt an anonymous e-cash standard.

6.6 Cheque Payment Systems on the Internet

Magnetic Ink Character Recognition (MICR)

In this system, data are printed at the bottom of cheques in magnetic ink, for an electronic read is a typical use of electronics for cheque processing.

Check Free Payment Services of CheckFree

In September 1995, CheckFree offered the electronic cheque service CheckFree Payment Services on the Internet. Upon customer request, this service issues an electronic cheque and executes settlement between customer and retailer. If needed, a paper cheque can also be issued to the retailer. This system implements not only cheque processing but also electronic cheque issuance.

Electronic Cheque (E-cheque)

FSTC is a consortium of 60 organizations in the US including financial institutions, clearing houses, universities, and companies. It was founded in 1993 for the development of payment systems for E-commerce (EC). Bank of America, Citibank, and Chemical Bank are a few of the well-known participants.

In September 1995, FSTC commenced an electronic cheque system on the Internet called electronic cheque. This is one of FSTC's five major development projects, the others being:

1. Cheque truncation
2. Electronic commerce
3. Security measures
4. Smart card system.

In this electronic cheque system, a consumer possesses an electronic cheque book on a Personal Computer Memory Card International Association (PCMCIA) card. As needed, cheques are written electronically from the e-cheque book on the card. They are then sent over the Internet to the retailer, who in turn sends the e-cheques to the customer's bank. Settlement is made through a financial network such as an ACH. In addition to payment data, commercial data such as invoice number and date of receipt can be enumerated, thereby achieving a higher degree of efficiency by eliminating duplication. With a view to increasing the practicality of the system, FSTC is experimenting with the adoption of a smart card as an electronic cheque book. An electronic signature with public key encryption has been adopted by FSTC for ensuring data security over the Internet.

6.7 Risk and E-payment Systems

In Figure 6.1, the risks of e-commerce model are shown. There are three major risks:

1. Data Protection—The abuse of data related to users
2. Data Reliability—The authentication of parties involved
3. Taxation—Issues related to tax.

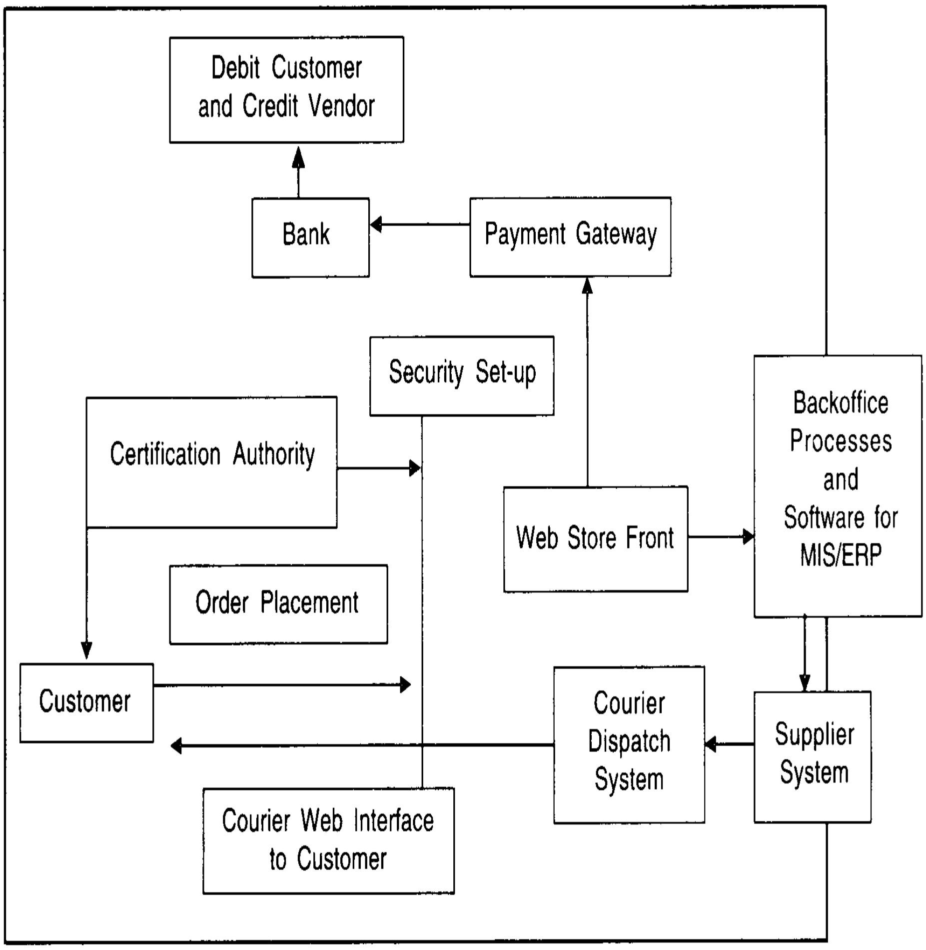


Fig. 6.1 Risk and e-payment systems.

Related to the above main issues is the type of legal framework in which this model works. Fraud, financial misdemeanours, and tax avoidance are not found just in electronic commerce, but e-commerce presents new ways to commit old crimes. Electronic commerce is difficult to regulate for two main reasons:

1. The scope of electronic commerce, and the technology involved changes rapidly. Traditionally, the formulation of the law has been an evolutionary process, adapting to suit the needs of society. Where electronic commerce is concerned, the pace of change is and has been too great for this process to take place. This result in a situation where there is a choice of either applying current legislation or enacting new legislation specifically formulated to meet the challenge of electronic commerce.

2. The very nature of the technology involved means that it is transnational. This leads to problems as to which legal system has jurisdiction over e-commerce transactions.

Data Protection

Although the number of businesses on the Internet has grown, many of these organizations are simply maintaining a 'Web presence' by providing information about themselves and their products, and have not yet undertaken Internet-based transactions. This inertia is probably due to concern about the security of transactions and user authorization. Technologies concerned with authorization include firewalls, password access, smart cards, and biometrics fingerprinting. However, in order to provide secure electronic transactions (SET), encryption technologies are used. Encryption technologies, which are supported by the appropriate legal mechanisms, have the potential to allow global electronic commerce to develop.

One essential challenge of e-commerce is risk management. Operation of e-payment systems incurs three major risks: fraud or mistake, privacy issues, and credit risk. Preventing mistakes might require improvements in the legal framework. Dealing with privacy and fraud issues requires improvements in the security framework. Curtailing credit risk requires devising procedures to constrict or moderate credit and reduce float in the market.

Risks from Mistake and Disputes: Consumer Protection

Virtually, all e-payment systems need some ability to keep automatic records, for obvious reasons. From a technical standpoint, this is not a problem for electronic systems. Credit and debit cards have them, and even the paper-based cheque creates an automatic record. Once information has been captured electronically, it is easy and inexpensive to keep (it might even cost more to throw it away than to keep it). For example, in many transaction processing systems, old or blocked accounts are never purged and old transaction histories can be kept forever on magnetic tape.

Given the intangible nature of electronic transactions and dispute resolution relying solely on records, a general law of payment dynamics and banking technology might be that no data need ever be discarded. The record feature is an after-the-fact transcription of what happened, created without any explicit effort by the transaction parties. Features of these automatic records include: (i) permanent storage, (ii) accessibility and traceability, (hi) a payment system database, and (iv) data transfer to payment maker, bank, or monetary authorities.

The need for record keeping for purposes of risk management conflicts with the transaction anonymity of cash. One can say that anonymity exists today only because cash is a very old concept, invented long before the computer and networks gave us the ability to track everything. Although a segment of the payment-making public always desire transaction anonymity, many believe that anonymity runs counter to the public welfare because too many tax, smuggling, and/or money laundering possibilities exist. The anonymity issue raises the question: can e-payments be done without an automatic record feature?

Many recent payment systems seem to be ambivalent on this point. For instance, the Mondex electronic purse touts equivalence with cash, but its electronic wallets are designed to hold automatic records of the card's last twenty transactions with a built-in statement. Obviously, the card-reading terminals, machines, or telephones could maintain records of all transactions. With these records, the balance on any smart card could be reconstructed after the fact, thus allowing additional protection against loss or theft. This would certainly add some value versus cash.

Managing Information Privacy

The e-payment system must ensure and maintain privacy. Every time one purchases goods using a credit card, subscribes to a magazine, or accesses a server, that information goes into the database. Furthermore, all these records can be linked so that they constitute in effect, a single dossier. This dossier would reflect what items were bought, and where and when. This violates the unspoken law of doing business, that privacy of customers should be protected as much as possible.

Managing Credit Risk

Credit or systemic risk is a major concern in net settlement systems, because a bank's failure to settle its net position could lead to a chain reaction of bank failures. The digital central bank must develop policies to deal with this possibility. Various alternatives exist, each with advantages and disadvantages. A digital central bank guarantee on settlement removes the insolvency test from the system because banks will more readily assume credit risks from other banks.

Without such guarantees, the development of clearing and settlement systems and money markets may be impeded. A middle road is also possible; for example, setting controls on bank exposures (bilateral or multilateral) and requiring collateral. If the central bank does not guarantee settlement, it must define, at least internally, the conditions and terms for extending liquidity to banks in connection with settlement.

6.8 Designing E-payment Systems

Despite cost and efficiency gains, many hurdles need to be overcome for the spread of e-payment systems. These include several factors, mostly non-technical in nature, that must be addressed before any new payment method is made successful. They are as follows:

1. Privacy. A user expects trustworthiness of a secure system; just as the telephone is a safe and a private medium, free of wiretaps and hackers, electronic communication must merit equal trust.

2. Security. A secure system verifies the identity of two-party transactions through "user authentication", and reserves flexibility to restrict information/services through access control. Tomorrow's bank robbers will need no getaway cars—just a computer terminal, the price of a telephone call, and a little ingenuity. Millions of dollars have been embezzled by computer fraud. No systems are yet foolproof, although designers are concentrating closely on security.

3. Intuitive interfaces. The payment interface must be as easy to use as a telephone. Generally speaking, users value convenience more than anything.

4. Database integration. With home banking, for example, a customer wants to play with all his accounts. Separate accounts are stored on separate databases. The challenge before banks is to tie these databases together and allow customers access to any of them while keeping the data up-to-date and error-free.

5. Brokers. A "network banker"—someone to broker goods and services, settle conflicts, and facilitate financial transactions electronically—must be in place.

6. Pricing. One fundamental issue is how to price payment system services. For example, should subsidies be used to encourage users to shift from one form of payment to another—from cash to bank payments, from papers based to e-cash? The problem with subsidies is the potential waste of resources, as money may be invested in systems that will not be used. Thus, investment in systems not only might not be recovered, but also substantial ongoing operational subsidies will be necessary. On the other hand, it must be recorded that, without subsidies, it is difficult to fix up an affordable price to all services.

7. Standards. Without standards, the welding of different payment users into different networks and different systems is impossible. Standards enable interoperability, giving users the ability to buy and receive information, regardless of which bank is managing their money.

None of the above hurdles are insurmountable. Most of these will be overcome within the next few years. These technical problems, experts hope, will be solved as technology is improved and experience is gained. The biggest question concerns how customers will take to a paperless and (if not cashless) a less-cash world.

6.9 Cryptography

Cryptography relies on two basic components: an algorithm (or cryptographic methodology), and a key. Algorithm is the method used to encrypt the message, and key is the object used to decrypt the message. For instance, in a system where letters are substituted for other letters, the "key" is the chart of paired letters and algorithm is the substitution. In modem cryptographic systems, the algorithms are complex mathematical formulae, and keys are strings of bits. If two parties want to communicate, they must use the same algorithm. In some cases, they must also use the same key. Many cryptographic keys must be kept secret. Sometimes algorithms are also kept secret, as the method of encryption may hold the very method used to decrypt the message.

Cryptosystems are being increasingly used in encryption, authentication, integrity, non-repudiation, and management of other crypto systems like key management. A crypto system is a mathematical function for processing data, and there is nothing secret about the function except the key.

Examples of Encryption Techniques

Caesar's Method

This is one of the oldest known techniques of encryption. It traces its history back to Roman times. It is a really simple method of encrypting a message. It involves shifting each letter of the message to a letter that appears k letters after it. In the method that was first devised by the Romans, k was equal to 3. What this meant was that each letter was shifted 3 places to the right. For example, 'A' would be transformed to 'D', 'B' to 'E', 'C' to 'F', and so on.

So, starting with ABCDEFGHIJKLMNOPQRSTUVWXYZ and sliding everything up by 3, you get DEFGHIJKLMNOPQRSTUVWXYZABC where, D = A, E = B, F = C, and so on. Using this scheme, the plain text "SECRET" encrypts as "VHFUHW". To enable someone else to read the cipher text, you tell him or her that the key is 3. This is clearly a secret key system, the secret key being the value of k. Clearly, this is not a very safe system of encryption, as trying all possible values of k, namely 1 through 26, can easily crack it.

Letter Pairing

This method is similar to Caesar's method. Here, instead of shifting each letter to some places to its right, letters are paired off with each other in a random manner. For example, consider the pairing A —> **Z,** B —> Y, **C** —> **X,** and so on.

The method overcomes the limitation of Caesar's method and cannot be encrypted even by using various values of k. Yet, this is not a safe method at all, and can easily be decrypted by using techniques such as frequency analysis. If a large enough message is intercepted, then by counting the number of times a letter appears, the third party can judge which letter stands for which by comparing the data with the average frequencies of usage of letters of the language. For example, we know that 'E' is the most often used letter, and hence the most repeated letter would probably stand for 'E'.

The two examples given above are simple yet interesting encryption techniques. In the following few pages, we will discuss some of the latest and most widely used encryption techniques.

RSA

RSA stands for Rivest, Shamir and Adieman—the three cryptographers who invented the first practical commercial public key cryptosystem. Today it is used in Web browsers, e-mail programs, mobile phones, virtual private networks, secure shells, and many other places. With sufficiently large keys, you can be confident of foiling the vast majority of attackers. Until recently, the use of RSA was very much restricted by patent and export laws. However, the patent has now expired and US export laws have been relaxed. RSA encryption uses large prime numbers for its purposes.

It works on the basic fact that large numbers are extremely difficult to factorize. If we take the product of two arbitrarily large (but secret) prime numbers of say, 50 digits each and multiply them, then using the most current supercomputing technology it would take more than a thousand years to factorize them. This method has brought to the fore a branch of mathematics called 'number theory' that is till now considered to have no practical applications.

RSA uses two large prime numbers. Numbers must be quite large in length, 100 to 300 bits, and must have a prime value. Only the person who wants to decrypt the message should know these. Using these, a mathematical algorithm is developed which produces a public key. Anyone who wants to encrypt a message uses this algorithm. The key is based on the two large primes used, and is known only to the person who has developed the particular algorithm.

RSA seems to be a reliable and a fast algorithm, but the serious persisting flaws consist of the hiding of two initial numbers chosen from the IP table. Once discovered, intruders can use these numbers to reconstruct the message and the keys.

DES

This is an example of a widely used secret key encryption system. In 1972, the National Institute of Standards and Technology (NIST) decided that a strong cryptographic algorithm was needed to protect non-classified information. The algorithm was required to be cheap, widely available, and very secure. NIST envisioned something that would be available to the general public and could be used in a wide variety of applications. So they asked for public proposals for such an algorithm. In 1974, IBM submitted the Lucifer algorithm, which appeared to meet most of NIST's design requirements.

The modified Lucifer algorithm was adopted by NIST as a federal standard on November 23, 1976. Later its name was changed to Data Encryption Standard (DES). The algorithm specification was published in January 1977, and with the official backing of the government it became a very widely employed algorithm in a short time.

DES encrypts and decrypts data in 64-bit blocks, using a 64-bit key (although the effective key strength is only 56 bits, as explained below). It takes a 64-bit block of plain text as input, and outputs a 64-bit block of cipher text. It always operates on blocks of equal size, and it uses both permutations and substitutions in the algorithm.

Unfortunately, over time, various short cut attacks were found that could significantly reduce the time needed to find a DES key by brute force. And as computers became progressively faster and more powerful, it was recognized that a 56-bit key was simply not large enough for high security applications. As a result of these serious flaws, NIST abandoned their official endorsement of DES in 1997 and began work on a replacement, to be called the Advanced Encryption Standard (AES). Despite the growing concerns about its vulnerability, DES is still widely used by financial services and other industries worldwide to protect sensitive online applications.

Attacks on Crypto Systems

One of the most important perspectives of key management is to prevent attacks or to make attacks practically infeasible. Theoretically, all crypto systems are susceptible to direct key search attacks and, from a theoretical perspective, all keys are breakable. But from a practical point of view, this is not always the case for most of the widely used crypto systems around. There are basically two types of crypto systems:

Symmetric Key Crypto Systems

This is historically known as the secret key system. In this crypto system, the key for the underlying mathematical function can be used to reverse this mathematical function (hence 'symmetric'). There are two types of symmetric key crypto systems: 'stream' ciphers are used in mobile communication, and 'block' ciphers are used for encryption/authentication. Examples of some block ciphers are Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), and SAFER. Symmetric systems are built by repeatedly using simple mathematical operation involving the key. Thus, they can be executed at a high speed.

These crypto systems find their use in systems where a large amount of data is processed.

Asymmetric Key Crypto Systems

This is also known as public key system. The key for the underlying mathematical function cannot be easily used to reverse the mathematical function. A separate key is required to do this (hence the name 'asymmetric'). Participants in such a system will have a key pair— public and private key.

This system is based on a one-way mathematical function—easy in one direction but very difficult to reverse, as for example, multiplying two large numbers is easy but factorizing this product can be very difficult. Diffie-Hellman, RSA, El Gamal are based on this theory. Asymmetric key crypto systems are flexible to implement as compared to secret key systems, but are much slower to execute. This system is widely used in digital signature, key management, and entity authentication.

Private Key and Public Key

In Figure 6.2, the message is encrypted with a public key and sent to the recipient. The recipient opens it with his public key.

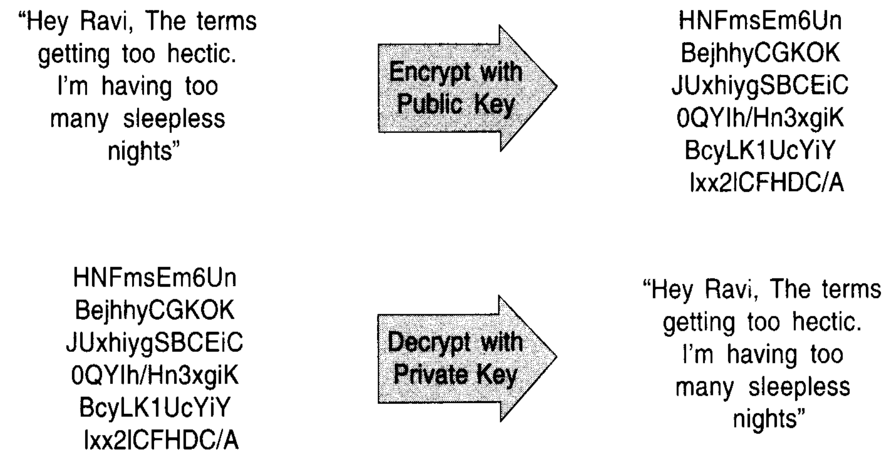


Fig. 6.2 Role of public and private key.

For asymmetric key crypto systems, the situation is different. It is generally believed that the difficulty of finding an unknown private key depends upon the difficulty of some well-known mathematical problems. The problem of finding an RSA private key is believed to be equivalent to factorizing a large number that is the product of two large primes. From the invention of asymmetric cryptography (mid-1970s) until recently, there were a number of algorithms that could factor such numbers and they all took roughly the same time. In the last few years, a new algorithm—the General Number Field Sieve (GNFS)—has been invented that can factor a number more quickly than the previous algorithms. The discrete algorithm problem used for El Gamal and DSS has a similar complexity. As with DES, a RSA Data Security challenge number (RSA-130) with 430 bits was issued. This number has been factorized (April 1996), again using an effort distributed over the Net. The total effort used in factorizing RSA-130 is believed to be 500 Mips years (equivalent to a computer running 500 million instructions per second for a year). Such figures make it just about conceivable that with concentrated effort distributed over the Net, it is just possible to factorize a 512-bit number as the product of two primes. This means RSA system with 512-bit private keys are potentially vulnerable to such attacks.

In future, increase in computing speed will make it possible to factorize larger-sized numbers. However, it is entirely possible that overnight someone will invent a new algorithm and all the figures will have to be revised.

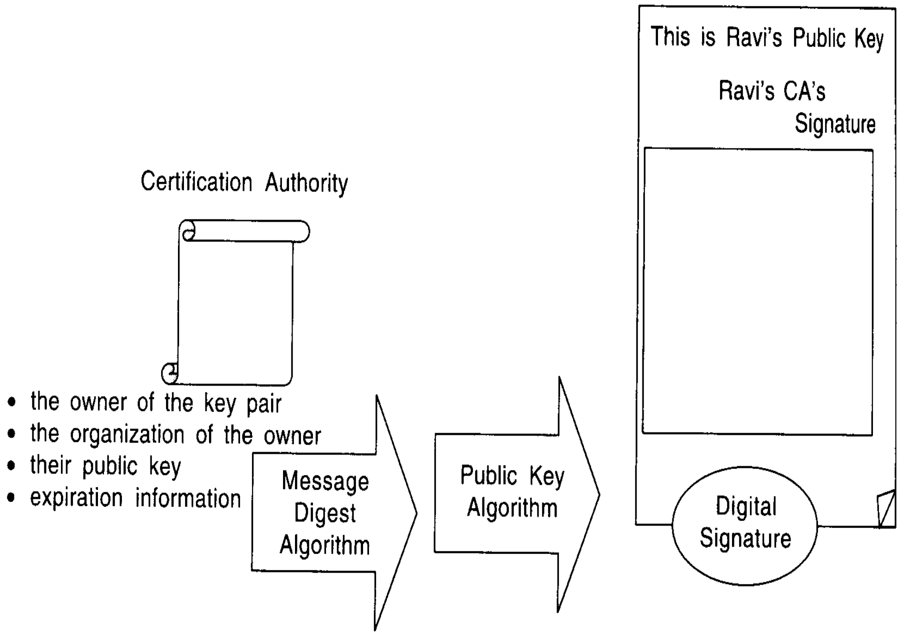
Although popular media has floated the perception that DES keyspace is so small that it is possible for anyone with a PC to break any DES-based crypto system, it is far from the truth. Well, it is true that 56-bit key is too small, but not for the computing power of j a PC. DES is vulnerable when attacked with an immense computing power. Even after AES | becomes the new standard, we will see DES in use for some time to come.

6.10 Digital Signature

Digital signatures provide information regarding the sender of an electronic document. The technology has assumed huge importance recently, with the realization that it may be the remedy to one of the major barriers to growth of electronic commerce: fear of lack of **security.** Digital signatures provide data integrity, thereby allowing the data to remain in the same state in which it was transmitted. The identity of the sender can also be authenticated by third parties.

The most widely used type of cryptography is public key cryptography, where the sender is assigned two keys—one public, one private. The original message is encrypted using the public key while the recipient of the message requires the private key to decrypt the message. The recipient can then determine whether the data has been altered. However, although this system guarantees the integrity of the message, it does not guarantee the identity of the sender (public key owner). In order to remedy this, a Certificate Authority is required.

In Figure 6.3, Ravi (the sender) uses his private key to compute the digital signature. In order to compute the digital signature, a one-way hashing algorithm may be used to first calculate a message digest, as is done by RSA. The message digest is an efficient way to



represent the message, as well as being a unique number that can only be calculated from the contents of the message. The sender's private key is used at this point to encrypt the message digest. The encrypted message digest is what is commonly called a digital signature.

A certification authority (CA) performs the task of managing key pairs, while the verification of the person or entity bound to that key pair is initially ascertained at the time of application by the registration authority. A certificate is issued by a CA and links an individual or entity to its public key, and in some cases to its private key. Certification authorities can offer different grades of certificates, depending upon the type of initial identification provided by the individual.

From an information security viewpoint, these simple "electronic signatures" are distinct from the "digital signatures" and in the technical literature, although "digital signature" is sometimes used to mean any form of computer-based signature. These guidelines use "digital signature" only as it is used in information security terminology, as to mean the result of applying the technical processes.

Legal Position of Digital Signatures

Although the digital signature technology has been available for some time, it has only recently become feasible to use digital signatures to authenticate a document. This breakthrough has made digital signatures one of the most important areas of development within electronic commerce. It is important because the technology and the law governing it must develop in a way that promotes—or at the very least does not inhibit—the growth of electronic commerce.

A substantial amount of legislation regulating the use of digital signatures and their legal status has been enacted. So far, this has been enacted on a state by state basis, resulting in those countries taking contrasting legal positions. International law on digital signatures has yet to be formulated.

Developments are also taking place at a global level. Bodies such as the Internet Engineering Task Force (IETF), the International Organization for Standardization (ISO), and W3C are currently working on standardization of digital signatures. The OECD has issued 'Guidelines for Cryptology Policy', which includes a guide for states on the creation of legislation governing the use of digital signatures. UNCITRAL has also released draft legislation on electronic commerce, including guidelines for digital signatures.

Signatures and the Law

A signature is not a part of the substance of a transaction, but rather its representation or form. Signing writings serve the following general purposes:

Evidence

A signature authenticates the writing by identifying the signee with the signed document. When the signer makes a mark in a distinctive manner, the writing becomes attributable to the signer.

Legality

The act of signing a document calls to the signer's attention, the legal significance of the signer's act, and thereby helps prevent "inconsiderate" engagements.

Approval

In certain contexts defined by law or custom, a signature expresses the signer's approval or authorization of the writing, or the signer's claim that it has legal validity.

Efficiency and Logistics

A signature on a written document often imparts a sense of clarity and finality to the transaction, and may lessen the subsequent need to inquire beyond the face of a document Negotiable instruments, for example, rely upon formal requirements, including a signature for their ability to change hands with ease, rapidity, and minimal interruption.

Authenticity

To achieve the basic purposes of signatures outlined thus, a signature must have the following attributes:

Signer authentication. A signature should indicate who signed a document, a message or a record, and should be difficult for another person to produce without authorization.

Document authentication. A signature should identify what is signed, making it impracticable to falsify or alter either the signed matter or the signature without detection.

Signer authentication and document authentication are tools used to exclude impersonators and forgers, and are essential ingredients of what is often called a "non-repudiation service" in the terminology of information security profession. A non-repudiation service provides assurance of the origin or delivery of data in order to protect the sender against false denial by the recipient that the data has been received, or to protect the recipient against false denial by the sender that the data has been sent. Thus, a non-repudiation service provides evidence to prevent a person from unilaterally modifying or terminating legal obligations arising out of a transaction effected by computer-based means.

Optimally, a signature and its creation, and its verification processes should provide the greatest possible assurance to both the signer's as well as the document's authenticity with least possible expenditure.

Affirmation

The affixing of the signature should be an affirmative act, which serves the ceremonial and approval functions of a signature and establishes the sense of having legally consummated a transaction.

Digital signature technology generally surpasses paper technology in all these attributes. To understand why, one must first understand how digital signature technology works.

How Digital Signature Technology Works

Digital signatures are created and verified by cryptography. Digital signatures use public key cryptography, which employs an algorithm using two different but mathematically related "keys": one for creating a digital signature or transforming data into a seemingly unintelligible form, and another key for verifying a digital signature or returning the message to its original form. Computer equipment and software utilizing two such keys are often collectively termed an "asymmetric crypto system".

The complementary keys of an asymmetric crypto system for digital signatures are arbitrarily termed private key, which is known only to the signer and used to create the digital signature, and the public key, which is ordinarily more widely known and is used by a relying party to verify the digital signature. If many people need to verify the signer's digital signatures, the public key must be available or distributed to all of them, perhaps by publication in an online repository or directory, where it is easily accessible. Although the keys of the pair are mathematically related, if the asymmetric crypto system has been designed and implemented securely it is "computationally infeasible" to derive the private key from the knowledge of the public key. Thus, although many people may know the public key of a given signer and use it to verify that signer's signatures, they cannot discover that signer's private key and use it to forge digital signatures. This is sometimes referred to as the principle of "irreversibility".

Another fundamental process, termed hash function, is used in both creating and verifying a digital signature. A hash function is an algorithm which creates a digital representation or "fingerprint" in the form of a "hash value" or "hash result" of a standard length which is usually much smaller than the message but nevertheless substantially unique to it. Any change to the message invariably produces a different hash result when the same hash function is used. In the case of a secure hash function, sometimes termed as a "one-way hash function", it is computationally infeasible to derive the original message from the knowledge of its hash value. Hash functions therefore enable the software to create digital signatures to operate on smaller and predictable amounts of data, while still providing robust evidentiary correlation to the original message content, thereby efficiently providing assurance that there has been no modification of the message since it was digitally signed.

Thus, the use of digital signatures usually involves two processes—one performed by the signer, and the other by the receiver of the digital signature. They can be discussed as follows:

Digital Signature Creation

This uses a hash result derived from and unique to both the signed message and a given private key. For the hash result to be secure, there must be only a negligible possibility that the same digital signature could be created by a combination of any other message and a private key.

Digital Signature Verification

This is the process of checking the digital signature by reference to the original message and the given public key, thereby determining whether the digital signature was created for that same message using the private key corresponding to the referenced public key.

To sign a document or any other item of information, the signer first delimits precisely the borders of what is to be signed. The delimited information to be signed is termed "message" in these guidelines. Then a hash function in the signer's software computes a hash result unique (for all practical purposes) to the message. The signer's software then transforms the hash result into a digital signature using the signer's private key. The resulting digital signature is thus unique to both the message and the private key used to create it.

Typically, a digital signature (a digitally signed hash result of the message) is attached to its message and stored or transmitted with its message. However, it may also be sent or stored as a separate data element, so long as it maintains a reliable association with its message. Since a digital signature is unique to its message, it is useless if it is wholly disassociated from its message.

Verification of a digital signature is accomplished by computing a new hash result of the original message by means of the same hash function used to create the digital signature. Then, using the public key and the new hash result, the verifier checks: (i) whether the digital signature was created using the corresponding private key, and (ii) whether the newly computed hash result matches the original hash result which was transformed into the digital signature during the signing process. The verification software will confirm the digital signature as "verified" if: (i) the signer's private key was used to digitally sign the message, which is known to be the case if the signer's public key was used to verify the signature because the signer's public key will verify only a digital signature created with the signer's private key, and (ii) the message was unaltered, which is known to be the case if the hash result computed by the verifier is identical to the hash result extracted from the digital signature during the verification process.

Various asymmetric cryptosystems create and verify digital signatures using different algorithms and procedures, but share this overall operational pattern.

The processes of creating a digital signature and verifying it, accomplish the essential effects desired of a signature for many legal purposes:

Signer Authentication

If a public and a private key pair is associated with an identified signer, the digital signature attributes the message to the signer. The digital signature cannot be forged, unless the signer loses control of the private key (a "compromise" of the private key), such as by divulging it or losing the media or device in which it is contained.

Message Authentication

The digital signature also identifies the signed message, typically with far greater certainty and precision than paper signatures. Verification reveals any tampering, since the comparison of the hash results (one made at signing and the other made at verifying) shows whether the message is the same as when signed.

Affirmative Act

Creating a digital signature requires the signer to use the signer's private key. This act can perform the "ceremonial" function of alerting the signer to the fact that the signer is consummating a transaction with legal consequences.

Assurance

The processes of creating and verifying a digital signature provide a high level of assurance that the digital signature is genuinely the signer's. As with the case of modem Electronic Data Interchange (EDI), the creation and verification processes are capable of complete automation (sometimes referred to as machinable), with human interaction required only in exceptional cases. Compared to paper methods such as checking specimen signature cards— methods so tedious and labourious that they are rarely used in practice—digital signatures yield a high degree of assurance without adding greatly to the resources required for processing.

The processes used for digital signatures have undergone thorough technological peer review for over a decade. Digital signatures have been accepted in several national and international standards developed in cooperation with, and accepted by many corporations, banks, and government agencies. The likelihood of a malfunction or a security problem in a digital signature cryptosystem designed and implemented as prescribed by the industry standards is extremely remote and is far less than the risk of undetected forgery or alteration on paper or of using other less secure electronic signature techniques.

Digital Signature and Indian Websites

Some of the websites which use digital signatures are given in Table 6.4.

INDIAN WEBSITES THAT USE DIGITAL SIGNATURE

Shopping and Auctions sites	SifyMall Bazee Fabmall Rediff
Bookings and Reservations	All major airlines Indian Railways
Service Companies e-payments	Celluar Providers ISPs
Net Banking	ICICI HDFC

TABLE 6.4

Public Key Certificates

To verify a digital signature, the verifier must have access to the signer's public key and have assurance that it corresponds to the signer's private key. However, a public and a private key pair has no intrinsic association with any person; it is simply a pair of numbers.

In a transaction involving only two parties, each party can simply communicate (by a relatively secure "out-of-band" channel, such as a courier or a secure voice telephone) the public key of the key pair each party will use. Such an identification strategy is no small task, especially when the parties are geographically far away from each other, conduct communication over a convenient but insecure channel such as the Internet, are not individuals but rather corporations or similar artificial entities, and act through agents whose authority need to be ascertained. As electronic commerce increasingly moves from a bilateral setting to the many-on-many architecture of the World Wide Web on the Internet, where significant transactions will occur among strangers who have no prior contractual relationship and will never deal with each other again, the problem of authentication/non repudiation becomes not merely one of efficiency, but also of reliability. An open system of communication, such as the Internet, needs a system of identity authentication to handle this scenario.

To that end, a prospective signer might issue a public statement, like: "Signatures verifiable by the following public key are mine". However, others doing business with the signer may for good reason be unwilling to accept the statement, especially where there is no prior contract establishing the legal effect of that published statement with certainty. A party relying upon such an unsupported published statement in an open system would run a great risk of trusting a phantom or an imposter, or of attempting to disprove a false denial of a digital signature (non-repudiation), if a transaction should turn out to prove disadvantageous for the purported signee.

The solution to these problems is the use of one or more trusted third parties to associate an identified signer with a specific public key. That trusted third party is referred to as a certification authority in most technical standards and in these guidelines.

To associate a key pair with a prospective signer, a certification authority issues a certificate, an electronic record which lists a public key as the "subject" of the certificate, and confirms that the prospective signee identified in the certificate holds the corresponding private key. The prospective signee is called the subscriber. The certificate's principal function is to bind a key pair with a particular subscriber. A recipient of the certificate desiring to rely upon a digital signature created by the subscriber named in the certificate (whereupon the recipient becomes a relying party) can use the public key listed therein to verify if the digital signature was created in corresponding to the private key. If such verification is successful, this chain of reasoning provides assurance that the corresponding private key is held by the subscriber named in the certificate, and that the digital signature was created by that particular subscriber.

To assure both message and identity authenticity of the certificate, the certification authority digitally signs it. This can be verified by using the public key of the certification authority listed in another certificate by another certification authority (which need not be on a higher level in a hierarchy), and that certification can in turn be authenticated by the public key listed in yet another certificate and so on, until the person relying on the digital signature is adequately assured of its genuineness. In each case, the issuing certification authority must digitally sign its own certificate during the operational period of the other certificate used to verify the certification authority's digital signature.

A digital signature, whether created by a subscriber to authenticate a message or by a certification authority to authenticate its certificate (in effect a specialized message), should be reliably time-stamped to allow the verifier to determine whether the digital signature was created during the operational period stated in the certificate, which is a condition upon the verifiability of a digital signature under these guidelines.

To make a public key and its identification with a specific subscriber readily available;] for use in verification, the certificate may be published in a repository or made available by other means. Repositories are online databases of certificates and other information available for retrieval and use in verifying digital signatures. Retrieval can be accomplished automatically by having the verification program directly inquire the repository to obtain certificates as needed.

Once issued, a certificate may prove to be unreliable, such as in situations where the subscriber misrepresents his identity to the certification authority. In other situations, a certificate may be reliable enough when issued but come to be unreliable sometime thereafter. If the subscriber loses control of the private key ("compromise" of the private key), the certificate becomes unreliable, and the certification authority (either with or without the subscriber's request depending on the circumstances) may suspend (temporarily invalidate) or revoke (permanently invalidate) the certificate. Immediately upon suspending or revoking a certificate, the certification authority must publish notice of the revocation or suspension or notify persons who inquire or who are known to have received a digital signature verifiable by reference to the unreliable certificate.

The Secure E-payment Process Method

Secured payment transaction system is critical to e-commerce. Without a secured payment transaction system, e-commerce will be a castle built on sand.

There are two common standards used for secure e-payments—SSL and SET. Secure Socket Layer (SSL) and Secure Electronic Transactions (SET) are two major players in the secured payment transaction market. Both use RSA public-key cryptography for encryption and authentication, but SSL and SET are very different protocols to approach payment transaction security.

SSL

SSL is a secured socket layer between HTTP and TCP on a Web server. It is a transport layer security protocol. SSL provides a simple encrypted connection between the client's computer and merchant's server over Internet. It also provides authentication for the merchant's server with its digital certificate from a certificate authority.

This is a secured connection for cyber shoppers to send payment information to e-tailor's Web shop. It can be used as a simple order form including payment information on the Web. But it does not include the payment process protocol with credit card company and issuing banks.

Currently, the fast growing Internet consumer commerce is mainly based on accepting credit card over SSL. One of the reasons for the growth in this direction is that SSL provide' secured connection with encryption and authentication between two computers over the Internet. SSL provides a security handshake in which the client and server computers exchange a brief burst of messages. In these messages, they agree upon the level of security they will use to exchange digital certificates and perform other tasks. Each computer unfailingly identifies the other. It is not a problem if the client does not have a certificate, because the client is the one who is sending sensitive information. On the other hand, the server with whom the client is doing business ought to have a valid certificate. Otherwise, you (the client) cannot be certain that the commerce site actually belongs to the one whom it refers to. After identification, the SSL encrypts and decrypts information flowing between the two computers. This means that information in both the HTTP request and the HTTP responses are encrypted. Encrypted information includes the URL the client is requesting, any form containing information the user has completed (which might include a credit card number), and HTTP access authorization data such as user names and passwords. In short, all communication between SSL-enabled clients and servers is encoded. When SSL encodes everything flowing between the client and the server, an eavesdropper will receive only the unintelligible information.

Is SSL really secure? Yes, SSL indeed provides the secured connection for payment transaction between customers and merchants. It is more secure than phone and postal mail delivery. But the security ends at the merchant's site. It does not keep the credit card numbers after the transaction is completed.

SET

SET is a messaging protocol designed by VISA and MasterCard for securing credit card transactions over open networks, such as the Internet.

In the SET protocol, a transaction has three players—the customer, the merchant, and the merchant's bank. SET protocol has three principal features as listed in the following:

- All sensitive information sent within the three parties are encrypted.
- All three parties are required to authenticate themselves with certificates from the SET certificate authority.
- The merchant never sees the customer's card number in plain text.

The third feature actually makes Internet commerce more secure than traditional credit card transactions, such as pay by credit card in store, over phone, or through mail order form. It is also more secure than SSL.

To implement SET in e-commerce on Internet, it requires the SET point-of-sale client software such as SET "electronic wallet" implemented widely in the client's Web browser. It is a big challenge to make such a point-of-sale software widely available to the Internet community.

6.11 Online Financial Services in India

Web-based banks figured their pitch was irresistible—by eliminating physical branches, tellers, and bankers' hours, they could slash costs and offer customers higher interest rates and more convenience. But in reality, customers want human contact, or at least an ATM. The j multichannel strategy is what is important to people. They want to he able to use the Web. | Online banks have also learned that convenience means more than just twenty-four-hour | banking. In fact, some aspects of the virtual banking model are flat-out inconvenient. For example, online banks require that deposits be made by cheque or money order, eliminating | the cash option available at traditional banks. Adding physical infrastructure, though, adds I to an on line bank's operating costs and may force it to lower interest rates paid on savings. Online banks maintain that they still run more efficiently than traditional banks because of practices such as online account managers, loan officers, and so on. That allows them to manage a branch with a smaller staff than a traditional bank. Although a multichannel approach may appeal to customers, the strategy undermines the very premise of online- only institutions, and makes them less distinguishable from traditional banks that also offer Web-banking services. It is a lot easier and cheaper for an existing bank to roll out Internet services than it is for an Internet bank to buy enough ATMs or branches to compete on a national level.

Online banking is also known as cyber banking, home banking, virtual banking, and includes various banking activities that can be conducted from anywhere instead of at a physical bank location. Consumers can use e-banking to pay bills online or to secure a loan electronically. Electronic banking saves a lot of time and money for users. For banks, it offers an inexpensive alternative to branch banking and a chance to enlist remote users. Many physical banks offer home banking services, and EC is used as a major competitive strategy. Online banking is growing in India.

Features of e-banking in India

1. Can access current account balances at any time.
2. Can obtain charge and credit card statements.
3. Can pay bills online.
4. Can download account transactions.
5. Can transfer money between accounts.
6. Can keep a track of accounts online.
7. Can send e-mails to the bank.
8. Customers have a flexible schedule.
9. Can also use additional services like free phone banking, ATM withdrawals, bill paying,

International banking and the ability to handle trades in multiple currencies are critical for international trade. Although some international retail purchasing can be done with a credit card number, other transactions require international banking support. Many banks offer such services online.

Personal Finance Online

Often electronic banking and portfolio management are combined with personal finance. However, specialized personal finance vendors offer more diversified services, with features like:

1. Bill tracking
2. Tracking of bank accounts, expenditures, and credit cards

3. Portfolio management, including reports and capital gain (losses) computations
4. Investment tracking and monitoring of securities
5. Stock quotes
6. Personal budget organization
7. Record keeping of cash flow, and profit and loss computations
8. Tax computations and preparations
9. Retirement goals, planning, and budgeting.

Online Billing and Bill Paying

People prefer to pay monthly bills like telephone, utility, electricity etc., online. More so, the recipients of such payments are even more eager to receive money online, as the processing costs are lower! In India, banks like ICICI and SBI make it easier with a facility of paying bills from online accounts.

ICICI provides this feature absolutely free of cost and offers customer to view the bill, status checks, and queries. For certain billers, one can see the bill online and pay immediately or schedule the payment of bills. Now there is no more hunting around for the right amount to be paid. Paying these Bills online will ensure that one does not miss any due dates. It acts as a reminder.

SBI on the other hand also provides a feature called Autopay. One can set up AutoPay instructions with an upper limit to ensure that bills are paid automatically whenever they are due. The upper limit ensures that only bills within the specified limit are paid automatically, thereby providing the customer complete control over these payments.

Auxiliary Services

ICICI offers a few auxiliary services online as part of their online services, apart from bill payment and e-banking.

Online shopping: using the Internet banking ID and transaction password, one can visit affiliated shopping sites online and make online transactions.

Online Trading[6]: one of the most popular features of ICICI is their online trading feature. Their products and services offer the following features:

1. Trading in shares
2. Trade in derivatives
3. Investing in mutual funds
4. IPOs and bonds online
5. Personal finance and portfolio, risk management
6. Customer servicing

Some banks like SBI also offer other features like telephone and SMS alerts.

6.12 Summary

The discussion of this chapter begins with evolution of the concept of money. In the subsequent topics, issues related to credit cards, mobile payments and cheque payment systems on the internet were discussed. The risks involved in e-payment systems are given focus. Cryptography and digital signatures are used to provide the security to e-payment systems. Information about online financial services available in India is provided at the end.

EXERCISES

1. List four security requirements for safe e-payments.
2. Describe the pros and cons of secret key encryption and public key encryption, and their complementary use.
3. Define digital signature and digital envelope.
4. Describe the security schemes adopted in SSL and SET.
5. Define the concept of micropayments, and provide examples of its use.
6. Define e-cash, and list the different types of e-cash.
7. Explain why the traditional payment systems are inadequate for e-commerce.
8. Why are micro payments so important for the future of e-commerce?
9. Discuss some of the issues involved in international and cross-border financial transactions.
10. Surf the site of ICCI bank and find out the financial services that they offer.
11. What is a digital certificate?
12. Who are the agencies that provide digital certificates in India?
13. What is a key?
14. Explain the symmetric key system.
15. What e-payment security mechanisms are used by various banks in India?
16. What is the RSA algorithm?

UNIT – IV

7. E-Customer Relationship Management

In this Chapter we will discuss

- Importance of CRM
- E- CRM solutions
- E- CRM tool kit
- Data mining in CRM
- CRM automation

Structure of the chapter

7.1 Introduction

Customer Relationship Management (CRM) is defined as the aligning of business strategy with the corporate culture of the organization, along with customer information and a supporting information technology of the customer interactions that promote a mutually beneficial relationship between the customer and the enterprise. Primarily, customer relationship management is a business strategy, but it is a business strategy enabled by the advances in technology. Widespread implementation of customer information. Enterprise Resource Planning (ERP) systems, sales force automation, and integrated point-of-sale systems have made customer information readily available in large volumes. Reduced costs and higher levels of performance for database management platforms allow us to gain access to this customer information and gain new insights into our customers and their behaviour through a variety of analysis methods. Advances in contact management technology and supporting infrastructure allow us to take advantage of this information in increasingly cost-effective and innovative ways. Perhaps most significantly, the Internet provides a completely new way for an enterprise to interact with its customer—the electronic channel, or the e-channel. With consumers buying everything—from groceries to automobiles—on the Internet and the businesses beginning to shift their purchasing activities to industry-oriented virtual marketplaces, the characteristics of customer interaction are constantly changing. In the business environment, the focus is being shifted to customer retention.

The link between customer satisfaction and the return on investment is the profit for a company, as shown in Figure 7.1.

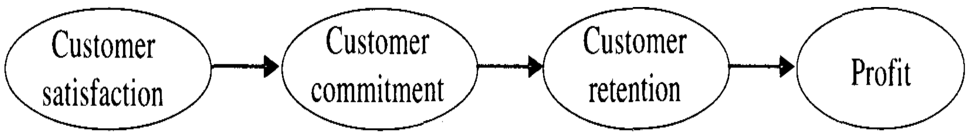


Fig. 7.1 Customer satisfaction and profit.

Customer Relationship Management

Beyond the glamour of developing the e-channel, business is investing heavily to deploy, customer relationship management in traditional channels. In most cases, these capabilities are developed independently, requiring expensive integration later on to achieve the vision of true customer relationship management on an enterprise-wide scale. Integration of these resources is one of the key challenges of successful deployment of CRM across the enterprise, This is because it has a direct impact on the consistency of the customer experience with the enterprise. So how does the enterprise integrate systems across functions and channels? It does not happen by accident, but through foresight and planning. All the functions and the channels must come together to develop an enterprise-wide strategy for CRM. Only then can the enabling information technology be fully integrated with maximum efficiency and effectiveness. This technology spreads customer information throughout the enterprise and it must be based on a unified information architecture.

Independently developed CRM capabilities within the various parts of the enterprise usually begin based on function-specific short-term needs. Marketing begins to implement CRM with a variety of products, often combined with integrated suites to plan, execute, and monitor marketing campaigns and perform database marketing. Lead management and sales force automation capabilities are deployed to support the field sales force. Systems that manage the supply chain and product delivery are deployed to support mass customization and to provide up-to-the minute information about the goods in transit, to the customer. Field service representatives and contact centers deploy sophisticated telephony and information systems to provide ongoing customer service and cross-selling.

These separate capabilities do provide a means to support function-specific and channel specific CRM strategies. Business culture can shift from product-focus to customer-focus. Sales and marketing can focus on retention and increase of share of customers instead of acquisition and market share. Customer service can identify and take advantage of cross-sell and up-sell opportunities. However, customer information does not freely flow across the enterprise. To obtain the vision of customer relationship management, information must move about freely. This requires integration.

Only through the integration of marketing, sales, fulfillment and service across business partnerships, the direct sales force, the tele-channel and the e-channel, is the vision of customer relationship management realized. Customer information must flow like water within, around, and through these functions and channels to ensure that the enterprises can build mutually beneficial relationship with the customers, and even amongst their customers Everyone in the enterprise participating in the conversation with the customer needs access to the latest information on the customer's profile, behaviour, and expressed needs. Marketing provides the latest promotions and offers for individual customers, based on their interaction on the website. Products are customized to meet specific customer needs and customer service is fully done, resulting in increased levels of customer satisfaction and loyalty. With an enterprise-wide view of each customer, the value of each relationship is measurable, am each relationship is managed based on this value. Every customer touch becomes an opportunity to modify customer behaviour in a beneficial way "based on the totality of information at the disposal of the enterprise. Achieving this vision results in unprecedented competitive advantage in some industries ... or mere survival in other industries.

7.2 E-CRM Solutions

E-Customer Relationship Management or E-CRM solutions are especially valuable to companies that face the following circumstances:

1. Business is driven by mission-critical customer service requirements

2. Current costs for CRM run high

3. Large volumes of information is distributed

4. A complete customer care solution is needed.

E-CRM solutions can be deployed and managed to provide increased revenues and decreased costs for companies while improving customer service. E-CRM goals can be achieved with Internet business strategies, web-based CRM specification development, web systems design and project management, interactive interface design and electronic publishing.

The strategy for e-CRM can be visualized in three stages, as given in Figure 7.2.

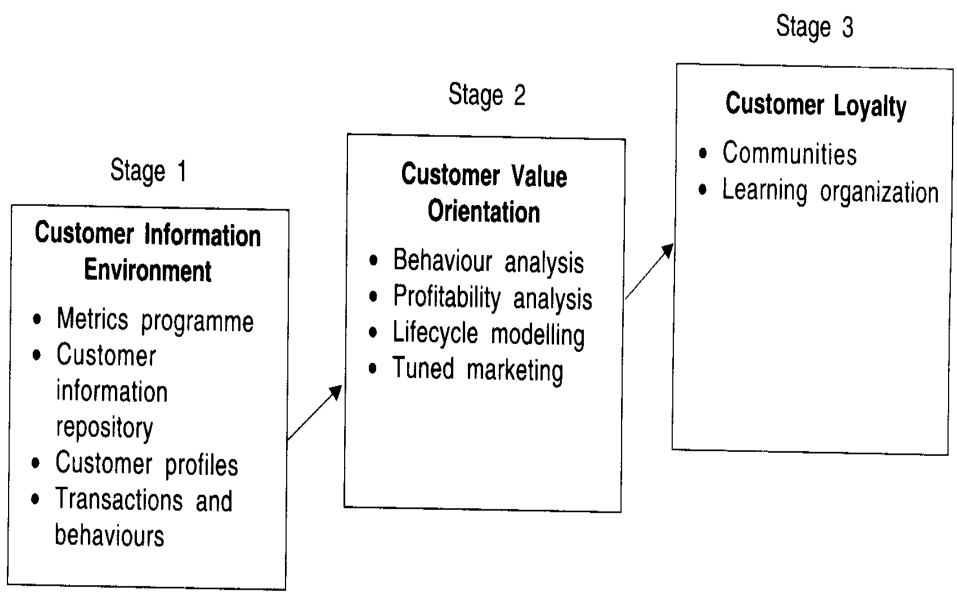


Fig. 7.2 Strategies of a customer focussed business.

Customer Information Environment

In the first stage, building up of a customer information environment and acting on it forms the starting point. It consists of Metrics programmes. Customer information repository, and monitoring customer behaviours.

Customer Value Orientation

In the second stage, operational effectiveness is the focus. Customers want value for their money. They believe that they have got value, when the perceived benefits they receive from something exceed the costs of owning it. These components are represented in Figure 7.3.

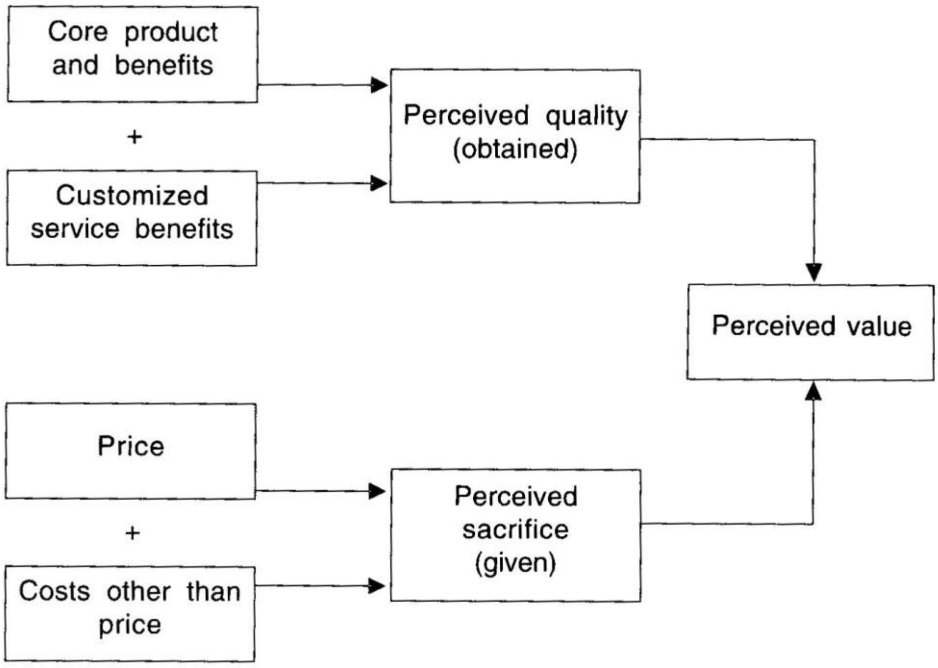


Fig. 7.3 Perceived value.

Customer Loyalty

In the third stage, the focus is on the integration of internal process of the organization with the customer in creating a community.

Moving costly customer services to the Internet is critical to staying competitive. Providing customer services on the Internet means a lot more than just having a website. With the users demanding more services via the Internet, leading companies have realized the importance of their e-services strategies on the Web.

Most companies are focussed on today's most critical business challenge—attracting and retaining customers. These companies require customer-directed e-business solutions and E-CRM to meet those requirements. Companies benefit from huge cost savings and increased revenues. Customers benefit from on-demand access to information, less hassles with better support, and less expensive services.

The strategy of the portals is to become global supermarkets providing everything for individuals, families and organizations. Their customer base is what stock market considers to be the most important asset of these companies. Table 7.1 summarizes the customer relationship valuations.' As seen in the table, each customer is worth $4000 for Amazon. So, increasing the number of customer, in itself is an aim of the portal.

TABLE 7.1

VALUATION OF COMPANIES BASED ON CUSTOMER BASE

Company name	*Electronic customer relationships (in million)*	*Market capitalization (in million)*	*Value of eacl relationship ($)*
AOL	50	$100	2000
Yahoo!	40	$40	1000
Amazon	13	$26	4000
eBay	5	$20	4000

When Humans Are Not Enough-—Or When There Are Not Enough of Them

For many e-customers, the Web is like an infinitely large shopping mall they have all to themselves. Although the absence of long lines at the checkout counter and the freedom from the hassles of parking are welcome, the lack of other shoppers and even salespeople can make them feel lonely. For a social shopper—a woman who enjoys shopping with friends— looking for a product on the Web can be similar to going to a movie all alone. The fun factor is missing, regardless of how great the movie is. On the other hand, if she's a mission shopper—she enters, extracts the goods, and then makes her exit as soon as possible—then shopping on a highly structured website can be a welcome respite from the time-consuming task of searching the malls. In either case, even a potentially annoying salesperson can be a welcome sight when the woman simply cannot find the product she is looking for.

These two aspects highlight several important elements in human customer service interactions. The most obvious is variability. What constitutes a good customer service in one area need not necessarily apply to another. There is also variability at the trade, organization, and individual levels. For example, an individual may have different expectations of what constitutes a good customer service in the airline, hotel, and restaurant industries. He probably has specific expectations about his favorite airline or hotel chain. Furthermore, he no doubt expects different levels of service at each location.

Variability in service can result from a variety of factors. Perhaps the staff in one location has insufficient training to understand their customers' needs. May be, they just do not care. Perhaps they are simply having a bad day. Today, many new products last only for three months in the marketplace, making it virtually impossible for a salesperson to become an expert on a particular product before another replaces it. Clearly, with some products and services, it is simply absurd to expect a salesperson without extensive training to become proficient in interfacing with customers in more than a superficial way.

If someone were to ask the person who manages the customer service division of a business to name his greatest assets and liabilities, he will say it is the people. It is a challenge to attract people and keep them attentive and educate them, but it is usually worth the effort. Good customer service representatives can provide personal, empathetic, quality, reassuring service, especially when they interact with the customer in person. Nothing beats an attentive,' knowledgeable sales or support person in terms of bonding customers to a company. Great sales and service representatives create a loyal following that is often independent of the company they represent.

Although there are situations when only a live customer service representative is required, this is not always possible. With today's busy lifestyle, there is simply not enough time to have face-to-face interaction. Increasingly, sales and support interactions occur with the assistance of communications and computer technology, even for costly items. For example, when time is a scarce resource and an unstructured conversation can resolve things in a few seconds, telephone is of great help, especially since it is universally available.

Despite these advantages of personal service sales and service representatives are expensive from a practical perspective, especially in a 24 hours, 7 days support model. In addition, there is the aforementioned variability in service, due to dozens of possible issues, such as a representative's disinterest in a particular product because there are dozens of other products he needs to know about. One of the major limitations of human customer service representatives is that they normally work with customers on a one-on-one basis. Scalability, the ability to work with multiple customers at once, is possible in group presentation situations, but then the personal, one-on-one interaction suffers. There are also errors, of both omission and commission, which can appear in any human-mediated transaction, regardless of the touch point. This is especially true when the transaction involves the manual entry of data.

As the effective interaction distance between customer and support staff increases from personal to phone, to live Web chat, to e-mail interactions, many of the positive qualities of personal interaction normally ascribed to a good customer service representative decrease. The potential for using the touch point in an emotionally intelligent interface diminishes as well. For example, it is much easier to foster an emotional bond with a customer through personal interaction than through e-mail. In addition, human-mediated interactions tend to generate fewer data and less granular data than is available through computer-assisted means, Often, this is simply because someone has to take time to record the data. Furthermore, it may be impossible for some employees to fulfill their data-logging requirements because they may lack the education needed to understand the product or service. For example, a new employee may not be able to differentiate between fabric types, saree styles, or designer labels. Another characteristic of human customer representatives is that they bring with then a variety of security and confidentiality issues, from both an employee and a technology perspective. That is, the equipment the support staff uses must be protected from viruses and break-ins, and employees must be trusted or guarded as well.

How Technology Can Help

Interactive computer and communications technology can assist in the sales and support process in several ways. Telephone, live chat and e-mail can enhance the effectiveness o customer service representatives. Computer-mediated e-mail, chat and animated chat can take over when a human representative is exhausted. They can serve as a filter, answering all but the most difficult questions for the representatives.

Web technology can also help offload the support issue to customers who enjoy helping each other on the Web. For example. Lands' End *(www.LandsEnd.com)* adds to the fun of shopping with its *Shop With a Friend*™ option. Two shoppers can browse together and add items to the same shopping cart.

For example, two friends working in different companies can go shopping during their lunch break, just as though they had met and gone shopping in the same brick-and-mortar retail outlet. There is no elaborate data warehousing or cluster analysis involved, just a two-way Web chat connection and a slight modification in their shopping cart model. The customers take care of navigating the Web and helping each other with product selection.

In a similar vein, several vendors, including Cahoots, Hypernix, ICQ, MyESPcom, Third Voice, and WebSideStory, offer live-chat technology to make online shopping less sterile and more emotionally engaging. Their idea is to create a sense of community for a particular website by allowing prospective customers to communicate with each other at any time, even without knowing each other's name.

For example, customers shopping for widgets on a particular website could ask if other customers had a good or bad experience with the widgets purchased there. Anyone visiting that website could respond to the query and discuss the merits and demerits of those widgets. The goal is to improve upon the Web's record of two-thirds cart abandonment. That is, about two-thirds of all shopping carts are abandoned at some point before final checkout. From the perspective of a website owner and the one paying for the live-chat capabilities, the danger is that the discussions may become derogatory and out of control.

Human-mediated personal contact, phone contact, live Web chat, e-mail, and animated Web chat are representatives of the range of possibilities currently available, where animated Web chat represents the greatest level of technological involvement. There are also several technologies on the horizon, such as two-way Web-based video links, but the realities of current bandwidth limitations of the Internet are holding these technologies at bay. Also, the value for each characteristic attributed to a touch point represents a typical case. As with any measurement or estimate, there is variability in the actual value shown.

Reducing Cost Per Contact

One of the effects of adding the appropriate technology to the customer support or sales mix is that there is often a reduction in the cost per contact, i.e. the money spent to connect with each customer. The cost per contact tends to be highest for personal, one-on-one interactions, simply because the representative's full attention is necessarily focused on a single customer. The customer receives the full benefit of the representative's training during the period of contact, as well as many of the resources that result in direct and indirect costs to the company.

With the addition of phone technology, the support representative is freed somewhat from dealing with one customer to the exclusion of all others. For example, he might be on the phone with one potential customer, while simultaneously composing an e-mail to another potential customer or client, filing papers, cleaning up his desk, or in some way contributing to his own and the company's future success.

Similarly, live. Web-based chat and e-mail have a relatively low cost per contact, in part because the support representative can multitask. For example, in the case of a live chat, the! representative can communicate with potential customers on the Web in spurts, and it between sessions, handle other support issues. Furthermore, since e-mail is normally handled in batches, often with canned responses, a customer service representative has time between e-mail runs to perform other functions.

Moving from primarily human to computer-mediated interactions, the cost per contact is potentially even lower. Computer-mediated e-mail, in which e-mail is generated by a bot, can respond to hundreds of e-mails during the time it takes a human to answer one or two. Similarly, computer-mediated chat, where real-time chat bots help customers, can reply to hundreds of queries per second. The same rationale holds for animated chat bots that incorporate emotive, animated graphic characters. The marginal cost of handling an additional customer is an insignificant increase in the server power and Internet bandwidth requirements,

Decreasing Development Time

Customer representatives are expensive to train, to keep motivated, and to retain, especially in this state of the economy. Training a representative for a new product or service may take a few days or up to several weeks, depending on the complexity and the number of products and services the representative is expected to sell or support. Development time is the greatest for representatives who work face-to-face with customers. One reason for this is that it includes recruiting time. Good all-round salespeople and representatives with fascinating manners, speech, dress, and charisma are hard to find. A business may be lucky enough to locate a representative who has excellent live chat skills, but whose squeaky voice may not do in phone support and whose green hair might not present the image the business is looking for in person-to-person sales.

Characteristics of human versus computer-mediated customer service representatives vary over a variety of touch points. This is illustrated in Table 7.2. As you can find, variability in service is the greatest with personal, one-on-one contact and telephone service,

With computer-enabled tools, such as liberty of canned phrases, customer service representatives can be trained to become proficient users of live chat and e-mail even if the) are slow typists. As long as the representative can recognize which phrases or responses to use in specific circumstances, even minimal keyboard skills will do. E-mail is one of the most forgiving touch points, since the dialogue does not occur in real time. A customer service representative has time to refer an unintelligible e-mail to a supervisor who can then answer it or route it to the appropriate person to handle.

In comparison to training human customer representatives, computer-mediated e-mail and chat have moderate development times. The likely questions and the corresponding answers have to be gathered and compiled into a knowledge base. The normal software development cycle of testing, modifying, and again testing and re-modifying the code and the knowledge base until everything checks out can take weeks, even with a simple support problem.

Creating Emotional Bonds

Although the golden standard for creating an emotional bond between the customer and a company is to have a dedicated, charismatic salesperson or a representative, technology can be of great help in creating an emotional bond. As illustrated in Table 7.2, personal contact is capable of creating the most profound emotional bond. Live chat is also capable of supporting a meaningful dialogue that can help create an emotional bond, but it is not as powerful as the phone or direct contact. Since e-mail lacks most of the cues we normally associate with a conversation, such as immediacy, it has the lowest likelihood of creating a meaningful emotional bond.

TABLE 7.2

COMPARISON BETWEEN HUMAN AND COMPUTER INTERACTION[2]

Characteristic	*Human*				*Computer*		
	Personal	*Phone*	*Live chat*	*E-mail*	*E-mail*	*Chat*	*Anim chat*
Cost per contact	●	◆	■	■	■	■	■
Development time	●	◆	■	■	◆	◆	●
Emotional bond	●	◆	◆	■	■	◆	◆
Emotive	●	◆	◆	■	■	◆	◆
Empathetic	●	◆	◆	■	■	■	◆
Error prone	●	●	●	●	■	■	■
Flexibility	●	●	●	●	◆	◆	◆
Interactivity	●	●	◆	■	■	◆	●
Continuity	■	■	◆	◆	◆	◆	◆
Personal	●	●	●	●	●	●	●
Personality	●	◆	◆	■	■	◆	◆
Quality	●	◆	◆	◆	●	●	●
Reassuring	●	●	◆	■	■	◆	◆
Reliability	◆	◆	◆	◆	●	●	●
Responsive	◆	◆	◆	■	◆	●	●
ROI	■	◆	◆	◆	●	●	●
Scalability	■	■	■	◆	●	●	●
Transference	●	●	■	■	■	■	◆
Variability	●	●	◆	◆	■	■	■

● High; ◆ Medium; ■ Low

Computer-mediated chat and animated chat, when appropriately implemented, have the best chances of creating an emotional bond with the customer.

Presenting Emotive Content

Human beings are emotional creatures. We react to not only language and voice intonation and the subject, but also to dozens of subtle cues, in the form of physical gestures. For this reason, it can be stated that personal interactions convey the most emotive content. E-mail;

has the lowest emotive content capacity, in part because of the time factor. Both chat and e-mail can enhance the messages with the use of emotive icons or emotions. Of the computer-mediated options available, animated chat has the greatest potential for conveying emotive messages to a customer.

Displaying Empathy

Great salespeople and customer representatives are empathetic; they can understand the customer's situation or at least give the impression that they do. It is the impression that matters to customers; they want to feel that they have been listened to. This feeling can be communicated best in person, but to some degree over a phone conversation, and to a lesser extent over a live chat conversation. Because it lacks immediacy, e-mail tends to be a poor communications conduit for empathetic thoughts and feelings. Computer-mediated communications, such as e-mail and live chat, do not fare very well when the goal is to communicate feelings that may be difficult for a computer to convey. In this regard, animated chat communications can sometimes convey a sense of understanding, when used as the touch point.

Reducing Human Error

Humans are simply more error-prone than computers when it comes to manipulating symbols and values. Assuming there is an accurate customer data to work with, computer-mediated customer communications can have a much lower error rate than human-mediated communications in tracking orders, verifying charges, and identifying repeat customers.

Increasing Flexibility

While computers might excel in flawlessly following human instructions, good customer service representatives excel in flexibility. Regardless of the touch-point, a good representative, when properly trained, can help rectify errors or retrieve missing data that current computer-mediated systems cannot.

Improving Interactivity

Interactivity, the ability of representatives to respond to a customer's queries in near real-time, is best in person and over the phone. E-mail interactivity suffers from an inherent lag from the time a problem statement is made to the response, but the lag time tends to bf smaller when the e-mail is computer-mediated. Chat, whether live or computer-mediated, car support a moderate level of interactivity.

Increasing Continuity

From the customer's perspective, continuity can be extended with computer-mediated cha and e-mail. Continuity is important in forming a bond with customers, especially with personal, and to a lesser extent, phone interactions. Computer-mediated communications can provide infinite continuity. For example, the names used to identify a chat bot can be held constant, and the appearance of animated figures used in animated chat communications can remain constant as well.

Adding a Personal Touch

Even human-mediated communications tend to rely on computer-generated or warehoused customer data to the same extent that computer-mediated communications do. In other words, most touch-points are already leveraging computer technology to provide a personal touch.

Communicating Personality

Computer hardware, programs and websites, all have personalities. However, just as personal interactions tend to have a great potential to exhibit personality, animated chat, where an anthropomorphic figure can communicate with visual cues, text and even voice, has a much greater chance of communicating personalities to customers. The challenge is to create personalities that customers can relate to in a positive way.

Increasing Quality

The quality of customer dialogue tends to be highest when it is controlled by a good salesperson or motivated customer service representative. Phone, live chat, e-mail, and other touch-points can also be of high quality, but are usually not as high as of a good salesperson. Computer technology can help with these other touch-points by minimizing variability and otherwise contributing to quality control. Computer-mediated communications can have consistent, high-quality dialogues with customers, because all possible responses can be validated before they are presented to customers.

Providing Reassurance

An important aspect of the sales process is reassuring customers that their purchase decisions are correct, their problems have been solved, and that their products are on the way. Computer technology can be used for something as ordinary as helping reassure customers about the status of their order, or as sophisticated as creating a personal profile of customers and using it to explain why the products they just ordered are in their best interest.

Increasing Reliability

Humans vary in their reliability from person to person and from day to day. Computers are reliable machines as long as human-generated viruses do not attack them. A business can rely on computer-mediated communications with customers as long as it has tightly controlled parameters. In short, computers excel where reliability is an issue.

Improving Responsiveness

Properly trained sales and support staff can do a good job of responding to customer needs in a timely manner. E-mail has the lowest responsiveness of the human-mediated communication simply because of the inherent delays in e-mail communications. By definition, e-mail camel with it, a perceptible delay that is not noticed or at least is not significant in a live chat, for example. Because of the rapid 24 x 7 response made possible by computers, computer-mediated chat and animated chat are potentially much more responsive than a customer representative or salesperson could be.

Improving Return on Investment (ROI)

Generalizing the Return on Investment (ROI) for a customer representative or computer technology is complicated. There are always specific circumstances, such as the cost of money and the specifications of the people or computer technology involved. However, il today's economy, it is generally understood that the turnover is high. This is especially true in the customer-support area, where temporary and seasonal workers fill a relatively large number of representative jobs. It is because of the variable nature of the labor supply and the low cost per contact for computer-mediated dialogue, that the ROI for computer-mediated support of all types is potentially greater than for human-mediated support.

Increasing Scalability

In general, humans do not scale very well. Most interactions are on a one-on-one basis, suet as personal, phone, and live-chat communications. E-mail is scalable because it may bf handled in batches, with the same generic answer being applied to hundreds of questions In contrast, computer-mediated touch points are virtually infinitely scalable, given an adequate infrastructure, including supporting server hardware.

Controlling Transference

Transference is, ascribing the characteristics of one person to another, often at a subconscious level. This may be the result of similarities in appearance, style of speech, or mannerism and can be a positive or a negative factor in the sales and customer-relations process. For example, a salesman may subconsciously remind a woman of a trusted relative, and she will instinctively believe everything he says. Conversely, the same salesman could remind her o an unscrupulous salesperson she dealt with in the past, and she develops the same negative attitude towards this one. In human-mediated communications, transference occurs primarily with personal contact, but may also occur in phone conversations.

Transference can be an asset in computer-mediated interactions. For example, a business can provide customers with the ability to modify the animation and synthesized speech t suit their preferences. It could present customers with a menu of animated figures including male, female, young and old, from which they could choose. In addition, it could allow customers to specify the speaking style of each figure, from businesslike to casual. Customers do not generally create figures to learn from or deal with what they do not relate to positively.

Decreasing Variability

Variability is a characteristic of human-mediated communications that is virtually absent in properly designed computer-mediated dialogues. This variability may be a nuisance, as for example, if the customer inquires about tax code information. An animated chat bot may not be as engaging as a human, but a business will know, to what information are its customers being exposed.

Where Interactive Web Technology Shines

From the above discussion, it is apparent that of the characteristics listed in Table 7.2, Web-based customer support has the following advantages:

1. Lower cost per contact
2. An emotional bond with the customer
3. An ability to communicate with more emotive content
4. Fewer errors
5. Greater customer interactivity with a website
6. Improved reliability
7. Greater responsiveness
8. Greater return on investment
9. Improved scalability
10. Less variability in the quality and content of communications.

What really matters is how businesses apply these potential benefits of interactive technology to their Web presence. If the goal is to create an Emotionally Intelligent Interface, then a business could use these technologies towards setting the tone of interaction, involving its customers in a mutually beneficial dialogue, and using interactivity to establish a meaningful relationship.

When potential customers visit a website, they should be made to feel comfortable with the company and confident that it can fill their needs efficiently and economically. At a brick-and-mortar store, the sales staff and the layout and decoration of the reception area of the store perform this function. The environment established by the technologies incorporated in the website can dictate customers' responses to the business, and how long their visit to the website lasts. Creating a welcoming environment can entail something as simple as creating a panel of potential customer service representatives and allowing customers to choose which one they would like to interact with, whether the representatives are real or virtual.

7.3 E-CRM Toolkit

An E-CRM 'toolkit' covers a wide diversity of channels (see Figure 7.4). In order to bring true customer management across online business, one needs the E-CRM products to fulfil the following criteria:

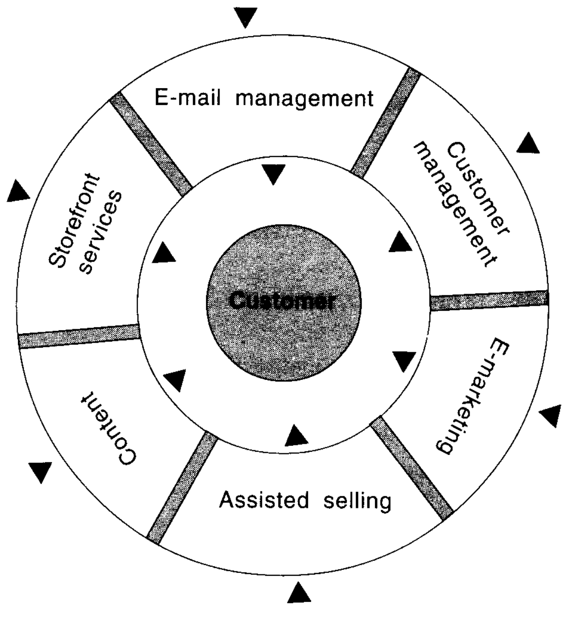


Fig. 7.4 E-CRM toolkit.

Content Is the system delivering the contents a customer wants to see? How is it being managed on the IT platform?

Storefront and Merchandising Services

With large numbers of visitors failing to complete transaction at the checkout, it is needed to ensure that your storefront services propel your customers to the cash point.

E-mail Management

Are e-mail campaigns focused to provide an offer that customer cannot refuse? How are these tied in with websites so that customers enjoy a seamless experience?

Customer Management

Is the company managing data across all the sales and marketing functions to its best?

E-marketing

How well are e-marketing efforts targeted? How well do they combine with online selling

Assisted Selling

One needs only to look at the Dell business model to see how assisted selling can enhance the shopping experience and achieve business success. But what assisted selling approach will work best for any company?

7.4 Typical Business Touch-points

Typical business touch-points from a consumer perspective include: Media—TV, radio, newspaper and flyers; Physical—the physical plant, such as a showroom or retail outlet; Personal— direct people contact, including salespeople and customer representatives; Mail—correspondence, bills, and payments through postal service; Phone—telephone communications with sales, marketing, and customer service representatives; Fax-facsimile communications, including quotes and invoices; E-mail—communications via computer regarding orders and services; and Web—information and ordering through the Web. Figure 7.5 illustrates the state where every touch-point is significant. The arrows therein indicate the relative significance of each touch-point.

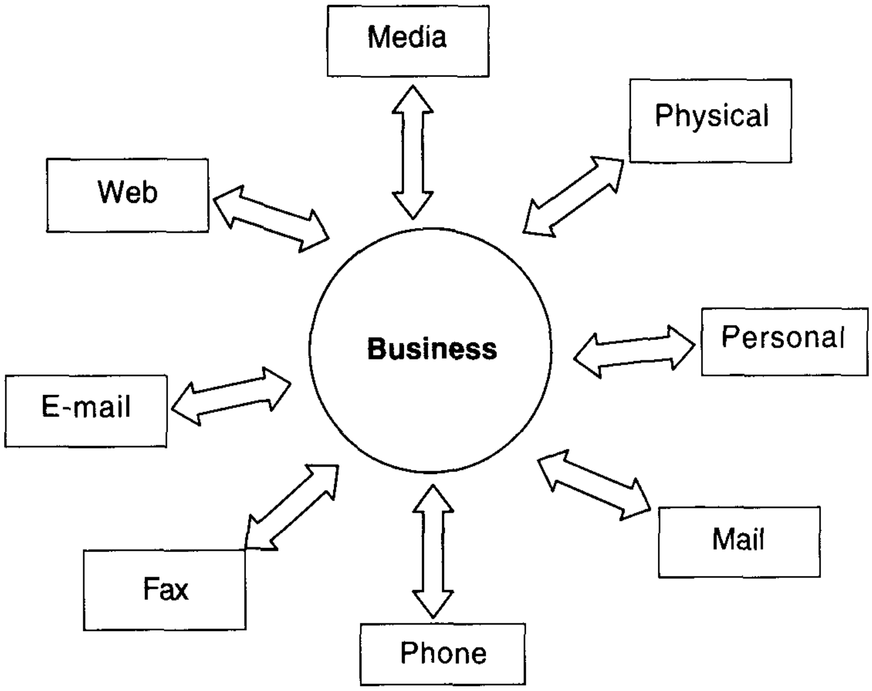


Fig. 7.5 Touch-points for normal CRM.

For any company, it simply is not enough to know "who buys what?" in order to build a successful, profitable marketing campaign. It needs to know who its customers are, and how much it should invest on them. This necessitates the maintenance of a consolidated database. The components of the data warehouse can be found in Figure 7.6.

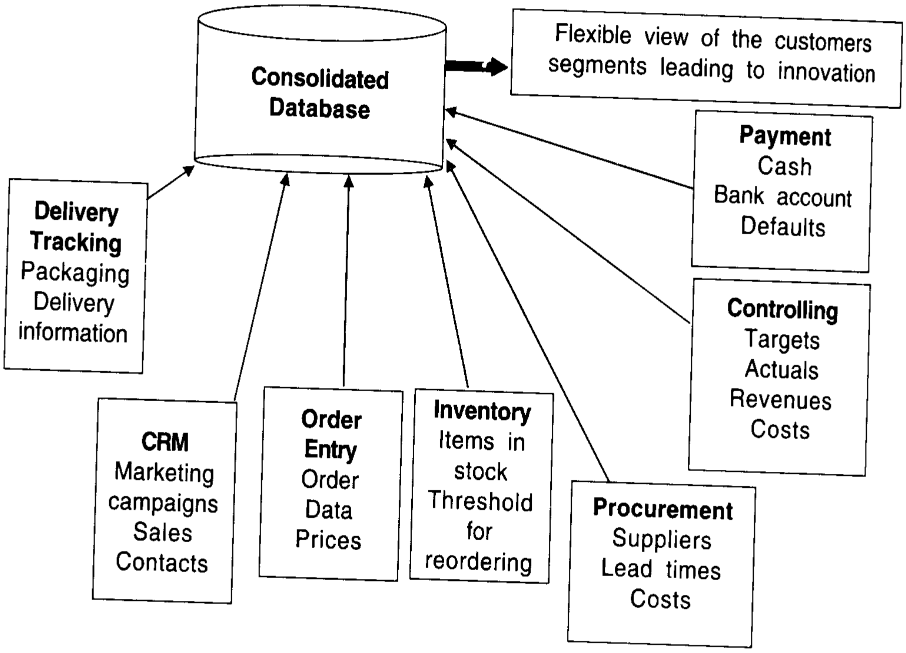


Fig. 7.6 Data warehouse architecture.

Converting Clicks to Customers

To leverage technology and thereby realize the greatest benefit from a Web presence, i business must first know what it is after, in terms of a relationship with its customers Assuming that the goal is to provide a website with an Emotionally Intelligent Interface management also has to appreciate the possibilities within the business resource and technology constraints. Note that the technologies with the greatest degree of interactivity provide the greatest potential for a sale. A business needs to pull everything together in a way that harmonizes with its customers; the business should use the technology at its disposal so that the odds of creating a loyal customer following are maximized.

Managing Customer Value Orientation and Life Cycle

The CRM industry has matured rapidly over the past few years. Contact managers having evolved into full-function sales force automation systems. CRM front-office suites *no* support marketing, sales and service. Integration between

CRM systems and enterprise resource planning (ERP) systems is becoming more common, if not commonplace.

The E-CRM market is new and rapidly evolving. Implementing CRM for traditions front-office marketing, sales and service operations is becoming the top priority for most companies. That prospect has been challenging enough, being formidable to the new touch points such as the Web. Integration is still the key. Online or offline, client/server technology is still a major factor. Anyone who has implemented client/server applications between the various contact centers and touch points within an enterprise can afford the complexity and the cost involved in them. In short, CRM is a square peg and e-business is a round hole. However, everything is changing with the introduction of new. Web-based CRM solutions.

To help organize the chaos, E-CRM solutions can be grouped into two categories— Web-based solutions and Web-extended solutions.

The Web-based CRM solutions are designed from the bottom up, exclusively for the Internet. These are very innovative products, initially focused on the sales (e-commerce) function. More marketing and service capabilities will be soon added.

Web-extended CRM solutions are established (primarily client/server-based) CRM suites, originally designed for enterprise users with extensions, to include web-interface functions. There are three phases of CRM:

1. Acquisition
2. Enhancement
3. Retention.

Each has a different impact on the customer relationship, and each can more closely tie a company with its customer's life.

Acquisition

You acquire new customers by promoting product/ service leadership that pushes performance boundaries with respect to convenience and innovation. The value proposition to the customer is the offer of a superior product backed by excellent service.

Enhancement

You enhance the relationship by encouraging excellence in cross-selling and up-selling. This deepens the relationship. The value proposition to the customer is an advantage with greater convenience at low cost (one-stop shopping).

Retention

Retaining profitable customers for life should be the aim. Retention focusses on service adaptability, i.e. it delivers not what the market wants, but what the customers want. The value proposition to the customer enhances a proactive relationship that works well with the best interest of the customers. Today, leading companies focus on retention of existing customers much more than on attracting new customers. The reason behind this strategy is simple: If you want to make money hold on to your good customers. But do not be fooled; it is not as easy as it seems.

All the phases of CRM are interrelated as shown in Figure 7.7. However, performing the tasks well in all the three phases is a difficult proposition, even for the best of companies. Companies often have to choose which one of these dimensions will be their primary focus.

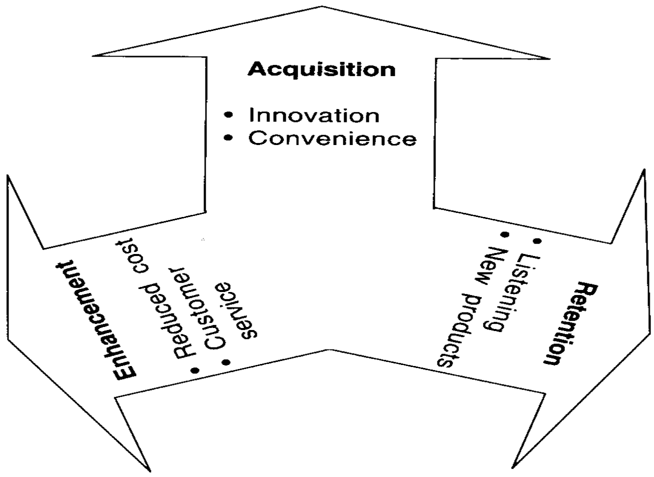


Fig 7.7 The three phases of CRM3.

The Customer Retention Goal

Attracting and retaining customers has rapidly emerged to be the most mission-critical function of leading businesses. Everything (products, services, pricing, and the like) is a commodity. Customer retention has replaced cost-effectiveness and cost-competitiveness as the greatest concern of business executives today. It costs five to ten times more to get new customers than to retain the existing ones. It is going to involve more efforts than web interactions to keep the customer brand-loyal.

The Power Shift

Give customers what they want. This can be a challenge, or it can be an opportunity. The same technology that has made it more difficult, can also make it easier. Customers are more important than business people. Companies need to do business with customers in their own way. The key is integration of the various points of customer contact, including Web, contact centers, wireless (field) and others. All customer interactions must be consistent, with clear value delivered to the customer and the company.

E-CRM is not the single answer to attracting and retaining customers, nor are e-customers the only valuable customers.

Indeed, Internet is not the only point of contact with the customers, nor are the other digital and online communication tools described in Figure 7.8. Five years and beyond from now, some customers will still prefer the telephone or face-to-face communications.

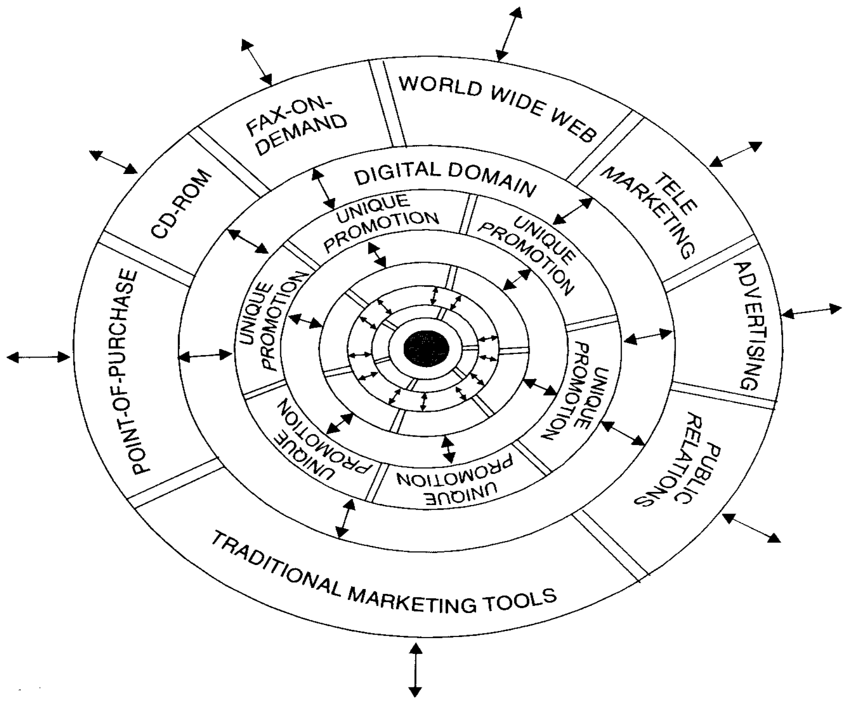


Fig. 7.8 Use digital and online tools to communicate.

Customers should not be segmented, based on the assumption that they will predominantly choose one point of contact with business. More likely, customers will have multiple points of contact, including our website, contact centre, sales and field service representatives. They expect a consistent experience from point to point. They expect the company to be easy to do business with.

Very soon, the "e" fancy will subside. Executives in every industry will recognize that the next major phase of the Web phenomenon is actually integration with other points of contact. Blended media is the true killer solution for business.

In the past, if marketers wanted to incorporate technology into their environment, they often looked outside the enterprise for help. Sales frequently outsourced lead management processes, and multiple vendors often managed call centres with information systems completely separated from each other and the enterprise. There were a number of reasons for this, such as the following:

1. Their internal IT department did not understand what was needed.

2. The IT department had other priorities and would take too long to develop the needed technology.

3. The functional areas did not trust their own internal data, believing it to be of too poor a quality to be useful.

4. The business people did not understand the technology, and so could not explain what was needed, technologically, to their IT personnel.

To support the transition of the enterprise from a customer-focused approach to doing business, individuals throughout the enterprise must have access to a set of capabilities! necessary to plan and manage customer interactions or customer touches. These capabilities can be categorized in two ways:

1. Operational, Tactical, or Strategic capabilities to the enterprise

2. Acquisition, Retention, and Expansion of a Customer Relationship

These two categories represent the business perspective of the capabilities and how they relate to the customer. However, it is probably more useful to look at capabilities from the customer's perspective. After all, the purpose of these capabilities is to gather customer information and use this information to modify customer behaviour in a mutually beneficial way. To look at these capabilities from the perspective of the customer, it is necessary realize how the customer interacts with the enterprise over time, as the enterprise:

1. acquires the initial customer relationship;
2. works to earn the customer's persisting loyalty; and
3. expands the relationship to gain a greater share of each customer's purchasing potential,

These activities represent a cyclical process of interactions between each customer and the enterprise, represented as the Customer Life Cycle (CLC). Using CLC as a tool, we can see how CRM capabilities affect customer interactions at various points in the life cycle, Figure 7.9 explains the concept.

Global Marketplace

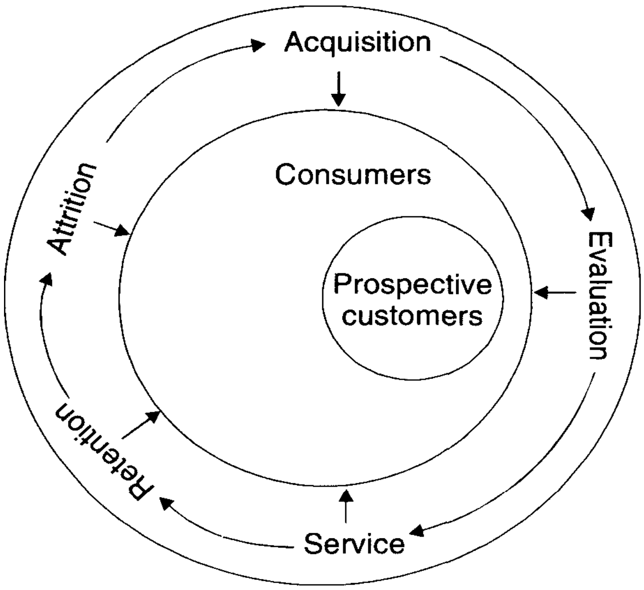


Fig. 7.9 Customer life cycle.

7.5 CRM Capabilities and the Customer Life Cycle

Customer acquisition consists of the business processes in the CLC leading up to the customer moment, when consumers become customers ... or not. This includes *awareness generation, knowledge transfer, consideration, pre-sales, and evaluation.* Capabilities include consumer surveys in business operations, tracking enterprise-wide customer interactions in business management, and market basket analysis in business intelligence. The enterprise clearly requires customer acquisition to maintain and expand revenues and profits. A business without new customer acquisition will shrink and eventually fail. But compared to customer retention and expanding "share of customer", customer acquisition can be expensive.

Expanding the "share of customer" is gaining the largest portion of acquisitions made by each individual customer in the global marketplace. The proportion of a customer's money that goes to a particular enterprise is known as the share of customer. Example capabilities include delivery of new information to a customer through business operations as the customer re-enters the CLC, taking advantage of cross-sell opportunities using business management capabilities, and identifying cross-sell opportunities through business intelligence capabilities. The benefits of expanding "share of customer" are similar to customer retention— additional sales without the cost of acquiring a new customer. However, expanding the share of customer is as valuable as customer retention. Most companies find that their most profitable customers are the ones that spend the largest percentages of their budgets with the enterprise. For example, one bank recently identified that every one of their most profitable customers (the top 20 per cent) gave their business to the bank, while none of the least profitable customers (the bottom 20 per cent) gave their business to the bank. What is new is the customer-centered nature of applications, which means organizing CRM processes around the customer rather than marketing, sales, or any other internal function. Measurements and feedback from the customer enable improvements in the CRM process. The customer's viewpoint becomes an integral part of the process, allowing it to change with the customer's needs. In other words, companies base their actions not on the priorities of functional fiefdoms, but on the overall corporate objective of providing customer satisfaction.

However, before aggressively deploying CRM applications (see Figure 7.10), managers might have to restructure customer-interaction processes. Functional and organizational structures tend to compartmentalize the various activities that go into serving the customer. Such fragmentation prevents customer information from being dispersed far enough within the organization to be useful; in fact, it often stands in the way of efforts to build a relationship. As a result, customized service is difficult and consequently, organizations tend to treat all customers the same—a damning impediment to building closer relationships.

To counter fragmentation, leading-edge companies strive to take a more customer-centered approach to CRM. There is a growing trend towards managing all the activities that identify, attract, and retain customers in an integrated fashion, that is, managing them as a process that cuts across functional departments. By addressing these activities as a set of CRM processes, organizations can create end-to-end communications and performance accountability for entire sets of activities. In short, a CRM infrastructure is really a portfolio of process competencies.

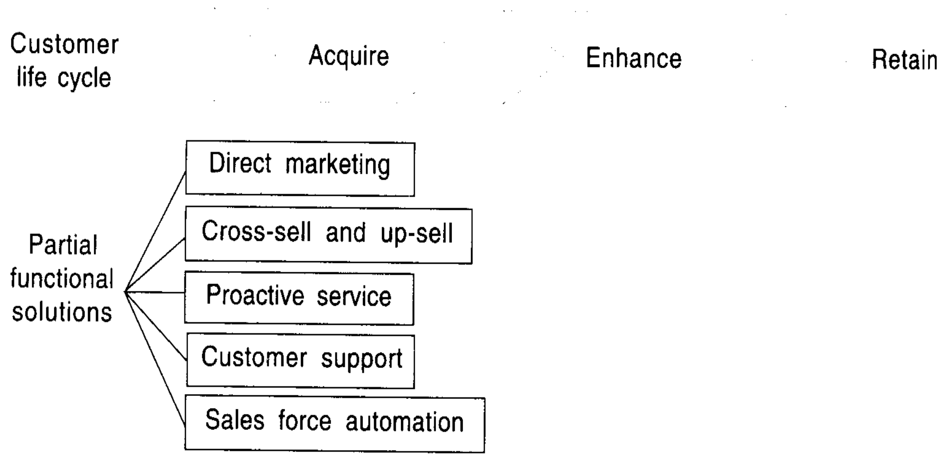


Fig. 7.10 Integrated CRM applications.

CRM capabilities supported by Business Operations include:

- Consumer surveys and focus groups
- Delivering information to consumers
- Tracking promotional materials
- Tracking samples
- Managing coupons
- Managing the point of sale
- Billing
- Invoicing
- Fulfilling orders
- Mass customizing products and services

CRM capabilities supported by Business Management include:

- Managing customer touches
- Managing marketing campaigns
- Monitoring marketing campaign performance
- Managing inventory levels
- Driving mass customization
- Managing cross-sell and up-sell opportunities
- Customizing marketing channels, such as the Web
- Personalizing communications
- Driving contact centre scripts
- Capturing key performance metrics

CRM capabilities supported by Business Intelligence include:

- Click stream analysis
- Market basket analysis
- Customer segmentation
- Cross-selling analysis
- Lifetime Customer Value (LTV) analysis
    - Recency/Frequency/Monetary (RFM) analysis
    - Dimensional "what if" analysis
    - Customer profiling
    - Cluster analysis
    - Factor analysis
    - Conjoint analysis
    - Discriminant analysis
    - Pricing analysis
    - Market channel profiling

Each of these capabilities can play a key role in the interaction of the enterprise and the customer. Functions of business operations include some capabilities that are not always associated with CRM, such as billing. But a bill is a regular, predictable customer touch. Why not include a cross-sell offer or product coupon with the bill? Many companies now do this, requiring coordination of billing with CRM capabilities. After all, a consumer who often moves an unsolicited mail directly from the mailbox to the trash can, will nearly always open a bill.

Privacy Issues and CRM

The most sensitive aspect of customer relations is privacy. All of us have boundaries, and don't trust people who become too familiar too soon.

From the business perspective, ubiquitous data and information that flow seamlessly from one touch point to another represents a kind of selflessness, regardless of the business model. The goal of every service-conscious business is to understand not only all customers, but their circumstances as well, and this requires information. In addition to the obvious business opportunities, there are numerous consumer benefits for ready access to personal information, no matter where the location is.

Paradoxically, Internet initially gave the illusion of privacy and anonymity. People could voice their opinions on any subject, view pornography, and read any topic they wanted, without disclosing their identity. However, it was a very short, temporary illusion. In the workplace, e-mails as well as the employees' activities on the Web are often monitored.

There is currently a hot debate over the rights of companies to create dossiers on consumers without their knowledge and then sell the information to third parties. While companies like DoubleClick *(www.DoubleClick.com)* received a lot of media attention for the intentional use of consumer data, other companies such as America Online, which have much more consumer information at their fingertips, have maintained a low profile. America Online, for example, maintains information on 21 million subscribers, including demographics, credit card numbers, and their whereabouts. Although America Online is not currently in the business of selling consumer data, it sells names and addresses to bulk mailers, and buys information about subscribers for targeted advertisements. Some service providers intentionally track subscriber movements with subscribers' knowledge, and sell the information to third parties. Subscribers are given free Internet access and extensive personal profiles.

Tracking consumer-purchasing patterns is not always used with the consumer's best interest in mind. For example, personal tracking data are often used in yield management, a! technique designed to maximize revenue and profitability. The idea is that some customers; are more profitable than others, especially those placing orders with short lead times. Since suppliers can charge higher prices for orders with short lead times, they reserve capacity for such orders and turn down less profitable, long-range orders. As customers are ranked in terms of profitability and system compatibility, less-profitable customers are deleted from the list and their orders declined. For example, a company may not be able to purchase hotel rooms in bulk for conferences, unless its conferences are to a certain minimum size. This mechanism is great for businesses, but may not be appreciated by some customers.

It is now clear that customer relations are based on a timeless, technology-independent, triad—service, trust, and loyalty. Customers have to trust that a business is working with their best interests in mind. Without trust, which is a major contributor to the emotional bond between a business and its customers, there can be no relationship. Furthermore, even the best intentions are worthless without action. A business must repeatedly provide a valuable, consistent service to prove its customers that the company stands behind its marketing rhetoric. If a business provides its customers with a valuable service and develops a trusting relationship, the business can do all it can to galvanize a loyal customer following.

7.6 Data Mining in CRM

Over the past few decades, there has been a constant shift in the way the companies react with their customers. Companies have found that they need to know the customers better, and for that they need to quickly respond to their needs and wants. It is no longer possible to wait until the signs of customer dissatisfaction are obvious, before taking action. To succeed, companies must be proactive and anticipate what a customer desires. This has made the companies to invest heavily into CRM.

To be successful, database marketers must first identify market segments containing customers or prospects with high-profit potential. They then build and execute campaigns that favorably impact the behaviour of these individuals.

The first task, i.e. identifying market segments, requires significant data about prospective customers and their buying behaviours. In practice, massive data stores often impede marketers, who struggle to sift through the minutiae to find the nuggets of valuable information. Data mining applications automate the process of searching the mountains of data to find patterns that are good predictors of purchasing behaviours.

After mining the data, marketers must feed the results into campaign management software that, as the name implies, manages the campaign directed at the defined market segments. In the past, the link between data mining and campaign management software was mostly manual. Successful companies need to react to each and every one of these demands in a timely fashion. The market will not wait for your response, and customers that you have today could vanish tomorrow. Interacting with your customers is also not as simple as it has been in the past. Customers and prospective customers want to interact on their terms, meaning that you need to look at multiple criteria when evaluating how to proceed. You will need to automate the offer, the person, the time and the channel.

The right offer means managing multiple interactions with your customers, prioritizing what the offers will be, while making sure that irrelevant offers are minimized. The right person means that not all customers are cut from the same cloth. Your interactions with them need to move towards highly segmented marketing campaigns that target individual wants and needs. The right time is a result of the fact that interactions with customers now happen on a continuous basis. This is significantly different from the past, when quarterly mailings were cutting-edge marketing. Finally, the right channel means that you can interact with your customers in a variety of ways (direct mail, e-mail, telemarketing, etc.). You need to make sure that you are choosing the most effective medium for a particular interaction.

It is important to realize, though, that data mining is just a part of the overall process but it needs to work with other technologies (for example, data warehousing and marketing automation), as well as with established business practices.

Consider a case where you are a marketing manager for a regional telephone company. You are responsible for managing the relationships with the company's cellular telephone customers. One of your current concerns is customer attention, which has been eating severely into your margins. You understand that the cost of keeping customers around is significantly less than the cost of bringing them back after they leave, so you need to figure out a cost-effective way of doing this.

Instead of providing the customer with something that is proportional to their value to your company (as done traditionally), you should instead be providing the customer with something proportional to your value to them. Give your customers what they need. There are differences between your customers, and you need to understand those differences in order to optimize your relationships. One big spending customer might value the relationship because of your high reliability, and thus would not need a gift in order to continue with it. On the other hand, a customer who takes advantage of all of the latest features and special services might require a new phone or other gift in order to stick around for another year. Or they might simply want a better rate for evening calls because their employer provides the phone and they have to pay for calls outside of business hours. The key is in determining which type of customer you are dealing with.

It is also important to consider timing in this process. You cannot wait until a week before a customer's contract and then pitch them an offer in order to prevent them from churning. By then, they have most likely decided what they are going to do and you are unlikely to affect their decision at such a late date. On the other hand, you do not to start the process immediately upon signing up a customer. It might be months before they have an understanding of your company's value to them, so any efforts now would also be wasted. The key is finding the correct middle ground, which could very well come from your understanding of your market and the customers in that market. The best way to go about it is to use data mining to automatically find the optimal point.

Clustering and Segmentation Methodology

Customer clustering and segmentation are two of the most important data mining methodologies used in customer-relationship management. They use customer-purchase transaction data to track buying behaviour and create strategic business initiatives. Businesses can use this data to divide customers into segments based on such "shareholder value" variables as current customer profitability, some measure of risk, a measure of the lifetime value of a customer, and retention probability. Creating customer segments based on such variables highlights obvious marketing opportunities.

For example, high-profit, high-value, and low-risk customers are the ones a company wants to keep. This segment typically represents the 10 to 20 per cent of customers who create 50 to 80 per cent of a company's profits. A company would not want to lose these customers, and the strategic initiative for the segment is obviously retention. A low-profit, high-value, and low-risk customer segment is also an attractive one, and the obvious goal here would be to increase profitability for this segment. Cross-selling (selling new products) and up-selling (selling more of what customers currently buy) to this segment are the choices for marketing initiatives.

Within behavioural segments, a business may create demographic subsegments. Customer demographic data does not typically correlate to customer shareholder value, which is why you do not use it together with behavioural data to create segments. However, demographic segmenting can steer marketers into selecting appropriate advertising, marketing channels, and campaigns to satisfy the strategic behavioural segment initiatives.

For example, imagine a bank with a high-profit and a low-profit behavioural customer segment, both of which have a demographic subsegment of young-family, high-income professionals. The marketer would want to ask the following question: Why do these similar demographic segments behave differently, and how do I turn the low-profit group into a high-profit group? It is difficult if not impossible to answer why, but data mining provides an answer to the how. Affinity analysis may reveal that the high-profit group of young, wealthy professionals has a distinct product pattern—mortgages, mutual funds, and credit cards. The low-profit group may have a product pattern that partially fills that of the high-profit group—mutual funds and credit cards. The marketing campaign to increase the profitability of the low-profit segment would thus be to market mortgages to them.

Thus, behavioural clustering and segmentation help derive strategic marketing initiatives by using the variables that determine customer shareholder value. By conducting demographic clustering and segmentation within the behavioural segments, you can define tactical marketing campaigns and select the appropriate marketing channel and advertising for the tactical campaign. It is then possible to target those customers most likely to exhibit the desired behaviour (such as buying a mortgage product, in our bank example) by creating predictive models.

Data mining can be applied to deal with huge customer data. With the results of data mining, one can slice and dice the customer data. Table 7.3 provides the data mining solutions for customer management.

TABLE

DATA MINING SOLUTIONS AND CUSTOMER MANAGEMENT

Data mining task	*Algorithms*	*Business problem*
Classification	Decision trees, Neural network, K-Nearest Neighbour.	Which segments do the customers belong to?
Associations and affinity grouping	Association rule induction.	What-if analysis
Clustering	Decision trees, K-Nearest Neighbour, Neural networks.	What are some valid ways to segment customers?
Description	Association rule induction, OLAP.	Which variables are important in determining an outcome

7.7 CRM and Workflow Automation

CRM consists of recording and making available all information pertaining to your customers and using it for effective customer satisfaction. There should be a smooth flow of information from the customer to your organization. This information should be stored in such a way that it is accessible to all concerned people, such as the sales executive, area sales manager, all the way up to the CEO. This makes CRM one of the most critical components of workflow within your organization. It centres around a knowledge base that captures all the customer information.

The information captured contains details on customers at various stages of the customer relationship—suspects, prospects, current and old customers. For each customer, information like the key contacts in the organization, decision makers and their buying cycles, as well as information on each contact is maintained. Basically, all case histories should be easily available. Figure 7.11 shows how a company's products reach the customers, and the intermediate stages.

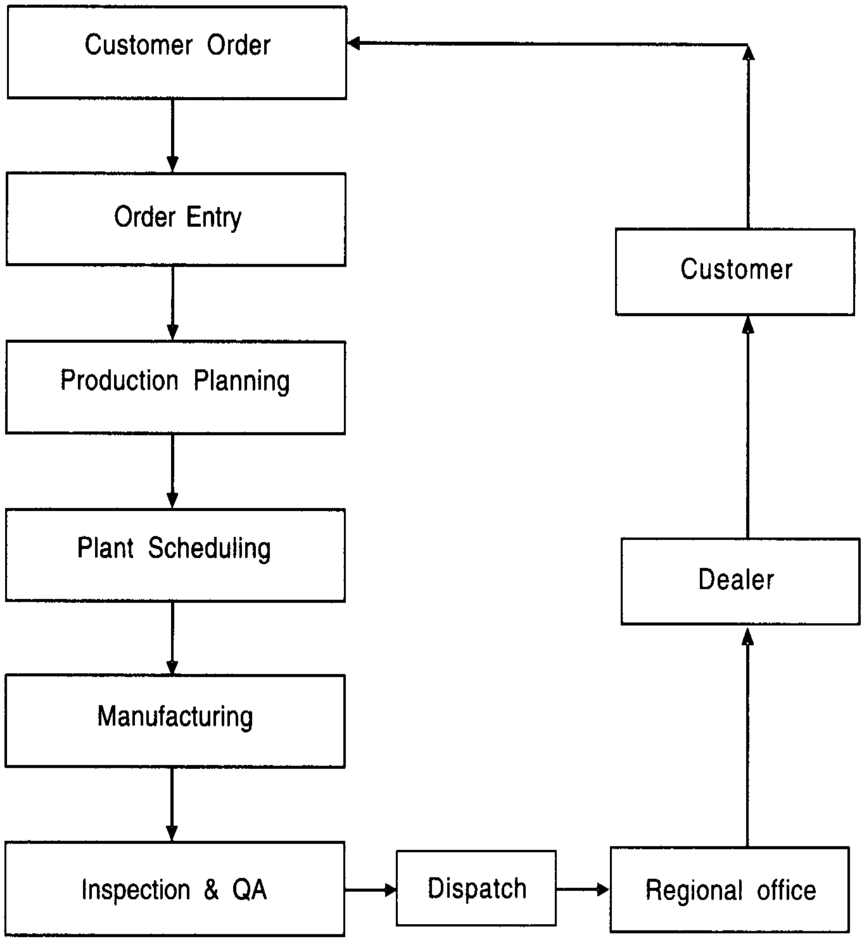


Fig. 7.11 Workflow for order fulfillment.

Advanced Planning and Scheduling implies organizing, forecasting and implementing the workflow.

7.8 Customer Relationship Management System for a Bank

The scope of Customer Relationship Management System (CRMS) is;

1. Creation of a Web intranet site to manage content and provide a platform for sharing information.
2. Creation of a self-managed cross-functional team.
3. High employee satisfaction.
4. Higher productivity.

CRMS is a tool to help grow the bank's Wealth Management business, better manage the enterprise around customer behaviours and develop products and services to attract, satisfy and retain current and potential customers.

Sources of Data for a CRMS

Almost all facilities are granted to customers based on a detailed understanding of their current circumstances.

• **Applications forms** are the primary source of generating information „ I.

• Call centre is another important source of data, especially during marketing campaigns Sales force is yet another critical form of generating data fl t'.

• **Group offices** also refer data, when requested

• **Existing customer database** is yet another reliable source *f.*

• **Market research** is performed from time to time

• Tools like **CRMS** help in analyzing customer data.

What is Customer Relationship Management in a Bank?

It is a business strategy that aims to understand, anticipate and manage the needs of an organization's current and potential customers.

It is a strategic, process, organizational and technical change, whereby a company seeks to better manage its own enterprise around customer behaviours.

Simply put, it involves four major drivers:

• *Prospecting* by identifying the 'best' prospective customers

• *Acquisition* by attracting them to become customers

• *Cross-Sell/Up-Sell* and build *Loyalty* by doing more and the right kind of business with them

• *Retention* by keeping them as long as possible, that is, win back and save you customers

Customer Relationship Management is known by different names like 'Total Customer Care', 'Customer Value Management', although globally it is better known by its acronym 'CRM'

7.9 Summary

The customer relationship management is crucial for the success of any organization. This chapter begins with the discussion of the importance of CRM in traditional and e-commerce based business environments. Information about the maintenance of information about the customers and the tools kits available to manage customer relationships are given in detail.

EXERCISES

1. Describe the typical profile of the Internet users.

2. Describe the purchasing decision-making process on the Web.

3. Explain the concept of customer loyalty and how to increase it using the Web.

4. Enter *amazon.com* and identify all customer services provided for free.

5. Go over a market research website, such as *www.acmelsen.com,* and discuss what might motivate a consumer to provide answers to your queries.

6. Surf *www.e-land.com* and list the types of consumer information you can collect from the site.

7. Enter *www.firefly.net* and share your experiences about how the information you provide might be used by the company for marketing a specific domain.

8. Access the Indian Railways site *indianrail.gov.in* and look at all the customer focus the site has.

9. After navigating the naukri.com site, suggest ways to improve customer service for this site.

8. E-Supply Chain Management

In this Chapter we will discuss

- What is supply chain
- The concept of e-scm
- Advantages of e-scm
- Trends in e-scm

Structure of the chapter

8.1 Introduction

E-commerce is slowly affecting the distribution channels through which consumers and businesses have traditionally bought and sold goods and services. The online channel provides sellers with the ability to reach a global audience and operate with minimal infrastructure, reduced overheads, and greater economies of scale, while providing consumers with a broad selection and unparalleled convenience. As a result, a growing number of consumers do business transactions on the Web, such as buying products, trading securities, paying bills, and purchasing airline tickets. Essentially, e-commerce is all about the transactional business process of selling and buying via the Internet. E-Supply Chain refers in particular to the management of supply chain, using the Internet technologies.

Communication is in real time and data can be integrated with back office systems, reducing paperwork. Using the Web to eliminate paper transactions can generate substantial savings of cost and time. It facilitates the removal of purchase orders, delivery confirmations, bills of material and invoices. The switch away from paper can also speed up response and improve communications with those in different time zones or who work outside normal office hours, such as a customer's night shift supervisor. Another significant potential benefit is a reduction in the errors associated with activities such as re-keying data, receiving orders by telephone calls and handwritten faxes.

The Web permits improvements in both procurement and fulfillment, particularly in terms of stock availability and on-time delivery. Visibility throughout the entire supply must be completely transparent to achieve full customer satisfaction and leverage the full benefits of e-logistics. This is achieved through the movement of information in tandem with goods and services. Customers thus have complete real-time consignment status information ova the Web, while suppliers and delivery companies can save on the staff time previous!) devoted to answering queries on order status. This is an essential difference between 'old economy' and 'new economy' logistics. The challenges posed by greater inventory pipeline visibility are not just technical in nature, they also include issues concerning openness and partnership relations. Collaboration is necessary for more precise forecasting, scheduling am resource planning.

At the warehouse and distribution level, facilities must provide inventory control at the individual shipment or even item level. Distribution and warehouse centers must have the flexibility to meet the diverse requirements of customers. This need for flexibility and adaptability is further driven by new forms of international competition, increasing levels of globalization that mean ever-changing customer requirements. Again, inventory visibility and information transparency in the e-logistics system are the keys to success, e-logistics also improves the delivery of goods and services at reduced cost through development of methods for supply chain management, including advances in data management, and increasingly sophisticated planning and scheduling systems.

Just in Time (JIT) production has been around for decades but traditionally has mainly been used when supplying a relatively small number of customers. Information Technology now makes it possible to overcome the administrative problems associated with building large numbers of individual orders on a JIT basis. In some sectors, this will facilitate a move towards the system, epitomized by Dell, of building products to order, in a high volume plant, and shipping them direct to the end user. Real value emerges from the combination of the e-logistics system with other information technology-based processes such as MRP or ERP, and market information and customer data systems. In addition, the integration of a company's computerized Management Information Systems with its logistics software and data facilitates the analysis of buying and selling patterns to serve customers better and cut costs.

The amalgamation of supply chain management and customer relationship management can radically improve competitiveness. Cost reductions and customer service enhancements occur in conjunction with each other, rather than being mutually exclusive as assumed in 'old economy' strategic thinking. The objective of the right product in the right place at the right time and cost is accommodated to a greater extent than previously possible.

E-logistics enables organizations to see the big picture by capturing and sifting through data for procurement and fulfillment. Ultimately, management of the entire supply chain is e-enabled, and logistics-generated data can feedback into strategic and tactical decisions made by other parts of the organization. The Internet ultimately provides access to true rather than forecasted supply and demand information. E-logistics also permits a closer integration of a company's internal business systems with collaborative information from partners and Web-based functions and information. In essence, e-logistics represents the foundation for improved business processes, allowing for real-time visibility, seamless channel linkage and collaborative solutions in the supply chain.

Give customers what they want, when and how they want it, at the lowest cost

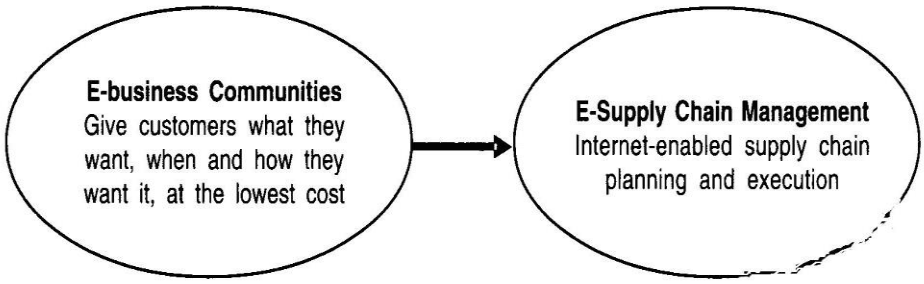


Fig. 8.1 E-SCM—value proposition.

E-business communities can target new markets by offering low entry costs, relatively minimal complexity with more flexibility and a convenient way of transacting business. The trend of outsourcing and strategic alliances in most industries provides an added impetus to support the sharing of supplier, customer, and corporate information, that was once proprietary with competitors and other cross-industry players. Businesses today are finding themselves in an environment in which unprecedented information-sharing among all participants is driving fundamental changes in the interactions, business practices, and operations of everyone' involved (see Figure 8.1).

One needs only to consider the recent collaboration between the "big three" auto makers in the USA in launching the automotive network exchange (ANX), to further understand the impending effects of electronic business communities. ANX will establish a standard method for parts suppliers to communicate with and obtain order information from the auto' manufacturers. The potential result will be a lower cost structure for the entire auto industry, in which all participants will benefit. At the same time, such benefits will greatly modify the competitive strategies and interactions among all participants. It is a Web-based relationship in the supply chain. The growth of Web-based e-commerce has generated a number of approaches for creating a model of how it impacts business.

Business partners and customers connect together through the Internet to participate in commercial trading and participate in communications and interaction. Each of these areas has a set of strategic activities and issues. Opportunities for creating values occur in each of these. Compared to logistics, the discipline it developed from. Supply Chain Management (SCM) is a relatively new term. While overall logistical concepts have been around for many centuries, SCM did not make its appearance in the literature until the last decade. For a long time, logistics was a concept limited to the military sector, and it is only since the middle of the 20th century that logistics has come to be accepted in the business sector. Today, SCM may be described as the integrated management approach for planning and controlling the flow of materials from suppliers, through the distribution channel, to the end user. Compared to the internal focus of traditional logistic approaches, SCM emphasizes the management of upstream and downstream relationships and the role of supply chain optimization in increasing customer value at a lower cost.

8.2 Supply Chain

Supply chain is a process umbrella under which products are created and delivered to customers. From a structural standpoint, a supply chain refers to the complex network of relationships that organizations maintain with trading partners to source, manufacture and deliver products.

The organizational process of making the product and selling it stands between the supply markets and the customer markets. In the old way of doing things, the following seven processes were not integrated:

1. Procurement planning
2. Production planning
3. Demand planning
4. Inbound logistics
5. Capacity utilization
6. Distribution of products
7. Customer service

Because these seven processes were not integrated, they are shown as separate processes in Figure 8.2.

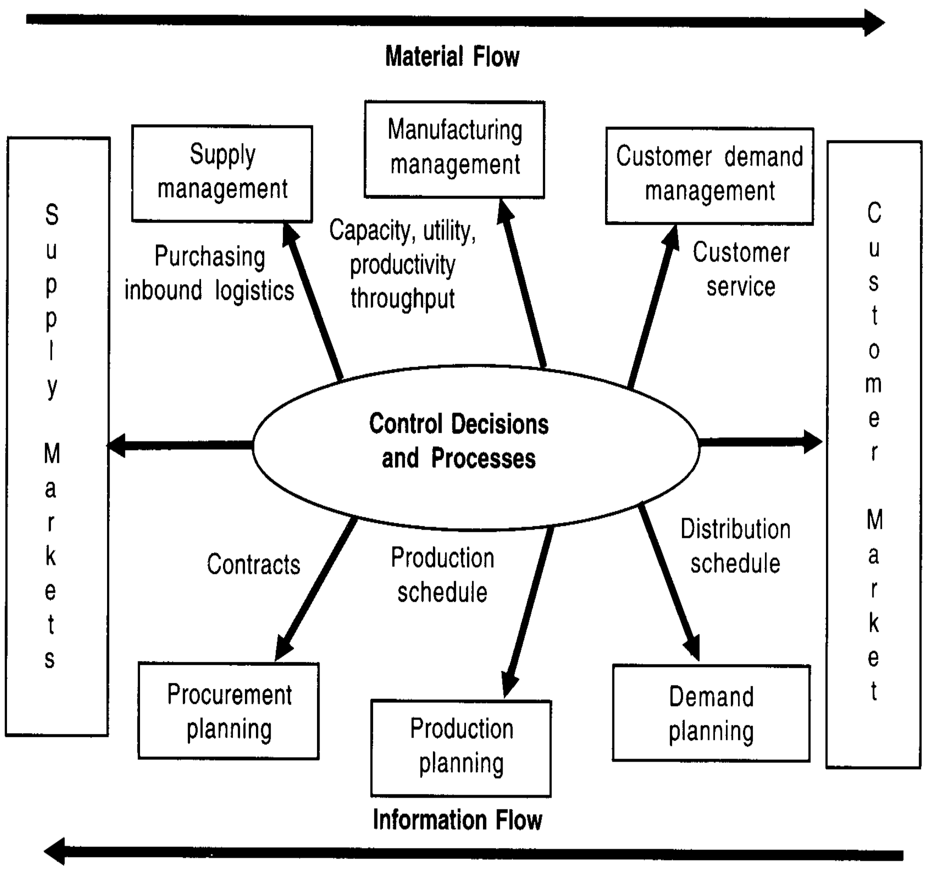


Fig. 8.2 The old way of managing supply and information flow.

The New Way

The flow of materials and information through a business, from the initial purchasing function through the operation and eventually to the customers, is known as the supply chain.

The concept of SCM is a holistic view of coordinating functions that transfer data and material resources from the suppliers to consumers in the finished form to make the process efficient and cost effective. The importance of e-commerce to manufacturing and distribution is undoubtedly a part of SCM. If high speed, low cost, communication and collaboration with customers and suppliers are critical success factors for effective SCM, then the e-chain is the future. Let us visualize the new way of managing the supply chain as in Figure 8.3.

The very essence of SCM is its effective collaboration throughout a network of customers and suppliers. The potentials in productivity, cost reduction and customer service are enormous. Of course, the benefits are based on effectively employing e-commerce, which makes information quality an even higher priority than before. Providing the right amount of relevant information to those who need to know it when they need to know it is in fact an effective supply chain management from an information point of view.

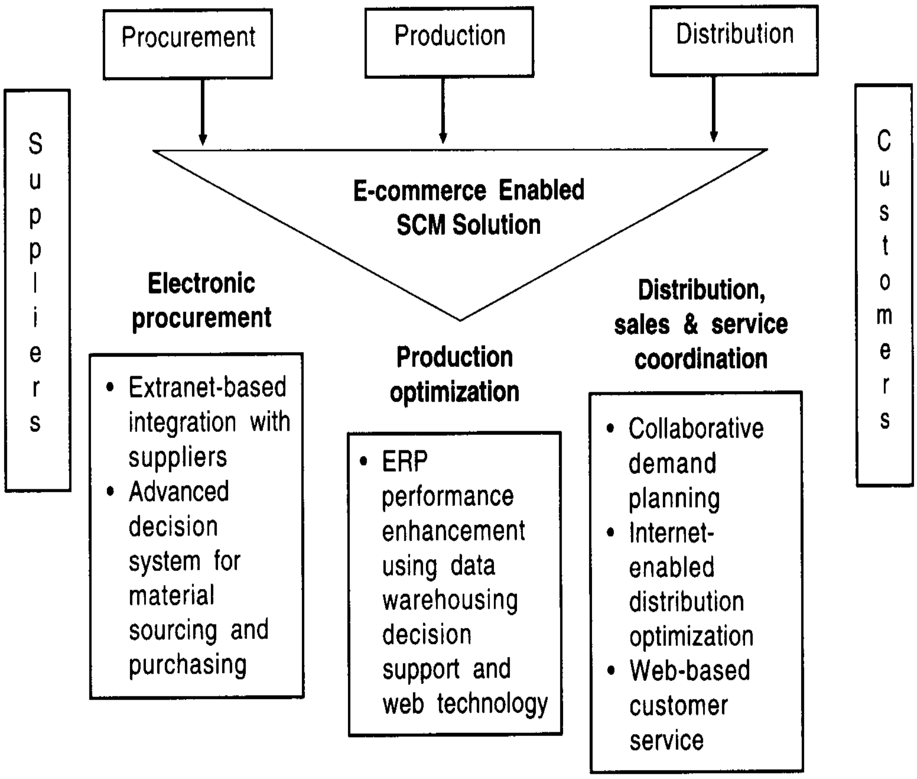


Fig. 8.3 The new way of managing supply chain.

Good supply chain practitioners know that information should be passed on only to those who need to know it, and in the form in which they should receive the information. For example, demand information, inventory positions, order-fulfillment, supply management and a whole host of other information exchange activities will change how we sell products, supply products, and make and receive payments for goods and services. The e-supply chain will have customers and suppliers seamlessly linked together, throughout the world, exchanging information almost instantly. The velocity of relevant information flow will be so fast that responding to the inevitable changes in expected vs actual customer demand will allow faster changes in the actual material flow.

Fast access to relevant supply chain information can pay-off handsomely at a Iowa cost, less inventory, higher quality decision-making, shorter cycle times and better customer service. One of the biggest cost savings is in the overheads associated with lots of paperwork and its inherent redundancies. The non-value added time of manual transaction processing could instead be focused on higher revenue creation activities without proportional increases in expense. For example, a customer's purchase order instantly becomes the supplier's sales order, which then results in packing, shipping and subsequently, an invoice.

The result in cycle time compression, lower inventories, decision-making quality, reduced overhead costs among other benefits, makes e-chain processing a highly desirable Wet application. Supply chain processes can now be more streamlined and efficient than was even thought of just a few years ago. For many companies, more effective supply chain management is where the profit and competitive advantages will emerge.

Federal Express *(http://www.fedex.com)* and UPS *(http://www.ups.com)* offer product tracking information to customers. The "business-to-business" space includes the myriad upstream and downstream transactions that can enhance channel coordination and customer relationships. JC Penny *(www.jcpenny.com)* shares packing, shipping, inventory and product movement with suppliers. Philips Petroleum *(www.phillipsbb.com)* shares product movement trends and forecasts with pipeline partners. In this case, the "marketspace" involves the company, its partners and its customers, and provides the opportunities for supplier customer. The Web enables all suppliers in a supply chain to identify and coordinate data transfers with each other. Research laboratories, pharmaceutical distributors and end-users, for example, can all swap information on new product developments, specific diseases and treatments within these settings.

It is proposed that, with marketspace reconfiguring the traditional value proposition, Supply Chain Management needs to manage the organizational complexity of adopting a dynamic mix and emphasis between content, context and infrastructure. This ability to focus on one layer of value creation has enabled organizations, such as AOL and *lastminute.com* to be far more innovative. Shifts towards virtual organizational architecture focusses on the importance of knowledge and intellect in creating value. By the creation of organizational integration mechanisms on the Internet, such as discussion groups. Web forums and video conferencing, virtual multi-functional teams become enablers of the three independent vectors. The process of innovation, with the adoption of an integrated approach throughout the supply chain, requires a trade-off between autonomy and control, of which the balance decided upon is unique to partner relationships.

The organizational challenge of reaching an acceptable balance between autonomy and control is probably best achieved by the idea of subtle control. The "players" must have access to a wide range of external technological services, such as the Internet and other complementary online networks, in order to operate effectively. They must have access to electronic capabilities using fiber optics, high-speed digital switches, satellite downlinks and compatible EDI ensuring reliable, efficient information flows among suppliers, manufacturers, and distributors while protecting proprietary data. Shared resources, such as harmonized electronic transfer across transportation modes and onsite education and training facilities will also help companies improve their SCM in the emerging marketspace. Even small and medium-sized enterprises now increasingly rely on international networks of suppliers, distributors and customers, frequently via the Internet, to improve their global competitiveness by reducing fixed and operating costs.

Individualization of both product and process driven innovation requires high levels of organizational integration in being able to respond to market demands. Integration along the supply chain in the virtual market can be viewed as being a mix of both formal and loose integration mechanisms, similar to the Internet infrastructure. A common theme which is identified as important to organizations in the development of creativity and innovation, is the relevance of both technological and organizational integration.

Three types of 'Nets' are used to support the e-supply chain. One of them is the Intranet. An Intranet is an internal network maintained within the boundaries of a company. The second type of Net is the Extranet, which connects participating companies, be they customers or suppliers. Here, a customer could have access to the ERP system to know, for instance, his order status, while the supplier could access inventory data to support the automatic replenishment process. The third type of Net is the Internet, which is open to the general public. Using the Internet, a company could publicize its products/services and also accept online orders from its customers.

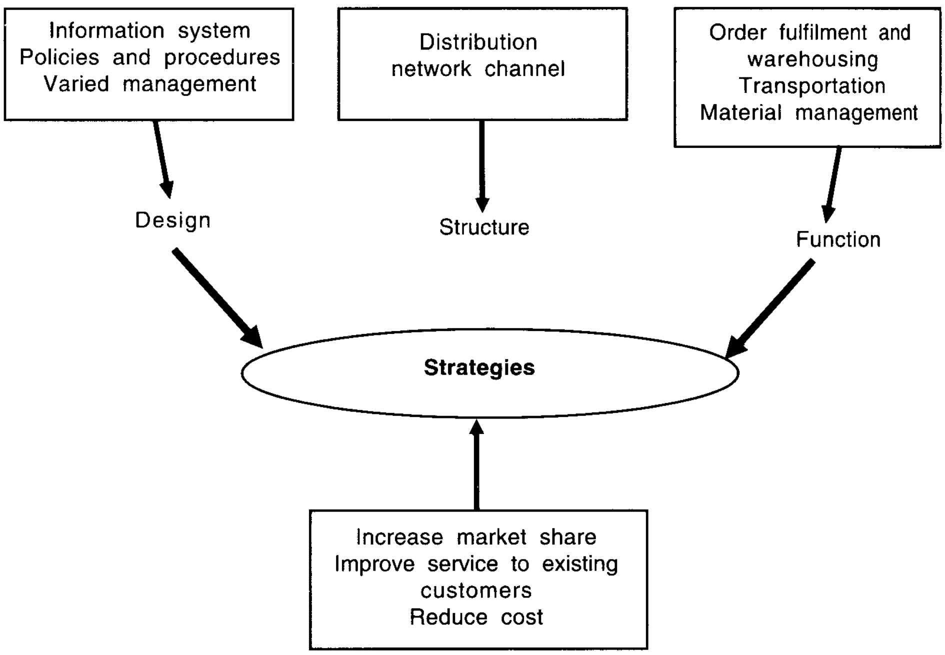


Fig. 8.4 Objectives of supply chain management.

SCM systems will be substantially altered in terms of strategy, process, and system. Mistakes here could prove very costly in the near and longer terms. E-commerce has and will continue to redefine how companies will compete for customers. While e-commerce offers some exciting opportunities to improve SCM effectiveness by lowering the costs and increasing the speed of order-to-delivery, it is by no means the first stop on the right path to having highly competitive e-supply chain capabilities.

Before taking a big leap into the e-supply chain, companies need to know why they are taking the leap. They need to fulfill the objectives of SCM as illustrated in Figure 8.4. B) no means should any company perform the common leap into the latest technology without getting thorough and appropriate answers to questions such as the following:

1. What business opportunities are available for us to improve market presence, sales, cost of operation, service, communication, cycle time, supply-base management, and so on?

2. Do we know and understand our supply chain priorities?

3. How should we structure Web-enabled linkages with our customers and suppliers for pre-eminent supply chain performance?

4. What e-supply chain approaches can we appropriately invest in for near and longerterm business performance gains?

5. Do we have an executive-level champion providing the necessary linkage to top management for effective implementation of e-supply chain management?

6. Have we carefully defined an action plan for pre-implementation preparation activities?

7. What are the missing technical links in our current system or our choice of software?

8. What planning and implementation tasks will be accomplished and when?

9. Do we understand the real benefits of an e-supply chain versus the cost to develop?

10. What e-supply chain strategy will give us the leverage to transform ourselves into marketplace leaders?

Undoubtedly, spending time in the upfront strategy development to improve order-to-delivery cycle and supply chain management will pay big dividends. The hard part is the prerequisite tasks of discovering and thinking through supply chain opportunities and then developing a strategy and plan for an e-supply chain that will improve a company's performance more than its competitors. But without an e-supply chain roadmap, the direction taken may not take the company to its desired destination. The biggest loss of missing the target can never be regained. It is essential to do it right the first time.

In these days of ERP, information technology and other high-tech systems, the tips presented here may seem too simple. These things are simpler to talk about than to actually execute. But put into effect, their pay off can be tremendous.

E-logistics of UPS

United Parcel Service has introduced UPS e-logistics, a provider of integrated, end-to-end supply chain management packages for e-business. UPS e-logistics is marrying the expertise of its partners Oracle, Price Water house Coopers and EXE Technologies with its global fulfillment and distribution network, information technology infrastructure and logistics expertise of the UPS Logistics Group, to offer a complete range of services to manage the back-end of the e-business supply chain.

The company's services include warehousing and inventory management, order fulfillment, inbound and outbound transportation, returns management, customer call centre and management reporting. UPS e-logistics said that the pre-built services are standardized, can be bundled and configured, and are scalable for future growth.

UPS e-logistics serve both business-to-business and business-to-consumer e-commerce clients, ranging from e-business start-ups to the dot-corn divisions of established corporations. Nearly a year in the making, it is the first business to be launched by the UPS e-ventures incubator.

Partners Price Water house Coopers provides overall systems integration consulting and project management services; software maker Oracle Corp. offers full enterprise resource planning with integral order management and advanced planning and scheduling functionality. EXE Technologies, a leading provider of multi-channel fulfillment, warehouse and distribution software, provides warehouse management systems at all UPS e-logistics distribution centers. United Parcel Service is extending its reach to services traditionally performed by distributors and integrators: logistics fulfillment, call centre support and website development and implementation. And the delivery giant's move could pave the way for other carriers, such as Federal Express, DHL and Airborne Express, to enter or boost their presence in this spa down the road.

Supply Chain Management—It Is All About Fulfilling Customer Needs

Supply Chain Management covers all aspects of a business. From the stage of raw mater to the end user, each and every aspect of the cycle is covered by the management system be it sourcing, product design, production planning, order processing, inventory management transportation and warehousing, and customer service. This complex sequence of steps us to be very difficult to manage efficiently and in the days when organizations have to fight hard to maintain their bottom-line, optimizing these steps become a necessity.

While you enter a store to buy a certain material, just try to imagine the sequence of steps that had brought the material where you see it. On the material, you will find a price tag with all the details of its date of manufacture, date of expiry, lot number, etc. The shop that you have entered has carefully placed it on the shelf after procuring it from a distributor and noting all these details for billing and tracking future complaints. The store also maintains an inventory of this material and hundreds of similar materials that are available in the store and along with this a minimum stock level and a reorder level. This product, like all other products in the store, has been sourced from a distributor who sourced it from the manufacturer. The manufacturer had procured the raw materials required for the production from one or many of his suppliers. A third-party transport and warehousing infrastructure was utilized to ship the material from the manufacturer to the distributor and from the distributor to *the* store that you have just entered.

After your purchase is complete, the point-of-sale updates this information at various places—the stock level comes down and revenue increases. The information of decrease stock level should reach the distributor who has to replenish the stock before it becomes zero and the distributor is also to be paid his due amount. This chain is again pushed backwards to the lowest level of the supplier who has to supply the material in time. So, there is constant flow of money and material between these establishments in order to satisfy the needs of the customer.

The Supply Chain Management manages the flow between different stages to maximize productivity and minimize stock-outs or overstocking. The solution spans across the different companies involved, and the system used by these companies should be able to talk to each other and understand each other's requirement. An SCM system is a combination of many applications—demand, inventory and transportation planning—covering the stages of the supply chain. The increase in product variety and demand for customized products increases demand uncertainty, making it difficult to forecast demand, which is further aggravated by the ever-shortening life cycle of products—this has made supply chain management an inseparable part of today's business.

Smart Chains, Smarter Gains

An efficient supply chain management can bring down the prices of commodities by as high as 40 per cent. This is not with the help of a budget sop, but by reducing average inventory levels, lowering transport costs, lowering warehousing costs—among others. Children will be excited on having *Maggi* at Rs 6 against the prevalent price of Rs 10.

Industry estimates show that a company spends between 17 per cent and 50 per cent of the price for just moving the goods from their manufacturing plant to shop shelves. This includes the margin of the retailer and of the distributors. Most of it is taken up by logistics and holding inventory, and these costs can be controlled, optimized and reduced, thus reducing price or increasing profit.

Now if we can practically apply this model on a Rs 50,000 crore FMCG company with thousands of wholesalers and retailers, the result will be mind boggling. This will not only give the company a cost benefit but also will also result in improved customer service levels, improved competitiveness and an overall gain in profitability for the organization.

Managing logistics is a nightmare for all company executives in the sales and purchase departments. Handling logistics not only adds cost to the business but also increases the number of business processes and involves lot of resources. The logistics chain starts from the supplier end, and continues to the customer end involving members in surface, air, sea express couriers, brokers, customs, excise, etc. This is for the sales part. Later it will also include similar contacts for the after sales support, repair and maintenance. Many of the companies cannot take up this load and outsource these activities to experts, and many companies manage this efficiently and make huge profits.

Technology in logistics has been advancing in three phases. The first phase is to monitor the logistics chain. Herein, technology helps companies monitor orders, inventory and shipments with all parties. Since logistics is a business a process at the most basic level, IT is used to automate the process to gain visibility. This is primarily done through an enterprise-wide software developed in-house or procured from the solutions already available. Companies like Blue Dart, an integrated air express carrier, use an in-house developed package called COSMAT-II (Computerized Online System for Monitoring and Tracking). They started using this software way back in 1989 when very few standard solutions were available, and have improved it all through these years with the changing needs of business.

Gati, another Indian pioneer multimodal express cargo company, also uses an in-house system that links their various processes in the logistics chain. Over the years, they have included features like vehicle monitoring system. Web-enabled access to various applications, etc. The Lemuir group has further included warehousing, transportation and distribution system with full visibility of the processes. They found it very useful as they could adapt to any internal or external changes or requirements within hours.

The second phase of maturing technology adoption focusses on management capabilities in which the technology must provide the data and intelligence gathering tools necessary to manage the flow of goods and establish business rules to manage exceptions. More evolved technology backbones like GeoVista of the Geo-Logistics group are capable of handling high levels of sophistication.

The final phase of technology in logistics is that of optimization, wherein discrete parts of the chain as well as the entire chain is mathematically optimized to suggest actions which will lead to achievement of preset objectives within constraints. Specialized SCM tools like i2 and Manugistics help in achieving this.

The Indian logistics industries are still immature and yet to adopt the full potential brought about by the supply chain management solutions, as most of the companies have trucking and transportation background plus these are quite expensive taking into consideration the multi-location setup.

Developing software in-house is also a resource-intensive work that involves lot of time. The Internet has helped companies to adopt an SCM solution by lowering communication cost, creating VPNs, intranets and making applications available through Web-enablement. It has also simplified the technical complexity of spreading IT across the multiple-entity of the logistics chain.

Many companies have further improved their SCM by partnering with high-traffic e-commerce sites to fulfill their delivery chain. Blue Dart, for example, will help Fabmart customers to view their order status by providing a link on the Fabmart site and taking him to the Blue Dart site where the dispatch information is located. Customers are more informed now than ever about where their shipment is lying.

AFL effectively uses a Personal Digital Assistant (PDA)—based airway bill scanning and data capturing system for pick-up and delivery, that has reduced the data entry, resulting in cutting down customer response time and improved customer services. The location master is downloaded from the desktop computer to a PDA integrated with a barcode scanner everyday. This contains a setup of the route with relevant customer information for delivery. For the pickup process, the airway bill is scanned and the customer's signature is captured on the PDA. The airway bill is scanned at each stage—handover, arrival and final delivery. All this is then downloaded on to the desktop, which synchronizes with the enterprise system. Use of GPS (Global Positioning System) is also increasing. Global positioning system help pinpoint the location of a moving target and then with the help of a GSM network, transmit the information to the required location.

It is no surprise that some top FMCG companies like Nestle, P&G have tied up with logistics companies like TCIL, Concor in an initiative called an Efficient Customer Response(ECR), with a one-point mission to clean-up India's supply chain.

Supply Chain Management in Wal-Mart World

Wal-Mart is an ultimate example of Supply Chain Management implementation. Here, vendor have joined hands with Wal-Mart to establish a strong supply chain management that would maximize Wal-mart's internal profits.

Wal-Mart, starting with P&G, has incorporated vendor-managed inventory, category management, and other inter-company innovations. In order to build this strong SCM infrastructure, Wal-Mart entered into an alliance with P&G and in return got a dedicated account team representing key P&G functions of sales/marketing, distribution/supply chain management, IT and Finance. P&G had one Vice President dedicated for this project, who made the CFO of Wal-Mart as his customer. Customer value maximization was their only drive. Over the past decade, Wal-Mart has invited more of its major suppliers to jointly develop powerful supply chain partnerships. These are designed to increase product flow efficiency and, consequently, Wal-Mart's profitability.

Top managers have learned how to integrate their supply chains with major customers like Wal-Mart. What most companies have not sorted through, however, is what to do with all of their other customers. A common answer to the question of how to structure relationships with other customers is to try to apply the Wal-Mart relationship to all customers. This approach is implicit in commonly shown PowerPoint slides that offer a view of a company's evolving supply chain role. In one version of this view, the company starts as a stable supplier, evolves into a reactive supplier, then an efficient reactive supplier, then an efficient proactive supplier, and finally becomes a revenue and margin driver. This seems logical, with the company's supply chain capabilities inexorably increasing in sophistication over time, enabling the company to develop even more effective integration with its customers.

The problem, however, is that developing Wal-Mart-like supply chain partnerships requires a lot of resources and management attention. It also requires willing, innovative partners. Pursuing this approach too widely would be both costly and frustrating. In the past, suppliers to the retail trade typically had rather monolithic supply chains. The order fulfillment process was designed with a "one size fits all" approach. Customers generally received the same list price, regardless of ordering efficiency. There was very little effective forecasting. Some inventory priority was given to major customers in the event of allocations. Products were delivered in the manner that customers requested, regardless of the inefficiency entailed.

But today, the retailers themselves are changing dramatically. There is very visible consolidation, with the top ten retailers expected to comprise about half of the industry's revenues in a few years. Retailers have very different degrees of willingness to innovate, and the innovators are growing fast. Most retailers were used to having significant buyer power, and many are still very focused on exerting price pressure on their suppliers rather than seeking increased profitability through process innovations. At the same time, the leading retailers are consolidating their supplier bases. They are looking more and more to major suppliers for supply chain innovations and prioritization, and in return, they are giving them increasing shelf space.

As a result of this history, major retail suppliers find themselves stretched. They are forced to meet the increasing needs of their largest customers while they are devoting disproportionate resources to their smaller customers. This untenable situation is forcing major suppliers to rethink their account relationships and extended supply chains. The key to providing excellent, consistent service at a reasonable cost is service differentiation. This concept can be adapted to guide the development of an appropriate set of broader supply chain policies. It is essential for successful profitability management, because it enables a supplier to match its cost structure and innovation initiatives to account potential. Service differentiation is also good for the customers. It enables them to plan their operations around a very high and consistent level of service. However, it does require that customers establish well-disciplined operations, as the supplier should adhere to a specific set of agreed-upon processes.

What Happens at Dell?

An outstanding example of e-supply chain is the one in force at Dell Computers, the US-based PC manufacturer. The company publicizes its products through the Internet. Any customer can order a PC of a configuration of his choice and pay for it online, using his credit card. Once the order is registered, the e-supply chain takes control of the execution. The system triggers three actions simultaneously—one to Dell's suppliers in Taiwan for providing parts, second to its assembly shop in Singapore, and third to its courier company, with all the data being transferred through the extranet. The intranet takes care of intend transactions relating to realization of collections from customers and effecting payments to the suppliers/service providers. Dell's success lies in reducing costs and improving customs satisfaction. Figures 8.5 and 8.6 explain how the model for supply chain operates.

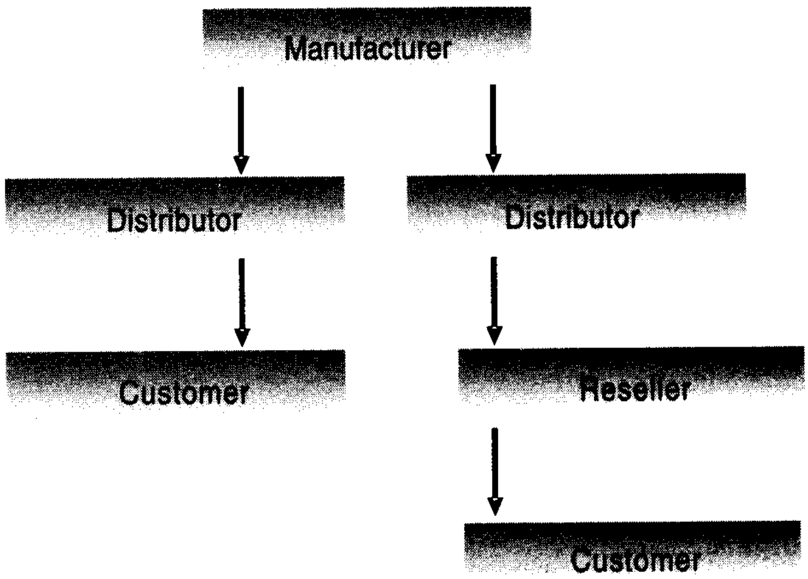


Fig. 8.5 Industry model for supply chain.

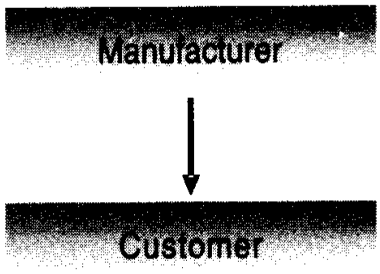


Fig. 8.6 Dell model for supply chain management.

The Pay-off

Every company aims at reducing costs and cycle time and increasing revenue. E-supply chain supports these objectives. Companies find that enterprise integration leads to a new level of relationship, be it with its customers or suppliers. Customers can quite literally check the status of their orders, and suppliers can gain access to inventory levels to find out weather they need to replenish stock, all through the extranet. The benefits of reduced cycle time provide measurable competitive advantage in terms of both cost and performance. When we speak of cycle time, we refer to the time it takes to react to a new demand from the customers. The faster we move a critical data through the Internet, the quicker we can react and deliver the end product to the customer. This leads to enhanced customer satisfaction and promotes revenue growth.

8.3 Seven Ways to Reduce Inventory

How much inventory does he need to run a business effectively, is a perpetual concern of every manager. If he has too much, he may find himself confronted with cash-flow problems; if too little, he runs the risk of customers accusing him of poor service. So what is the way out? Here are seven tips that can help him strike the right balance.

1. ***Improve data accuracy.*** Introduce a well-designed cycle counting system. It will help you know how much of inventory to have and where you are. A well-designed and implemented cycle counting system pays for itself within a short time.

2. ***Cut your lead-time.*** If lead-time is long, you cannot but have more inventories in your system. Think of a 'rush' order in one week for a valued customer. The rush order does not wait in the long queue of WIP (Work-in-Progress) inventory for something to happen.

3. ***Increase the velocity of your operation.*** The amount of inventory you have has a lot to do with how fast you can replace it. If for instance, you can replace the same item in one day, a two-day supply will be more than enough to fill any order and, a stock out—if it occurs—will be for only one day, not until the next batch is produced. On the other hand, if it takes six weeks to replace an item, you will need to re-order with at least six weeks (plus safety stock and 'Just in Case' inventory) supply or be at the risk of a stock out.

4. ***Eliminate misalignment from your process.*** It is not unusual for companies to buy raw material in thousands, produce product in hundreds, and sell in units. The result is the piling up of inventory that runs the risk of slow movement, obsolescence and damage, and tie up of valuable cash. 'Just in time' techniques are aimed at eliminating such misalignments.

5. ***Clean your attic.*** There are companies, which carry an item that typically may be ordered once a year, if at all. Some companies may keep an item in the fond hope that someone will buy it some day or other, or hold on to an item because too much of money was spent on it. The answer to all this is simple: liquidate, donate or have a sale.

6. ***Eliminate variation.*** Erratic vendors may have product quality related problems on the shop floor, which can cause unnecessary inventory to pile up. The typical way *of* dealing with such situations is to order early, order more than needed, and increase safety stocks throughout the system.

7. *Replenish based on market demand.* Forecasts may seem advantageous but it must be remembered that many are no more than informed guesses. Using market demand as reference for replenishing finished goods is a better approach to keep your inventory level aligned with what customers are actually buying.

E-SCM Provides "Real-time" Benefits

E-SCM is being transformed by the rapid growth of Internet-based communications. The movement to Internet-based communications represents a paradigm shift from the client server model. The power of Web-based applications is their ability to allow people to communicate mission-critical, real-time information anywhere in the world instantaneously. This migration has precipitated the widespread adoption of Internet software applications utilizing the latest technology to fulfill these new and complex communication needs. As these applications emerge, their immediate and measurable benefit make them essential business tools. With the increasingly competitive business landscape, it has become a strategic necessity to optimize a company's supply chain in a fashion that leverages the potential of the Internet. Some of these are:

- Global trading capabilities
- Mass personalization and customization
- Global knowledge exchange
- Global communities
- Collaborative workflow
- Industry specific (vertical) marketplaces
- Horizontal marketplaces
- Enterprise-to-Enterprise connectivity
- E-marketplace-to-E-marketplace connectivity

E-SCM—The Strategic Advantage

Rapid Deployment and Scalability

The e-SCM suite of applications is based on an "open" Internet Application Architecture that provides enterprise-wide scalability and rapid deployment to numerous end-users.

Real-time Processing

E-SCM creates an open, integrated system that addresses the complex e-business and supply chain management needs and requirements by allowing the exchange of "real-time” information to take place with employees and their trading' partners (customers, supplier distributors, manufacturers) regarding product configuration, order status, pricing, and inventory availability. Such functions improve order accuracy and provide 100 per cent order fulfilment through accurate inventory information. This "real-time" data enables users to make informed ordering, purchasing and inventory decisions, and thereby enhances the quality and scope of customer service.

Return on Investment

In addition to increasing productivity and reducing overall operating expenses, e-SCM maximizes selling opportunities by capturing valuable customer information—buying patterns, frequency of visits, preferences, order history—and then uses this information for up-selling, cross-selling and promotional opportunities. E-SCM provides the tool sets to achieve new business by reaching out to customers that you never could before.

Benefits

Some of the benefits of e-SCM are enumerated below:

1. It is Web-based (client and server), not Web-enabled;

2. It incorporates broadcast and active messaging to proactively notify an individual of a condition that requires attention;

3. It supports the exchange of "real-time" information through trading communities such as employees, customers, suppliers, distributors and manufacturers;

4. It has open Internet Application Architecture which allows for rapid deployment and scalability, combining unlimited internal/external users in a "real-time" environment;

5. It has an interface capability with any third party software;

6. It is platform independent;

7. It is a fully integrated system;

8. It has Web visibility and processing capability—24 x 7;

9. It is rules-based.

8.4 E-supply Chain Components

The components of e-supply chain are as follows:

Advanced Scheduling and Manufacturing Planning Program

This automated program provides detailed coordination of all manufacturing and supply efforts based on individual customer orders. Scheduling is based on real-time analysis of changing constraints throughout the process, from equipment malfunctioning to supply interruptions. Scheduling creates job schedules for managing the manufacturing process as well as logistics.

Demand Forecasting Program

This module supports a range of statistical tools and business forecasting techniques. It constantly takes into account changing market scenarios and economic factors while making decisions.

Transportation Logistics Program

This program facilitates resource allocation and execution to ensure that materials and finished goods are delivered at the right time and at the right place, according to the planning schedule, at minimal cost. It considers such variables as transportation mode and availability of each mode such as airlines, trains, and trucks.

Distribution Planning Program

This is integrated with demand forecasting, manufacturing schedules and transportation logistics to reach the customer.

Order Commitment

Order commitment is linked to all the other modules so that accurate delivery of goods and services can be guaranteed. These are illustrated in Figure 8.7.

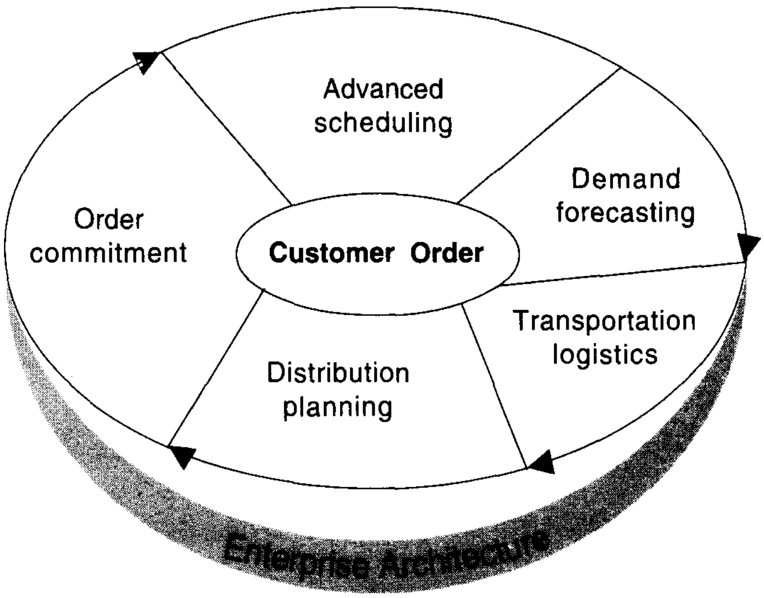


Fig. 8.7 E-SCM components.

E-supply Chain Architecture

Historically, the elements in the supply chain have consisted largely of separate legal applications at the headquarters, factory, store and distribution levels. These applications have targeted only distinct levels of supply chain and not the entire supply chain levels. So this three tier architecture as found in Figure 8.8, shows a bottom up view of the entire supply chain management.

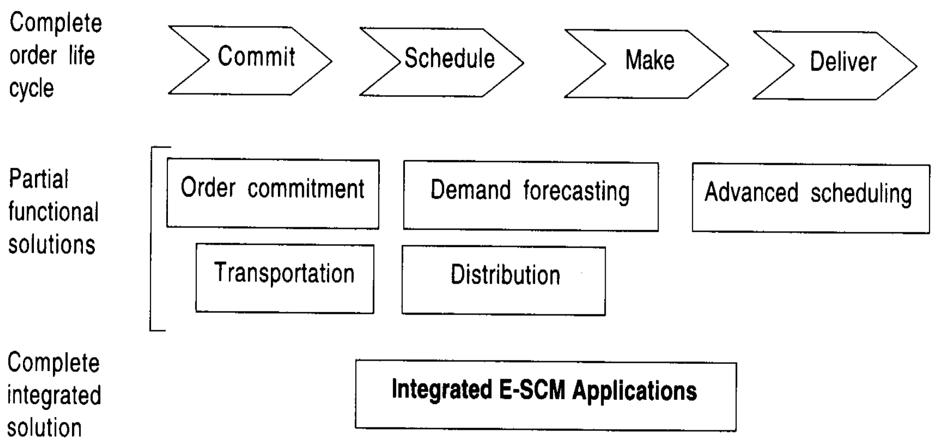


Fig. 8.8 E-supply chain architecture.

For food and other quick-turnaround businesses, as their time quotas shrink, customers look for companies that serve them fast. The message to the marketplace is clear: To succeed, companies must reduce the processing time between search, selection, order entry, and order fulfillment. Delays at any step of the process are unacceptable!

8.5 Major Trends in E-SCM

What does e-SCM trend mean for e-business? When one considers the challenge of meeting the demands of busy, time-starved, dissatisfied consumers in an environment of hostile competition, low margins and countless sales outlets selling similar products, it becomes clear that changing the entire business model is the only plausible strategy (see Table 8.1). E-business applications must cut the time customers wait for service. Customers now penalize companies that infringe on their time through delays, mistakes, or inconveniences. If companies do not expedite processes, customers will go to someone who does it faster. If one company does not make it easy for the customer to do business, another will.

It is very important that managers understand and diagnose the cause behind service delays. They need to analyze if an integrated system can speed-up service. If so, they need to strategize, design and implement such systems as soon as possible. Unfortunately for some companies, their managers may wake up too late to heed the sound of their customers' fists pounding on the counters for faster service. These companies will not be in business for long.

In the e-business world, innovation is derived from spotting the trend well before any one else does and from the sophisticated exploitation of information and technologies to create value. It is the senior managers in particular who will be called on to lead the innovation charge. Today, every manager is wondering how the Internet can remake his or

TABLE 8.1

MAJOR TRENDS IN E-SCM

Trends	*Characteristics*
Consumer trends	Speed of service. Self-service. Integrated solutions, not piecemeal products.
Service/Process trends	Convergence of sales and services: Customization and integration Ease of use: Making service consistent and reliable. Flexible and convenient service delivery. Streamlining the supply chain.
Organizational trends	Contract manufacturing: Becoming brand-intensive, not capital-intensive. Business process outsourcing: retain the core, outsource the rest. Increasing process transparency and visibility. Constant innovation and employee retention.
Enterprise technology trends	Enterprise applications: Connect the corporations; Infrastructure convergence: Increase melding of voice, data, and video. Multichannel integration: Computer telephony integration and voice recognition wireless applications. Leveraging legacy investments: The rise of middleware for application integration.

her business. In a concerted search for growth, corporations are intent on mastering the art of trend spotting in order to discover new products and services, design new business processes and structures, even to create completely new businesses.

8.6 Summary

This chapter deals with supply chain management which is crucial for the success of any business organization weather it is traditional or e-commerce based. The new way of maintaining the supply chain with the existing electronic tool kits is dealt in detail. The supply chain management strategies to improve profit of the organization through the fulfillment of customer needs, by reducing the inventory costs are discussed.

EXERCISES

1. Explain how FedEx meets the quick delivery requirement using the Internet.

2. What should be the architecture that will assure JIT delivery at the time of ordering?

3. Analyze the workflow in DHL. A short description is given here.

DHL can now access the DHL global Web page *(http://dhl.com)* and locate their freight, book a package to be picked up, calculate freight costs, and check delivery times, just to name a few. The global website allows customers to open an account, track international and domestic shipments, calculate freight costs and the projected time of delivery, and print out forms such as customs declarations. International customers have hotlinks to the DHL website so that they can track their purchases. The Web has been fundamental to DHL for developing new supply chain forms through far faster communication on the Internet. The information captured contains details on customers at various stages of the customer relationship—suspects, prospects, current, and old customers. For each customer, information like the key contacts in the organization, decision makers and their buying cycles, as well as information on each contact is maintained. Basically, all case histories should be easily available. There are many customized solutions that help you automate CRM and the associated workflow.

4. Analyze the supply chain management of a company with regard to CRM and SCM, based on the workflow.

UNIT - V

9. E-strategy

In this Chapter we will discuss

- Information and strategy
- Value chain
- Planning a e-commerce project
- Knowledge management
- Data warehousing and mining

Structure of the chapter

9.1 Information and strategy

Whether they call it "the post-industrial society", "the third wave" or "the knowledge era" most policy makers, academics and business leaders would agree that we have recently entered a new era. Undoubtedly, some of the defining characteristics of this era—which shall here be referred to as "the information age"—are still to emerge and develop. However, will now recognize that the information age differs markedly from the industrial age in seven important respects. These differences can be summarized as in Figure 9.1.

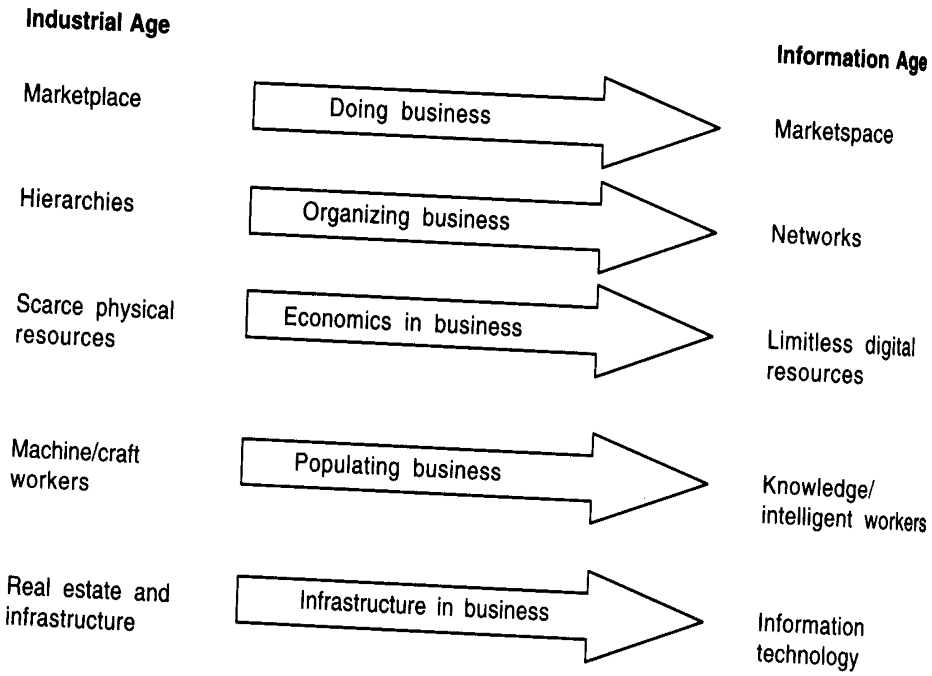


Fig. 9.1 Industrial age vs. information age.

Over the past 40 years or so, many business analysts have tried to determine what has been driving these changes. The consensus has shifted over time. At first, it was thought to be the automating power of computers and computation. Then, it was the ability to collapse time and space through telecommunications. More recently, it is found to be the value-creating power of information, a resource which can be reused, shared, distributed or exchanged without any inevitable loss of value; indeed, value is sometimes multiplied. And today's fascination with competing on invisible assets means that people now see knowledge and its relationship with intellectual capital as a critical resource, because it undermines innovation and renewal.

Information and Strategy

All these claims are valid in some ways and therefore, there are diminishing returns to arguing which is the critical motive force. But we can recognize that today every business is an information business. Let us first take the perspective of industrial structure. We see battles in the marketplace all the time, as "content" companies try to acquire related content businesses, not only because of their thirst for information but also because of the opportunities for synergy created by repackaging, reuse and navigation. More significantly perhaps, content companies acquire or build alliances with communication companies, and vice versa. Both sides recognize that to command the airwaves is to command the distribution channels of the information age, and that the high value added opportunities are likely to rely on selling content and repackaging and reusing it in manifold ways. Sometimes, novels are made into television films. That is an example of repackaging opportunity.

It is not just the obviously information-intensive companies that are trying out these new strategies. More and more "traditional" companies follow some of the same logic. So, when SmithKIine Beecham acquired Diversified Pharmaceutical Services in 1994, the purchase was as much about buying the data embedded in prescriptions and healthcare administration processes—which could then guide research and development programs and sales management—as about more conventional synergies.

When Indiaworld was bought by Satyam Online, the sale soon turned out to have a similar information thread. So, we need to rewrite, or at least re-examine, the industrial economic rules of vertical integration and diversification.

Indeed, it becomes difficult in the world of intangible assets and electronic distribution channels to be clear to define vertical or horizontal integration. Microsoft takes stakes in software, communications and information-providing businesses, and America Online acquires Netscape. Are these "horizontal" or "vertical" manoeuvres?

If you choose to take an information perspective, businesses converge, partly because of the integrated e-strategy, exemplified in Figure 9.2. In other words, brand, technology, market and service are the four aspects of e-strategy. In some cases this happens because the product is information-based, as in the case of Disney and ABC. In other cases, it is because processes are information-based, such as in our pharmaceuticals examples. In still other cases, it is simply because market understanding or decision-making is information based. So retailers,

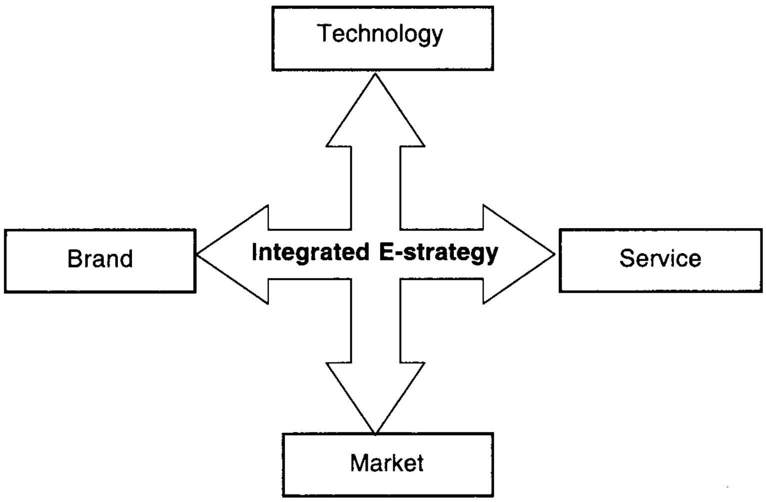


Fig. 9.2 Convergence.

financial services, organizations and airlines will form alliances because of the information (and sales) potential of customer cards.

While the price-system coordinates the economy, managers integrate activity inside the firm. Increasingly, strategic advantage requires the integration of external activities and technologies. So, an integrated e-strategy implies integration of technology, brand standing, customer-service and meeting the needs of the market.

The Virtual Value Chain

Information can be captured at all stages of the physical value chain. Such information can be used to improve performance at each stage of the physical value chain and to coordinate across it. However, it can also be analyzed and repackaged to build content-based products or to create new lines of business. Thus, insurance companies, for example, are becoming adept at analyzing customer and claims information and then tele-selling both financial and physical products. A company can also use its information to reach out to other companies' customers or operations, thereby rearranging the value system of an industry; if you like, sectors become "value jigsaws" which can be rearranged so that traditional sector boundaries disappear.

As digital technologies converge, the whole concept of physical value chain undergoes a change. Today the focus is on the virtual value chain, which can be seen in Figure 9.3,

And while entrepreneurs are often adept at collecting and processing information about threats and opportunities—by networking, observing and getting about—many look to information and IT as their source of new products and services. The entrepreneurs of the future are "infopreneurs".

Figure 9.4 summarizes the discussion so far. From at least six perspectives, every

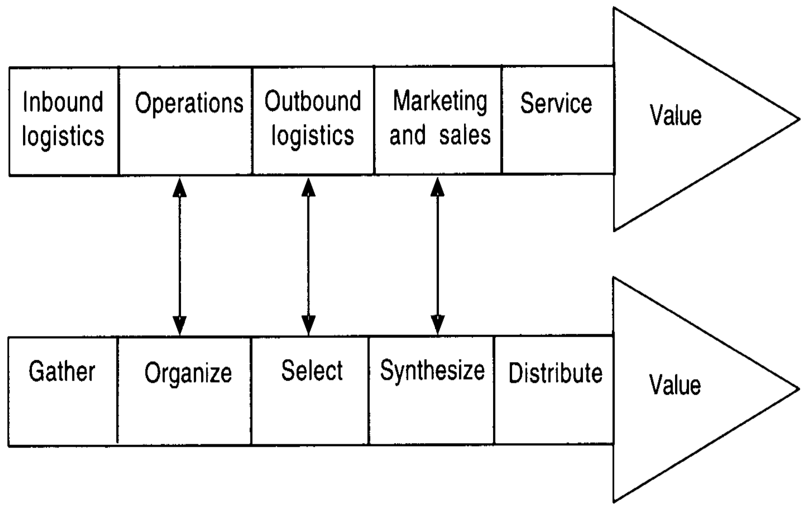


Fig. 9.3 The new value chain and the physical value chain.

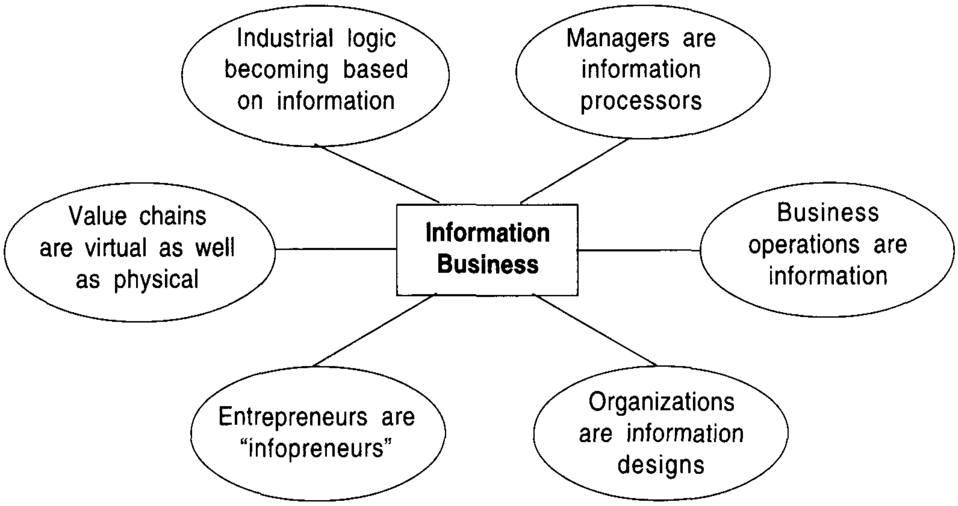


Fig. 9.4 Every business is an information business.

business is an information business. One consequence of this is that either no business strategy is complete without an information strategy, or that business strategy and information strategy need to be integrated. IT, information systems and information as a resource no longer just support business strategy; they indeed help to determine it. But what does an information strategy look like?

Figure 9.5 is a conceptual framework which distinguishes Information Systems (IS) strategy from IT strategy. IT, which was about the "how"—the technology infrastructure or platform—often seemed to distract attention from IS, which was the "what"—the identification and prioritization of systems or applications for development.

Then comes information management strategy, which was about the "who"—the all important question of roles and responsibilities in the delivery, support and strategic development of IS and IT. All of these were influenced by the business or organizational strategy, which

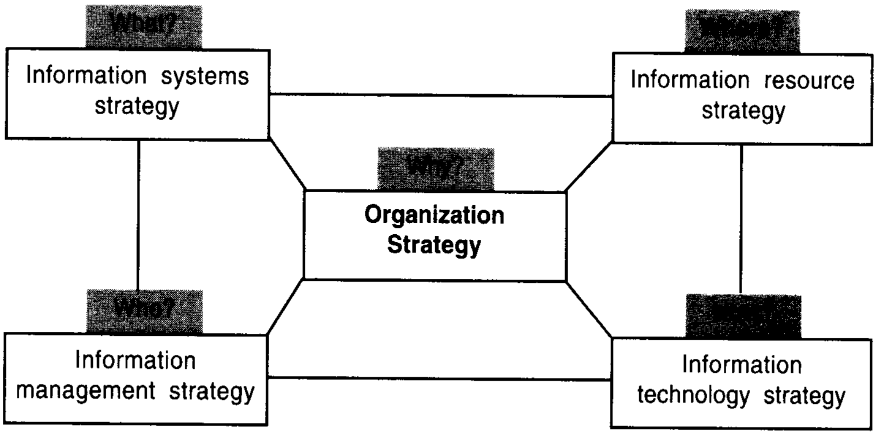


Fig. 9.5 Information strategy framework.

was concerned with strategic intent ("why") and organizational architecture. In a perfect world, corporations strove for a good fit between these four domains.

Now we can see that a fifth domain is missing—one we still find difficult to formalize but in which companies increasingly have objectives, principles and policies. The fifth domain is the domain of information as a resource, or of Information Resource (IR) strategy, It is perhaps the "where" question: where are we going? Much value creation can come from information, but it is not always clear what the end result will look like.

In more traditional content companies, such as advertising agencies, broadcasters and movie companies, you will find policies about not giving away or even releasing content that others could reuse. And in financial services companies, you will find executives scratching their heads as to 'Why they never collected critical data such as date of birth when their customers registered with them?' and 'Why information resellers make money out of their transaction data'.

One aspect of IR strategy is the increasing interest in the distinction among data, information and knowledge. Some chief information officers and chief knowledge officers believe that such classifications are of little help, and some academics have certainly put their careers behind by agonizing over such questions. Others, however, feel that conceptualizations such as those in Figure 9.6 offer the solution.

	Data	**Information**	**Knowledge**
Content	Events	Trends	Expertise
Form	Transactions	Patterns	Learnings
Information task	Representation	Manipulation	Codification
Human element	Observation	Judgment	Experience
Organizational intent	Automation	Decision-making	Action
Value test	Building block	Uncertainty reduction	New understanding

Fig. 9.6 From data to knowledge.

1. To some degree, information is derived from data, and knowledge from information, and thus we are reminded that data has enormous potential—far beyond just being representative of a transaction.

2. Information has characteristics, particularly of human interpretation, above and beyond data. Knowledge has something more than information, perhaps learning. A logical test of the value of an additional piece of knowledge could be whether it provides new understanding.

3. Articulating and seeking to classify these intangible resources at least alerts people to their value and, more particularly, to the different sorts of investments they require. Technology is suited to data processing. Knowledge processing is much more of a human activity.

What is clear is that such frameworks and the past works of philosophers, economists, political scientists, computer scientists, psychologists and management scholars on the nature of information as a commodity or a process, have relevance and value for the information age. There are some old lessons to be re-learnt but some new rules and ideas are also required, for the world of information and intangible assets is very different from that of the industrial age and physical assets.

9.2 Seven Dimensions of E-commerce Strategy

In order to understand the process of e-commerce strategy, systematic examination of the strategic factors involved has to be considered. Looking at the most successful e-commerce companies, we see a strategy emerging, which is modeled in Figure 9.7.

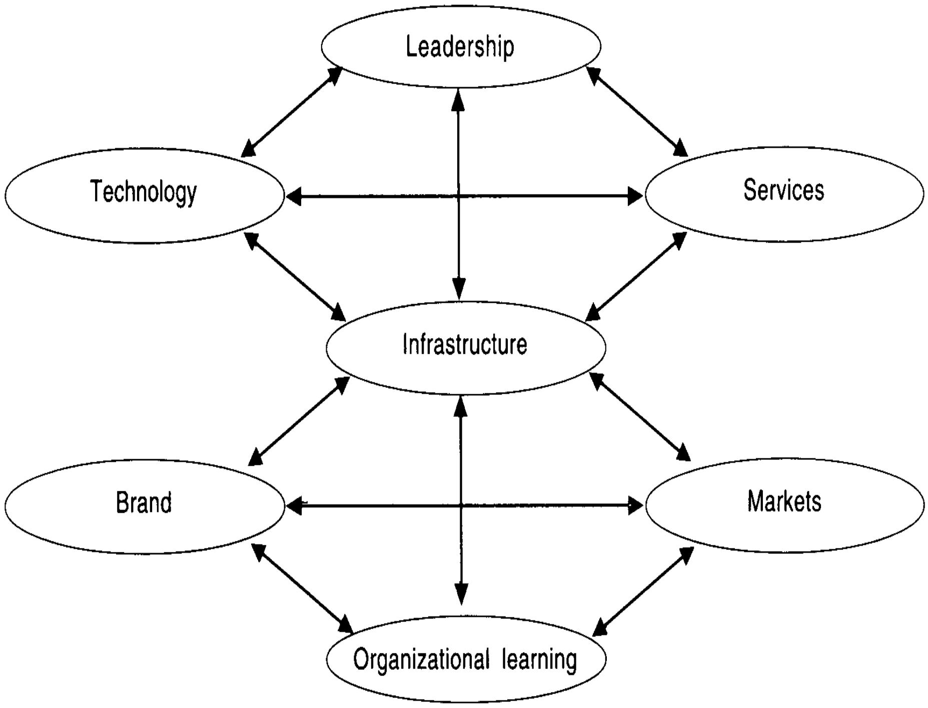


Fig. 9.7 The seven dimensions of e-strategy.

It can be argued that this model can be applied to all forms of organizations in the traditional sectors. However, this model is specially applicable to assisting the needs of e-commerce strategies. The bonds of an e-strategy lie in the preparation of the ground before the functional issues are addressed. Leadership, organizational learning, and infrastructure form the bonds as shown in Figure 9.8. Clearly, there is a strong interaction among these three components.

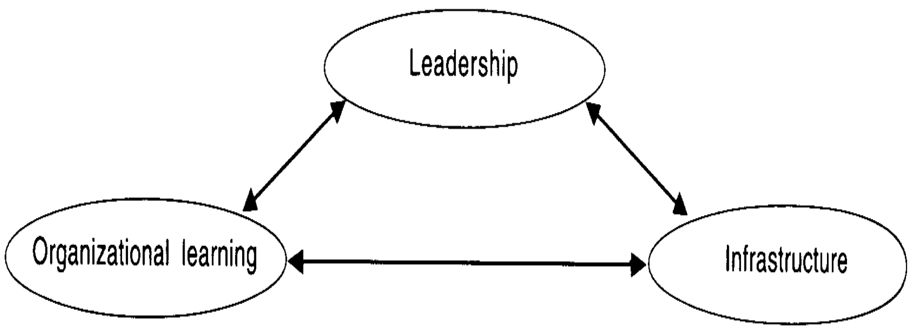


Fig. 9.8 The bonds of e-strategy.

The primary drivers and the creators of strategic vision in an organization are the CEO and the senior executives. The market for intellectual capital in the form of experienced, proven, and successful leadership has never been more extreme. Once the need to develop e-strategy is identified, the single most important issue facing the executives is the IT infrastructure. This spans the technology spectrum from a single Internet file server connected to an ISP to the information-intense online transaction processing. Leadership with vision facilitates, encourages and allows an environment to develop within the organization, where institutional learning and memory thrive.

Internal Technology Leadership: The 7S Framework

The essence of the McKinsey's 7S model is that a firm is the comprehensive sum of its parts, and the internal dynamics of an organization clearly determine that organization's ability to compete, the premise being that both the strategy and the structure of the organization determine the management's effectiveness. The McKinsey 7S model attempts to create an awareness of the factors that, when utilized together, will assist in the formation of an organization that is greater than the sum of its parts. The hub and spokes unite the seven factors, as can be seen in Figure 9.9. The factors are defined in Table 9.1.

The Alignment of Technology and Corporate Planning

The whole basis of technology formulation is the ability of the organization's executive to achieve alignment between the technology strategy and the strategy of the enterprise as a whole.

Structure

The second key issue that organizations need to address in leveraging technology towards reaching a position of marketspace leadership is their ability to manage their internal structural

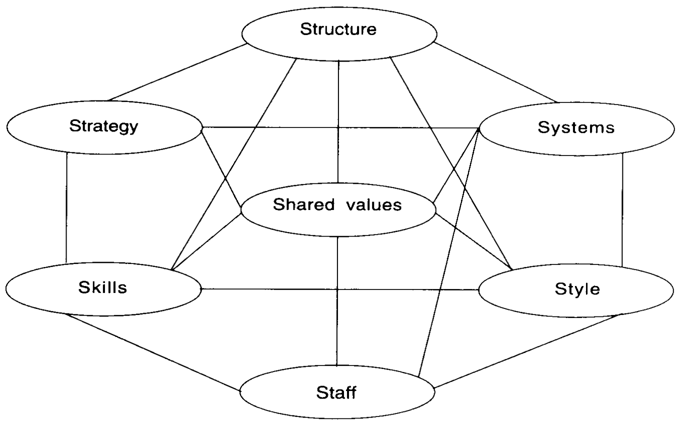


Fig 9.9 The Mckinsey 7s framework

TABLE 9.1

SEVEN FACTORS OF THE McKINSEY 7S FRAMEWORK

Component of the 7S framework	*Definition*
Strategy	Strategy can be defined as the determination of a course of action to be followed in order to achieve a desired goal, position or vision.
Structure	An organization's structure is the interrelationship of processes and human capital in order to fulfil the enterprise's strategic objectives.
Systems	The organization's information systems and infrastructure.
Staff	Human resources management.
Style	Corporate style is a synthesis of the leadership philosophy of executive management, the internal corporate culture generated, and the orientation the organization adopts to its markets, customers, and competitors.
Skills	The unique or distinctive characteristics associated with an organization's human capital.
Shared values	The concepts that an organization utilizes to drive towards a common goal through common objectives and a common value set.

dimensions, generally characterized by a company's organizational chart. Organizations must ensure that their structural characteristics facilitate their ability to be flexible and agile enough| to effectively and efficiently meet the needs of their markets as they change.

Systems

This is the nervous system through which the organization communicates to its environment, In developing an e-strategy, one of the hidden strength an organization can create is a flexible systems infrastructure. The three major dimensions of technology infrastructure are:

- Enterprise Resource Planning (ERP) systems
- Data warehousing
- Knowledge management

ERP systems can help cut costs across the value chain by re-engineering their processes. For this, the ERP systems should incorporate flexibility without complexity. And to improve their relationships with customers, organizations need to generate information and content that add value from the processes themselves.

Data warehousing can be seen as the basis of a knowledge repository that, when used effectively, enables cost reduction strategies to be identified, added-value services to be achieved at a manageable cost, and the delivery of an improved data effectiveness within the organization.

The third dimension of an organization's e-commerce infrastructure is that of knowledge management, an area that can be defined as the formal management of an organization's knowledge resources.

Staffing

Human capital is the bedrock of any organization. As organizations evolve towards becoming knowledge-based, the value of an organization's intellectual assets cannot be overstated and magnified by a scarcity of IT skills. So, outsourcing has been a trend in many organizations.

Skills

The two skills that form the pillars between which the Information Systems structure is supported are the technical skills and relationship management skills.

Style

Style can be defined as 'characterization of how key managers behave in achieving the organization's goals, and also the cultural style of the organization'. Managers succeed and fail in inspiring peak performance, not only according to their ability to appreciate the values and motives of those they direct, but also according to their willingness to align their OWB managerial styles to the personal, situational and organizational environment. The bottom line for every effective manager is to deliver results. Since management is also an art, ever) manager has a personalized way of doing things.

Shared Values

Shared values can be defined as the significant meanings or concepts that an organization utilizes to drive towards a common goal through common objectives and a common value set. Key to achieve these are the driver for flexibility in process, for lower transaction costs, and for achieving mass customization for the customers.

9.3 Value Chain and E-strategy

The intensity of information in the value chain and in the product offers some clues to the role of e-commerce in an industry. Industries that have high information intensity are much more likely to develop quickly into e-commerce than those that do not. An industry with high information intensity, like the computer business, is much more likely to depend on e-commerce than one with low information intensity, like the sand and gravel business.

To determine the intensity of information in one's industry, he has to look at his value activities and value chain. These concepts will help in figuring out what may happen in the future.

Value Activities

Value chain activities are the things that the company does to design, produce, sell, and service products. Typical value activities for a manufacturing firm would be things like:

- Gathering customer needs
- Designing products
- Purchasing materials
- Producing products
- Promoting products
- Selling products
- Servicing products
- Servicing customers

Assessment of Information Intensity

Assessment of the intensity of information in the value chain and value activities takes the next priority. The industry that has high information intensity in the value chain would have characteristics like those listed below:

- A large number of direct suppliers or customers
- A complex product line
- A product that needs a lot of information to sell

• A product composed of many parts

• Many steps in the production process

• A long order fulfillment cycle time.

Next, if there is high information intensity in the products of your industry, it is reasonable to adopt e-commerce. Characteristics of high information intensity in the product would be a product that:

1. Provides information
2. Involves information processing
3. Requires the buyer to process a lot of information
4. Has high user training costs
5. Has many alternatives uses.

The Validity of This Technique

Most of the early adopters of e-commerce have come from industries that would score highly if rated on the information intensity scale; those with low scores have not participated! so far.

Software business embraced the Web from the beginning and today, much of the business is conducted online. Products are promoted on the Web and sales leads are generated.1Product information is supplied to prospective customers on the Internet—not just online brochures but rich, interactive information via demonstrations. Sales transactions are initiated electronically by buyers, orders are fulfilled in some cases by immediate download, payment is quickly made electronically via credit card, and customer service is delivered by e-mail and| Web-based tools.

How do software companies rate on the information intensity scale? They typically need a large customer base to survive. Their products are complex and customers expect a lot of information before they buy. The products have many components and features, and they take a long time to create. The product mainly provides information and information processing. It typically has a high learning curve and many uses.

As shown in Figure 9.10, we have a very general value chain for Internet commerce This value chain is focused on the interactions of a business with its customers. The detail will certainly be different for different businesses (and for some different business models), but we have found this general approach to be very effective in organizing an approach to do business online. The components of this general value chain are the following:

1. Attract customers by means of advertising and marketing; invite and retain interests of the customers;

2. Interact with customers by means of sales, and convert their interests into 'orders'; |

3. Act on customer instructions and manage orders such as order capture, payment and fulfillment;

4. React to customer requests and involve in customer service and offer technical support.

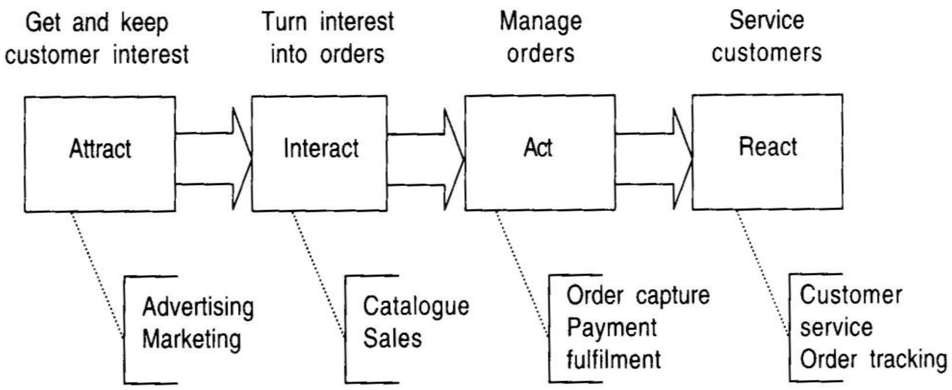


Fig. 9.10 The commerce value chain.

Looking at the value chain for a business helps to define areas of focus such as what the business is best at, or where the most emphasis should be given. Even in businesses that may appear to be very similar, differences in emphasis can have major effects, both for Internet commerce and for more traditional forms.

Components of the Commerce Value Chain

The key components of the value chain can be very different for different industries, and even among different businesses within a particular industry, such as in the following example. In this section, we will look at a generic value chain for Internet commerce. In part it serves as an example of how one might break down a value chain to analyze it more closely, and in part it exemplifies some of the most important components of business on the Internet. Throughout this section, we use catalogues for consumer retail purchases as examples. In the next chapter, we will look at several different kinds of businesses and how the commerce value chain applies to them.

Attract Customers

The first component of the generic Internet commerce value chain is to attract customers. By this we mean, whatever steps we take to draw customers into the primary site, whether by paid advertisements on other websites, e-mail, television, print, or other forms of advertising and marketing. The point here is to make an impression on customers and draw them into the detailed catalogue or other information about products and services for sale. Instead of attract, the catchword today is '**addict**' the customers.

Interact with Customers

The second component is interaction. By this we mean, turning customer interest into orders. This phase is generally content oriented and includes the catalogue, publication, or other information available to the customer on the Internet. The content may be distributed by many different mechanisms, such as the World Wide Web or e-mail. In some cases, there may be links between Internet commerce and contents distributed by other media, such CD-ROMs.

Editorially, contents may change infrequently or frequently. Technically, content may be static or dynamic. Static content typically consists of prepared pages, such as those from a catalogue, that are sent to a client upon request. These pages must be recreated and updated whenever the information on them changes. Dynamic content, on the other hand, is generated at the time of the request, drawing upon one or more information sources to produce an appropriate page of information for the client. Some sources of information for dynamic content include databases, such as a parts database with pricing information, the capabilities of client software, such as what graphic formats can be used or even who the clients are, or what organizations they are with. Dynamic content is often used when the editorial content changes frequently, or when the natural storage medium for the information is a database, or when the information is used for multiple purposes.

Act on Customer Instructions

The next component in the commerce value chain is to act. Once a buyer has searched through a catalogue and wishes to make a purchase, there must be a way to capture the order, process payment, handle fulfillment and other aspects of order management.

Order processing. Often a buyer wishes to purchase several items at the same time, so |the order processing must include the ability to group items together for later purchase. This capability, sometimes called a shopping cart in the case of retail transactions, usually include the ability to modify the contents of the shopping cart at any time. Thus, the buyer is able to discard items, add new ones, change the quantities, and so on. When the buyer is ready to complete the purchase, it is often necessary to compute additional charges, such as sales tax and shipping costs. The order processing system then presents the buyer with an itemized order form including all charges, so that the buyer can pay for the items.

Payment. Depending on the terms of the order, the buyer may pay for it (or provide payment instructions) as part of the order capture. Once an order is finalized, the buyer can make the payment. As in the real world, there may be many ways to pay for an item. Some of the methods may be online analogues of those found in the real world: credit cards, purchase orders and the like. Other methods of payment may exist only on Internet commerce, using new technologies developed especially for a networked system. For example, in an online publishing system, it may be feasible to charge a small amount for a single magazine article, rather than requiring someone to purchase the entire magazine. The most important property of an online payment system is that the seller can use it to collect payment from the buyer. That is, no matter which payment mechanisms each one may be capable of, there must be at least one they can agree on. This property has several implications. First, the seller's system must be able to handle the kinds of payment important to the seller's business. For example, credit cards are commonly used for consumer retail transactions, but businesses often buy from each other using purchase orders. There may also be non-technical constraints on what payment methods can be used. To accept credit cards, a merchant must have an account with an acquiring bank that handles the transactions. Without such an account, creating the technical infrastructure to allow for credit card payment is useless.

Second, the seller must be careful about imposing requirements on the buyer's system. If the buyer must have a particular software package to handle a particular kind of payment system, the universe of possible buyers is likely to be much smaller than it would be otherwise. In some cases, of course, all of the desired customers will have such software, or be willing to obtain it. Again, the key point is to keep the customer and the business in mind when selecting the technology.

Note also that completing this stage does not necessarily mean that funds have been transferred into the seller's bank account. Some payment instruments, including both credit cards and purchase orders, extend credit to the buyer who will make the actual payment later. In such cases, it is common for the seller's system to authorize the transaction, whether by requesting such authorization from a third party (such as the bank that issued a credit card) or its own internal rules (such as whether a purchase order relationship has been established). As such, final settlement of a transaction may not take place until the item has been shipped.

Fulfilment. Now the order has been placed and the payment made (or at least a satisfactory promise of payment). The next step is fulfiling the order. How that happens depends on the type of thing purchased. If the item ordered is a physical good (sometimes called a hard good), it will be delivered to the buyer. The order is usually forwarded to a traditional order processing system, with the result that someone picks up the object, packs it, and ships it. In this case, the online commerce system must have a method for forwarding orders. This step could be as simple as printing out or taxing an order form for a person to handle, or it may use a more complicated interface, such as EDI, with another computer system. The precise mechanism, of course, depends on how orders are handled by the rest of the business.

A second kind of order is a request for a service to be performed in the real world. For example, one might order a singing telegram online. Although the fulfilment happens in the physical world, this is a service, not a physical good. For our purposes, however, we can think of these as being handled like physical goods. The order is passed on to a system or a person who fulfils it.

The third kind of order is more closely tied to the Internet commerce system. We call this category, digital goods. Digital goods include a wide variety of online delivery, including software that is delivered online, magazine or news articles, reports, access to a database for a period of time, and so on.

React to Customer Inquiries

Finally, after a sale is complete, the customer may have some questions or difficulties that require service. Although many questions require a person to answer, others can be answered with the appropriate information system. For example, a transaction system that keeps track of all of a customer's purchases, can generate a statement summarizing them. Customers who wonder whether or not their orders have been shipped, might check back with the system. A more complicated example is how the system handles a failure when delivering a digital good.

Suppose that a customer buys a software package online. While the software is being downloaded to the customer's computer, an error in the network causes the download to fail. What can the customer do? Clearly they should not buy the item again, so they need SOB "proof of purchase"—such as a receipt—that the fulfillment server will accept in order t allow the customer to attempt another download.

Using people to answer customer service calls can be very expensive, so it is worth investing in systems that eliminate questions that do not require the capabilities of a person. As noted previously, these systems often provide routine (or even exceptional) information in response to simple queries. But it is very important to design the system to cater to the needs of the customer in solving any problem that may arise in the process of transaction.

The Quantitative Approach for E-strategy

Speed, round-the-clock availability, and security are the most common indicators of quality of service of an e-business site. Management faces a twofold challenge. On the one hand companies must meet customer expectations in terms of quality of service. On the other hand, companies have to keep site costs under control to stay competitive. Therefore capacity, reliability, scalability, and security are key issues to e-business site managers. E business sites are complex computer-system architectures, with multiple interconnected layers of software and hardware components, such as networks, caching proxies, routers, high speed links, and mainframes with large databases. The nature of e-business workload is also complex due to its transactional nature, secure requirements, payment protocols, an the unpredictable characteristics of service requests over the Internet. Planning the capacity of e-business sites requires more than just adding extra hardware. It requires more that intuition, ad hoc procedures, and rules of thumb. There are many possible alternative architecture and one has to be able to determine the most cost-effective architecture. This is where the quantitative approach of this book and capacity planning techniques for e-businesses corn into play.

9.4 Planning the E-commerce Project

A successful business plan for an e-commerce initiative should include the following activities

1. Identifying the initiative's specific objectives
2. Linking objectives to business strategies
3. Managing the implementation of business strategies
4. Overseeing the continuing operations of the initiative, once it is launched.

In setting the objectives for an e-commerce initiative, managers should consider the strategic role of the project, its intended scope, and the resources available for executing it.

Identifying Objectives

Businesses undertake e-commerce initiatives for a wide variety of reasons. Common objectives that a business might hope to accomplish through e-commerce could include increasing sales in existing markets, opening new markets, serving existing customers better, identifying new vendors, coordinating more efficiently with existing vendors, or recruiting employees more effectively.

Resource decisions for e-commerce initiatives should consider the expected benefits and expected costs of meeting the objectives. These decisions should also consider the risks inherent in the e-commerce initiative and compare them to the risks of inaction—a failure to act could concede a strategic advantage to competitors.

Linking Objectives to Business Strategies

Businesses can use downstream strategies, which are tactics that improve the value that the business provides to its customers. Alternatively, businesses can pursue upstream strategies that focus on reducing costs or generating value by working with suppliers or inbound logistics.

You have already learnt about the different things that companies do on the Web. Although the Web is a tremendously attractive sales channel for many firms, companies can use e-commerce in a variety of ways to do much more than selling: they can use the Web to improve their business strategies and their competitive positions. As described in earlier chapters of this book, e-commerce opportunities can inspire businesses to undertake activities such as:

- Building brands
- Enhancing existing marketing programs
- Selling products and services
- Selling advertising
- Improving after-sale service and support
- Purchasing products and services
- Managing supply chains
- Operating auctions
- Creating virtual communities and web portals.

Although the success of each of these activities is measurable to some degree, many companies have undertaken these activities on the Web without setting specific, measurable goals. In the mid 1990s—the early days of e-commerce—businesses that had good ideas could start a business activity on the Web and not face competition. Successes and failures were measured in broad strokes. A company would either become the *ama-i.on.com* or the *eBay* of its industry, or it would disappear, either slipping into bankruptcy or be acquired by another company.

As e-commerce is now beginning to mature, more companies are taking a closer look at the benefits and costs of their e-commerce projects. Measuring both benefits and costs is becoming more important. A good business plan will set specific objectives for benefits to be achieved and costs to be incurred. In many cases, a company will create a pilot website to test an e-commerce idea, and then release a production version of the site when it WM well. These companies must specify clear goals for the pilot test, so that they know when the site is ready to scale up.

Measuring Benefit Objectives

Many companies create websites to build their brands or enhance existing marketing programs. These companies can set goals in terms of increased brand awareness, as measured market research surveys and opinion polls. Companies that sell goods or services on their sites can measure sales volume in units or dollars. A complication that occurs in measuring either brand awareness or sales is that the increases can be caused by other things that the company is doing at the same time or by a general improvement in the economy. A good marketing staff or outside consulting firm can help a company sort out the specific causes and effects of marketing and sales programs. Firms may need these groups to help set and evaluate these kinds of goals for e-commerce initiatives.

Companies that want to use their websites to improve customer service or after-sale support might set goals of increased customer satisfaction or reduced costs of providing customer service or support. For example, Philips Lighting wanted to use the Web to provide an ordering system for its smaller customers, that did not use EDI. The primary goal for this initiative was to reduce the cost of processing smaller orders. Philips had identified that over half the cost of processing smaller orders was towards handling inventory available and order status requests. Customers who placed small orders often called or sent faxes asking for this information. In 1999, Philips built a pilot website and invited a number of its smaller customers to try it. The company found that customer service phone calls from the test group of customers dropped by 80 per cent. Based on that measurable increase in efficiency, Philips decided to invest in additional hardware and personnel to staff a version of the website that could handle virtually all its smaller customers. The reduction in the cost of handling small orders justified the additional investment.

Companies can handle a variety of similar measures to assess the benefits of other electronic commerce initiatives. Supply chain managers can measure supply cost reduction, quality improvements, or faster deliveries of ordered goods. Auction sites can set goals for the number of auctions, the number of bidders and sellers, the dollar volume of items sold the number of items sold, or the number of registered participants. The ability to track s numbers is usually built into auction site software. Virtual communities and Web portals measure the number of visitors and try to measure the quality of their visitors' experiences. Some sites use online surveys to gather these data. However, most settle for approximations provided by measuring the length of time that each visitor remains on the site and the frequency of his visits. A summary of benefits and measurements that companies can make to assess the value of those benefits is found in Table 9.2.

TABLE 9.2

MEASURING THE BENEFITS OF E-COMMERCE INITIATIVES

E-commerce initiatives	*Common measurements of benefits provided*
Build brands	Surveys or opinion polls that measure brand awareness.
Enhance existing marketing programs	Change in per unit sales volume.
Improve customer service	Customer satisfaction surveys, the number of customer complaints.
Reduce cost of after-sale support	Quantity and type (telephone, fax, e-mail) of support activities.
Improve supply chain operation	Cost, quality, and on-time delivery of materials or services purchased.
Hold auctions	Quantity of auctions, bidders, sellers, items sold, registered participants; dollar volume of items sold.
Provide portals and virtual communities	Number of visitors, number of return visits per visitor, and duration of an average visit.

No matter how a company measures the benefits provided by its website, it usually tries to convert the raw activity measurements to dollars. Having the benefits measured in dollars lets the company compare benefits to costs and compare the net benefit (benefits minus costs) of a particular initiative to the net benefits provided by other projects. Although each activity provides some value to the company, it is often difficult to measure that value in dollars. Usually, even the best attempts to convert benefits to dollars yield only rough approximations.

Measuring Cost Objectives

At the first glance, the task of identifying and estimating costs may seem much easier than the task of setting benefits objectives. However, many managers have found that information technology project costs can be as difficult to estimate and control as the benefits of those projects. Since Web development uses relatively new hardware and software technologies, managers have little experience on which they can make estimates. Most changes in the cost of hardware are on the decline, but the increasing sophistication of software provides an ever-increasing demand for newer, cheaper hardware. This often yields a net increase in overall hardware costs. Even though e-commerce initiatives tend to be completed within a shorter time frame than many other information technology projects, the rapid changes in web technology can destroy a manager's best-laid plans very quickly.

In addition to hardware and software costs, the project budget must include the costs of hiring, training, and paying the personnel who will design the website, write or customize the software, create the content, and operate and maintain the site. As more companies build e-commerce sites, people who have the skills necessary to do the work are demanding increasingly higher compensation.

The initial cost of building an electronic commerce site is not the whole story, unfortunately. Since Web technology continues to evolve at a rapid pace, most businesses will want to take advantage of what that technology offers, to remain competitive. Most experts agree that the annual cost to maintain and improve a site once it is up and running, whether it is a small site or a large site, will be between 50per cent to 100 per cent of its initial cost.

As an increasing number of traditional businesses create Web versions of their physical stores, the cost to build an online business that is a true differentiator—a site that stands out and offers something new to customers—will continue to increase. Much of the cost in such a website is for elements that make a major difference in how well the site works, but are not readily apparent to a site visitor. For example, Kmart's Web business site *BlueLight.com,* cost more than $140 million to create. The site's home page is certainly well-designed and highly functional, but the typical visitor would never guess how much this company spent to build its site. Much of the site's cost was incurred in building connections to Kmart's vast inventory and logistics databases.

Comparing Benefits to Costs

Most companies have procedures that call for an evaluation of any major expenditure of funds. These major investments in equipment, personnel, and other assets are called capital projects or capital investments. The techniques that companies use to evaluate proposed capital projects range from very simple calculations to complex computer simulation models. However, no matter how complex the technique is, it always reduces to a comparison of benefits and costs. If the benefits exceed the cost of a project by a comfortable margin, the company invests in the project.

A key factor in creating a business plan for e-commerce initiatives is the process of identifying potential benefits (including intangibles such as employee satisfaction and company reputation), identifying the costs required to generate those benefits, and evaluating whether the benefits exceed the costs. Companies should evaluate each element of their e-commerce strategies using this cost/benefit approach. A simplified representation of the cost/benefit approach appears in Figure 9.11.

You might have learned techniques for capital project evaluation, such as the payback method or the net present value method, in your accounting or finance courses. These evaluation approaches provide a quantitative expression of a comfortable benefit-to-cost margin for a specific company. They can also mathematically adjust for the reduced value of benefits that the investment will return in future years (benefits received in future years are worth less than those received in the current year). Managers often use the term Return on Investment (ROI) to describe any capital investment evaluation technique, even though ROI is the name of only one of these techniques.

Although most companies evaluate the anticipated value of e-commerce initiatives in some way before approving them, many companies see these projects as absolutely necessary investments. Thus, they might not subject them to the same close examination as they do to other capital projects. These companies fear being left behind as competitors stake their claims in the online marketspace. The value of early positioning in a new market is so great that many companies are willing to invest very large amounts of money with no near-term prospects of profit.

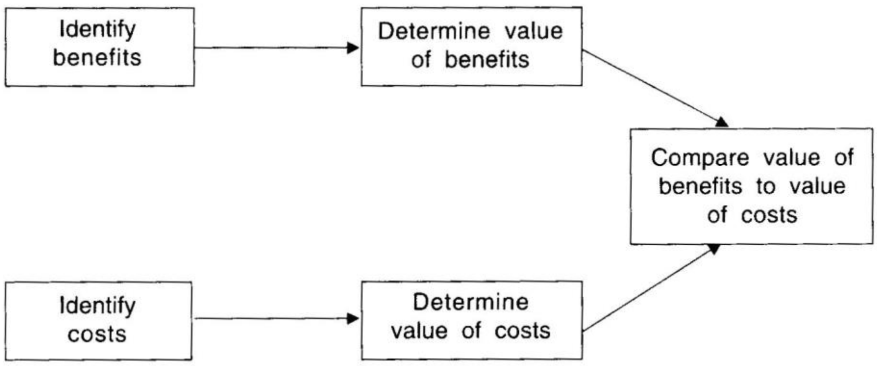


Fig. 9.11 Cost/benefit evaluation of e-commerce strategy elements.

Newspaper websites are a very good example of this desire to establish a foothold in the online marketspace. Gannet's *USA Today* and Dow Jones' *Wall Street Journal Interactive Edition* sites are a few profitable electronic commerce initiatives in the newspaper business. *Editor & Publisher* magazine estimated that online news websites lost a total of $80 million in 1998 alone. Despite the losses, most newspaper companies believe that they cannot afford to ignore the long-term potential of the Web, and feel compelled to make whatever investment is required to move into the online world.

9.5 E-Commerce Strategy and Knowledge Management

Knowledge management can be defined as *the capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services, and systems and raise its intellectual capital.*

The facts and information written on papers, stored in computers or stacked in file-cabinets of companies is not knowledge. Knowledge is all this, coupled with the cognitive process of perception, thinking, and understanding a person forms on the basis of this information available to him. So, knowledge resides in the brain of a person and is a dynamic entity.

To address the issue of information explosion, the software industry has begun to develop solutions that help capture, analyze and leverage explicit and tacit knowledge. The term for this solution area is knowledge management.

Knowledge can be defined as *processed and meaningful inferences derived from available information.* Knowledge can be of two types *Tacit and Explicit Knowledge.* Explicit knowledge can be expressed in words and numbers, and easily communicated and shared in the form of hard data, scientific formulae, codified procedures or universal principles. However, knowledge so expressed represents only the tip of the iceberg. Knowledge is primarily something not easily visible and expressible. It is highly personal and hard to formalize, making it difficult to communicate and share it with others. Subjective insights, intuitions fait into this category. Furthermore, tacit knowledge is deeply rooted in an individual's action i experience, a well as in the ideals, values or emotions that he or she embraces.

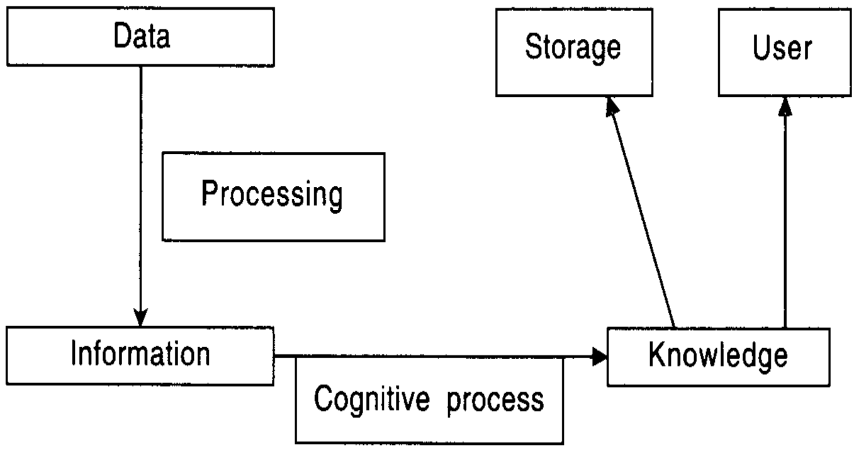


Fig. 9.12 Difference between data, information and knowledge.

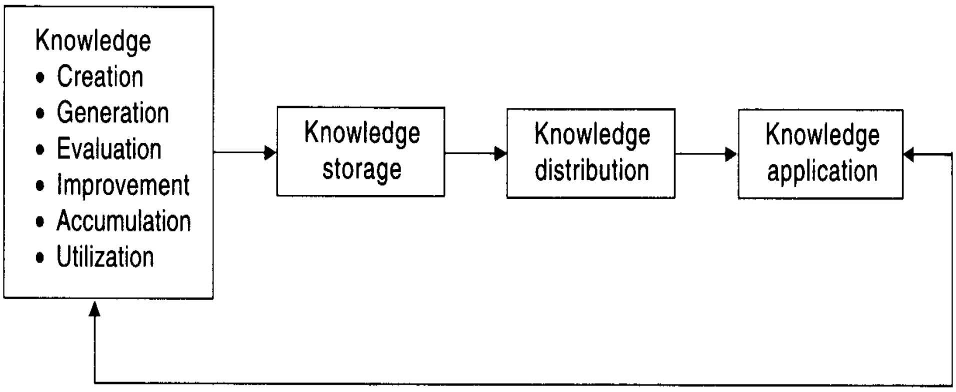


Fig. 9.13 Stages of creation of knowledge management.

The objective of knowledge management is to make the process of knowledge sharing more effective. This means that corporate knowledge be made available in forms which are readily accessible. This could take the form of knowledge document, process and rules. This could be done in the form of information technology. The various technologies used to do this are:

- Data Warehouses
- Groupware
- Workflow Management Systems
- Distribution via Internet/Intranet
- Web Mining

The general objectives while designing a knowledge management system are the following

- Improve learning and foster innovation by streamlining information access and retrieval, putting content in context.

- Enhance information organization, thus allowing enterprises to maximize the value of information, deliver products and services faster, and provide users a rich knowledge discovery.

• Protect knowledge assets to reduce the duplication of work and to enable organizations to identify knowledge gaps.

• Automate knowledge management.

Importance of Knowledge Management

The importance of knowledge management can be gauged from the following factors:

• The marketplace is increasingly competitive and the rate of innovation is rising, such that knowledge must evolve and be assimilated at an ever-faster rate.

• Corporations are organizing their businesses to be focused on creating customer value. Staff functions are being reduced, and management structures are being pruned to bring in greater flexibility.

• Competitive pressures are reducing the size of the workforce which holds this knowledge.

• Knowledge takes time to acquire and mature. Employees have less and less time for this.

• There are chances that experts may leave the organization or retire, leading to loss of knowledge.

• There is a need to manage increasing complexity, as more and more companies are becoming transnational in nature.

• Loss due to high employee turnover in knowledge industries can be minimized.

• Reduction in training cost for new employees.

• Avoid duplication of efforts and reduce repetition of mistakes.

A change in strategic direction may result in the loss of knowledge in a specific area. A subsequent reversal in policy may then lead to a renewed requirement for this knowledge, but the employees with that knowledge may no longer be there.

Information Technology Impact on KM

KM has benefited enormously from the huge investments in information technology (IT) in recent years. With the IT investment has come a blossoming of KM tools that address some of the most nagging problems plaguing KM implementation in the past.

1. IT for knowledge management has become affordable for most organizations.
2. "Smarter" search engines have enabled information to be organized from a socio-cultural and user perspective rather than codified according to a library system.
3. The rise of the knowledge portal has contributed to the "branding" of knowledge management in organizations.
4. IT tools for KM are actually more complicated than they appear, and they do require significant energy to implement and sustain.
5. IT is helping to build knowledge management into work processes—from project management to product development to selling.
6. The importance of making connections—of people to people and of people to information —is the driver to use IT in KM initiatives.

Information and knowledge form a virtuous circle. We define knowledge as "information in use." Knowledge cannot exist without information. With good information, people can make better decisions and take intelligent action.

Some Applications of KM

Wipro

Wipro Infotech offers a comprehensive suite of IT infrastructure solutions, professional services, communication services, and business solutions.

Knowledge Management in Wipro Infotech has three objectives:

- Mature the organization to a competency-based and knowledge-driven organization,
- Enable new technology/practices adoption for diversification and growth.
- Develop competency extension framework to create new business opportunities.

The Wipro Infotech KM framework has three main components, which enable the organization. They are:

- Learning
- KEEP (Knowledge Enhancement, Extraction and Practice)
- CARE (Competency Augmentation with Research Excellence)

Learning ensures that people build their competency using a mix of tools and processes like e-learning, competency assessment and competency development through specialize training and personalized instruction. Learning is based on the Competency model.

KEEP

Through the KEEP (Knowledge Enhancement, Extraction and Practice) initiative, Wipro ensures collection of disparate knowledge and expertise within the organization into a central repository. The knowledge is supplemented by gathering additional information from various external resources. The four pillars of KEEP are: taxonomy (a uniform structure through which knowledge can be stored and accessed), IT enablers, practice-based offering, and knowledge channels.

CARE

Through CARE (Competency Augmentation with Research Excellence), they leverage on the expertise and knowledge built-up in the organization, to come up with innovative products and services and inculcate creative thinking within Wipro Infotech that capitalizes on people's competency and expertise, supplementing it with a technology tracking activity, resulting in higher intellectual property.

Also, the company has a system to maintain the KM progress reports.

HLL

HLL has formed Communities of Practice (COP) around their key functions, like branding, packaging, etc. Packaging is their one of the most successful COP. Here in brief is explained the formation, functioning and key activities which this knowledge community is doing.

Packaging in HLL is very important for providing protection to the product in transit and storage, as well as its contribution to pack presentation/brand image. Total packaging cost is very significant. Packaging professionals work very closely with different product categories. The challenge is to deliver packaging and operational excellence right across all categories. The task is to ensure that the collective knowledge of the packaging community irrespective of the category to which they are linked, is fully leveraged for maximum, collective value addition.

The packaging team formed a knowledge community consisting of the packaging developing managers and officers and packaging buyers of various businesses in the company. Some of the key suppliers were also invited to be part of the community. This community developed a charter. The charter included areas for improving speed and quality of innovations, identifying opportunities for technology-led cost effectiveness, and creating processes for achieving packaging synergy through harmonization, exchange of best proven practices and cross-category transfer of key insights obtained.

The community is very focused on learning, sharing and effective implementation of its charter. Knowledge is shared in a structured way, with each team member wearing two 'hats'—one of the business/category unit and the other of packaging. The community meets periodically to share knowledge in a structured way and monitors progress on implementation of the charter. This has enabled systematic implementation of packing innovation projects and preparation of best practice documents. The following approaches have been adopted:

- Clarification of business objectives from the business team, understanding the packaging skills chain, and improving appreciation of consumer needs through participation in 'consumer clinics'.
- The team identifies well-defined knowledge blocks in the packaging area and appoints sub-teams to specialize/lead in each of the knowledge blocks.
- The packaging community organizes 'knowledge workshop' to generate new ideas and opportunities. It focusses on capability building through continuous skill-mapping, gap analysis and need-based training.
- The team has developed an intranet application with collaboration tools.

The case of the packaging community demonstrates that KM is essentially a process to increase the capacity for energetic and focussed action, by connecting people to people and people to knowledge; that KM facilitates capability building; it raises the floor, raises the ceiling; that it promotes a culture of faster transfer of best proven practices and insights; and that an organized KM process reduces the scope for 'reinventing the wheel'

Knowledge Management and Intellectual Capital

Companies are typically well versed in assessing and valuing tangible assets such as buildings, machinery, cash and so forth, but such measures do not include the value of the workforce, their knowledge, the way they use computer systems, and so on. In an information society, such intangible assets may represent significant competitive advantage. In service-oriented companies, there may be few tangible assets, yet the organization may be extremely valuable. Organizational resources can be split into two categories: tangible and intangible. Tangible resources are those typically found on the balance sheet of a company: cash, buildings, machinery and so forth. The other category comprises intangible assets: people and their expertise, business processes, intellectual property and market assets such as customer loyalty, repeat business and so forth. Collectively these intangible assets are referred to as Intellectual Capital. In our society, more and more businesses are evolving whose value is not based on their tangible assets but on their intangible ones. Examples include the service sector and any enterprise where business relies on people, such as software development.

However, although intangible assets may represent competitive advantage, some organizations do not understand their nature and value. They do not understand what know-how, management potential or creativity they have access to with their own employees. Because they are devoid of such information, they are downsizing and re-engineering in a vacuum. They do not know that if they are laying off expertise, they will have to rehire next month.

Intangible assets such as know-how, customer relations, networking infrastructure, business processes, patents and so on, which also add value to the organization, are rarely measured, nor their growth monitored and nurtured as part of a corporate growth strategy. These elements are collectively referred to as Intellectual Capital (1C).

One way to look at intellectual capital as perceived by investors, is to look at the difference between the net worth of a company with its market capitalization. Companies with higher intellectual capital will have higher market capitalization, as shown in Table 9.3.

In the case of TISCO, Infosys etc., the market capitalization is three times the net worth, On the other hand, the market capitalization of Bombay dyeing is half of its net worth.

9.6 E-Business Strategy and Data Warehousing and Data Mining

A data warehouse is a *structured, extensible environment* designed for the analysis of *nonvolatile data, logically and physically transformed* from multiple source applications to align with business structure, updated and maintained for a long time period, expressed in simple business terms, and summarized for *quick analysis.*

COMPANY NET WORTH AND MARKET CAPITALIZATION

Company	*Latest year*	*Net worth*	*Market capitalization*
		(Rs. Cr.)	(Rs. Cr.)
TISCO	Mar-04	4515.80976	14010.7502
TELCO/TATA MOTORS	Mar-03	2596.776	4969.692
IOC	Mar-03	18927.91036	12130.1213
ONGC	Mar-03	35738.7576	51189.81
BOMBAY DYEING	Mar-03	353.379	174.72
INFOSYS	Mar-03	2858.9132	6686.2
WIPRO	Mar-03	3329.4	9558.3075
SATYAM	Mar-03	2134.5115	5565.0775
		($ Million)	($ Million)
MICROSOFT	Jun-03	61.1793	296.725
INTEL	Dec-03	37895.00	169390.65
GM	Dec-03	25267.52	24509.4944
IBM	Dec-03	27948.00	145609.08

Importance of Data Warehouse for an Organization

The utility of data warehousing to an organization comprises:

1. *Immediate information delivery.* Data warehouses decrease the length of time between business events occurrence and executive alert. Using a data warehouse, daily. weekly and monthly sales reports are available on a daily basis. Given this data delivery time compression, business decision makers can exploit opportunities that they would otherwise miss.

2. *Data integration from across and even outside the organization.* To provide a complete picture, data warehouses typically combine data from multiple sources such as a company's order entry and warranty systems. Thus, with a warehouse, it may be possible to track all interactions a company has with each customer—from that customer's first inquiry, through the terms of their purchase, all the way through any warranty or service interactions.

3. *Future vision from historical trends.* Effective business analysis frequently includes trend and seasonality analysis. To support this, warehouses typically contain data of multiple years.

4. *Tools for looking at data in new ways.* Instead of paper reports, warehouses give users tools for looking at data differently. They also allow those users to manipulate their data. An interactive table that allows the user to drill down into detailed data with the click of a mouse can answer questions that might take months to answer in a traditional system.

Characteristics of a Data Warehouse

The main features of a data warehouse are:

• ***Subject oriented.*** Data warehouses are designed to analyze the data. Suppose, sales executive wants to learn more about the top 10 customers, a data warehouse is built with a focus on sales, thus imparting itself subject orientation.

• ***Integrated.*** Integration is closely related to subject orientation. Data warehouse must put together data from disparate form into consistent format. They must resolve the naming conflicts and inconsistencies among units of measure, in order to be integrated,

• ***Non-volatile.*** This means that once data has been entered into the data warehouses it cannot be changed.

• ***Time variant.*** In order to find business trends, management needs to analyze large amount of data quickly in contrast to OLTP(On Line Transaction Processing), where performance requirements lead to archival of history data.

Functions of a Data Warehouse

The principal functions of a data warehouse are:

• ***Extracting.*** Chucking out of data from disparate sources.

• ***Integrating.*** Putting together the extracted data into a consistent format.

• ***Filtering.*** Process of extracting the data from the OLTP or external data sources, For example, the user may be interested in only the last five years' sales data.

• ***Standardizing.*** As the data will be moved from different OLTP database or flat file system to one target, data need to be standardized.

• ***Transforming.*** Data is extracted from OLTP databases and external data sources, Data transformation will have to be carried out on the extracted data before data is carried to the warehouse.

• ***Cleaning.*** To ensure data quality, accuracy.

Data Warehouse Architecture

A Data Warehouse Architecture (DWA) is a way of representing the overall structure of data, communication, processing and presentation that exists for end-user computing within the enterprise. The architecture is made up of a number of interconnected parts:

- Operational Database/External Database Layer
- Information Access Layer
- Data Access Layer
- Data Directory (Metadata) Layer
- Process Management Layer
- Application Messaging Layer
- Data Warehouse Layer
- Data Staging Layer

Business Use of a Data Warehouse

No discussion of the data warehousing systems is complete without review of the type of activity supported by a data warehouse. Some of the activity against today's data warehouses is predefined and not much different from traditional analysis activity. Other processes such as multi-dimensional analysis and information visualization were not available with traditional analysis tools and methods.

Standard Reports and Queries

Many users of the data warehouse need to access a set of standard reports and queries. It is desirable to periodically, automatically produce a set of standard reports that are required by many different users. When these users need a particular report, they can just view the report that has already been run by the data warehouse system rather than running it themselves. This facility can be particularly useful for reports that take a long time to run.

Such a facility would require report server software. It is likely that these reports can be accessed only using the client program for that system. This facility would need to work with or be part of the preferred data warehouse access tool previously mentioned. Many end-user query and analysis tools now include server software that can be run with the data warehouse to serve reports and query results. These tools are now providing a Web interface to the reports. In many data warehouse systems, this report and query server becomes an essential facility. The data warehouse users and administrators constantly need to consider any reports that are candidates to become standard reports for the data warehouse. Frequently, individual users may develop reports that can be used by other users.

Data Mining

Data mining, in simple terms, can be called as the extraction of hidden predictive information from large databases or data warehouses. The growth of data warehousing has created huge chunks of data. These chunks represent a valuable resource to the enterprise. But to extract value from these data chunks, we must "mine" for high-grade "nuggets" of precious metal, i.e. the gold in data warehouses and data marts.

Data mining tools predict future trends and behaviours, allowing businesses to make proactive, knowledge-driven decisions. The automated, prospective analyses offered by data mining move beyond the analyses of past events provided by retrospective tools typical of decision support systems. Data mining tools can answer business questions that traditionally were too time-consuming to resolve. They scour databases for hidden patterns, finding predictive information that experts may miss because it lies outside their expectations.

Most companies already collect and refine massive quantities of data. Data mining techniques can be implemented rapidly on existing software and hardware platforms to enhance the value of existing information resources, and can be integrated with new products and systems as they are brought online. When implemented on high performance client/ server or parallel processing computers, data mining tools can analyze massive databases to deliver answers to questions such as, "Which clients are most likely to respond to the next promotional mailing, why?"

Data mining software allows users to analyze large databases to solve business decision problems. Data mining is, in some ways, an extension of statistics, with a few artificial intelligence and machine learning twists thrown in. Like statistics, data mining is not a business solution, it is just a technology. Consider a catalogue retailer who needs to decide who should receive information about a new product. The information operated on by the data mining process is contained in a historical database of previous interactions with customers and the features associated with the customers, such as age, zip code, and their responses. The data mining software would use this historical information to build a model of customer behaviour that could be used to predict which customers are likely to respond to the new product. By using this information, a marketing manager can select only the customers who are most likely to respond. The operational business software can then feed the results of the decision to appropriate touch point systems (call centers. Web servers, e-mail systems, etc.), so that the right customers receive the right offers.

The Scope and the Techniques Used

Given databases of sufficient size and quality, data mining technology can generate new business opportunities by providing these capabilities:

- ***Automated prediction of trends and behaviours.*** Data mining automates the process of finding predictive information in large databases. Questions that traditionally required extensive hands-on analysis can now be answered directly from the data — quickly. A typical example of a predictive problem is "targeted marketing". Data mining uses data on past promotional mailings to identify the targets most likely to maximize return on investment in future mailings. Other predictive problems include forecasting bankruptcy and other forms of default, and identifying segments of a population likely to respond similarly to given events.

- ***Automated discovery of previously unknown patterns.*** Data mining tools sweep through databases and identify previously hidden patterns in one step. An example of "pattern discovery" is the analysis of retail sales data to identify seemingly unrelated products that are often purchased together. Other pattern discovery problems include! detecting fraudulent credit card transactions and identifying anomalous data that could represent data entry keying errors.

Data mining techniques can yield the benefits of automation on existing software and hardware platforms, and can be implemented on new systems as existing platforms are upgraded and new products developed. When data mining tools are implemented on high-performance parallel processing systems, they can analyze massive databases in minutes. Faster processing means that users can automatically experiment with more models to understand complex data. High speed makes it practical for users to analyze huge quantities of data. Larger databases (larger in depth as well as breadth), in turn, yield improved predictions. The following techniques are used in data mining:

• ***Artificial neural networks.*** Non-linear predictive models that learn through training and resemble biological neural networks in structure.

• ***Decision trees.*** Tree-shaped structures that represent sets of decisions. These decisions generate rules for the classification of a dataset. Specific decision tree methods include Classification and Regression Trees (CART) and Chi-Square Automatic Interaction Detection (CHAID).

• ***Genetic algorithms.*** Optimization techniques that use processes such as genetic combination, mutation, and natural selection in a design based on the concepts of evolution.

• ***Nearest neighbour method.*** A technique that classifies each record in a dataset based on a combination of the classes of the k record(s) most similar to it in a historical dataset (where $k^3 = 1$). Sometimes called the k-nearest neighbour technique.

• ***Rule induction.*** The extraction of useful if-then rules from data based on statistical significance.

Many of these technologies have been in use for more than a decade in specialized analysis tools that work with relatively small volumes of data. These capabilities are now evolving to integrate directly with industry-standard data warehouse and OLAP (On-line Analytical Processing) platforms.

Business Applications

A wide range of companies have deployed successful applications of data mining, early adopters being industries such as financial services and direct mail marketing. The technology is applicable to any company looking to leverage a large data warehouse to better manage their customer relationships. Two critical factors for success with data mining are: a large, well-integrated data warehouse and a well-defined understanding of the business process within which data mining is to be applied, such as customer prospecting, retention, and campaign management.

Some of the applications of data mining in business are as follows:

A pharmaceutical company can analyze its recent sales force activity and their results to improve targeting of high-value physicians, and determine which marketing activities will have the greatest impact in the next few months. The data needs to include competitor market activity as well as information about the local health care systems. The results can be distributed to the sales force via a Wide Area Network that enables the representatives to review the recommendations from the perspective of the key attributes in the decision process. The ongoing, dynamic analysis of the data warehouse allows best practices from throughout the organization to be applied in specific sales situations.

A credit card company can leverage its vast warehouse of customer transaction data to identify customers most likely to be interested in a new credit product. Using a small test mailing, the attributes of customers with an affinity for the product can be identified.

A diversified transportation company with a large direct sales force can apply data mining to identify the best prospects for its services. Using data mining to analyze its own customer experience, this company can build a unique segmentation identifying the attributes of high-value prospects.

A large FMCG company can apply data mining to its retailers to improve its sales process. Data from consumer panels, shipments, and competitor activity can be| applied to understand the reasons for brand and store switching. Through this analysis, the manufacturer can select promotional strategies that best reach their, target customer segments.

9.7 Summary

This chapter covers topics related to information and strategy, value chain, planning e-commerce projects, knowledge management with data warehousing and data mining.

EXERCISES

1. Describe the value chain of e-commerce.

2. Describe the procedures for implementing e-commerce.

3. How would you start performing the industry analysis for a small business that wants to launch an e-commerce project?

4. What might be the typical competitive strategy for a company trying to launch bookselling business?

5. Survey three different online travel agencies (e.g. *cheo.ptickets.com, priceline /previewtravel.com)* on the Web and compare their business strategies for customer Focus on how they compete against physical travel agencies.

6. Go to Nissan Motor Corporation's website *(Nissan.com}*. Find out how Ni complements its promotion and sales program with its Web presence. What are business values added by its website?

10. Mobile Commerce

In this Chapter we will discuss

- Wireless technologies, protocols and security
- Growth of wireless communications
- Success stories in m-commerce

Structure of the chapter

10.1 Introduction & growth of M-commerce

Mobility is one of the key factors which help business thrive. Businesses that embrace the idea of Mobile Information Society will reinvent themselves as real-time organizations, where access and interaction can be instant. New brands, partnerships and customer loyalties are on the rise, thanks to the growing number of mobile terminals. It is estimated that by the end of 2002, there will be 1 billion mobile phone subscribers in the world' and this is an evidence of their increased role in businesses—both to the customers and to the companies.

Tables 10.1, 10.2, 10.3, 10.4, 10.5 and 10.6 illustrate the tremendous growth potential for mobile commerce

TABLE 10.1

USERS OF WIRELESS FINANCIAL SERVICES IN WORLD REGIONS, 2000–2005

(*In millions*)

Region	*2000*	*2005*
North America	0.45	34.97
Western Europe	3.89	76.55
Asia-Pacific	4.81	83.74

Growth of Mobile Commerce

Three major segments that can substantially benefit from anywhere and have anytime access to information and services with the use of mobile phones are: financial services, providers, healthcare industry, and corporations with a mobile workforce.

Tightening competition, globalization and changes in customer behaviour present new challenges to many service organizations. Combined with advances in technology, they have

TABLE 10.2

GLOBAL MOBILE COMMERCE REVENUES, 2000–2005 (US$ millions)

Region	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
North America	0.0	0.1	0.2	0.7	1.8	3.5
Western Europe	0.0	0.1	0.5	1.7	4.6	7.8
Asia	0.4	1.3	2.6	5.0	7.4	9.4
Latin America	0.0	0.0	0.0	0.1	0.2	0.5
Other	0.0	0.0	0.1	0.2	0.4	1.0
Global	**0.4**	**1.5**	**3.4**	**7.6**	**14.5**	**22.2**
US	0.0	0.1	0.2	0.6	1.7	3.3
Japan	0.4	1.2	2.1	3.5	4.5	5.5

TABLE 10.3

NORTH AMERICAN AND GLOBAL WIRELESS WEB USERS, 2000–2005

(In millions)

Region	2000	2001	2002	2003	2004	2005
North America	0.2	0.3	14	37.5	63.7	95.6
World Total	6	16	77	190	322	484

TABLE 10.4

GLOBAL WIRELESS WEB SUBSCRIBERS AND mCOMMERCE USERS

(In millions)

	2000	2001	2002	2003	2004
Wireless subscribers	469	643	821	1006	1192
Wireless Internet users	6	16	77	190	322
mCommerce buyers	22	65	139	249	373

put several industries into round-the-clock operations. Financial institutions are no exception. Their distribution systems and customer interfaces have gone through major changes. By innovatively combining mobile technology with other distribution channels, financial services providers can establish closer, more profitable, and more stable customer relationships.

For financial services providers, the mobile phone has introduced a new channel to reach customers—one that is personal, easy-to-use, secure, location, and time independent Bank branches are becoming increasingly expensive to operate, and the established self-service solutions, such as ATMs and Internet banking, cannot provide competitive efficiency or satisfy the needs of the new generation of customers who want to do business when it is most convenient for them. Tables 10.5 and 10.6 demonstrate the potential of the wireless financial payments.

TABLE 10.5

WORLDWIDE USERS OF WIRELESS FINANCIAL PAYMENTS, 1999–2004

(In million)

	1999	2000	2001	2002	2003	2004
Europe	0.5	2	4	10	19	31
Asia-Pacific	0.5	3	7	13	21	29
US	n/a	n/a	n/a	0.5	1	2

TABLE 10.6

PERCENTAGE OF WAP-ENABLED BANKING IN WESTERN EUROPE, 2000

Year	Total (In million)
2000	2
2001	5
2002	13
2003	24
2004	32

10.2 Success Stories of Mobile Commerce

Nordea

In October 1999, Nordea became the world's first financial institution to offer Wireless Application Protocol (WAP) banking services. Customers can track their account and credit card transactions, transfer funds between accounts, pay bills both domestically and abroad, trade equities, and read customer e-mail and short news items from the bank with their mobile phone. The service also allows customers to shop in Nordea's virtual marketplace, Solo Mall.

Deutsche Bank

As the biggest bank in the Euro zone, Deutsche Bank has responded to the explosion of WAP-based services. At the heart of these services is the Nokia WAP solution based on the Nokia WAP Server. In accordance with worldwide security standards, the solution is highly secure and implements 'Wireless Transport Layer Security (WTLS).

SGS **Mobile Application**

Since December 1999, the Scandinavian Garment Service (SGS), one of the leading logistics companies in the Nordic and Baltic region, has been using a Nokia Active Server-based mobile application to keep its drivers and customers informed about the status of shipments. Prior to implementing the mobile solution, less than 50 per cent of shipments appeared on SGS's order-tracking website on the shipment day. Today 97 per cent of all regularly scheduled shipments are listed on the site, lowering customer service costs and increasing customer satisfaction.

WAP-based Accommodation Reservation in Scandic Hotels

Scandic Hotels is the first hotel chain in the world to offer their guests the opportunity to access services via a WAP-enabled phone. In addition to accommodation reservation opportunities, customers can receive news, special offers, and other relevant information. The service is enabled by a Nokia WAP solution, comprising the Nokia WAP Server, mobile handsets, and consulting services.

Houston Makes Fine Wireless

The city of Houston has ordered from Motorola, a wireless system for writing traffic tickets. Motorola's premier hand-held citation application will enable Houston's police officers to retrieve and relay data through wireless, and prepare traffic citations on the spot from a single hand-held device. It eliminates the need to hand-write traffic tickets. The system automatically prepares a clearly printed citation in seconds with only a few strokes of a stylus. The wireless citation system allows officers in the field to enter required citation data, collect officer notes, capture officer's and offender's electronic signatures, as well as print the citation itself.

Sun Latches on to the Smart Tags

Sun Microsystems is entering the Radio Frequency Identification (RFID) world. It has joined an Auto-ID program to build radio frequency identification tags which can be used with everything from razor blades to soup cans. Sun hopes to supply the mammoth servers that will process all the information produced by these devices. Sun has joined the Auto-ID program at the Massachusetts Institute of Technology, funded by Procter & Gamble, Gillette, Wal-Mart, Unilever, Tesco, Target, and other corporations. One of the goals of the Auto-ID program is to keep store-shelves full. On any given afternoon, 8 per cent of the items that U.S. shoppers are looking for are out of stock. Auto-ID uses passive tags that respond to a specific radio signal. A tiny capacitor on the chip stores enough energy from the incoming signal to send out a response. The tags only respond when near a special reader device. The tags also have a miniature chip and enough memory to keep track of a digital identity. The memory is of 96 bits, tiny by computer standards but provides a huge number of combinations of ones and zeros.

The technology is set up to identify more than 268 million manufacturers with more than a million individual products each. The memory stores an electronic product code, or EPC, which is linked with an Internet service called the Object Naming Service (ONS) that keeps track of data for every EPC-labelled object. Researchers are also working on a pared-down 64-bit version of EPC.

Mobile Health Services

There is a growing need for the wireless services in health care and medicine. In the US, the Institute for Safe Medication Practices has called for the elimination of handwritten prescriptions by 2003. The provision of wireless hand-held devices means that prescribing can be done electronically. In addition, other tasks that can be carried out wirelessly include billing, lab ordering, referrals, and clinical decision support. The same technology could be used to reduce medical error or give health care providers the information resources to make life-critical decisions whilst on the move.

The benefits of the wireless technology can be illustrated with a number of different examples. Patient information can be obtained by health care professionals from any given location because they can be connected wirelessly to the institution's information system. Physicians' access to patient histories, lab results, pharmaceutical information, insurance information and medical resources would be enhanced immeasurably, thus drastically improving the quality of patient care. Hand-held devices can also be used in home healthcare, as for example, effective monitoring of blood sugar and blood pressure levels.

Connecting hospitals wirelessly does not impersonalize medicine or change the way a physician interacts with a patient. Yet it gives opportunity for efficient collection of information entered on hand-held devices—information which is then easily made available to any healthcare professional who is able to access it from the hospital's wireless LAN. In exactly the same way, a change in the status or location of a patient can be immediately documented wirelessly, and medication profiles can be checked. The ultimate effect of Wireless Local Area Network (WLAN) is to free hospital staff from the tether of a stationary PC. Where handhelds are in use, there are two operating systems vying for market share—Palm OS and Windows CE. The Palm OS is currently the most popular, a likely reason being its comprising over 90 per cent of all new WLAN installations. In 2001, the 802. llb standard became the format of choice within the hospital segment. Network unit sales in this market continued to be brisk into 2002, with a noticeable demand increase for the newly released 802.11 a chipset-equipped hardware.

The sensitive nature of patients' medical records has made information protection a genuine concern among buyers of 802. llb products. Currently, the only native wireless encryption system that exists to safeguard data during transmission is the Wireless Equivalent Protocol (WEP) that utilizes basic access control mechanisms such as user authentication keys. The reported design flaws in WEP architecture are now forcing 802.11 working group committees to consider viable add-on encryption schemes for the ultimate goal of a secure WLAN environment.

TABLE 10.7

PROJECTED USE OF WIRELESS DATA APPLICATIONS, 2000–2005

(*In millions*)

Application	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Messaging	100	230	399	611	916	1268
E-commerce/retail	12	36	107	195	318	469
Financial services	50	123	225	357	529	798
Intranet (corporate)	5	20	49	81	129	206
Internet, WAP	4	20	85	183	344	614
Entertainment	61	143	246	372	554	775
Navigation	47	146	239	345	488	785

10.3 Wireless Applications

A wireless application is a software that runs on a wireless device that exchanges content over a wireless network. The actual wireless applications are distinguished from one another based on the wireless devices, networks and application families, which can be summarized as:

• ***Web phones.*** The most common device is the Internet-ready cellular phone, which we call a Web phone. There are three major Web phones: the US HDML & WAP phone, the European WAP phone, and the Japanese I-mode phone. With them, you can exchange short messages, access the Web with a micro browser, and run personal service applications such as locating nearby items of interest. Most Web phones work only when they have a network connection. Newer advanced Web phones can:' run applications,

• ***Wireless handholds.*** Another common device, the wireless handheld, such as a Palm, can also message and use a micro browser. The industrial handhelds, such *as* Symbol or Psion, can perform very complex operations such as completing orders and taking customer signatures. They have the advantage of working offline.

• ***Two-way pagers.*** *A* device used often in business is the pager. The most popular is the two-way pager because it lets you receive and send a message as well as use a micro browser.

• ***Voice portals.*** *A* recent innovation is the voice portal, which lets you have a conversation with an information service by using a kind of telephone or mobile phone.

• ***Communicating appliances.*** Such electronic devices are fitted with wireless technology that can participate in the Internet. Examples include wireless cameras, watches, radios, pens, and many other devices.

Web PCs. The standard Internet-connected personal computer is still used as an access method to mobile accounts, wirelessly or otherwise.

10.4 Technologies for Mobile Commerce

Wireless Spectrum

The electromagnetic spectrum, or simply spectrum, is the entire range over which communicating devices transmit energy waves. The electromagnetic spectrum is assigned common groupings of energy waves, commonly called *airwaves,* that make bands of the spectrum. Over the airwaves, TV, radio, cell phones, or any wireless Internet devices communicate with a transceiver. Each kind of transceiver uses dedicated frequency ranges that are measured in hertz (Hz); 1 Hz is one cycle per second.

An interesting property of the spectrum is that higher frequencies travel shorter distances. They take more power to transmit. With enough power, they can be life-threatening. Higher frequencies can be modulated to carry more bits per second than longer waves, but they are subject to atmospheric interference. Broadcasters generally prefer owning a lower frequency because it costs less to transmit a signal, it carries farther, and it is generally "safer".

The US Federal Communications Commission (FCC) and similar agencies around the world break up the spectrum and assign bands for specific purposes. Bands are ranges of frequency with common names. Worldwide bodies, such as the International Telecommunications Union (ITU), also make frequency agreements, so that devices will operate clearly worldwide. Regulating radio interference is necessary so that wireless devices do not interfere with one another. To prohibit interference from a neighboring transmitter, the FCC restricts bands of coverage.

The owner of popular mobile cellular bands must obtain an FCC license, which guarantees the owner, exclusive use in a territory. Other parts of the spectrum go unlicensed, such as the Instrument Medical Scientific (ISM) at 2.4 GHz and Unlicensed National Information Infrastructure (U-NII) at 5 GHz. Unlicensed sections of the spectrum are open to use by any transmitting device. It may interfere with, and—to express colorfully—it may step on the signal of another wireless devices. With intelligent signal processing, interference conflicts can be minimized.

Over the time, the FCC has been licensing higher and higher spectrum with wireless technology. In the 1980s, the FCC licensed 800 MHz for cell phones; this part of the spectrum sits above the established AM and FM spectrum. When cellular spectrum was used up in 1996, the FCC auctioned off the higher-spectrum 1900 MHz licenses to operate at a lower power range called Personal Communications Services (PCS). Your cell phone today typically uses either the 800 MHz or the newer 1900 MHz band of the spectrum to transmit signals. A "dual-band" cell phone can use either of these parts of the spectrum.

WAP

Wireless Application Protocol (WAP) was invented and is driven by the WAP Forum—a group originally formed by Nokia, Ericsson, Motorola and *Phone.com* in 1997. WAP is an open specification that offers a standard method to access Internet-based content and services from wireless devices such as mobile phones and PDAs (Personal Digital Assistants). The WAP model is very similar to the traditional desktop Internet. The mobile device has an embedded browser, and the operator's network that optimizes the transmission of the content software that connects to a WAP Gateway (software infrastructure residing in for the wireless network) and makes requests for information from Web servers in the normal form of a URL. The content for wireless devices can be stored on any Web server on the Internet. Content must be formatted suitably for the mobile phone's small screen and low bandwidth/ high latency connection. Content is written in a markup language called Wireless Markup Language (WML). WML script enables client side intelligence. The main benefits of WAP include:

1. Non-proprietary method to access Internet-based content and services

2. It is network independent

3. It has been adopted by 95 per cent of handset manufacturers and is being implemented by the majority of carriers

4. WAP browsers can be built on top of any operating system, including PalmOS, EPOC, Windows CE, FLEXOS, OS/9, JavaOS, etc.

Origins of WAP

While all the four companies that founded the WAP Forum had a hand in the currently available WAP technology set, its basis was a gift from *Phone.com.* The company incorporated in 1994 as Libris Inc., changed its name twice: first to Unwired Planet and then to *Phone.com,* By November 1995 the company hosted the first public demonstrations of its UP.Browser, a micro-web browser for cellular phones.

While HTML and related technologies such as JavaScript, Java, and Flash work well for desktop computers and laptops with large displays, it is a poor markup language for devices with small screens and limited resolution. Colour graphics, animation, and sound, challenge the developers under the best of conditions. Additionally, these types of devices lack the processing power and memory to handle multimedia.

To combat this, *Phone.com* developed a set of technologies related to HTML but tailored to the small screens and limited resources of hand-held, wireless devices. Most notable is Handheld Device Markup Language (HDML). HDML on paper looks similar to HTML, but has a feature set and programming paradigm tailored to wireless devices with small screens.

Between November 1995 and June 1997, Unwired Planet negotiated major contracts with many prominent cellular phone makers to use their HDML-based UP.Browser, and with cellular phone infrastructure companies to install UP.Link Servers to handle requests from the UP.Browser. Mitsubishi demonstrated the UP.Browser running on their Mobile Access Phone in January 1996. AT&T Wireless, Bell Atlantic Mobile, Samsung, QUALCOMM, and GTE quickly followed with announcements that they too would utilize Unwired Planet's technology.

In June 1997, Unwired Planet, along with Ericsson, Nokia, and Motorola, announced the formation of the WAP Forum. Instead of fighting imminent competition from other companies offering their own standards, these companies sought to make their technologies the standard for mobile Internet access. Unwired Planet offered HDML—the markup language, and the Handheld Device Transport Protocol (HDTP); Nokia brought their Smart Messaging protocol; Ericsson offered their Intelligent Terminal Transfer Protocol (ITTP). This alphabet soup simmered for a few months until April 1998 when the Forum delivered the WAP 1.0 specification. This specification is a set of documents describing the protocol. There are several of them and, they are long and technical. They cover everything from the overall architecture and security information to the binary format of a WAP application and a description of WMLScript (similar to JavaScript). The documents contain enough information for any developer to learn the minutiae needed for creating WAP-based products.

Philosophy of WAP

WAP takes a client/server approach. It incorporates a relatively simple micro-browser into the mobile phone, requiring only limited resources on the mobile phone. This makes WAP suitable for thin clients and early smart phones. WAP puts the intelligence in the WAP Gateways whilst adding just a micro-browser to the mobile phones themselves. Micro-browser-based services and applications reside temporarily on servers, not permanently in phones. WAP is aimed at turning a mass-market mobile phone into a "network-based smart phone". The WAP is envisaged as a comprehensive and scaleable protocol designed for use with any mobile phone—from those with a one-line display to a smart phone—and any existing or planned wireless service, such as the Short Message Service, Circuit Switched Data, Unstructured Supplementary Services Data (USSD), and General Packet Radio Service (GPRS). Indeed, the importance of WAP can be found in the fact that it provides an evolutionary path for application developers and network operators to offer their services on different network types, bearers, and terminal capabilities. The design of the WAP standard separates the application elements from the bearer being used. This helps in the migration of some applications from SMS or CSD to GPRS for example. WAP has been designed to work with all cellular standards and is supported by major worldwide wireless leaders such as AT&T Wireless and NTT DoCoMo, and multiple input terminals such as keypads, keyboards, touch-screens and styluses.

WAP embraces and extends the previously conceived and developed wireless data protocols. *Phone.com* created a version of the standard HTML Internet protocols designed specifically for effective and cost-effective information transfer across mobile networks. Wireless terminals incorporated a HDML (Handheld Device Markup Language) micro-browser, and *Phone.corn's* Handheld Device Transport Protocol (HDTP) then linked the terminal to the Uplink Server Suite that connected to the Internet or intranet where the information being requested, resides. The Internet site content was tagged with HDML. This technology W<B) incorporated into WAP, and then renamed using some of the many WAP-related acronyms, such as WMLS, WTP, and WSP. Someone with a WAP-compliant phone uses the in-built; micro-browser to make a request in WML, a language derived from HTML especially for wireless network characteristics. This request is passed to a WAP Gateway that then retrieval the information from an Internet server either in standard HTML format or preferably directly prepared for wireless terminals using WML. If the content being retrieved is in HTML: format, a filter in the WAP Gateway may try to translate it into WML. A WML scrip language is available to format data such as calendar entries and electronic business c for direct incorporation into the client device. The requested information is then sent f the WAP Gateway to the WAP client, using whatever mobile network bearer service available and most appropriate.

As we explore the WAP transaction model, shown in Figure 10.2, you will find that is fundamentally the same as the Web transaction model in Figure 10.1, but with a few key differences.

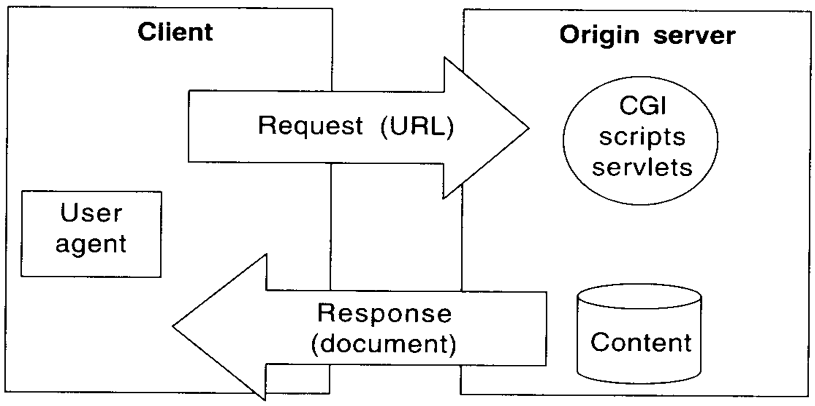


Fig. 10.1 The WWW transaction model.

The most significant difference is the need for what is called a gateway between the client and the Web server, which contains the information you are interested in accessing, The gateway's duties include the translation of WAP formatted messages received from the WAP device into HTTP messages that can be sent to any Web server on the Internet. When the Web server responds, it will most likely send a file containing WML and WML Script, the WAP equivalents of HTML and JavaScript. It is the gateway's job to change that text file into a WAP binary file and encrypt it. A file in this format is more suitable for wireless transmission to the device that requested the information,

The gateway is also responsible for knowing the character sets and languages of the WAP devices that use it. Whether it is an English WAP device talking to a German Web server or a Japanese WAP device requesting information from a French Web server, the gateway needs to ensure that the requester receives a coherent message.

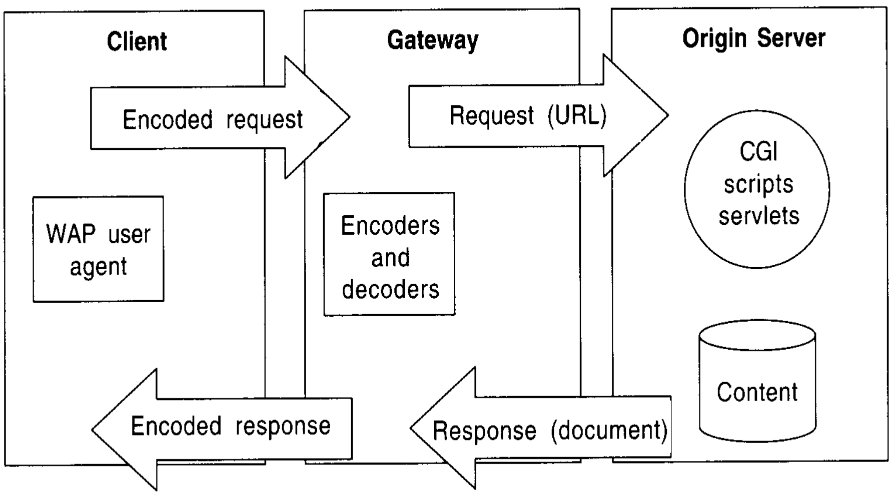


Fig.10.2 The WAP transaction model.

WAP Step-by-Step

Let us walk through a typical WAP transaction, so as to understand the steps involved in retrieving information from the Web server:

• A user requests a URL by entering it into a WAP device. (Alternately, an already-running WAP program requests a URL on behalf of the user.) For the sake of argument, let us say the request is for *www.wmlserver.com/ myweather.wml.*

• The WAP device encodes the request into an encrypted, compact binary format suitable for transmission over a wireless link, and sends it to the WAP gateway.

• The gateway examines the message, converts it into a valid HTTP-based URL request, and forwards it to *www.wmlserver.com.*

• When *wmlserver.com* receives the request, it fulfils it by returning the requested document back to the gateway.

• The gateway converts the HTTP response back into an encrypted, binary format and ships it off to the WAP device.

• The WAP device decodes the response and displays the results on the WAP device's screen.

As you can observe, there are some similarities between the Web and the WAP transactions. For instance, they both use a request-response process, whereby the browser initiates the process. They both also use Web servers to deliver the requested content. These similarities let companies with investments in Web technology and resources leverage that knowledge to design WAP-based systems.

WAP Architecture

Figure 10.3 shows the Wireless Application Protocol in a series of layers. This layered format mimics the International Standards Organization (ISO) Open Systems Interconnection (OSI) network model. The OSI Model defines a layered framework for generically describing, designing protocols. The OSI Model has seven layers. WAP uses six, but the approach! Similar.

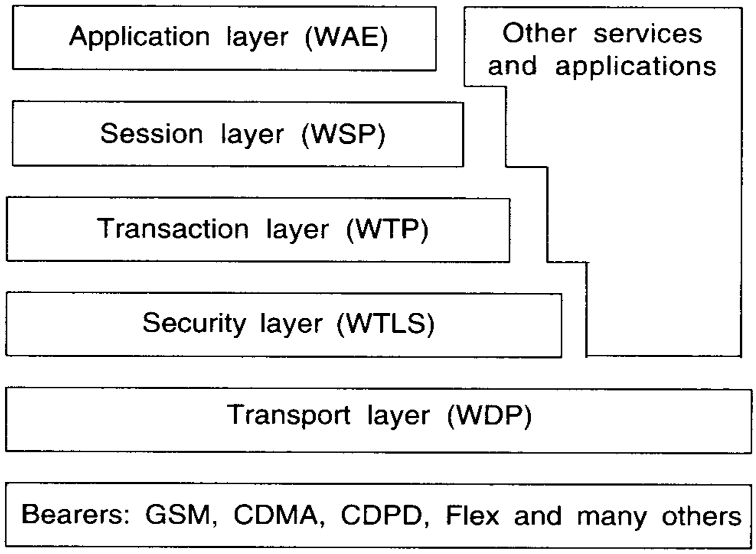


Fig. 10.3 The WAP architecture.

Each layer in Figure 10.3 is responsible for managing some part of WAP. Additional each layer is only allowed to interact with the layer above and below it. This helps to define clear roles for each layer. URL requests from a WAP device start at the application layer a get processed until the request goes out over a bearer network to the gateway. Responses enter the device at the bearer level, and are transformed and finally displayed at the application layer.

WAP requests from an application must be transformed into a certain format before being sent wirelessly to a gateway and finally off to a Web server to have the request fulfilled. The response on the return trip is unencrypted and decoded before being displayed on the screen. Each request and response must proceed through the set of layers in Figure 10.3 in the correct order each and every time. With all these in mind, let us analyze the WAP architecture layers.

WAP Application Environment (WAE)

The Wireless Application Environment layer is the one you are most likely concerned with if you are considering deploying WAP applications. It encompasses the devices, the content development languages you use (WML and WML Script), the telephony APIs (WTA) accessing telephony functionality from within WAE programs, and some well-defined com formats for phone book records, calendar information, and graphics.

Wireless Session Protocol (WSP)

WSP layer provides a consistent interface to WAE for two types of session services; connection mode, and a connectionless service. Without getting bogged down into details, it is important to note the services this layer enables, such as the following:

- Creating and releasing a connection between the client and server.
- Exchanging data between the client and server using a coding scheme that is much more compact than traditional HTML text.
- Suspending and releasing sessions between the client and server.

Wireless Transaction Protocol (WTP)

Now we are getting a bit more technical. WTP provides transaction services to WAR It handles acknowledgements so that you can tell if a transaction succeeded. It also provides retransmission of transactions in case they are not successfully received, and removes duplicate transactions.

WTP manages different classes of transactions for WAP devices: unreliable one-way requests, reliable one-way requests, and reliable two-way requests. A reliable request means that acknowledgements are sent from the receiving device. An unreliable request from a WAP device means that no precautions are taken to guarantee that the request for information makes it to the server. You might think that this is a ludicrous transaction type. Why would anyone request something, but not care if it was actually fulfilled? One-way paging networks work is in this fashion. If you page someone and the pager is off or out of range, that person does not receive the message.

Wireless Transport Layer Security (WTLS)

WTLS provides services to protect your data, and includes data integrity, privacy, authentication, and denial-of-service protection. Data integrity guarantees that the data sent is the same as that received. WAP privacy services guarantee that all transactions between the WAP device and the gateway are encrypted. Authentication guarantees the authenticity of the client and the application server. Finally, denial-of-service protection detects and rejects data that come in the form of unverified requests.

Wireless Datagram Protocol (WDP)

WDP provides a consistent interface to the higher layers of the WAP architecture so that they need not concern themselves with the exact type of wireless network the application is running on. Among other capabilities, WDP provides data error correction.

Wireless Communications Networks (Bearers)

The bearers, or wireless communications networks, are at WAP's lowest level. WAP is designed to run on a variety of networks, including Short Message Services (SMS), circuit switched connections, and packet-switched networks. Each type of network has pros and cons in terms of performance, delay, and errors.

A Closer Look at WAE

Hopefully, the background on the Web and WAP transaction models provide a high-level picture of this technology. Now that we have dug a bit deeper into the layers of the WAP protocol, let us examine the place where the majority of developers spend their time. It is also the place that you should most likely concern yourself with if you are thinking of using WAP technology. It is the Wireless Application Environment, in short, WAE. It has four key components:

1. *Micro-browser.* Micro-browser defines how WML and WML Script are interpreted by a WAP-enabled device for presentation to the end user.

2. *Wireless Markup Language* *(WML).* It is similar to HTML and defines how data should be formatted and presented to the user.

3. *WML Script.* Similar to JavaScript, WML Script provides some programming logic for performing calculations within an application.

4. *Wireless Telephony Applications.* WTA provides functionality so that developers can integrate micro-browser functions with the telephone. For example, an incoming call may trigger the micro-browser to search your contact list and show the information at the time the call is received.

These elements of the WAE were not just made up by a team of mad scientists bent adding more acronyms to our world. WAP is based on a range of existing Internet technologies.

Wireless Datagram Protocol (WDP)

WDP allows WAP to be bearer independent by adapting the transport layer of the underlying bearer. WDP presents a consistent data format to the higher layers of the WAP protocol stack, thereby conferring the advantage of bearer independence to application developers.

Short Message Service (SMS)

Given its limited length of 160 characters per short message, SMS may not be an adequate bearer for WAP because of the length of the protocol. The overhead of the WAP protocol that would be required to be transmitted in an SMS message would mean that even for the simplest of transactions, several SMS messages might in fact have to be sent. This means that using SMS as a bearer can be a time-consuming and an expensive exercise. Only one network operator—SBC of the US—is known to be developing WAP services based on SMS.

Circuit Switched Data (CSD)

Most of the trial WAP-based services use CSD has the underlying bearer. Since CSD relatively few users currently, WAP could kick-start usage of and traffic generated by this bearer. However, CSD lacks immediacy—it takes 10 seconds to connect the WAP client to the WAP Gateway, and this is the best case scenario when there is a complete end-to-end digital call. When there is a need for analog modem handshaking, the connect time is increased to about 30 seconds.

Unstructured Supplementary Services Data (USSD)

USSD is a means of transmitting information or instructions over a Global System for Mobile (GSM) network. USSD has some similarities with SMS since both use the GSM network's signaling path. Unlike SMS, USSD is not a store and a forward service and is session-oriented such that when a user accesses a USSD service, a session is established and the radio connection stays open until the user, application, or time-out releases it. This has more in common with CSD than SMS. USSD text messages can be up to 182 characters in length. USSD has some advantages and disadvantages as a tool for deploying services on mobile networks.

Turnaround response times for interactive applications are shorter for USSD than SMS because of the session-based feature of USSD, and because it is not a store or a forward service. USSD can be up to seven times faster than SMS to carry out the same two-way transaction. Users do not need to access any particular phone menu to access services with USSD—they can enter the USSD command direct from the initial mobile phone screen. Since these commands are routed back to the home mobile network's Home Location Register (HLR), services based on USSD work just as well and in exactly the same way when users are roaming. USSD works on all existing GSM mobile phones. Both SIM Application Toolkit and the WAP, support USSD. USSD Stage 2 has been incorporated into the GSM standard. While USSD was previously a one-way bearer useful for administrative purposes such as service access. Stage 2 is more advanced and interactive. By sending in a USSD2 command, the user can receive an information services menu. As such, USSD Stage 2 provides WAP-like features on existing phones.

USSD strings are typically too complicated for the user to remember, involving the use of the "*" and "#" characters to denote the start and finish of the USSD string. However, USSD strings for regularly used services can be stored in the phone book, reducing the need to remember and re-enter them. As such, USSD could be an ideal bearer for WAP on GSM networks.

General Packet Radio Service (GPRS)

GPRS is a new packet-based bearer that has been introduced on many GSM and Time Division Multiple Access (TDMA) mobile networks from the year 2000 onwards. It is an exciting new bearer because it is immediate (there is no dial-up connection), relatively fast (up to 177.2 Kbps in the very best theoretical extreme), and supports virtual connectivity, allowing relevant information to be sent from the network as and when it is generated.

There are two efficient means of proactively sending ("pushing") content to a mobile phone: by the Short Message Service, which is of course one of WAP bearers; or by the user maintaining more or less a permanent GPRS (mobile originated) session with the content server. However, mobile terminated IP traffic might allow unsolicited information to reach the terminal. Internet sources originating such unsolicited content may not be chargeable. A possible worse case scenario would be that mobile users would have to pay for receiving unsolicited junk content. This is a potential reason for a mobile vendors to not support GPRS Mobile Terminate in their GPRS terminals. However, by originating the session themselves from their handset, users confirm their agreement to pay for the delivery of content from that service. Users could make their requests via a WAP session, which would not therefore need to be blocked. As such, a WAP session initiated from the WAP micro-browser could well be the only way that GPRS users can receive information onto their mobile terminal!, Since all but the early WAP-enabled phones will also support the General Packet Radio Service, WAP and GPRS could well be synergistic and be used together widely. For the kinds of interactive, menu-based information exchanges that WAP anticipates, CSD is not immediate enough because of the need to set up a call. Early prototypes of WAP services based on CSD were therefore close to unusable. SMS, on the other hand, is immediate but is always stored and forwarded, such that even when a subscriber has just requested information from their micro-browser, the SMS Centre resources are used in the information transfer. As such, GPRS and WAP are ideal bearers for each other.

Additionally, WAP incorporates two different connection modes—WSP connection mode, or WSP connectionless protocol. This is very similar to the two GPRS Point-to-Point services-connection-oriented, and not connection-oriented. The predominant bearer for WAP-based services will depend on delays in the availability of WAP handsets and delays in the availability of GPRS terminals.

Applications

WAP is being used to develop enhanced forms of existing applications and new versions of today's applications. Existing mobile data software and hardware supplies are adding WAF support to their offering, either by developing their own WAP interface or more usually partnering with one of the WAP Gateway suppliers profiled above. Previously, application developers wrote proprietary software applications and had to port that application to different network types and bearers within the same platform. By separating the bearer from the application, WAP facilitates easy migration of applications between networks and bearers. At such, WAP is similar to Java in that, it simplifies application development. This reduces the cost of wireless application development and therefore, encourages entry to the mobile industry by software developers.

WAP Programming Model

Pull Architecture

Push and Pull are two ways of transferring information to and from a phone, via WAP. Pulling occurs when the user opens an Internet connection and initiates a request through the phone. Push does not require the user to initiate the request; instead a third-party application begins the information transfer. Whether the user is the one to open the Internet connection or not, depends on the network being used. Figure 10.4 illustrates a simple pull transaction and the steps involved in it.

Step I: The client (1) makes a request to a URL through his or her device.

Step 2: The URL request is encoded and sent over the airwaves through a wireless protocol (2).

Step 3: The URL is received by the WAP gateway (3) and is decoded. *Step 4:* The info is transferred to a web server via a normal HTTP request (4).

Step 5: The Web server (5) retrieves an answer to the request using CGI scripts, ASP, or WMLscript. Calls to databases or other websites might be made to retrieve the answer.

Step 6: A WML or HDML packet is sent back to the gateway via HTTP.

Step 7: The packet is encoded once more and sent back to the client via wireless protocol.

Step 8: The phone interprets the packet and displays the response on its display screen.

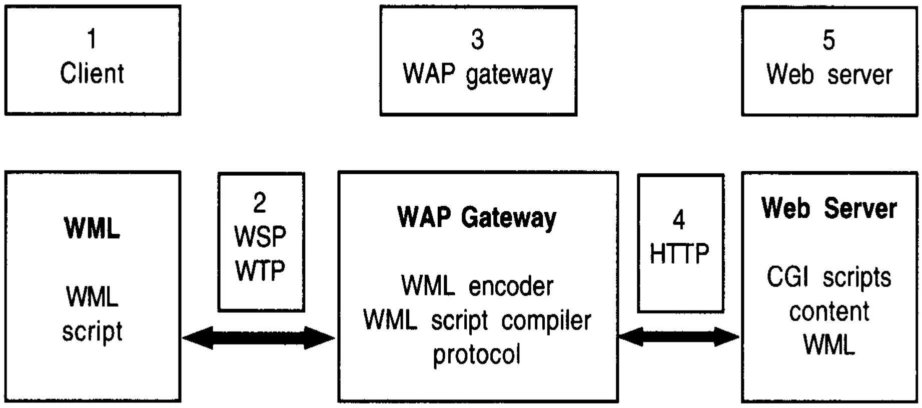


Fig. 10.4 Pull architecture.

Micro-browser

We have already discussed what the general duties of a micro-browser are. Like a regular Web browser, it submits requests for information, receives results, and interprets and displays those results on screen. There are also some secondary tasks associated with the job of a micro-browser.

The micro-browser includes both WML and WMLScript interpreters. As the phone receives binary information in this format, the micro-browser interprets that data and decides how to display and execute WMLScript.

Though not specified in the WAP specification, the micro-browser may have additional! capabilities. For example, the phone may include RAM for caching information in the same 3 way computer hard drives cache information for regular Web browsers. If so, the micro browser will have the software that helps it decide when a page should be cached, how long j the information in the cache is valid, and when to remove items from the cache.

The micro-browser is also responsible for understanding the HTTP 1.1 protocol. As already described, the gateway is responsible for much of the translation between the WAP and HTTP protocols. However, when a request is sent from a WAP device, the micro-1 browser must be able to include valid

HTTP information in the request so that the Web server j knows how to interpret the request.

Finally, the micro-browser needs to know how to manage the limited resources of the WAP device. These devices are limited in screen size, processing power, RAM, ROM, and input/output capabilities. The micro-browser is responsible for juggling the demands of this j limited environment.

WML

WML is similar to HTML. However, WML borrows heavily from the constructs of the Extensible Markup Language (XML)—the Internet successor to HTML. The creators of| WML accounted for the limited resources of WAP devices. However, they kept the tag-based design of HTML and in some areas, built more robust features into WML than those provided by HTML.

To see what we are talking about, look at the following snippet of HTML:

<html> <head> <title>Empyrean Design Works</title> </head>

<body>

<hl>Welcome</hl>

<p>Empyrean Design Works is a firm for mobile, wireless,

full service software design and strategy, and handheld technologies. <html>

Now, here is an example of WML code.

<wml>

<card id="first" title="Empyrean Design Works">

<p>Empyrean Design Works is a full service software design and strategy firm for mobile, wireless, and handheld technologies.</p> </card> </wml>

While the two pieces of code do not look identical, notice the similarities between HTML and WML. Instead of starting and ending the document with < html > and < /html **>,** a WML document uses < wml > and < /wml >. Also, notice that < p > is used in both languages as a way to mark a new paragraph within the document.

Both WML and HTML render similarly in their respective browsers. WAP browsers are just much more screen size challenged.

WML as a language has the following general features:

Support for text and images. This includes presentation hints like line breaks, formatting (bold, italic, and emphasis), and other placement clues. Not all devices support all text styles. WAP-compliant devices are not required to support images (this should change over time as devices become more capable), although the protocol does support them.

Support for user input. WML includes text entry fields, choice lists, and controls that invoke tasks. For instance, you can assign a URL to a specific button on a device such that when the user presses the button, a request is sent for a new document. The WAP specification has no specific definitions on how user input is accomplished. For example, if a WML program includes a list of options, the user may have to make their choice by pressing hardware buttons, tapping an on-screen button, or using voice input. It is up to each device manufacturer to determine how an options list is implemented.

A variety of navigation mechanisms. Based on the Internet-standard URL naming scheme, WAP lets you move between documents. Each WAP device may also incorporate a history mechanism for documents already visited, so that the user can revisit a previous document just by pressing a Back button, much like revisiting a previous page in a web browser.

Support for multiple languages and dialects. WML provides support for multiple languages and dialects by using the 16-bit Unicode character set.

State and context management features. State management implies that variable values can be passed from document to document. Additional capabilities include variable substitution and caching of variables and documents to maximize cache hits on the device and minimize wireless server requests.

WMLScript

WMLScript adds a lightweight procedural scripting language to each WAP device. Loosely based on JavaScript, WMLScript lets programmers add intelligence to WAP programs, and reduces the necessity for requesting information from the Web server. Programmers can use WMLScript for the following:

Input validation. As users enter data like their name, a dollar amount, or a phone number, WMLScript can validate the input against some template. For example, it can check that the dollar amount entered is under $100 and includes two digits after the decimal.

User interaction. WMLScript lets an application interact with a user without constantly needing to contact a Web server for more documents. For instance, the if ... then ... else capability lets the program logic decide which document to show next or display an error message of some sort without first going over the network.

WMLScript also includes libraries that provide a wide range of functionality, including math calculations, string processing, and URL manipulation, for instance.

Wireless Telephony Application Interface (WTAI)

WTAI is designed to let network operators access the telephony features of a WAP device. They can do such things as initiate phone calls using WML and WMLScript, accept incoming calls, hang up calls, send and receive text messages, and manipulate phone book entries OB the device. Besides those functions that are common to all WAP devices, WTAI support!' telephony extensions that are specific to certain wireless telephone networks like GSM and Personal Communication Services (PCS).

WAP is a feature-rich application environment. Its programmability and telephony features' make it very suitable for creating mobile applications. Its compact form, encryption, and error-handling make WAP suitable for the challenges of wireless transactions.

WAP will undoubtedly continue to evolve to support advanced features and functionality that will appear in smart phones in the near future.

If you want to delve into more details, you can download the WAP specifications from the WAP Forum's website at *www.wapforum.com.*

10.5 Wireless Technologies

AMPS and European Analog Cellular

Advanced Mobile Phone Service or AMPS, is the analog cellular transport used throughout North America and in other parts of the world, notably Central and South America, New Zealand, and Australia. It has the best coverage of all North American systems.

AMPS operates at 800 MHz. It is a voice-only analog transport. You can also use it with a cellular modem for circuit-switched data communications. AMPS is slowly being replaced with various competing digital networks. For the foreseeable future however, it will be the most readily available cellular network in North America.

At the same time AMPS systems were being built in the United States, a variety of incompatible analog systems were when being promoted in Europe and the rest of the world, Although they all operated in the 900 MHz frequency range, the European systems did not work well with each other. These

900 MHz European analog systems, which we do not identify individually, are rapidly being phased out in favour of all-digital systems.

TDMA

Time Division Multiple Access (TDMA) is a digital transport that divides the frequency range allotted to it into a series of channels. Each channel is then divided into time slots. Each conversation within that channel gets a time slot; hence the term "division" in the name.

TDMA has been in use for quite some time in Europe as the basis for the GSM (Global System for Mobile Communications). More recently, it is being adopted in North America, in some PCS systems.

It is possible to overlay TDMA on top of an AMPS transport, converting an analog network to a hybrid analog/digital network. Some AMPS carriers in North America have been doing this to add security, capacity, and data capabilities to their older voice systems. This type of network has several names, such as Digital AMPS (D-AMPS) and North American TDMA (NA-TDMA).

CDMA

Code Division Multiple Access (CDMA) is a digital transport that has been in use by the US military since the 1940s. However, as a commercial wireless transport, it is the new kid on the block compared to TDMA and AMPS.

Pioneered by US-based QUALCOMM, a CDMA transmitter assigns a unique code to each wireless connection and then broadcasts its data out on the channel simultaneously with all other connections. The receiver is able to decode each conversation by knowing the unique code assigned to each connection.

CDMA is often described as a party in a room where everyone speaks a different language. If everyone speaks at approximately the same volume, you should be able to hear all the conversations. If you know the unique code (language) used by each speaker, you can hear and understand all the conversations.

CDMA advocates the claim that it has some definite advantages over TDMA. First and foremost, CDMA enables simultaneous usage: approximately 10-20 times AMPS, and three times TDMA. It uses less power, giving you much better phone battery life. It is also more secure, because it hops from one frequency to another during a conversation, making it less prone to eavesdropping and phone fraud. Other benefits include fewer dropped calls and better voice quality.

CDMA is being widely deployed in North America in new PCS systems, but less widely throughout the world. Like TDMA, it can also be overlaid on top of AMPS systems to create hybrid analog/digital networks.

For more information about CDMA, visit QUALCOMM's website at *www.qualcomm.com.*

GSM

In the late 1980s, noting the wide disparity of analog cellular systems in Europe, various European political, trade, and academic interests started collaborating on an all-digital cellular communications network. Eventually called GSM, it has gone on to be the most widely deployed digital network in the world to date. It is used by millions of people in more than 200 countries.

Using an all-digital, TDMA-based network, every GSM phone has access to a variety of data functions at speeds limited to 9600 bps (the effective throughput is typically about half that speed). These services include direct-connect Internet access (both circuit-switched and packet data) without requiring a modem, mobile fax capabilities, and short message service.

GSM started operating in the 900 MHz frequency range in all European countries, Additional networks are being deployed in the 1800 MHz frequency range. An alternate name for GSM is PCN (Personal Communication Network), the European equivalent of PCS (Personal Communication Services). For more information about GSM, visit *www.gsmdata.com,*

Voice/Data Networks

Table 10.8 lists each of the major cellular voice communications networks that also support data. The table lists alternate names, the type of technology (analog, digital, or hybrid), the frequency range used by the network, and the part of the world where it's predominant,

Note that the locations are either US or Europe, which indicate that most of these networks are most popular in either the United States or Europe. However, they also enjoy some degree of success in other parts of the world. This is indicated by the word "global" in the location column.

A network is a unique combination of a spectrum block, a transport, and a protocol. Different networks often have multiple common names and transport, and protocol names are often used interchangeably. This can make things a bit confusing.

All of these networks support circuit-switched data connections. You can use circuit-switched connections to access WAP data, but it's very inefficient. All of these networks, except for pure AMPS, support packet data-like connections or SMS, both of which can be used for WAP.

TABLE 10.8

VOICE/DATA NETWORKS

Network names	*Classification*	*Frequency*	*Location*
AMPS	analog	800 MHz	US/global
AMPS/CDPD	analog	800 MHz	US
CDMA	analog/digital	800 MHz	US/global
iDENanalog/digital	800 MHz SMR	US	
TDMA/D-AMPS/NA-TDMA	analog/digital	800 MHz	US/global
GSM/GSM 900	digital	900 MHz	Europe/global
GSM/GSM 1800/PCN	digital	1800 MHz	Europe/global
CDMA/PCS/PCS 1900	digital	1900 MHz	US
TDMA/PCS/PCS 1900	digital	1900 MHz	US
GSM-NA/GSM 1900/PCS 1900	digital	1900 MHz	US

In spite of the fact that the cellular communications landscape is currently a mess, particularly in North America, proponents of the various networks are hard at work on two more generations of their respective technologies, insuring that things will get even more chaotic. What is being promised is an increase in speed. By 2005, speeds should reach up to 2 Mbps (million bits per second), letting us do such things as quickly send photographs from digital cameras to our friends and family, and receive real-time video using portable wireless devices.

Like the current state of affairs, there are several high-speed wireless data technologies with names such as GPRS, CDMA2000, and EDGE, that are being touted as the next wave of wireless data. Several of these systems are currently being tested in limited trials in various parts of the world. This means that the current confusing wireless communications landscape will get even more complicated as current technologies are replaced by their younger siblings. In general, data speeds will get faster. Data connections with cell phones (or data-only devices like two-way pagers) should also get easier and less expensive. That is great news for WAP.

In stark contrast to other technologies and markets, these companies created the WAP Forum to share information and to create an open standard. Each of the companies independently recognized the imminent convergence of voice and data communications. Due to this openness, WAP has escaped the tragic end that other technologies often encounter as companies and alliances struggle to establish their standard. Additionally, this openness has fostered a rapid adoption rate by the majority of handheld paging and cellular phone companies. In less than three years, WAP evolved from an idea in four companies' minds to a worldwide industry standard currently being implemented.

10.6 Different Generations in Wireless Communication

The First Generation *(1G)*

The first generation of cellular phones can be traced to the early eighties, and is marked by the use of **Analog** technology. The bandwidths used then were confined to a maximum of 30 kHz. The most widely used analog cellphone standard in this generation was the Advanced **Mobile Phone System (AMPS).** In 1983, AMPS was approved by the FCC and first used in Chicago. AMPS is the analog cellular transport used throughout North America and other parts of the world, notably Central and South America, New Zealand, and Australia. The AMPS system uses 832 full-duplex channels, each consisting of a pair of simplex channels. AMPS uses a range of frequencies between 824 MHz and 894 MHz. Each simplex channel is 30 kHz wide, and AMPS uses Frequency Division Multiplexing (FDM) to separate the channels. The 832 channels can be divided into four categories:

(a) *Control* (base to mobile) to manage the system,

(b) *Paging* (base to mobile) to alert mobile users to calls for them,

(c) *Access* (bidirectional) for call set up and channel assignment, and

(d) *Data* (bidirectional) for voice, fax, or data.

The problem with AMPS is that in the 800 MHz band, radio waves are 40 cm long and travel in straight lines. Hence they are absorbed by trees and plants, and bounce off buildings, leading to a high level of echo and signal distortion. Hence, AMPS is slowly being replaced by various competing digital networks.

The Second Generation *(2G)*

The first generation of mobile phones was analog; the second generation was **digital.** Just as there was no worldwide standardization during the first generation, there was none in the second either. Four 2G systems are in use now, namely, D-AMPS, GSM, CDMA, and PDC. We will look at two of the more popular technologies: **GSM and CDMA.**

Group System Mobile (GSM)

GSM was the first European digital standard, developed to establish cellular compatibility throughout Europe. It is the first digital cellular system to be used commercially, and its success has spread to all parts of the world, including countries in Asia, Middle East, Africa, North, Central and South America, and Australia. Over 80 GSM networks are now operational, making it the most widely deployed digital network in the world to date, used by millions of people in more than 200 countries.

Communication using GSM is based on the **Time Division Multiple** Access **(TDMA)** digital standard. See Table 10.9. TDMA is a digital transport scheme, wherein multiple users are granted access to the same radio frequency source by limiting the subscribers' transmitted and received signals to time slots.

TABLE 10.9

TECHNICAL SPECIFICATIONS OF STANDARD (GSM)

Mobile Frequency Range	Rx: 925–960 MHz; Tx: 880–915 MHz
Multiple Access Method	TDMA/FDM
Duplex Method	FDD
Number of Channels	124 (8 users per channel)
Channel Spacing	200 kHz
Modulation	GMSK (0.3 Gaussian Filter)
Channel Bit Rate	270.833 kilobits

GSM operates at 900 MHz. A GSM system supports 124 pairs of simplex channels. Each simplex channel is 200 kHz wide, and supports eight separate connections on it using TDM.

GSM cell phones require SIM (Subscriber Identity Module) cards for their operation. The SIM is a smart card that identifies the user terminal. By inserting the SIM card into the terminal, the user can have access to all the subscribed services. Without the SIM card, the terminal is not operational. To connect to the specific service providers in these different countries, GSM users simply switch subscriber identification module (SIM) cards.

Code Division Multiple Access (CDMA)

Over 35 countries have either commercial or trial activity ongoing in the field of CDMA. These include countries in the regions of North America, Caribbean, Africa, Latin America, Europe, and Russia. However, CDMA is most popular in the Asia Pacific region, with around 8,44,00,000 users. There are already 43 Wireless Local Loop (WLL) systems in 22 countries using CDMA technology, and the number of global users of CDMA has surpassed 202 million.

CDMA is an air link interface coding scheme, wherein multiple subscribers are granted access to the same radio frequency source by assigning subscribers' transmitted and received signals a spectrum-spreading code. Developed originally by QUALCOMM, CDMA is characterized by its high capacity and its small cell radius, and the fact that it employs spread spectrum technology and a special scheme. It was adopted by the Telecommunication Industry Association (TIA) in 1993. IS-95 is a standard for CDMA (Code Division Multiple Access) digital cellular. See Table 10.10.

A CDMA transmitter assigns a unique code to each wireless connection and then broadcasts its data out on the channel simultaneously with all other connections. The receiver is able to decode each conversation by deciphering the unique code assigned to each connection. Basically, instead of dividing the allowed frequency range into a few hundred channels, CDMA allows each station to transmit over the entire frequency spectrum all the time.

TABLE 10.10

TECHNICAL SPECIFICATIONS OF STANDARD CDMA OR IS-95

Mobile Frequency Range	Rx: 869-894 MHz; Tx: 824-849 MHz
Multiple Access Method	CDMA/FDM
Duplex Method	FDD
Number of Channels	20 (798 users per channel)
Channel Spacing	1250 kHz
Modulation	QPSK/OQPSK
Channel Bit Rate	1.2288 megabits

CDMA normally operates in a band of 1.25 MHz (versus 200 kHz for GSM), but it supports many more users in that band than any of the other systems. In practice, the bandwidth available to each user is at least as good as GSM, if not better.

The Third Generation *(3G)*

The most recent generation of cellular radio systems for mobile telephony are referred to as third generation (3G) technologies, and generally refer to those that promise to provide very high transmission speeds and performance. The technical framework for 3G has been, defined by the International Telecommunications Union (ITU) as part of its International Mobile Telecommunications 2000 (IMT-2000) program. The third generation will be the first cellular radio technology designed from the outset to support wideband data communication! at the same level of its voice communications.

CDMA 2000 and WCDMA

The two 3G models of CDMA are Wideband CDMA (WCDMA) and CDMA 2000, and both use the direct spread spectrum type of modulation.

WCDMA is a third-generation technology proposed by Ericsson, that increases data transmission rates in GSM systems using CDMA instead of TDMA. CDMA 2000 has been proposed by QUALCOMM. It is basically an extension of IS-95 and backward compatible with it.

With the onset of the third generation, an urgent need is being felt to have a common standard across the telecom spectrum, so that there are no compatibility problems and technical differences. Efforts are now being made towards this integration.

10.7 Security Issues Pertaining to Cellular Technology

With the advent of cellular services, it has become very important to look at the security aspect of these technologies. Security issues include eavesdropping or hacking into mobile conversations, denial of service, identity theft, data piracy and jamming.

In general, the aim of a mobile phone security system would include:

- To make the radio path as secure as the fixed network, which implies anonymity and confidentiality to protect against eavesdropping;

- To have strong authentication to protect the operator against billing fraud;

- To prevent operators from compromising each others' security, whether inadvertently or because of competitive pressures.

On the other hand, a security process must not:

• Significantly add to the delay of the initial call set up or subsequent communication;

• Increase the bandwidth of the channel;

• Allow for increased error rates, or error propagation;
• Add excessive complexity to the rest of the system;
• Be-cost ineffective.

The Global Coverage

No. of Global GSM Users	1050 million
No. of Global CDMA Users	186 million
Global Monthly SMS	36/user
Total 3G Users	130 million
The Number One Mobile Country	China (300 million)
The Number One GSM Country	China (282 million)
The Number One in Handsets (Q1 of 2004)	Nokia (35.5%)

GSM vs CDMA

	GSM	CDMA
Digital	Yes	Yes
Network Type	P-GSM 900 (primary) 900 MHz band	CDMA 800, 800 MHz band (X1 is available.. but is not being talked about here)
Maximum talk range from a tower (note you will need a car kit for your mobile to achieve these numbers in some cases)	35 km (stock cell) 70 km ER, EER 105 km possible with special towers	Approx 110 km
Max Output Power	2 W	200 mW (in AMPS mode 600 mW)

Background Noise Suppression	Yes (Included in EFR)	Yes
Talktime	Higher due to DTX and the "pulse" nature of TDMA.	Lower due to CDMA transmitting all the time.
Standby Times	Higher due to DRX and the "pulse" nature of TDMA	High
International Roaming	Yes (over 138 GSM countries worldwide)	Very low; 15
Worldwide customers	200 million	35 million
Dual Mode with AMPS (Analogue)	No	Yes
SMS	Yes	Yes
Fax + Data	Yes	Yes
Voice Quality	High (Because of EFR)	High
Built in "Intelligence"	High	Medium

10.8 Mobile Commerce

A wireless business is one that involves exchanging Internet contents with a network of mobile people via wireless devices. The broad scope of a wireless business includes hardware, software, and suppliers of network products and services, with a special concern for content as a primary value, motivating the end wireless user. Together, these elements support wireless industry and commerce. Is there such a thing as a wired business? Of course, wired businesses provide service to everyone who uses the Internet and a telephone. Wireless businesses are companies that use WANs, LANs, and PANs to connect rapidly moving employees and customers via the wireless Internet with many sources of information. Wireless content, rather than the software or hardware, is the primary value in a wireless business!

Initially, a wireless business is viewed as a channel for wired business. In contrast to conventional business models, the uniqueness of wireless consumership lies in a business model where companies must become networks. Unlike in the physical business world, networks allow instantaneous feedback. It is a fact that your business has an operational component to respond to customer e-mail and Web forms, mobile customers, and the movement of fresh Internet content throughout the business. You create a medium that connects a network of subscribers, wherever they happen to be and whatever they happen to be doing. When conceiving a wireless business, consider the customer's new frame of reference. Looking down the road to 3G networks where everyone's antenna is connected, companies are considering different business models as they have evolved a wireless identity in the current era of wireless channels. Since wireless business markets are not well established, it is difficult to identify superior market dynamics and supplier relationships, and predict revenue. Money may pass through the content provider or the network provider. You may earn income from transactions, subscriptions, or traffic. While the cauldron of the marketplace finds formulae for a viable wireless business, remember that the technology is at an early stage, without full infrastructure in place.

To widen the reach of a business or its market share, companies will provide a *wireless channel.* For some companies, building a wireless Internet system is simply a matter of doing business, to increase commercial access to customers or to other businesses. Some established companies—such as Charles Schwab stock brokerage, offer a wireless channel under the model of extending service to customers. The business goal of "creating a presence" by setting up a website has metamorphosed into "extending a relationship" by opening a wireless channel. Currently, companies let customers track packages wirelessly, check on a flight, or make stock trades. For companies offering a wireless channel, wireless technology is simply another form of a business relationship. When you provide a wireless channel to a large company, you must demonstrate how it will increase transactions, add service capacity, or save costs by reducing loads on the more expensive parts of the enterprise. A typical cost justification compares the costs of a customer-generated machine transaction with live staff answering telephones or processing the service.

Wireless business is fundamentally about exchanging information of personal value and figuring out how to get machines to handle the routine part of the communication. To share and synchronize content and interests with a wide array of servers, is the basis of a wireless business. Both commercial and barter models for personal information are at work. In the long run, low cost, micro-billed subscription for personal content and service is likely to succeed.

M-Commerce in India

According to a press release by the TRAI (Telecommunications Regulatory Authority of India), the subscriber base for mobile services continued to maintain its growth during first month of the year 2004[11]. During the month, approximately 1.67 million mobile subscribers were added, bringing the total of this category to beyond 31.6 million.

After the new liberal Telecom policy declared in 1999, cellular tariffs have dropped by over 90 per cent since May 1999—a feat unparalleled by any other sector or industry in India. The average airtime tariff in year 2001 was prevailing around Rs. 2 per minute, as against the peak ceiling tariff of Rs. 16.80 per minute.

GSM and CDMA in India

Evolution

Mobile Telephony evolved with the introduction of the GSM as the standard service bypassing! all other obsolete technologies in 1994. The cellular licences have been made technology-independent since 1999, and the National Telecom Policy(NTP) was established. Cellular mobile services were one of the first areas to be opened up to private competition.

The establishment of NTP and the amendment to the TRAI Act, coupled with the falling costs of handsets, has made mobile telephony available to all. By March 2001, the industry had invested nearly Rs. 16,000 crores in cellular infrastructure, and it is estimated that these investments will grow to Rs. 20,000 crores in the next 4-5 years, thus making it one of the bigger FDI sources. CDMA is one of the newer players on the scene, and has been readily grabbing the market share.

Future of m-commerce in India

If statistics are anything to go by, the SMS rage will drive m-commerce in India. According to Merrill Lynch, SMS could bring in as much as $75.6 million of revenues for Indian GSM operators by the year 2005. During 2000-2003, while peer-to-peer messaging had been growing at a CAGR of 46 per cent, the application-driven SMS traffic had been growing by a whopping 204 per cent during the same period. Of late, the trend has been visible in India too. Take Escotel, for instance, whose territory does not include any of the big cities. As much as 25 to 30 per cent of the total SMS sent on its network is application-driven. Idea Cellular in Delhi claims a similar figure. These figures, however, vary from month to month; with the cricket season, for example, taking the average up.

The industry is quite optimistic about the future of m-commerce. Wireless is considered to be the next big thing in the communications industry. The growth rate of mobile phones has already outnumbered the growth of fixed line phones in India. Once a secure, easy-to-use method for paying over a mobile is devised, m-commerce will become a reality in India.

10.9 Summary

The wireless communication is growing at faster phase in the past one and a half decade. Several technologies are discussed in this chapter related to the mobile communication. Some success stories of m-commerce are given for better understanding of the m-commerce pros and cons. Way to achieve security in wireless communication are

given much focus. Also given information about various generations of mobile technology.

EXERCISES

1. Visit *www.ericsson.com* and look at all the business opportunities that they offer with regard to GPRS, EDGE, PDC, GSM, and TDMA. Comment on one of the case studies.

2. What is bluetooth? Get the information from *www. blue tooth, corn.*

3. Study the 3G technologies by visiting the sites of ericsson, mpegtv, nokia, and mobile wireless Internet forum.

4. What does the future hold for mobile commerce? Look at the UMTS Market forecast study

   (www.analysis.co.uk/news/umts/default.htm).

5. Compare and contrast the wired business scenario in India with the wireless business scenario?

6. What are the special characteristics of WAP devices as compared to wired devices?

7. Compare and contrast CDMA and GSM in the Indian context. Why is the Reliance company betting on CDMA?

8. Study the potential for mobile commerce in India?

11. Intelligent Web Design

In this Chapter we will discuss

- What features constitute a good site
- What are the requirements and objectives of good website
- How to analyze the good website structure
- Tools for the design of web sites

Structure of the chapter

11.1 Good Web Site Features

Surveys have shown that four factors constituting the elements of a good website encourage viewers to return to the site. These are:

• **High quality content.** Having the right information at the right place and right time,

• **Ease of use.** The structure of the side should not be overcomplicated or too big. You never get lost in a good site, since it is always clearly signposted.

• **Quick to download.** Good sites also download quickly. Bad sites are cumbersome and slow. Visitors would not wait.

• **Frequently updated.** Good sites put up new information which is useful, relevant and timely for their audience, which takes money, time and energy to maintain.

Figure 11.1 shows the customer interface elements that are needed in a website

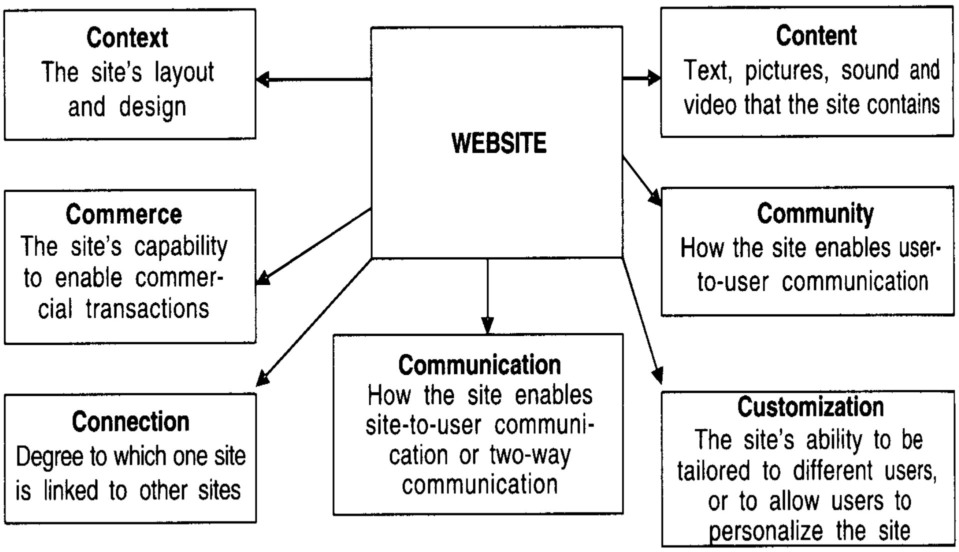


Fig. 11.1 Interface elements in a website.

The Web gives the customer unlimited choice, with millions of sites to select from. In order to make the customer visit, stay and revisit your site, the site must have a unique proposition for the visitor. This is called an **Internet Value Proposition (IVP).**

Ideally, a good website needs to find a proposition that explains how and what their organization is offering. For example:

• Is different from its competitors

• Is not available in the real world

• Makes a difference to the customer's life

At the very least the proposition should clearly show the offered services and the credibility to deliver. Once a proposition has been finalized, the following steps need to be taken:

1. First we need to leverage the proposition in traffic-building by combining it with the URL or Web address and advertising it.

2. We need to clearly state the proposition on-site.

3. We need to deliver on the proposition through all interactions a customer has, including online and offline fulfillment and service.

The two basic aspects of site context are function and aesthetics.

Function. The vast amount of information displayed on a website must be presented to the customer in a coherent manner, and the customer must be able to move freely throughout the website. Three factors are critical in the layout of the site:

1. Section breakdown. This describes the way that the site is organized into subcomponents. For example, www.chennaibazaar.com is an online retail store whose site structure includes search, different kinds of merchandise, gift ideas, and help. There are also categories of goods—men's, women's, kid's clothes.

2. Linking structure. Linking structure describes the way in which alternative sections of the site are linked. Clicking on sarees on the homepage of www.chennaibawar.com takes you to the sarees section, with lots of choices. This linking structure enables the users to easily move back and forward between the sections of the site.

3. Navigation tools. Navigation tools refer to the site tools that facilitate the movement of the user throughout the site. Navigation tools for www.chennaibaz.aar.com include sarees search for all occasions.

Aesthetics. Aesthetics = Multimedia + Colour + Style + Layout and Typography

The aesthetic nature of the site is largely captured by visual characteristics such as colours, graphics, photographs, font choices, and other visually-oriented features. Two aesthetic features are described below.

• **Colour scheme.** The colour scheme refers to the colour choices throughout the site. As one might guess, www.chennaibaz.aar.com has emphasized a colourful screen, with different colours splashed for different items.

• **Visual themes.** Visual themes capture the story or stories portrayed across the site. Women clad in sarees catch the attention of the audience easily.

There are basically four dimensions of website content. These are examined below and then applied to the now familiar example of Gear.com.

Offering mix. The content of the site can include product information and/or services. Frequently, sites include a mixture of these three elements, www.chennaiba2.aar.com focuses almost exclusively on product content, with significantly less emphasis on information or services.

Appeal mix. This refers to the promotional and communications messaging projected by the company. Academic literature has identified two broad types of appeal: cognitive and emotional. Cognitive appeals focus on the functional aspects of the offering, like low price, reliability, availability, customer support, and degree of personalization. Emotional appeals focus on emotionally resonant ties to the brand or product—humour, novelty, warmth, or stories.

Multimedia mix. This term refers to the variety of media—text, audio, image, video, graphics—incorporated into the site. There is very limited use of product photographs.

Content type. Current content on a website is highly time-sensitive, whereas reference content is less time-sensitive and has a longer shelf life. www. timesofindia. corn. the online version of The Times of India, offers an archive of articles published in the past.

Personalization plays an important role in making a website customer-effective. Internet based personalization delivers customized content and services for the individual, either through Web pages, e-mail, or through push-technology. Personalization contributes to website in the four following ways:

- **Sell.** Personalization can make it easier for customers to select their products, Customers of an online supermarket do not want to select a new shopping basket of goods each time they shop.

- **Serve.** Customers who uses an online travel booking service do not want to have to key in the same journey details if it is a common itinerary. Instead, personalization helps them to save their itinerary.

- **Speak.** Through personalization, customers can select the type of communication they want to receive from a company as part of permission marketing.

- **Sizzle.** All the above can help add value, strengthen the brand, and develop the relationship.

To attract users and make them return, some sites provide a variety of features. Some of:

them are described below:

• **Login registration.** Having previously registered on a site, the user returns and enters the requisite information through the site interface. The site recognizes the returning user, and configures itself to the user's preset preferences.

• **Cookies.** Most sites, to identify visitors, attempt to track and gather data on returning user's behaviour by quietly saving, identifying and tracking information on the user's local disk storage in temporary files called cookies.

• **Personalized e-mail accounts.** Many sites provide free e-mail accounts to send and receive e-mails from the site, using a unique e-mail address.

• **Content and layout configuration.** Users can select screen layouts and content sources based on their interests.

11.2 Requirements of Intelligent Websites

Building an intelligent website that optimally leverages all sources of information for an online company does not happen overnight. It takes several iterations, a significant investment in technology, and an accumulation of knowledge that comes only with experimentation, trial and error. Companies that are new to the online game usually are at stage zero and use almost no data at all, whereas companies more advanced in e-business intelligence are able to integrate data coming from transactions, clickstream, and other sources to build powerful consumer relationships and market leadership.

There are four primary types of customer information that are leveraged through e-business intelligence:

1. Demographics. This describes the basic attributes of the customers—who they are, what neighbor-hood they live in, what their income bracket is, their marital status, and so on.

2. Expressed preferences. This describes what topics customers have expressed an interest in (e.g. types of books or music they like, stocks they track, sports teams they follow). The preferences are usually captured through form-based questionnaires when the consumer registers for a site or service.

3. Past transactions. These are the records of past transactions that the consumers have had with the company (e.g. what books they have purchased, what auctions they have conducted). These are recorded when the consumer actually conducts his or her purchases.

4. Observed behaviours. This information is derived from observing the navigation the customer follows in using the website, as well as where he came from and where he went afterwards. This data, called clickstream information, comes from every single click throughout the consumer online experience, and it is collected in large log files.

As the e-commerce company gets more and more sophisticated in building an intelligent e-business, it should progressively leverage these different types of information in an efficient way. Let us now look at the steps e-commerce companies typically follow in leveraging their information, in the order in which they typically evolve as they get more and more skilled in exploiting the power of e-business intelligence.

Step 1: Basic Web traffic analysis. The very first type of analysis of any Web activity is the measure of Web traffic. In the early days of the Web, hit counters were the rage. Hits and page views are the lowest level of clickstream data—the sequential record of pages visited. This data provides a record of entry and exit points into a website, pages that were visited, links that were followed, the duration for which a person viewed a particular page, the precise day and time, the browser type, the visitor's IP address, and other information, This type of information is often used to help secure advertising dollars. It can also point to problems in a site—a problematic page, for example, where people drop off because response time is too slow. It can help a website establish its quality and systems maintenance practice to ensure that the site is able to absorb high traffic times.

Step 2: Customer interaction analysis. The next step is to go into more details about customer interactions with the website. The first type of measure is the conversion rate from a browser to a customer. Conversion rates have been viewed as a key indicator of I website's effectiveness.

Registered users are the people who have had to register for site usage, often by filling out a survey form. The New York Times, for instance, is a free site, but requires the users to fill in a registration form. Depending on the questions asked, this data could allow a website to size up its visitors and customers by profession, education, age, gender, race, leisure activities, merchandise purchasing, and so forth. Through the registration process, the site is able to get the demographic as well as the preference information. Recorded e-mail addresses provide a way for the site to communicate with these registered visitors.

This data may then be used to help inform personalization engines to serve the contents according to the visitor's interests. It enables the site to display the person's name when he visits, in a bid to build intimacy. A visitor with an expressed affinity for golf or gardening may then be served advertisements or contents, specific to those interests. Combined with clickstream data on the visitor's site usage, the website is able to develop a fuller picture of both individual visitors and its visitors population as a whole. Once users have become customers, the site is able to analyze the historical transactions to identify their most loyal customers and their purchasing patterns, as well as the segments they fall into with respect to interests, frequency, or profitability.

A 'dotcom' company should start by producing a series of standard reports that can be executed automatically on a regular basis, in order to provide business users with answers to the basic questions such as the following about the business:

• Who are my top 20 per cent customers? What percentage of my total revenue do they generate?

• What is the trend in the buy/view ratio—how effective was our site redesign?

• Which portals referred the greatest number of visitors?

• How many orders did we get this week?

• What was the average order size?

• What is our weekly sales volume?

• Can the production volume of my suppliers support sales fulfillment?

• How much ad revenue are we generating with the new site design compared with the old one?

Step 3: Real-time personalization. Personalization is the ultimate realization of the one-to-one marketing dream. Customers are recognized when they come in, can tailor the way they interact with the merchant, and receive promotions and marketing programs that perfectly fit their personal requirements and preferences.

The four primary ways of performing personalization are greetings, customization, narrowcasting, and recommend-dation.

Greetings are the most basic form of personalization. The customer is greeted by name and welcomed back when he or she comes on the site. Personalization engines recognize a visitor's Internet protocol address or cookies stored on his personal computer, and correlate that information with past visits in order to recognize the visitor.

Customization allows a customer to tailor the service he is receiving from an e-commerce site, or to configure the products he wants to buy. As an example, any Yahoo! user can customize his use of the popular search by creating a 'MyYahoo’ environment which is more adapted to his needs.

The 'MyYahoo!' page will, for instance, show only stock quotes for your portfolio, and the particular news subjects you are interested in.

One great example of customization is the American Airlines website. Once logged into the site, customers are welcomed by name, and they are shown the number of frequent flyer miles they have on their account, as well as customized information and special offers based on their profile and previous choice of preferences, including home airport, preferred destination, hotel and car rental companies, and preferred seating choices.

Narrowcasting is the delivery of time-sensitive information, personalized to each consumer. Instead of sending messages to a large numbers of customers, they can be intimated about particular events they want to be alerted about. These kinds of personalized messages can be sent through e-mail, phone, or pagers which enable the customer to be informed without having to connect to the site. Yahoo/Finance, for example, enables a customer to define an alert that will be delivered if a stock price fluctuates more than a certain percentage. United Airlines also provides flight-paging services via various wireless devices. Flight paging provides customers automatic notification of flight delays or cancellations so that they can remain informed of any changes in the status of United Airlines flights.

Recommendation enables a site to propose products that are tailored to the customers' requirements, whether they have been explicitly expressed by the consumer or implicitly calculated by the e-commerce engine. Recommendation technology has evolved dramatically in the past few years. It used to be based only on the preferences that a customer would have explicitly expressed at registration time. Now it can be done in real time and predicted automatically by the personalization engine using different types of information such as observed real-time behaviour, purchase histories, and expressed preferences. Finally, it can match that data with information regarding other consumers who share similar interests, using a technique known as collaborative filtering.

The system is then able to make recommendations that are quite accurate.

Step 4: Getting to fine-grained segmentation. Personalization technologies are not very adaptive to drive a massive marketing campaign, nor are they particularly suitable for many types of purchasing decisions with complex sales cycles and multiple decision-makers. The next step, therefore, is to enhance the site's marketing power by using an e-business intelligence system performing customer segmentation. We start with products that are at hand's reach through coarse segmentation, and we continue on to fine-grained segmentation.

The harvesting of Web generates large, complex data volumes. Companies are gathering data that is more finely grained than in the past. By integrating data from various systems, they are able to go beyond the basic profile of a customer who is a 35 year old male who buys a piece of electronics equipment on the average of once a year. Website active information on cookies, household and demographic information, online surveys, custom support calls, consumer credit reports and other sources enable the company to collect additional details. The number of attributes associated with one single piece of data can grow by several factors.

The mounting quantity and complexity of this data often beg for data mining. Data mining goes beyond reporting, query, and multidimensional analysis to automatically sift through large data sets to discern patterns that might otherwise be difficult to detect. It uses artificial intelligence technologies to conduct knowledge discovery—that is, it can look for patterns in large data sets and identify common elements.

Step 5: Going through the streams of clicks. Every move on a website, every a banner clicked through, every page request from every visitor is recorded by the website owners into massive log files; this is the clickstream information.

The clickstream data contains details on customer behaviour that are richer than what can be achieved in traditional channels. It moves a step beyond the department store practice of using video surveillance cameras to track customer movement throughout the store to improve merchandising.

Savvy online merchants are squeezing into the clickstream to answer some key business questions, such as:

- Which pages are drawing traffic that results in a purchase?
- Which ads are most frequently followed?
- What do our most profitable customers do on our website?
- What path is followed by those who buy our most profitable products?
- How can one predict when someone will be at the best point to propose a cross sell or upsell?
- What navigation do customers follow before abandoning their shopping?

Answering these questions enables a website to take informed actions like the following

- Optimize placement of the page and the link to it
- Increase advertising rates
- Segment those customers' characteristics and provide a special site for gold customer
- Encourage more customers down the most profitable path
- Propose cross-selling at the right time
- Examine the shopping process for weakness or obstacles that prompt customers to turn away.

Step 6: Enrich content with external data. Once a customer has made several purchases, the website is able to further enhance the customer profile. Demographic data from third party providers may be appended to the profile to provide a richer view of the customer base. Analyzing that enriched data might show, for instance, that a customer who buys history books falls into a demographic segment inclined to also buy classical music. Marketing pitches in the form of e-mails and personalized content may then be delivered to cross-sell classical music CDs.

This data is critical in building profitable repeat business. It enables refinements in one-to-one marketing in the form of e-mails, snail mail, and personalized content served during site visits. The overall customer base may be segmented by a host of characteristics to better understand who is buying what. The data may be analyzed to determine an overall customer score that provides the website with a roadmap on which customers are their best bets for marketing efforts.

The simple fact to be realized is, the more data you have about your customers, the more sophisticated data mining and segmentation models you will be able to build. Using third-party data to enrich your database will help you find segments that were otherwise undetectable. Sometimes this data must be purchased. Sometimes, you can devise business arrangements or partnerships that provide it. American Airlines and United Airlines, for example, have recognized that a great source of information that helps in their marketing efforts is the data coming from the affinity credit card businesses they have associated with their name, and their frequent flying programs.

Step 7: Reaching optimal intelligence. A company can reach optimal intelligence once it is able to combine historical transaction records, observed behaviour via clickstream data, and preferences expressed in online surveys.

11.3 Setting Website Goals and Objectives

The first thing that an e-business entrepreneur should do before any Web page is created, is to determine the goals, objectives, and overall purpose of the e-business website. Without these the website may not have the focus it needs to be successful. To help determine the goals and objectives, you should ask and answer questions such as the following. Will the website:

1. Allow customers to order products and services online?
2. Provide technical support for products and services?
3. Advertise products and services?
4. Build the e-business's image and brand?
5. Collect information about current and potential customers?
6. Provide links to related web pages?
7. Provide general or industry information? and
8. Recruit employees?

A quick look at this list of sample questions clearly indicates that most e-business websites have multiple goals and objectives. The answers to these and similar questions are used to determine the website's overall purpose.

Considering the Website's Target Audience

After you establish the website's goals, objectives, and overall purpose, the next step is to consider the website's target audience. In too many instances, e-businesses design website around the needs of the e-business rather than the needs of the target audience. It is critical to consider both the information the target audience wants and the tools it uses to access the Web. Again, a series of questions such as the following, should be asked and answered;

1. Is the audience composed of experienced internet users, novice users, or a mix of both? Experienced internet users are likely to be able to handle a more sophisticated level of website complexity than novice users.

2. What type of browser will the audience be using—Netscape, Internet Explorer, WebTV, or other specialized browsers? Some design techniques that are supported by later Web browser versions, such as animations and frames, may not be supported by earlier versions of the same browser or by other browsers.

3. At what speed does the audience connect to the internet—at 56 Kbps over a modem or over a high-speed dedicated connection? A website designed to be viewed successfully over a high-speed dedicated connection may be problematic for viewers using a slow modem connection.

4. At what screen resolution does the target audience view Web pages—640 x 480, 800 x 600, or higher? Websites designed to be viewed at 800 x 600 resolution without horizontal scrolling will greatly annoy those who view the site using a monitor will 640 x 480 resolution.

Answers to each of these questions will determine how the Web page design can enhance or detract from a visitor's viewing experience and, ultimately, the ability or failure of the website to meet its goals.

Planning the Budget

While planning the website, another important issue to consider is the budget. The decision to develop the website in-house or to outsource some or all of the development, will have an impact on the budget. In-house Web development may require the addition of technical personnel, software, hardware, and office space. Outsourcing part of the development will require contracts with Web designers, programmers, and testers.

You may need a digital camera to photograph products in a digital format. A scanner may be necessary to scan existing photos into a digital format. Software such as Adobe Photoshop and Flash may be needed to format and enhance the appearance of digital photos. The process may require Web design software. Finally, the e-business staff must expend time and effort to participate in designing, testing, and maintaining the website.

Once you have decided on the website's purpose, audience, goals, objectives, and budget, it is time to look at the websites structure and design.

11.4 Analyzing the Website's Structure

An e-business must carefully organize the information used as the website's content. A website must show visitors what information is available at the site, how to quickly find the information they want and need, and how to get additional information, if necessary. That information may include, but is not limited to the following:

- Name of the e-business
- Slogan, logo, or trademark
- Statement on mission or purpose
- Information on products or services
- Press releases and testimonials
- Employment information
- Contact information
- Maps to physical locations
- Website map
- Customer support information
- Purchase or customer information forms.

Designing the website to make it both attractive and well organized is the best way to give customers what they want from the site. Before considering the website content, you must design the site structure. Some website designs consist of a single level of separate and unrelated pages to which viewers have links directly from a home page. Although easy to use, this flat structure can be somewhat boring. Some websites have multiple layers of linked pages, creating a complicated structure that requires viewers to click through several pages to find the information they need. Viewing such unnecessarily complex websites can frustrate potential customers who want to find information quickly. One way to achieve balance in the structure of a website is to limit the number of linked pages and include important information as much as possible in the first three levels of linked pages.

When designing the structure of a website, it is a good idea to create a flow chart like the one provided in Figure 11.2, that logically depicts the website's navigational structure.

Once this is done, you can draw connection links between the pages. This presents a good picture of how a viewer would click through the site from page to page. It also helps identify potential navigation problems a viewer might experience. Sometimes, when a website structure is 10 levels deep, a viewer might have to click 10 times through those 10 levels of pages to find useful information. Most users want to find information within three to five mouse clicks. The best suggestion to have a website with ten levels is to organize the site into a flat structure with fewer levels, and include a search tool that allows viewers quick access to pages below the third to fifth levels. After you have determined the website structure, the next step is to plan the design of each page on the site.

Another very effective way to help viewers with navigation is to use a **hierarchical navigational outline** showing all the levels of links between the home page or another major page and the page currently being viewed. Viewers using this outline can quickly move up or down in the hierarchy and easily understand the relationship of the page being currently viewed to the page on which they started. Hierarchical navigational outlines are great visual cues to the linking relationships among pages, and should be used in addition to other navigational hyperlinks such as navigation bars.

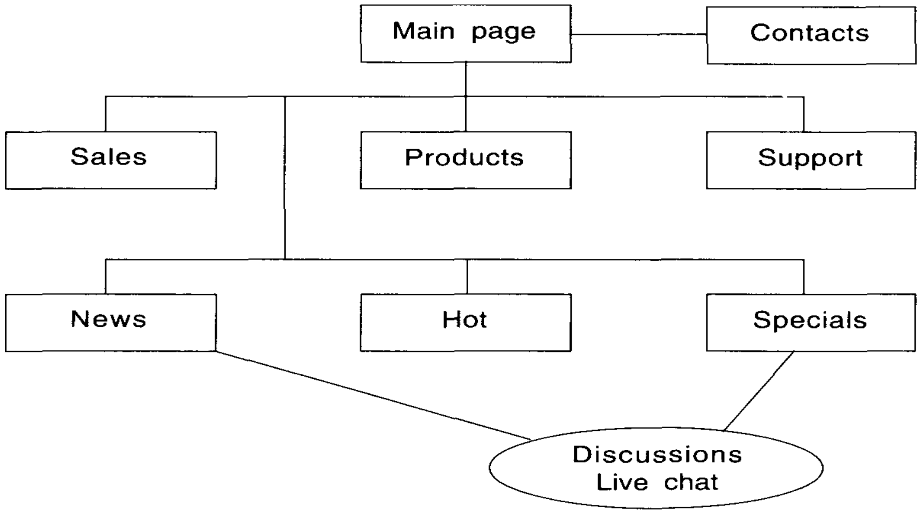


Fig. 11.2 Site structure of a website.

A site map is a Web page that shows each page of a website and how all the pages are linked together. A site map can be very useful to viewers if a website has many pages and a complex organization. A site map may be a graphic image, a text outline, or both. It is also important to find out whether all the links are properly installed. Programs like Frontpage2002 provide this facility. Figure 11.3 is a view from Frontpage2002 showing the hyperlinks.

When doing business on the Web, the customer is truly in charge and can easily switch over to an e-business's competitor with a click of the mouse. A viewer forms an impression of a website within the first few seconds of his visit. Good design can generate a favorable impression about the site, as the viewer responds to visual cues. A viewer with a favorable impression of a website is more likely to become its customer.

Good website design should enhance an e-business website's message and objectives without diverting the visitor's attention. For example, if viewers are thinking or talking about the design of an e-business website instead of its contents, the design is distracting from the website's message. Website design techniques include the use of the text, colour, graphic! sound, video, and Web technology such as animation, to convey the website's message.

Using Navigation Elements

Navigation elements are important because a viewer may not always enter a website from its home page. He or she may enter the website through any page of the site, using a search engine or a hyperlink from a different website. When this happens, the viewer must have a way to get to the site's home page or other major pages. Navigation elements like hyperlinks are important to assist the viewer in finding information about other pages of the website. A good example of a navigation bar is shown in Figure 11.4 taken from www. cdnow. corn.

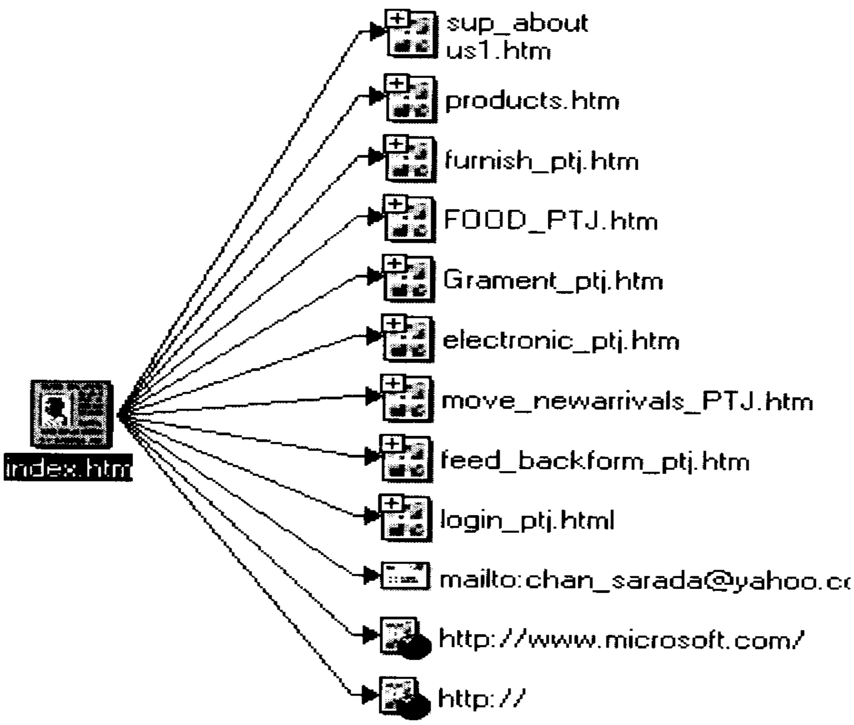


Fig. 11.3 Hyperlinks from the Index file.

An internal hyperlink is a connection between two pages of the same website. A well-designed website should have a logical navigation scheme, based on internal hyperlinks, that is easy for viewers to understand and to use. That navigation scheme should include an easy way for the viewers to interconnect all the major pages of the website, including the home page. Since viewers do not necessarily begin viewing a website from its home page, all pages should contain an internal hyperlink back to the home page.

A navigation bar is a series of icon or text hyperlinks to major pages of a website. Navigation bars using icons are often positioned at the top of a page, while navigation bars using text are often positioned on the left side or at the bottom of a Web page. The position of navigational bars should be consistent in all the pages of the website.

Another important navigational technique is the inclusion of 'top-of-page' hyperlinks at the bottom of each Web page. A top-of-page hyperlink can be a text or a graphic image that is linked to a position at the top of the current page. This hyperlink enables a viewer to quickly return to the top of the same page after having scrolled down.

Other Web design considerations include whether to use text or graphics or a combination of both to convey the website message; what typeface, colour combinations, background colours or images, and page layouts to be used? and whether or not the site should use flumes, animations, and multimedia. A startup e-business may want to get advice from a professional web designer when resolving these design issues.

Fig. 11.4 Navigation bar of ivivw.crfnow.com.

Maintaining Consistency

It is important that the Web design emphasizes consistency in its presentation. For example, there are certain elements that should necessarily appear on every page on a website. They

- Name of the e-business
- Contact information
- About the business
- Products and services offered
- Copyright information
- Navigation elements

The e-business name and contact information are important because customers may print a hard copy of individual pages (not necessarily the home page) from a website, and may want the e-business name and contact information available on the printout. Next in importance are the details about the business and the products and services offered online by them. If an e-business website has copyright protection, it is better to post a copyright notice on the site to remind viewers of that protection. Typeface and colours should also be consistent throughout the website.

Using Splash Pages

The first page of a website is very important and should do several things. First, it should make the identity of the e-business clear. No viewer should ever enter a website and find it difficult to identify the e-business. The entrance into a website is just the first of many opportunities to establish the identity of the e-business. Second, a first page should quickly summarize in a short description, the purpose of the website.

Some Web designers encourage the use of a splash page as a website's first page. A splash page, sometimes called an entry page, is a Web page that usually contains big, flashy, sometimes animated graphic images (and occasionally sounds) and is used to create a showy entrance to a website. After the animated graphics and sounds finish playing, the website home page automatically loads into the Web browser. Most splash pages also contain a text hyperlink to the home page that the viewer can click to bypass the animation and get right on to the website's home page. Web technology firms, graphic design firms, and related e-businesses often use a splash page to provide viewers with a preview of the quality of the technological or design services they offer.

Using Text and Icon Hyperlinks

Text and icon hyperlinks can also be positioned in the body of a Web page to help viewers navigate a website, or to allow viewers to access Web pages on different websites. Traditionally, text hyperlinks have been underlined and formatted with a dark colour, generally blue. Today, many websites do not use underlining for text hyperlinks, but use different accent colours to indicate text hyperlinks. Some websites use animated hyperlinks that appear or disappear as the viewer moves the mouse pointer over the hyperlink. When designing a website, remember that the whole point of hyperlinks is for viewers to have a quick access to information they want, which may be located elsewhere. Hyperlinks that are animated and appealing, but hard to locate and use, may frustrate viewers and drive them to the competitors' websites.

Often, websites use graphic hyperlinks instead of text hyperlinks. Certain graphic images can effectively communicate the purpose of a hyperlink, especially to global viewers who speak different languages. For example, an e-tailer might use a shopping cart icon in addition to the text Shopping Cart to indicate that it is a hyperlink to the shopping cart. Also, an envelope icon is often used to indicate a hyperlink viewers can click to send an e-mail message. However, graphic hyperlink can be confusing if the graphic image does not clearly indicate where the hyperlink takes the viewer. A well-designed website uses a combination of text and graphic hyperlinks.

Using Colour

Choosing the right colours for a website can be critical, because colour is one of the first things a viewer sees as a Web page loads in his or her browser. In general, bright colours such as blue, red, yellow, orange, and green are used on conservative corporate websites. However, bright colours such as red can be used effectively to call attention to specific Web page elements. Pastel colours (colours that contain a large proportion of white) are more relaxing and undemanding. Earth tones (brown, beige, tan) are unobtrusive and tend to contrast well with primary colours. A good rule to be followed while designing an e-business website is not to use too many different colours in the colour scheme. Also, the background colour should either be a very light and neutral colour (possibly white, which evokes a no-nonsense businesslike attitude) or black.

Colour choices should reflect the values of the website's audience. Since Internet is global, remember that people around the world respond differently to colours. For example, in the US, blue is a colour that represents trust; however, in Korea, the idea of trust is enforced with pastel colours, especially pink. Understanding the emotional effect of different colours on a website's audience can enhance the website's design.

Also important in selecting a colour scheme for a website, is the issue of available colours. Web pages use the RGB (red, green, blue) colour model that uses different numbers from 0 to 256 to represent each of the three colours. Web browsers are capable of displaying only a small set of the 16 million possible RGB colour combinations, and substitute a different colour if the one used on a Web page is not available in its recognizable RGB colour set. Therefore, most Web designers use a browser-safe palette of colours when designing a colour scheme. There are a number of websites that illustrate and discuss browser-safe colours.

Using Text

There are important differences between writing for the Web and writing for the printed page. Although the same basic grammar and spelling rules apply, the way a viewer reads the text online is different. Online readers scan the text instead of reading it word by word. They try to pick out a few words or phrases to get the information they want. Instead of long, scrollable pages with dense text, online readers prefer Web pages which are short and to the point. Finally, online readers prefer concise, factual information to marketing 'fluff in an overtly hyped language. Online readers like to scan text quickly; so, use frequent paragraph breaks, headings, bulleted lists, and ample blank space in Web page text. Online readers also prefer to read narrow columns rather than lines of text that go from margin to margin.

A font is a collection of characters that have the same appearance. A serif is the small tail at the end of a line in characters such as "I", "M", and "N". A serif leads the viewer's eyes smoothly to the next character. Fonts containing characters without a serif are called sans serif fonts. For the sake of consistency and easy reading, some Web designers suggest that Web page text should use only one or possibly two different fonts. A common combination in both print media and Web pages is to use a sans serif font, such as Arial, for headings and a serif font, such as Times New Roman, for body text. Web browsers display text in a font that a viewer has on his or her computer system. If a Web page contains fonts not available on the viewer's system, the Web browser will substitute a different font. For this reason, it is usually preferable to use common fonts such as Arial or Times New Roman for web page text.

Font styles or attributes, such as bold or italic, can be used to draw attention to a word or a phrase in a Web page body text. Underlining is often used for emphasis on a printed page, but underlining is generally not appropriate for emphasis on a Web page because most viewers associate underlining with hyperlinks. Finally, it is critical that all the text on a website be checked for spelling errors and professionally proofread and edited for grammatical and stylistic errors. Next comes a careful consideration of the use of background images on the pages of the site.

Background Images

Images and other multimedia options can, if used carefully, effectively communicate a website's message. Large background images that fill the whole screen can cause problems for viewers using different monitor resolutions. A small image that repeats over and over, called a tiled image, is preferable. Also, a background image may obscure the text on a Web page, making it difficult for viewers to read the text. Many Web designers therefore think that it is better not to use a background image, and instead go for a light-colored background. Others suggest using only a white or a black background colour.

Using Images and Multimedia

Almost every website uses images to enhance the site's design and to effectively communicate information. Some websites also make use of animation, sound, or video. All multimedia used should support the purpose of the website, and should not be included simply because it looks or sounds great.

Image file size is important when designing Web pages because the larger the image file size, the longer a Web page takes to upload. To minimize the upload time, Web page image files should be compressed. There are two primary types of compressed images used on Web pages: GIF images (usually pronounced "jif", as in "jiffy") and JPEG images (pronounced "jay-peg"), each with their own properties and uses. GIFs are often used for simpler images such as logos and icons, but are usually not used for photographs because photographs compress better as JPEG files. GIFs have some interesting features that JPEGs do not have. GIFs can be animated, like a very short movie or flipbook animation showing a sequence of frames rapidly. GIFs can also allow a transparent colour—a colour that will appear transparent on a Web page, allowing the background to show through. In order to reduce the loading time, it may be necessary to optimize the Web page image file sizes. There are several e-businesses such as Spinwave, GIF Wizard and xat.com that offer image optimization software packages.

There are some techniques that make Web pages containing images load faster. For example, a small version of an image, called a thumbnail, can be used to link to the larger version of the image. When the viewer loads a Web page, the small thumbnail images load faster. The viewer can click a thumbnail image to see the larger version of the image. Thumbnail images are often used by e-businesses to illustrate their product catalogues.

Sounds can also be added to play in the background as a page is viewed, or they can be used to respond to an event, such as clicking an icon. Sound files come in three formats: audio recordings (such as WAV files or AU files), which are like a digital tape recording of sounds; MIDI files, which describe the sequence of musical notes and how they are played; and streaming audio, which is like a radio broadcast over the internet. In general, there are few situations in which sound supports the purpose of an e-business website, except when the e-business is selling sound or creative design services. Also, many viewers get annoyed by the additional time required to download a page containing sound, and by the continuous sound playing in the background as they view a Web page.

Video is becoming more common as internet access becomes faster and compression methods improve. There are two methods of providing video: downloadable video, which can be downloaded and saved on the hard disk; and streaming video, which is like a radio broadcast. Advances in Web-browser technology now allow different kinds of animation text, images, and hyperlinks. Unfortunately, many websites include sound, video, and animation without considering how these features affect the website's effectiveness and usability from a viewer's perspective. Most Web designers agree that sound, video, and animation should be used only as a necessary tool to support an e-business site's purpose and message. Another feature that should be used sparingly is, frames.

Using Frames

A Web browser's display area can be divided into separate sections called frames. For example, the home page of a website might consist of two frames: a top frame containing navigational links, and a main frame containing scrollable content.

Unfortunately, frames may make a page look cramped and cluttered, and may, if not correctly designed, cause navigation problems for the viewer. Additionally, frames may cause problems for search engine robot or spider programs trying to index the website pages, and may make it difficult for a viewer to add the Web page URL to his or her 'bookmarks' or 'favorites’ folder. Because of these potential problems, many Web designers suggest avoiding frames in website design.

An important component of any website is its use of online forms.

Using Forms

Another Web page element that should not be overlooked is, use of forms. Forms, consisting of text labels and the related input boxes, option buttons, drop-down lists, or check box are used to collect information from viewers. Forms allow a viewer to enter specific information on the Web page and then send that information to the e-business's e-mail address or webs database. Forms are used for many things. Collecting site feedback, registering for approval to use website functions, and ordering products online are just three examples.

Sometimes a viewer is required to complete a paper form. Creating downloadable forms, as well as other documents, is a way to provide these paper forms without having to mail them or fax them to the user. A model form, or form template, is created in software application such as Microsoft Word. Then either the Word file itself is made available for download (which would require users to have Word installed on their own computers), or the file is converted into a format that any computer can read, such as plain text, rich text (RTF), or Adobe's PDF format. A PDF reader named Adobe Acrobat, which can be freely downloaded from the Adobe website, is used to read and print PDF document The advantage of a PDF file is that it displays and prints on any computer the way it was designed, regardless of the word-processing programs or fonts on a viewer's computer.

Designing a Website for a Variety of Displays

One of the most complex aspects of Web design is knowing that your page is at the mercy of the software and hardware configuration of each individual user. A page that looks great on your machine may look radically different, or perhaps even ghastly, when viewed on another user's set-up. This is partly due to the browser's functionality and the individual user's preferences (font size, colours), but the display device itself also plays a large part in the success of the page's design.

For the majority of your audience, the variation in displays is a function of the monitor and its size (or, more accurately, its resolution) and colour capabilities. However, it is important to keep in mind that the diversity does not end there. Some users may be watching your Web page on TV. Still others may be viewing it in the palm of their hand on a Personal Digital Assistant (PDA), also referred to as a palmtop, or a cell phone. Sight-impaired users may be listening to your page, not viewing it.

Dealing with Unknown Monitor Resolutions

Browser windows can be resized to any dimension, limited only by the maximum size of the monitor. Designing for an unknown amount of browser real estate is a challenge unique to Web design, and one that is particularly troublesome for designers who are accustomed to the printed page.

The first step in determining the likely size of your Web page is to look at the maximum amount of space provided by the computer monitor. Computer monitors come in a variety of standard sizes, typically indicated in inches. Some typical monitor sizes are 13", 14", 17", 19", 20", and 21".

The more meaningful measurement, however, is monitor resolution—the total number of pixels available on the screen. The higher the resolution, the more detail can be rendered on the screen. When you know the available number of pixels, you can design your graphics (also measured in pixels) and page elements accordingly. Table 11.1 presents a list of some standard monitor resolutions supported by Macintosh and PC platforms. This is not a complete listing—merely the most commonly occurring configurations.

TABLE 11.1

COMMON MONITOR RESOLUTIONS FOR PERSONAL COMPUTERS

Macintosh	*IBM compatible PC*
512 x 384	640 x 480
640 x 480	800 x 600 (common on laptops)
800 x 600 (common on Powerbooks)	1024 x 870
832 x 624	1280 x 1024
1024 x 768	1600 x 1200
1152 x 870	
1280 x 960	
1280 x 1024	
1600 x 1200	

Resolution is related to, but not necessarily determined by, monitor size. Depending on the video card driving it, a single monitor can display a number of different resolutions. For instance, a 17" monitor can display 640 x 480 pixels, 800 x 600 pixels, or even higher,

It is important to keep in mind that the higher the resolution on a given monitor, the more pixels are packed into the available screen space. The results are smaller pixels, which will make your images and page elements appear smaller as well. If you create graphics and pages on a monitor with a relatively high resolution, say 1280 x 1024, be prepared for everything to look a lot bigger on standard 14" monitors running at 640 x 480.

Live Space in the Browser Window

Knowing the size of the monitor is just the beginning. The operating system and the browser itself occupy a fair amount of this space. The amount of space that is actually available within the browser window (referred to in this chapter as the browser window's "live” space), is dependent on the computer's operating system, the browser being used, and the individual user's preferences settings.

Because so many factors are involved, determining exactly how much live space is available for each monitor resolution, is an inexact science. The information provided in Tables 11.2 and 11.3 should be used as general guidelines, not universal truths. Measurements were taken with the browser maximized to fill the available space in the window. The minimum live space is measured with all possible browser tools (such as buttons, location bars, and scrollbars) visible. The maximum live space is measured with all optional elements hidden, making the browser window as large as it can be for each particular resolution.

TABLE 11.2

LIVE AREA IN NETSCAPE NAVIGATOR 4.0 ON WINDOWS 95

Monitor resolution	*Minimum live space*	*Maximum live space*
640 × 480	623 × 278	635 × 380
800 × 600	783 × 430	795 × 500
1024 × 768	1007 × 598	1019 × 668
1152 × 870	1135 × 700	1147 × 770
1280 × 1024	1263 × 854	1275 × 924

LIVE AREA IN INTERNET EXPLORER 4.0 ON WINDOWS 95

Monitor resolution	*Minimum live space*	*Maximum live space*
640 × 480	623 × 278	635 × 380
800 × 600	783 × 398	795 × 500
1024 × 768	1007 × 566	1019 × 668
1152 × 870	1135 × 668	1147 × 770
1280 × 1024	1263 × 822	1275 × 924

Users with very high monitor resolutions (1024 pixels wide and higher), do not necessarily open their browser window to fill the whole area, but may keep several narrow windows open at the same time.

Monitor Colour Displays

Monitors also differ in the number of colours they are able to display, if they display colours at all. This is another aspect of the final display that may influence design decisions. Monitors typically display 24-bit (approximately 17 million colours), 16-bit (approximately 65,000 colours), or 8-bit (256 colours) colour. Colours taken from the "true" 24-bit colour space will dither (display with a speckled pattern) when rendered by browsers on 8-bit monitors.

However, there is a set of 216 colours, made up from the cross-section of the Mac and Windows system palettes, that will not dither on Mac and Windows 8-bit displays. This set of colours is known as the Web palette, among other names. Many designers choose to design web graphics and HTML elements using colours from this palette so that the pages look the same for all users.

If you are concerned about users with grayscale or black and white displays, be sure to design high-contrast graphics. When colours are converted to grayscale values (or dithered with black and white pixels), only the brightness of the colours matters. Imagine setting purple text on a real background; although the colours are of contrasting hues, they are close enough in overall brightness, such that the text will be illegible when the colours are displayed on a grayscale monitor.

Monitors also vary in the brightness of their displays. This is known as the gamma value. PC monitors tend to be much darker than Macintosh monitors, so colours that are deep and rich when created on a Mac, may look black when displayed on a PC. Likewise, graphics created on a PC may look washed out when viewed on a Mac.

11.5 Fixed versus Flexible Web Page Design

Closely related to the issue of varying monitor resolutions is the question of whether Web page should be designed to be flexible (resizing and adapting to various window sizes) or fixed at a particular size (giving the designer more control of the page's dimensions). There are very strong opinions on both sides. Naturally, there are good reasons for and against each approach. You may feel that you need a fixed structure for some sites and allow others to be flexible. You may feel that you have strong convictions that one or the other approach is the only way to go.

Flexible Design

Web pages are flexible by default. The text and elements in a straightforward HTML file will flow into the browser window, filling all available spaces, regardless of the monitor size. When the browser window is resized, the elements reflow to adapt to the new dimensions. This is the inherent nature of the Web. Designers who are initially traumatized by the unpredictability of where the page elements land up, usually just learn to let go of some control over the page.

Many designers make a conscious decision to construct pages so that they can withstand stretching and shrinking Web windows. This approach has advantages and disadvantages.

Advantages

• The reality is that Web pages will be displayed on a variety of monitor resolutions and conditions; keeping the page flexible allows it to be 'customized' for every display.

• The whole monitor space is filled, without the potentially awkward empty space left over by many fixed-width designs.

• Designing flexible pages is closer to the spirit and the nature of the medium. A 'good' Web page design by these standards is one that is functional to the greatest number of users.

Disadvantages

• On large monitors, the text line length can get out of hand when the text fills the width of the browser. Long lines of text are particularly uncomfortable to read on a screen, and so allowing the text to wrap to the width of the window or frame reduces poor reading conditions for some users.

• Elements float around large monitors, making it a less coherent design, that may be more difficult to use. Likewise, in very small monitors, elements get cramped together.

• The results of flexible design are unpredictable, and users will have varying experiences of your page.

Fixed Design

Those who require more control over the layout of a page may opt to design a Web page with a fixed width that will remain the same for all users, regardless of their monitor size or how the window is resized. This approach to Web design is based on design principles learned in print, such as maintaining a constant grid, the relationship of elements on the page, and comfortable line lengths.

Advantages

• The Web page will look the same, regardless of the monitor size. This is often crucial for companies interested in presenting a consistent corporate image for every visitor.

• Fixed-width pages and columns provide better control over line lengths. Tables can be used to prevent line lengths from becoming too long when the page is viewed on a large monitor.

Disadvantages

• If the available browser window is smaller than the grid for the page, pans of the page will not be visible and may require horizontal scrolling to be viewed. Horizontal scrolling is nearly universally considered to be a hindrance to ease of use, so it should generally be avoided. One solution is to choose a page size that will serve the most people, as discussed later in this section.

• It is still difficult to control type size in browsers, so elements may still shift unpredictably as a result of larger or smaller type than was used during the design process.

• Trying to absolutely control the display of a Web page is bucking the medium. The Web is not like print; it has its own peculiarities and strengths. Advocates of the flexible design strategy will tell you that fixed web page designs are out of place on the Web.

Creating fixed pages. Fixed Web page designs are created by putting all the contents of the page in a structural table with absolute measurements specified in pixels.

Some visual HTML authoring tools make it easy to create fixed-width designs. Most notably, GoLive Cyberstudio (www.golive.com) actually lays out your page on a grid as though it were a page-layout program, and then automatically generates the corresponding (and often complicated) table. Macromedia's Dreamweaver achieves fixed page layout via the absolute positioning functions of CSS.

Pop-up windows. Some websites take advantage of the ultimate in fixed Web page design by automatically popping-up a new window sized precisely for displaying the contents of the page. The advantage is that all viewers, regardless of their monitor size, will be certain to see the page in a browser window with the proper dimensions. It gives the designer even more control over the presentation of the page.

This trick is achieved by using JavaScript to launch a window with specific pixel dimensions, so the obvious disadvantage is that it will not work for users without JavaScnpt-enabled browsers. Furthermore, many users have a strong adverse reaction to having new windows spontaneously opened for them. It takes control of the presentation—indeed the entire desktop—away from the end user, which is unacceptable to many web designers. Furthermore, because users have different font settings, text will wrap or be cut off in unpredictable ways for some users.

Combination Pages

Of course. Web pages need not be all-fixed or all-flexible. It is certainly possible to create pages that are a combination of the two.

One common technique is to create a fixed page layout using a table, but centre the table on the page so that it is more balanced when displayed on large monitors (avoiding the blank right screen effect). The drawback of this technique is that the table can no long be precisely placed over a background image. Many sites use a band of colour in the background image to reinforce the columns in a fixed page design, but unfortunately, the background image remains in the same place even when the table is allowed to reposition itself on the screen.

Another approach is to use a table or frameset that consists of a combination of absolute and relative sized columns (or frames) measurements. In this way, when the window is resized, one column or frame remains of the same width, while the rest resize and reflows to fill the new available space.

Choosing a Page Size

Obviously, if you decide to design a fixed Web page, you need to make a decision about which screen size you want it to fit. Design common sense dictates that the page should be accessible (and display properly) to the greatest number of people. The idea is to find the most common monitor resolution and design pages that safely fill its live space.

Designing "Above the Fold"

Newspaper editors always design the front page with the most important elements "above the fold", that is, visible when the paper is folded and kept in a rack.

Likewise, the first screenful of a website's home page is the most important real estate of the whole site, regardless of whether the page is fixed or flexible. It is here that the user makes the decision to continue exploring the site or to hit the "Back" button and move along. Web designers have adopted the term "above the fold" to apply to the contents that fit in that important first screen. Curiously, my personal experience shows that users tend not to scroll beyond the first page, even when the vertical scrollbar is visible. That places the burden of enticing them to stay on the first screen.

As discussed throughout this chapter, a "screenful" can be quite different, depending on the resolution of the monitor. To play it absolutely safe, consider the space available for the lowest common denominator 640 x 480 monitor—approximately 600 x 300 pixels.

Some elements you should consider placing above the fold include:

1. The name of the site.
2. Your primary marketing message.
3. Some indication of what the site is about. For instance, if it is a shopping site, you might place the credit card logos or shopping cart in the top corner to instantly communicate that "shopping happens here."
4. Navigation to other parts of the site. If the entire navigation device will not fit (such as a list of links down the left edge of the page), at least get it started in the first screenful; hopefully users will scroll to see the remainder. If it is out of sight completely, it is that much more likely to be missed.
5. Any other information that is crucial for visitors to the site, such as a toll-free number or a special promotion.

11.6 Identifying Web Development Tools

There are many kinds of Web development software available—from Web page design software to all Web application environments. Some of the most common Web page design software includes Microsoft Frontpage and NetObjects Fusion; but there are many other programs, which range from freeware and shareware to other, more expensive applications.

Web Development Software

For simple website design, many people use Microsoft Frontpage or a comparable software application since these applications are easy to learn, provide a lot of functionality, and are relatively inexpensive. The cost of many Web design software applications ranges from around $50 to $150. Other, more expensive Web design software applications, such as NetObjects Fusion, have a more comprehensive selection of design features and provide more control over the design process. However, these more complex Web design software applications are also more difficult to use, and cost more than twice as much as an application like Frontpage.

For more advanced website development, there are other, much more sophisticated packages that are used for managing website development in addition to creating Web pages. Some of these software applications, such as Allaire's ColdFusion and Microsoft Active Server Pages (part of Microsoft Internet information Server, US), control connections from the Web server to a database, allowing dynamic content to be included instead of just static pages. Other software, such as Story Server from Vignette, provides content management tools. StoryServer allows non-technical users to enter the information to be displayed on the website, via online forms and templates.

Web Development Turnkey Packages

Many consulting and software companies sell what is called a turnkey package—a package that already has a website including a storefront ready to publish, except for any custom content to be input. Many companies that sell turnkey packages also provide, for an additional charge, the data necessary to input the custom content. Most of the framework for these turnkey sites is the same for all sites. Businesses that provide turnkey website development include Epiex, Maden Tech, and Zeus Technology.

There are also pre-packaged software solutions, which provide a series of templates used to create Web pages. An e-business simply selects the Web page templates appropriate for its website. The advantages of using a pre-packaged solution are, low cost and less time at the operational level. These pre-packaged solutions can be used to create a simple, one-page website or a complex e-tail site with thousands of products. A disadvantage of using pre-packaged solutions is the limited range of customization. A good example of a pre-packaged solution is the Yahoo! Store. An e-business can quickly build an e-tail website using the Yahoo! Store at a very low cost by entering the e-business's information into predefined web page templates in a matter of minutes.

Design Alternatives

There are alternatives to creating your own website from scratch. There was a time when the only templates you were likely to find on the Web were for single pages. At some point, these templates evolved to include multiple pages, but that was not the same thing as a template for an entire site design.

Outsourcing Web Design

Outsourcing Web design work can save a start-up e-business time and money spent on recruiting and hiring in-house Web design professionals. Outsourcing Web design can also enable an e-business to access experienced design specialists who are familiar with the normal practices and current technological changes. Before agreeing to an outsourcing contract, an e-business should thoroughly review several outsourcing candidates to get answers to the following questions:

1. What services do they provide?

2. What are their staff capabilities, and what portion of the design work, if any, will they subcontract?

3. Can they provide references and examples of their work?

4. What is their track record for completing projects on schedule?

Any contract to outsource Web design must also address the important issues of (i) who is responsible for updating and maintaining the site? (ii) what happens if updates are not made on a timely basis? and (iii) who owns the website content? An e-business must be sure not to give away copyright ownership of the resulting website to the designer. If in-house employees do the Web design and work within the scope of their duties, the copyright is with the e-business. However, if the Web design is outsourced to an independent contractor, the copyright ownership may remain with the creator of the design, unless transferred in writing to the e-business. It is important to clarify copyright ownership in writing as part of a We design agreement with an outside designer or developer. And, as with all other contractual relationships. it is a good idea to have an attorney review the terms of the written agreement.

An e-business that outsources its Web design may be able to take advantage of a usability analysis before the Web design is completed. For example, many Web design firms—such as Cyberplex, which has offices in both the US and Canada—employ usability analysts and human-computer interaction specialists who work directly with clients to fine tune the clients' website plans into usage scenarios and process flow diagrams. These scenarios and diagrams are then passed on to Web designers and technicians who use them as the basis for the website's design. Usability analysts look for ways to make certain that the appearance, layout, and interaction offered by a website reinforce the viewers' understanding of where they are at the website, what they can do at the website, and where to go next. After a website is constructed, it should be thoroughly tested.

Testing and Maintaining a Website

After the website is created, you should test the site thoroughly before sending it to the Web server and making it available to the public. Test it for usability, and make certain that everything on the website works correctly. One way to do this is to publish the website on a temporary location, called a staging server, and then perform a variety of tests on the website. For example, test all the hyperlinks and the online forms and see whether they relate to the Web page and the appropriate database, and all dynamic or active elements work as expected. In addition, the website should undergo a "stress test" to ensure that it can handle a heavy load of customer activity.

Unfortunately, many start-up e-businesses lack the in-house capability to do a thorough testing process. When this is the case, it is a good idea for an e-business to use the products or services of a professional online website testing company, such as Envive Corporation. Other companies such as Segue Software, BMC Software, and RSW Software, sell website testing software applications and services.

After a new website is thoroughly tested, it is sent to its final destination server, but this does not mean that all the work on the website is complete. An e-business must carefully monitor and evaluate its website activities, to determine the traffic level on the site, and the success or failure of the website in achieving its purpose. Viewer feedback must be solicited and evaluated. Your website should be re-examined at intervals, as it evolves over time.

A successful website must not be static. It must continue to evolve because of the dynamic nature of the Web, the constant advancement in Web technologies, and the growth in e-business possibilities. The underlying purpose of a website may be modified as new e-business opportunities arise. An e-business may need to restate its goals and objectives in the light of changing customer expectations and available technologies. Viewer feedback may require an evaluation of the overall web design as well as specific usability issues.

It is likely that the entire process of identifying the website's purpose, setting goals and objectives, reviewing Web design issues, creating and publishing the website, and monitoring its effectiveness will take place many times in the life of a successful e-business website.

To guide you in organizing your website into a coherent whole, some principles that sum up the basics of good site design are as follows:

1. Examine every element of your site from a single perspective only: that of the visitor to the site. What is good for the visitor is good for the site. That which hinders the visitor, obscures necessary information, or raises ambiguity is bad for the site.

2. The larger the site is, the greater the need for clear, concise organization of information. Organization applies at two levels: to the site as a whole, and to the individual page. For very large sites, there is a third level—the collection of pages from the subsite.

3. The page that loads quickly is better than the slow page. This rule does not apply to every site, but it does apply to the vast majority of websites. If you cannot get your pages in front of the visitor quickly, the visitor leaves. It is as simple as that.

4. Don't provide distracting links on pages where the distraction is not warranted. It is fine to have a link page that is 98 per cent links; it is not so fine to plough through the text with a hyperlink for every other word. Provide useful links, and spare out the useless ones.

5. Make sure you have got the right images. That old saying "a picture is worth thousand words" is not exactly correct. It can be improved upon as "the right picture is worth a thousand words". Just a little decoration can work wonders if it appeals to the viewer's aesthetic sense. Do not try to eliminate every unnecessary graphic, or your pages will look sterile and uninviting. This is a perfect example why it is hard to lay down exact rules for site design; finding the perfect balance between graphics and the text is an art, not a science.

6. Know the purpose of every graphic so as to decide if the time it takes to upload the graphic is justified. Does the graphic have any relevance to the page? If it is just a

decoration, is it a good and satisfying decoration? Does the graphic have a specific function—such as a link or a MAILTO? Knowing what the graphic is doing on the page will often result in recreating the graphic because you will realize it is not doing its job effectively. This takes time, though as a result, your Web page will be worth the effort.

7. Check the organization of your site. Find someone to cruise your website before you publish it, and find out where the rough spots are. When all is said and done, how long does it take for a new visitor to understand how your website is organized? you cannot figure this out yourself, because you already know how it is organized.

8. Prototype your website before you release it to an unsuspecting world. To look good, the typical large website needs to undergo several cycles of revision. You can no more think of all aspects of using a website than writing a large computer program perfectly on your first try. This analogy is more apt than we imagine. Bi are works in progress. Understanding this simple truth can save an awful finger pointing when the website is published. Assume that your website is full of holes and you are much more likely to find them. Oh—do not forget to allow time for fixing the problems you come across.

A website is a living thing. A large website is more like an ant colony. The larger the website, the harder it is to control. A good site design will allow the site to grow and evolve without major hurdles. All you can hope to do is to minimize the hurdles, if there are any.

There is nothing worse than a total redesign of a large website. As hard as it is to work through three or four prototypes, it is nothing, compared to shifting your entire website to a new design.

There is the ninth principle—to generate return traffic, i.e. your website has to updated with data from time to time, inviting people to visit your site in search of new data. Otherwise there is no inducement for a viewer to revisit it. Allowing change and development to meet this requirement is probably the toughest part of designing and maintaining a good website. To revise existing content and add new content not only refreshes the outlook of the site but also retains the attention of the visitors.

11.7 Strategies for Website Development

When companies began establishing their presences on the Web, the typical website was a static brochure that was not updated frequently with new information and seldom had any capabilities for helping the company's customers or vendors transact business. As websites have become the home not only of transaction processing but also of automated business processes of all kinds, these websites have become important parts of companies' information systems infrastructures.

The transformation occurred rapidly, taking only a year or two for most companies. But very few businesses have caught up with the changes in terms of how they develop and manage websites. Thus, the purposes and scope of websites have increased greatly, but few businesses today manage them as the dynamic business applications they have now become. The tools that companies have developed over the years to manage software development projects are designed to help those companies meet the needs of their current customers, and operate more effectively within existing value chains.

Many large and medium-sized companies have found it extremely difficult to develop new information systems and websites that work with such systems to create new markets or reconfigure their supply chains. In the past, companies that have had success in exploring new ways of working with their customers and suppliers by reconfiguring supply chains have had the luxury of time—in many cases, years—to complete those reconfigurations. However, the speed at which the Internet has changed markets and marketing channels throughout entire industry value chains, precludes lengthy reconfigurations. Now, companies that want to successfully adapt to the changed business environment of the information age must explore alternatives to traditional systems development methods.

Internal Development vs Outsourcing

Although many companies would like to think that they can avoid electronic commerce site development problems by outsourcing the entire project, savvy leaders realize that they cannot. No matter what kind of e-commerce initiative a company is contemplating, the initiative's success depends on how well it is integrated into and supports the activities in which the business is already engaged. However, few companies are large enough or have sufficient in-house expertise to launch an electronic commerce project without some external help. Even Wal-Mart, with an annual sale of more than $150 billion, did not undertake its 2000 website relaunch all alone. The key to success is finding the right balance between outside and inside support for the project. Hiring another company to provide the outside support for the project is called **outsourcing.**

The Internal Team

The first step in determining which parts of an e-commerce project to outsource, is to create an internal team that is responsible for the project. This team should include people with enough knowledge about the Internet and its technologies, to know what kinds of things are possible. Team members should be creative thinkers who are interested in taking the company beyond its current boundaries, and they should be people who have distinguished themselves in some way by contributing exceptionally to the company. If they are not already recognized by their peers as successful individuals, the project may suffer from lack of credibility.

Some companies make the mistake of appointing as e-commerce project leader, a technical wizard who does not know much about the business and is not well known throughout the company. Such a choice can greatly increase the likelihood of failure. Business knowledge, creativity, and the respect of the firm's line managers are all much more important than technical expertise in establishing successful e-commerce.

Measuring the achievements of this internal team is very important. The measurements do not have to be monetary. Achievement can be expressed in whatever terms are appropriate to the objectives of the initiative. Customer satisfaction, number of sales leads generated, and reductions in order-processing time are examples of metrics that can provide a sense of the team's level of accomplishment. The measurements should show how the project is affecting the company's ability to provide value to the consumer.

Increasingly, companies are recognizing the value of the intellectual capital they have built up in the form of employees' knowledge about the business and its processes. In the past, many companies ignored the value of their human assets because they do not appear in the accounting records or financial statements. Leif Edvinsson has pioneered the use of human capital measures at Skandia Group, a large financial services company in Sweden. In addition to acknowledging employees' competencies, Edvinsson's measures include the value of customer loyalty and business partnerships as part of the company's intellectual capita This networking approach to evaluating intellectual capital shows promise as a tool for assessing and tracking the value of internal teams and their connections to external consultants. These measurements are just now being adapted for use in measuring systems development efforts.

The internal team should hold ultimate and complete responsibility for the e-commerce initiative, from the setting up of objectives to the final implementation and operation of the site. The internal team will decide which parts of the project to outsource (and to whom those parts will be outsourced), and what consultants or partners the company will need to hire for the project. Consultants, outsourcing providers, and partners can be very important early in the project because they often develop skills and expertise in new technologies before most information systems professionals do.

Early Outsourcing

In many e-commerce projects, the company outsources the initial site design and development to launch the project quickly. The outsourcing team then trains the company's information systems professionals in the new technology before handing the operation of the site over to them. This approach is called **early outsourcing.** Since operating an e-commerce site can rapidly become a source of competitive advantage for a company, it is best to have the company's own information systems in which people work closely with the outsourcing team and develop ideas for improvements, as early as possible, within the tenure of the project.

Late Outsourcing

In the more traditional approach to information systems outsourcing, the company's information systems professionals do the initial design and development work, implement the system, and operate the system until it becomes a stable part of the business operation. Once the company has gained all the competitive advantage provided by the system, the maintenance of the e-commerce system can be outsourced so that the company's information systems professionals can turn their attention and talents to developing new technologies that will provide further competitive advantage. This approach is called **late outsourcing.** Although for years late outsourcing has been the standard for allocating scarce information systems talent to projects, e-commerce initiatives lend themselves more to the early outsourcing approach.

Partial Outsourcing

In both the early outsourcing and the late outsourcing approaches, a single group is responsible for the entire design, development, and operation of a project group—either inside or outside the company. This typical outsourcing pattern works well for many information systems projects. However, electronic commerce initiatives can benefit from a partial outsourcing approach too. In partial outsourcing, which is also called component outsourcing, the company identifies specific portions of the project that can be completely designed, developed, implemented, and operated by another firm that specializes in a particular function.

Many small websites outsource their e-mail handling and response function. Customers expect rapid and accurate responses to any e-mail inquiry they make of a website with which they are doing business. Many companies like to send an automatic order confirmation via e-mail as soon as the order or credit card payment is accepted. A number of companies provide e-mail auto-response functions on an outsourcing basis.

Another common example of partial outsourcing is an electronic payment system. Many vendors are willing to provide complete customer payment processing. These vendors provide a site that takes over when customers are ready to pay, and returns the customers to the original site after processing the payment transaction.

Internet service providers (ISPs) offer Web hosting services to companies that want to operate e-commerce sites but that do not want to invest in the hardware and the staff needed to create their own Web servers. ISPs are usually willing to accommodate requests for a variety of service levels. Small businesses can rent space on an existing server at the ISP's location. Larger companies can purchase the server hardware and have the ISP install, and maintain it at the ISP's location. ISPs provide the continuous staffing and expert^ needed to keep an e-commerce site up and running 24 hours a day, seven days a week. Most ISPs offer a wide range of services, including personal Web access for individuals. Some ISPs specialize in services to business. These larger ISPs cater to companies that want to operate e-commerce sites. They usually offer wider bandwidth connections to the Internet than smaller ISPs, and offer more reliable and continuous service.

A number of ISPs and other firms offer services beyond basic Internet connectivity to companies that want to do business on the Web. Many of these services were described earlier as candidates for partial outsourcing strategies, and include automated e-mail respond transaction processing, payment processing, security, customer service and support, order fulfillment, and product distribution.

Selecting a Hosting Service

For larger website implementations, the team will want to obtain the advice of consultants or other firms that rate ISPs and CSPS, such as Keynote Systems and the Directory of Internet Service Providers published by Boardwatch Magazine. The most important factors to evaluate when selecting a hosting service include:

- Functionality
- Reliability, bandwidth and server scalability
- Security
- Back-up and disaster recovery
- Cost

Companies that sell hosting services provide different features and different levels of service. The functionality offered by a service provider can include credit card processing and the ability to link to existing databases that store customer and product information. Some tracking software provides much more detailed information and easy-to-use report generators than other tracking software. You should determine the functionality offered by a hosting service and carefully evaluate whether that functionality will be sufficient to me the needs of your website.

The service should offer a guarantee that limits possible down time. E-commerce buyers expect hosting services to be up and running 24 hours a day, every day. Of course, no hosting service can promise never-to-fail service, but some can provide staffing and back-up hardware that minimizes reliability problems. Coordination of this function with the service provider can be very important. Usually, a business must have some round-the clock staff available or on-call to work with the service provider when an interruption occurs.

The bandwidth of the service's connection to the Internet must be sufficient to handle the peak transaction loads that its customers require. Sometimes a service provider will sign up new accounts faster than it can expand the bandwidth of its connections, resulting in access bottlenecks. A guarantee that specifies bandwidth availability or server response times is worth negotiating into a service provider contract. If you expect your site's traffic to increase rapidly, it is important that your service provider increases rapidly the server capacity and the bandwidth provided. In general, larger hosting services can scale up more easily than smaller hosting services. Again, it is worth negotiating some scalability into the service provider contract in such situations.

Since the company's information on customers, products, pricing, and other data will be placed in the hands of the service provider, the vendor's security policies and practices are very important. The service provider should specify the types of security it provides and how it implements security. No matter what security guarantees the service provider offers, the company should monitor the security of the e-commerce operation through its own personnel or by hiring a security consulting firm. Security consultants can periodically test the system and launch attacks on the security features used by the service provider to determine whether they are easily breached.

The hosting service should be able to guarantee close to 100 per cent reliability by having a workable disaster recovery plan in place. In addition to having off-site data back-up or mirroring, the hosting service should have a way to restore your site very quickly in the case of a natural disaster. Service providers offer many different pricing plans for different levels of service. Knowing what types of server hardware and software your site will require, and having a good estimate of the range of transaction loads the site is likely to generate, can help in negotiating a price for the hosting service.

11.8 Summary

This chapter deals with the concept of website which is very important for e-commerce. How to identify the website goals, what features make a web site an intelligent one, the tools available to design the websites are covered to a larger extent.

EXERCISES

1. Compare and contrast the website of Pepsi cola with that of Coca-cola.

2. Visit Harvard university website and comment on its animation graphics.

3. Compare the navigational bar of www.cdnow.com with www.boo.com.

4. Design a website for the following case using the techniques that you have learned Specify the following before undertaking the actual design:

   (a) Site structure

   (b) Navigational bar

   (c) Hyperlink structure

   (d) Colour schemes

   (e) Graphics and animation that you plan to use.

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