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Frontiers of Electronic Commerce

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Chapter 1

Welcome to Electronic Commerce

The cutting edge for business today is electronic commerce (e-commerce). Broadly defined, *electronic commerce* is a modern business methodology that addresses the needs of organizations, merchants, and consumers to cut costs while improving the quality of goods and services and increasing the speed of service delivery. The term also applies to the use of computer networks to search and retrieve information in support of human and corporate decision making.

More commonly, e-commerce is associated with the buying and selling of information, products, and services via computer networks today and in the future via any one of the myriad of networks that make up the *Information Superhighway* (*I-way*). Projections anticipate that the I-way will transform information transport technology for electronic commerce applications and provide an economic windfall similar to what the interstate highway system did for productivity in the nation's manufacturing, travel, and distribution systems [NII93]. The I-way is not a U.S. phenomenon but a global one, as reflected by its various labels worldwide. For instance, it is also called the National Information Infrastructure (NII) in the United States, *data-dori* in Japan, and *jaring*, which is Malay for "net," in Malaysia [AW94].

Factors fueling the avid interest in e-commerce run the gamut of the business process. From the broad perspective, e-commerce is well suited to facilitate the current reengineering of business processes occurring at many firms. The broad goals of reengineering and e-commerce are remarkably similar: reduced costs, lower product cycle times, faster customer response, and improved service quality. One major goal of the reengineering effort is to use electronic messaging technologies—a key building block of e-commerce—to streamline business processes by reducing paperwork and increasing automation. For example, electronic data interchange (EDI)—a fast and dependable way to deliver electronic transactions by computer-to-computer communication—combined with just-in-time (JIT) manufacturing methods,

enables suppliers to deliver components directly to the factory floor, resulting in savings in inventory, warehousing, and handling costs. And while EDI is primarily interorganizational, electronic mail (e-mail) does much the same thing, enabling firms to accelerate the document-based business processes both inside and across the organizational boundaries from simple order processing to complete supply chain mangement.

Technologies such as EDI and e-mail, widely used for years in work-flow and reengineering applications, are now diffusing into other aspects of commerce. The efforts of the late 1980s and early 1990s focused primarily on moving existing nonelectronic methods to an electronic platform to improve internal business process efficiency. Today, the emphasis has shifted from this narrow focus to the invention of entirely new business applications for reaching and getting close to the customer. The Information Superhighway and yet-to-be developed technologies will be key elements in this business transformation. And while earlier efforts resulted in small gains in productivity and efficiency, integrating them into the Information Superhighway will fundamentally change the way business is done. These new ideas demand radical changes in the design of the entire business process.

The effects of e-commerce are already appearing in all areas of business, from customer service to new product design. It facilitates new types of information-based business processes for reaching and interacting with customers—on-line advertising and marketing, on-line order taking, and on-line customer service, to name a few. It can also reduce costs in managing orders and interacting with a wide range of suppliers and trading partners, areas that typically add significant overhead to the cost of products and services. Finally, e-commerce enables the formation of new types of information-based products such as interactive games, electronic books, and information on-demand that can be very profitable for content providers and useful for consumers. In sum, companies believe that e-commerce can result in improved efficiency in finding and interacting with customers, in communicating with trading partners, and in developing new products and markets.

Clearly, a key element of e-commerce is information processing. All steps of commerce, except for production, distribution, and delivery of physical goods, are forms of information gathering, processing, manipulation, and distribution, which computers and networks are perfectly suited to handle. This information processing activity is usually in the form of business transactions, for which several broad categories can be observed:

- Transactions between a company and the consumer over public networks for the purpose of home shopping or home banking using encryption for security and electronic cash, credit, or debit tokens for payment (Chapter 7)

- Transactions with trading partners using EDI (Chapter 9)
- Transactions for information gathering such as market research using bar-code scanners, information processing for managerial decision making or organizational problem solving, and information manipulation for operations and supply chain management (Chapter 11)
- Transactions for information distribution with prospective customers, including interactive advertising, sales, and marketing (Chapter 13)

From a management perspective, all of these transactions require tight coordination and control among many participating organizations in order to minimize the exposure to risk. If we look at managing these transactions in light of global sourcing, an integral part of the increasingly global market, the complexity is compounded by long transportation distances, currencies, customs regulations, and language barriers. Codifying these transactions and coordinating them through software via the I-way can reduce the complexity of the task.

Many predict that electronic commerce will propel global computer networks from the fringe into the core of business. Despite the many unknowns in this rapidly changing area, e-commerce stands poised to make a momentous contribution to the way government, business, and individuals conduct business. To understand the various components of electronic commerce, we will first present a framework within which we can examine the various interlocking elements. Then we will examine electronic commerce applications, first in light of the supporting technology infrastructure, then in view of the various consumer and organizational needs.

1.1 ELECTRONIC COMMERCE FRAMEWORK

From the business activity already taking place, it is clear that e-commerce applications will be built on the existing technology infrastructure—a myriad of computers, communications networks, and communication software forming the nascent Information Superhighway. Figure 1.1 shows a variety of possible e-commerce applications, including both interorganizational and consumer-oriented examples. None of these uses would be possible without each of the building blocks in the infrastructure:

- Common business services, for facilitating the buying and selling process
- Messaging and information distribution, as a means of sending and retrieving information

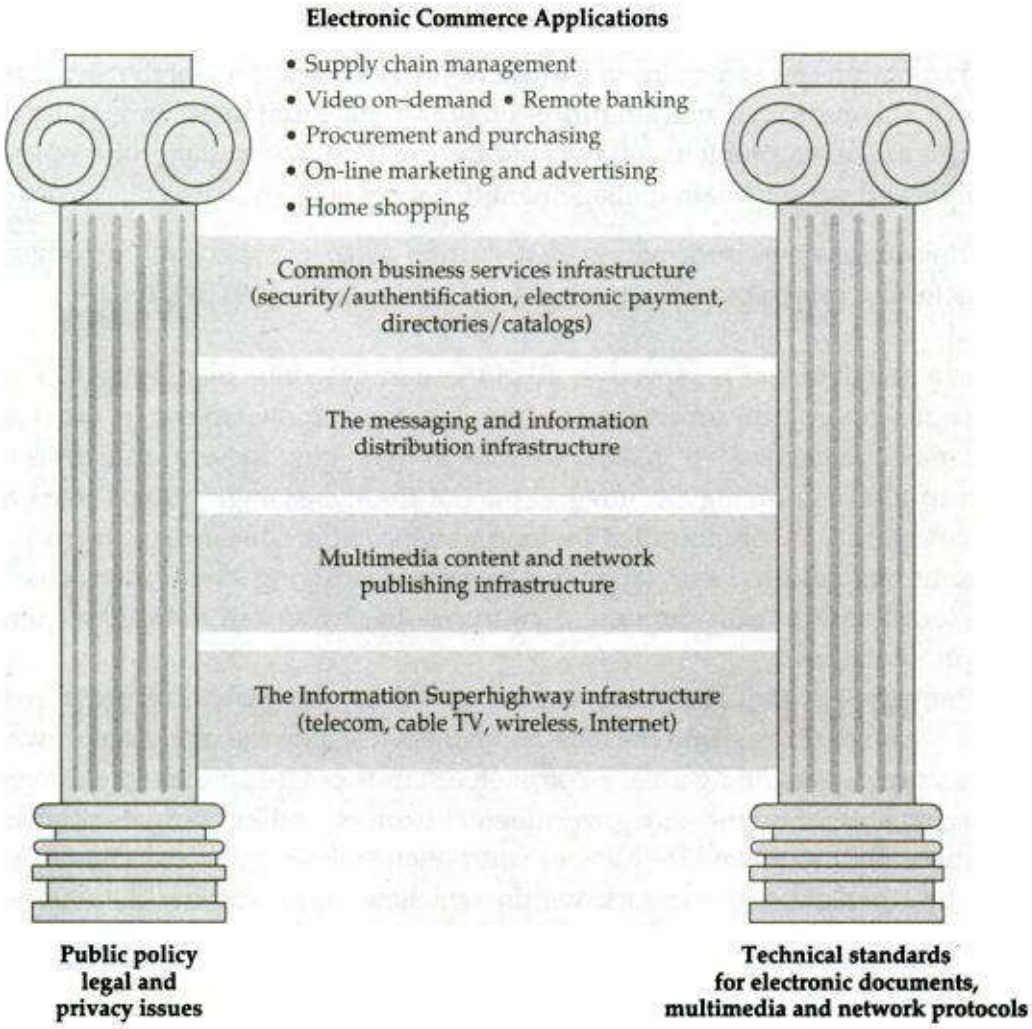

Figure 1.1 Generic framework for electronic commerce

- Multimedia content and network publishing, for creating a product and a means to communicate about it
- The Information Superhighway—the very foundation—for providing the highway system along which all e-commerce must travel

The two pillars supporting all e-commerce—applications and infrastructure—are just as indispensable:

- Public policy, to govern such issues as universal access, privacy, and information pricing

- Technical standards, to dictate the nature of information publishing, user interfaces, and transport in the interest of compatibility across the entire network

To better understand the integration of the various infrastructure components in our framework, let us use the analogy of a traditional transportation business. Any successful e-commerce application will require the I-way infrastructure in the same way that regular commerce needs the interstate highway network to carry goods from point to point. You must travel across this highway, whether you are an organization purchasing supplies or a consumer ordering a movie on demand. Understand, however, that the I-way is not one monolithic data highway designed according to long-standing, well-defined rules and regulations based on well-known needs. Rather, still under construction, the I-way will be a mesh of interconnected data highways of many forms: telephone wires, cable TV wires, radio-based wireless—cellular and satellite.

Far from complete, the I-way is quickly acquiring new on-ramps and even small highway systems. The numerous constructors are either in competition with or in alliance with one another, all in an effort to convince traffic to use their on-ramps or sections of the highway because, like tollways, revenues in e-commerce are based on vehicular traffic, in our case, vehicles transporting information or multimedia content. The myriad transactions among businesses means that the ultimate winner must select the technology for the I-way that best matches future business needs by using today's tools. Building an access road to a ghost town or a highway too narrow to handle the traffic will yield equally little return on investment for those who have been less successful at matching needs with the infrastructure.

Building the various highways is not enough. Transport vehicles are needed, routing issues must be addressed, and of course the transportation costs must be paid. On the I-way, the nature of vehicular traffic is extremely important. The *information and multimedia content* determines what type of vehicle is needed. A breakdown of potential everyday e-commerce vehicles into their technological components shows that they vary widely in complexity and may even need to travel different routes on the I-way, much the way an eighteen-wheeler may be restricted from traveling roads that cannot accommodate it:

Movies = video + audio
Digital games = music + video + software
Electronic books = text + data + graphics + music + photographs + video.

Once these vehicles (multimedia content) are created, where are they housed? What sort of distribution warehouses are needed to store and deliver their multimedia cargo? In the electronic "highway system" multimedia content is stored in the form of electronic documents. These documents are often digitized, compressed, and stored in computerized libraries or multimedia storage warehouses called *servers* that are linked by transport networks to each other and to the software/hardware clients that allow customers to access them.

Exactly how do the vehicles move from one distribution warehouse to another? In a traditional transportation business, diesel engines or gasoline-powered motors move the trucks along the roadways. On the I-way, *messaging software* fulfills this role, in any number of forms: e-mail, EDI, or point-to-point file transfers.

In addition to the development of new vehicles and systems, other key components of commercial transactions need to be examined. How can businesses assure customers of safe delivery? How can customers pay for using the I-way? The Common Business Services block of Fig. 1.1 addresses these supporting issues. Encryption and authentication methods have been developed to ensure security of the contents while traveling the I-way and at their destination (Chapter 5), and numerous electronic payment schemes are being developed to handle highly complex transactions with high reliability.

These logistical issues are difficult to address in long-established transportation systems. That complexity is compounded in the nascent world of electronic commerce by the unique interplay among government, academia, and private commercial endeavors as well as by the challenge of integrating otherwise incompatible transportation systems while maintaining an uninterrupted flow of traffic. And whereas traditional businesses are governed by the Commercial Code and detailed case histories, very basic policy and legal questions are materializing in relation to e-commerce. In the case of vehicular traffic over the interstate highway system, public policy issues concern pollution, consumer protection from fraud, environmental impact, and taxation. Similarly, in information traffic, public policy issues deal with the cost of accessing information, regulation to protect consumers from fraud and to protect their right to privacy, and the policing of global information traffic to detect information pirating or pornography. Again the issues themselves, let alone the solutions, are just now evolving and will become increasingly important as more and more people with variable intent enter the electronic marketplace.

The final pillar on which the e-commerce framework rests is *technical standards*, without which the impact of this revolution would be minimized. For instance, returning to our analogy with traditional transportation systems, railroads would not have flourished had each state established a separate

track standard (meter gauge versus broad gauge, for example) and goods would have to be constantly moved from one train to another every time the standard changed, as they do today at the border between Russia and Western Europe. Similar differences in standards exist today in electricity distribution (110 versus 200 volts) and video distribution (Sony Beta versus VHS), limiting worldwide use of many products.

Standards are crucial in the world of global e-commerce, to ensure not only seamless and harmonious integration across the transportation network but access of information on any type of device the consumer chooses—laser disc, PCs, portable hand-held devices or television + set-top boxes (cable converter boxes)—and on all types of operating systems. For example, without the adoption of video standards, video conferencing will never become widespread, as each manufacturer will attempt to develop equipment that maximizes their short-term profits rather than working toward customer goals such as interoperability.

While we have strived to limit our initial discussion of the elements of a framework for electronic commerce to an understanding of what part they play within this complex network, it is no accident that we have ended with a convergence of technical, policy, and business concerns. The concept of "convergence" is essential to the operation of the Information Superhighway and to the way the business world is gearing up to deal with it. It is only fitting that we preface our discussion of the one element of our framework we have not yet discussed in detail—e-commerce applications themselves—with a clarification of the concept of convergence.

1.2 ELECTRONIC COMMERCE AND MEDIA CONVERGENCE

The effects of convergence are already being felt. Many companies are pooling their resources and talents through alliances and mergers with other companies to make the electronic marketplace a reality. Part of their motivation may include reducing their risk in light of the uncertainty about what form this eventual global marketplace and e-commerce applications will take.

The term *e-commerce* has become irrevocably linked with the idea of convergence of industries centered on information that until today has been isolated—content, storage, networks, business applications, and consumer devices. *Convergence*, broadly defined, is the melding of consumer electronics, television, publishing, telecommunications, and computers for the purpose of facilitating new forms of information-based commerce. The public can be forgiven for finding the concept perplexing, since the popular press uses the terms *multimedia* and *cross-media* interchangeably. *Multimedia convergence*

applies to the conversion of text, voice, data, image, graphics, and full-motion video into digital content. *Cross-media convergence* refers to the integration of various industries—entertainment, publication, and communication media—based on multimedia content.

These two types of convergence are often closely related. For instance, in a new era of interactive TV, the lines between advertisements, entertainment, education, and services often become blurred. While watching an Olympic soccer match between Nigeria and Ireland, you may develop an urge to know more about Nigeria. Instead of running to the local bookstore and purchasing a book, you can link to an on-line database and search while not missing any part of the match. The information in these on-line databases is not limited to text but also provide photographs and digital videos (multimedia). In short, convergence requires removing the barriers between the telecommunications, broadcasting, computing, movie, electronic games, and publishing industries to facilitate interoperability.

Driving the phenomenon of convergence are some simple technological advances:

- *Convergence of content* translates all types of information content—books, business documents, videos, movies, music—into digital information. Once converted into digital form, that information can easily be processed, searched, sorted, enhanced, converted, compressed, encrypted, replicated, transmitted, and so on, in ways that are conveniently matched to today's information processing systems.
- *Convergence of transmission* compresses and stores digitized information so it can travel through existing phone and cable wiring. New switching techniques and other technological breakthroughs enable all types of information to travel to the home. Here we see a convergence of communication equipment that provides the "pipelines" to transmit voice, data, image, and video—all without rewiring the neighborhood.
- *Convergence of information access devices* have the sophistication to function as both computers and televisions. Other examples are the ubiquitous telephone, with internal fax machine, modem, and video monitor, capable of receiving fax, e-mail, and video.

Convergence is also being driven by of certain market conditions including the following:

- The widespread availability of increasingly low-cost, high-performance enabling component technologies, including semiconductors, storage and

display devices, communications systems, and operating systems, among others

- Entrepreneurs who are feeding on anticipated end-user demand for new applications—both products and services—that rely on the aforementioned enabling technologies
- Aggressive regulatory actions that are introducing competition in monopoly markets—local and long-distance communications, telecommunication and cable equipment, and right-of-way to customer's curb—and that serve to facilitate the rapid deployment of these new applications.

1.3 THE ANATOMY OF E-COMMERCE APPLICATIONS

Although no one knows what applications of electronic commerce will be successful in the long run, the potential payback for those who hold the winning numbers is a powerful driving force behind the development of the infrastructure and the convergence of numerous industries that we have examined in the previous sections. In Fig. 1.1 we showed e-commerce applications situated at the very top, and this is indeed indicative of how most applications rest on the entire infrastructure and reach out to consumers. It is important to understand, however, that applications can be found at all levels of the infrastructure itself. Not only is multimedia content a part of the infrastructure that will enable consumers to enjoy video on demand, but creation of that content is in itself an e-commerce application. Similarly, e-mail can be considered both a messaging infrastructure and a purchasable end product.

In the following subsections we will revisit many parts of the infrastructure we have already presented, this time in light of the business applications. Once again we have provided a point of reference, in Fig. 1.2. We will examine electronic commerce applications, multimedia content and multimedia storage servers as well as the information delivery system, the network service providers that serve as access points, and the devices that function as interfaces for various e-commerce applications.

Multimedia Content for E-Commerce Applications

Multimedia content can be considered both fuel and traffic for electronic commerce applications. The technical definition of multimedia is the use of

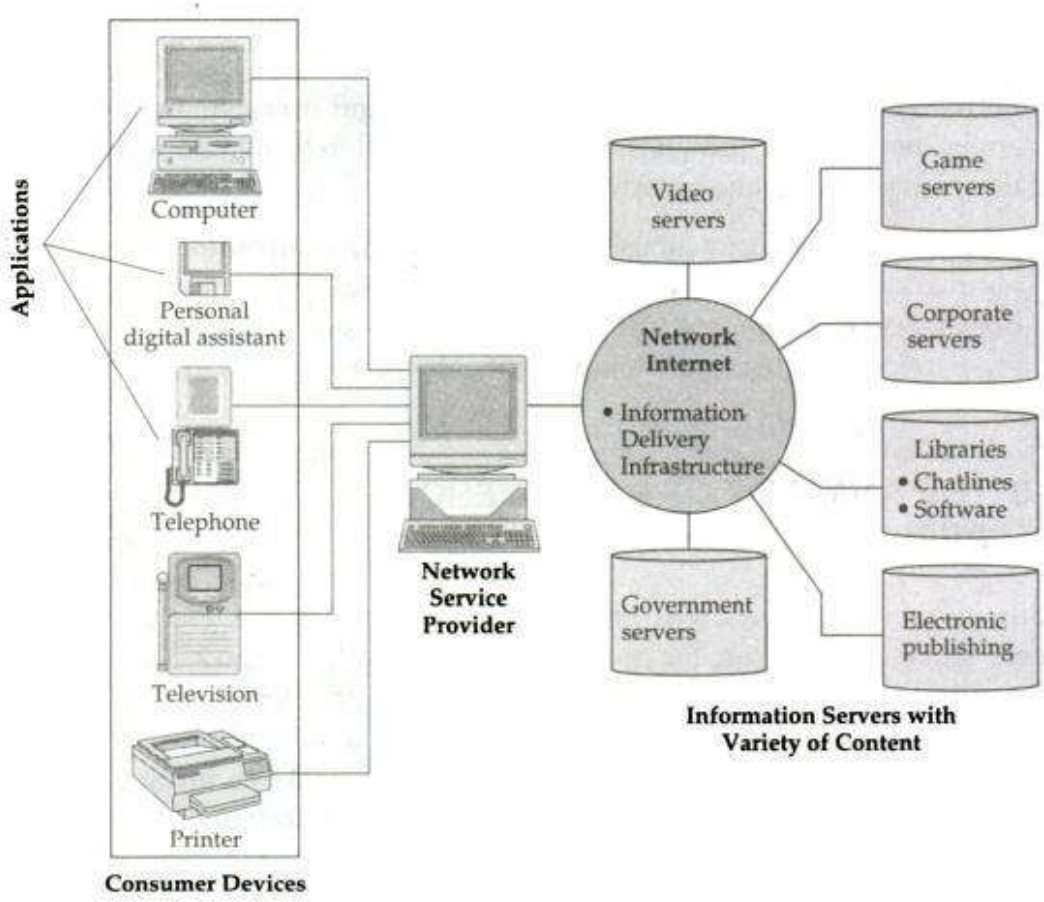

Figure 1.2 Elements of electronic commerce applications

digital data in more than one format, such as the combination of text, audio, video, and graphics in a computer file/document (see Fig. 1.3).

Multimedia mimics the natural way people communicate. Its purpose is to combine the interactivity of a user-friendly interface with multiple forms of content. In the popular press, multimedia is associated with the hardware convergence taking place in the telecommunications, computer, and cable industry as the next generation of digital, interactive home entertainment nears technical completion. From this perspective, multimedia has come to mean the combination of computers, television, and telephone capabilities in a single device.

Multimedia systems do much more than conventional database systems, which are oriented toward numeric processing (or number crunching). Business professionals are well aware that more than 90 percent of the information that firms use for business operations and decision making lives outside the "traditional" database systems. This external information—in the form of technical manuals, memos, e-mail, problem reports, sales brochures, and product design—is crucial for smooth organizational functioning.

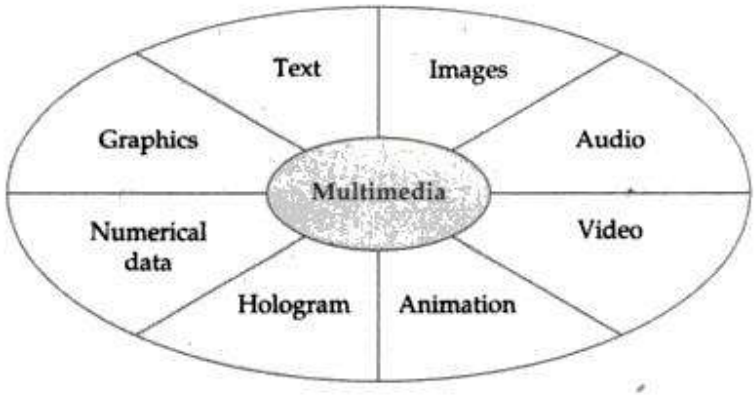

Figure 1.3 Possible components of multimedia

Because most business systems support only a fraction of the information and communications found in the workplace, the goal of multimedia is to increase the utility of all information through the processing and distribution of new forms such as images, audio, and video.

Thus many managers charting strategic directions now ask, Which applications of multimedia will have the greatest impact on their particular business operations? That question is being asked more frequently because computing and networking have advanced to the point where the distribution of multimedia is not only possible but also inexpensive. Although everyone agrees that multimedia represents the next generation of computing, few have a clear idea of what multimedia is all about, what it can do, and where it is heading. This is understandable since, the term *multimedia* covers so many things that it is often difficult to conceptualize. And, adding to the turmoil, telecommunications, cable/broadcasters, computer software and hardware providers each have a different view of what multimedia means. Everyone does agree, however, that whatever multimedia proves to be, business must be involved in it one way or another.

The traditional, separate business divisions, presented in Table 1.1, no longer hold true in the world of multimedia. For instance, an electronic book, no longer text only, often includes photographs, voice, video clips, animation, and a host of other things. In other words, every form of content is interrelated to other forms.

Access to multimedia content depends on the hardware capabilities of the customer. For a long time, the capability of the computer hardware was well ahead of the needs of software applications available to run on it. This gap is narrowing rapidly, however, with resource-hogging "application software" rich in multimedia content: electronic books, real-time information, movies, videos, and interactive services such as CD-ROM titles.

Telecommunications and cable companies, now aware of the importance of content for the future of e-commerce applications, have begun to acquire

Table 1.1 Traditional Division of Content by Industry

Industry	*Content Produced*
Entertainment producers	Cartoons, games, movies, video, music
Broadcast television productions	Gameshows, documentaries, entertainment programs
Print publishing	Books, reference collections, directories, catalogs
Computer software	Software programs: animation, games, productivity-enhancing tools

rights to the content they believe will have great value. This direction is evident in the protracted bidding war running into several billions of dollars between Viacom and QVC for Paramount Studios. The target: Paramount's library of movies, television series, and copyrights. The press and Wall Street have picked up on the programming-content theme with a vengeance, painting all content providers as winners and differentiating very little between possession and application.

This simplistic view fails to consider the key issue in e-commerce application development: What does the consumer want? For instance, the real catalysts to the business computing boom in the 1980s proved to be productivity-enhancing software like spreadsheets, word processing, desktop publishing programs, icon-based user interface, and graphics. Consumer acceptance will be positive if the technology is an e-commerce "killer" application that meets some suppressed need, as did the Lotus 1-2-3 spreadsheet for the IBM PCs and Nintendo's Super Mario Brothers for video games. These applications rapidly filled a need that the consumer never knew existed. No one has yet developed the "killer" application for e-commerce, and it is unlikely that an uncontested winner will emerge until the technical infrastructure is in place, clearly defined, or at least articulated.

The success of e-commerce applications also depends on the variety and innovativeness of multimedia content and packaging. The advantage goes to the current providers (or packagers) of multimedia content—to entertainment, broadcast television productions, traditional print publications, and software and information services. Supporting these content providers are the hidden brigade of small businesses or individuals producing content—writing articles, creating videos, developing software programs, and other important entrepreneurial activities. Plenty of opportunity, remains, how-

ever, for new players who can provide innovative content that meets consumer demands not fulfilled by existing providers.

Multimedia Storage Servers and Electronic Commerce Applications

Electronic commerce requires robust servers to store and distribute large amounts of digital content to consumers. These multimedia storage servers are large information warehouses capable of handling various content, ranging from books, newspapers, advertisement catalogs, movies, games, and x-ray images. These servers, deriving their name because they serve information upon request, must handle large-scale distribution, guarantee security, and complete reliability.

Digitized content eliminates the bulkiness and mechanical unreliability found in past equipment. Steady advances in digital memory technology are making mass-storage devices technologically feasible and increasingly cost-effective. For example, with the 256-megabyte and 1-gigabyte memory chips now under development, an entire feature-length movie could be stored on four to ten memory chips. Frequently requested or accessed content will be stored on such relatively expensive chips; content requested less often will be housed on less expensive media, such as optical disks and magnetic tape.

Client–Server Architecture in Electronic Commerce

All e-commerce applications follow the client–server model (see Fig. 1.4). Clients are devices plus software that request information from servers. The client–server model replaces traditional mainframe-based models that worked well for a long time. Mainframe computing, which traditionally meant "dumb" terminals attached to a computer housed in a glass house, is too costly and slow to cope with new data types like audio and video. In contrast, the dominant model of client–server architecture links PCs to a storage (or database) server, where most of the computing is done on the client. Even existing client–server models based on PC servers, while providing back-end technology for scalable and flexible database management, have to be reengineered to accommodate new data types.

The client–server model, allows the client to interact with the server through a request-reply sequence governed by a paradigm known as *message passing*. The server manages application tasks, handles storage and security, and provides scalability—ability to add more clients as needed for serving more customers—and client devices (from personal digital assistants to PCs) handle the user interface (see Fig. 1.4). In effect, the multime-

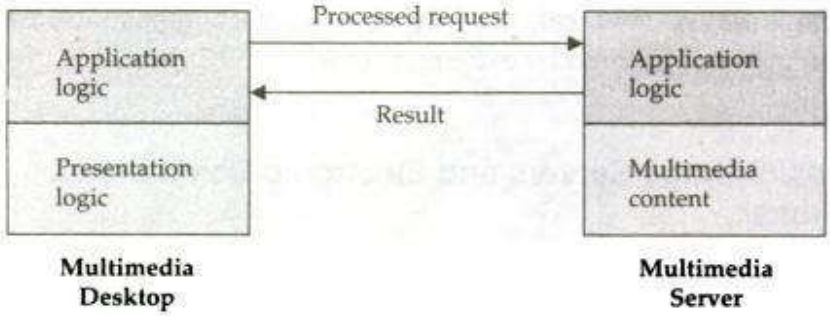

Figure 1.4 Distribution of processing in multimedia client–server world

dia server handles the critical elements (distribution, connectivity, security, accounting), and so is expected to simplify and make scaling more cost-effective.

Be aware, however, that the full impact of the fundamental shift in the computing paradigm from a host-terminal architecture to a networked client–server architecture will take several more years to be realized. There is a long way to go before the installed base of mainframes and minicomputers is networked or replaced by workstations and PCs. Commercial users have only recently begun downsizing their applications to run on client–server networks, a trend that electronic commerce is expected to accelerate.

Internal Processes of Multimedia Servers

The internal processes involved in the storage, retrieval, and management of multimedia data objects are integral to e-commerce applications. In general terms, a *multimedia server* is a hardware and software combination that converts raw data into usable information and then "dishes out" this information where and when users need it. It captures, processes, manages, and delivers text, images, audio, and video. Most multimedia servers provide a core set of functions to display, create, and manipulate multimedia documents; to transmit and receive multimedia documents over computer networks, and to store and retrieve multimedia documents.

To make interactive multimedia a reality, a server must do the following: handle thousands of simultaneous users; manage the transactions of these users (e.g., purchases, specific information requests, customer billing); and deliver information streams to consumers at affordable costs. The technical challenge is obvious when one realizes that traditional models of information management do not lend themselves to the new paradigm. First, the

data differ radically; we are no longer dealing with only table-formatted, alphanumeric data. Second, the computing platforms pose bottlenecks when trying to deliver large pieces of complex data.

Let us illustrate the issues by looking at video on-demand. Here, a single 90-minute video consuming over 100 gigabytes of storage space must be distributed to a large number of consumers. For these new requirements, platform choices include high-end symmetric multiprocessors, clustered architecture, and massive parallel systems. Massive parallel systems harness the power of cheap processors and intricately chain them to create a web that behaves as one single unit, although each processor has its own communications pathway to the outside world. This process avoids the congested pathways of traditional models while affording thousands of users information from the server. And finally one of the most compelling technical challenges is the management of enormous storage capacity required for these new forms of data, in particular digital video. Economical storage and manipulation of digital video is impossible without several magnitudes of compression accomplished by using video compression standards such as Motion Picture Expert Group (MPEG) (see Chapter 18). To address these technical challenges, new types of video servers are being developed.

Video Servers and Electronic Commerce

The electronic commerce applications related to digital video will include telecommuting and video conferencing, geographical information systems that require storage and navigation over maps, corporate multimedia servers, postproduction studios, and shopping kiosks. Consumer applications will include video on-demand and a range of interactive services such as shopping, video navigation (e.g., interactive TV guides), and directories (e.g., interactive telephone yellow pages).

The need for large-scale video storage has led to a unique business partnership between technology/transport and media companies in interactive TV trials and has resulted in the development of new video servers. *Video servers* (see Fig. 1.5 for a block diagram of a video server architecture) are an important link between the content providers (entertainment/media) and transport providers (telcos/wireless/cable operators). One important difference between video servers and the current client–server computer systems used extensively for data processing is that video servers are designed to deliver information to hundreds of consumers simultaneously via public telecommunications and cable networks. Video servers tackle the "simultaneous overlapping" supply problem that arises when providing on-demand services to large numbers of homes. Numerous households will want to

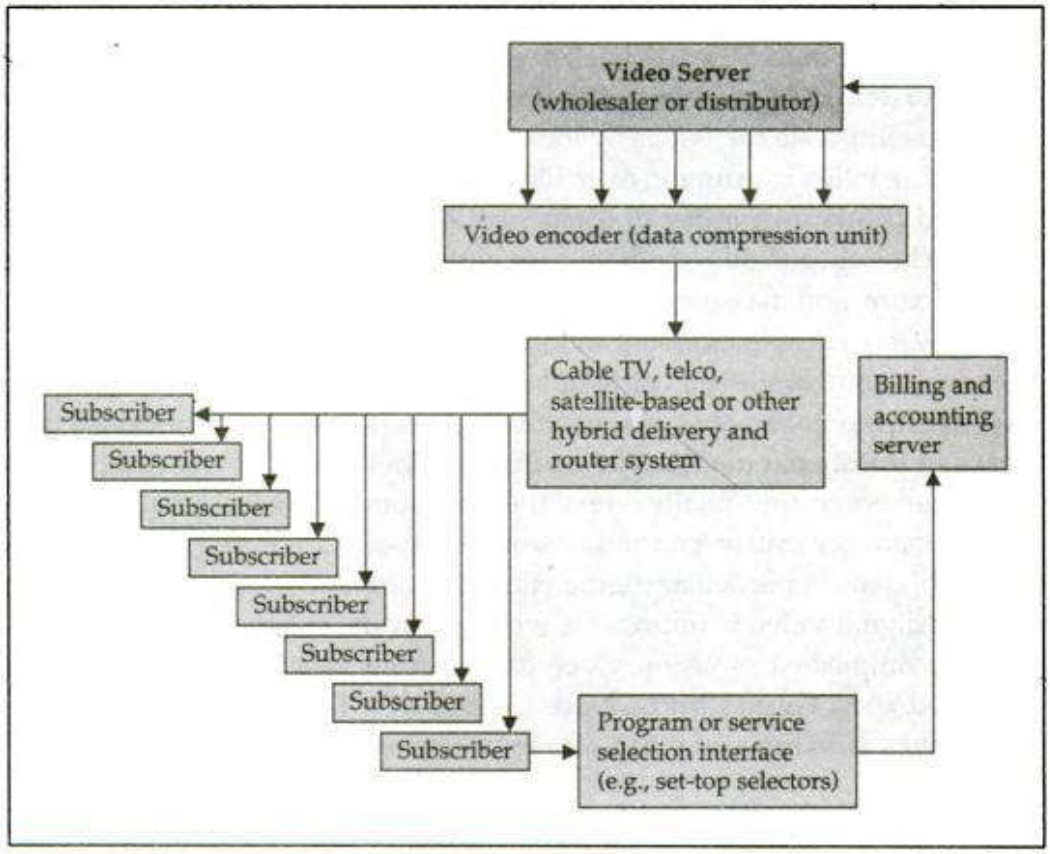

Figure 1.5 Block diagram of a generic video on-demand system

watch the film either simultaneously or at overlapping times. This problem can be approached from either the hardware or software end.

In the case of hardware solutions, servers can harness the power of massive parallel architecture—that is, using thousands of inexpensive microprocessors that are interlinked to create the illusion of one large computer. Each processor acts as a "video pump" and distributes a portion of the film so that a single film can be viewed by numerous households on-demand. One example of such a video server is nCube, which contains 512 processors, each equivalent to an Intel Pentium chip. The total random-access memory in such an architecture is 16,000 megabytes (16 gigabytes)—dwarfing the typical 8 megabytes found in a desktop computer.

All video servers need not be hardware-based. Rather than looking at the delivery of continuous media on-demand (e.g., audio and video) as a hardware problem solved with massive parallel machines, Microsoft has approached the problem as a customizable software issue. This software architecture, being developed under the code-name Tiger, is based on the Windows NT operating system. Tiger is expected to be implemented in

many ways—on personal PCs for individual or work-group use, as corporate servers for small- or mid-sized private networks, and as large servers for large-scale consumer use. The goal is to provide the power, functionality, and scalability to give users split-second access to thousands of media files and to allow laser disc–type functions such as pause, reverse, fast-forward, and jump-ahead to user-specified locations. Only time, economics, and customer preferences will decide which approach will dominate.

Information Delivery/Transport and E-Commerce Applications

Transport providers are principally telecommunications, cable, and wireless industries; computer networks including commercial networks such as CompuServe or America Online; and public networks such as the Internet. As noted earlier, the transport system does not function as a monolithic system, in the sense that there is no single Interstate 80 that connects the digital equivalent of New York's George Washington Bridge to San Francisco's Bay Bridge. Instead, the architecture is a mix of many forms of high-speed network transport whether it be land-based telephone, air-based wireless, modem-based PCs, or satellite transmissions (see Table 1.2). Literally, the transport routes for e-commerce applications are boundless.

The distribution of information has become a competitive market with a combination of offense and defense. Playing on the defense are telephone companies and cable television companies, providers that have enjoyed monopoly positions for decades. Now, however, their enormous investments in wiring and equipment have become vulnerable to new competition.

Table 1.2 Transport Routes

Information Transport Providers	*Information Delivery Methods*
Telecommunication companies	Long-distance telephone lines; local telephone lines
Cable television companies	Cable TV coaxial, fiber optic, and satellite lines
Computer-based on-line servers	Internet; commercial on-line service providers
Wireless communications	Cellular and radio networks; paging systems

Playing offense are computer companies that offer new hardware capabilities and software programs with the potential to define new markets. The computer companies are banking on public networks such as the Internet, which is expanding at an astounding pace (see Chapter 3). Another emerging threat will be wireless communications known as *personal communications services*, a form of walkaround telephony that bypasses the traditional telecommunications companies and uses wireless communications.

Each highway route provider faces a different but no less daunting set of challenges:

- *Telecom-based.* These providers, the most visible (and vocal) of all competitors, include long-distance and local telephone service providers. For the phone companies, the breakthrough for e-commerce applications delivery came in 1991 when scientists found a way to do what everybody had assumed was impossible: squeeze a video signal through a telephone wire. The technology, known as *asymmetric digital subscriber line (ADSL)*, has some unresolved drawbacks: It cannot handle live transmissions, and the picture it produces is not as clear as that provided by a well-tuned cable hookup. Researchers have recently improved the quality of the picture and with further compression expect to accommodate several channels of live video over a single telephone wire.
- *Cable-based.* These providers depend on coaxial cable as transport roads and will help determine which broadband applications and services the viewing public prefers. All leading cable providers are conducting trials with a variety of hardware and software, and most are expected to use fiber optic cable and coaxial wire as the delivery medium. The strategy among cable companies is to develop a "network neutral" content that uses digital compression and is adaptable to alternative delivery systems, such as wireless and satellites (see Chapter 2).
- *Computer network-based.* These providers are often dial-up linkages of lower bandwidth when compared to telecom and cable highways. Bandwidth is analogous to the number of lanes on a highway. Examples of on-line transport architectures are CompuServe, Prodigy, and America Online (see Chapter 2), which often tend to serve as both a transport road and content providers.
- *Wireless.* These operators are typically radio-based—cellular, satellite and light-based—infra-red. In fact, some of the most exciting transport architectures are invisible. New wireless-based systems require new ways of thinking about information delivery. The 1990s have been characterized by record-breaking growth in most wireless segments, including cellular, paging, and specialized mobile radio. This thriving market, considered to

have enormous growth potential through the year 2000 and beyond, was further boosted in 1993–1994 by a series of legislative and regulatory developments encouraging emerging wireless technologies.

Currently, about 65 percent of e-commerce applications are delivered online via computers equipped with modems, but the percentage of information delivered on CD-ROM continues to grow. Information delivery by telephone, called *audiotext*, is a promising medium, generating about $590 million in revenue in 1993 despite government regulations that have curtailed its growth [USIO94]. Audiotext is especially popular for delivery, in real time, of certain types of information such as stock quotes, mortgage rates, sports and lottery results, weather, and news. One major newspaper publisher estimated that more than one million calls will be made monthly to its audiotext service. However, the next generation of delivery media is expected to be interactive multimedia, a technology that combines computer, telephone, and television services. This technology could attract more home users to information services.

Consumer Access Devices

Which consumer devices provide the on-ramps to the transport architectures? Will the digital on-ramps be through existing televisions, personal computers, multimedia PCs, or televisions with so-called set-top boxes? or through all four? What computer operating systems will be the engines in these access devices?

Over the next decade hundreds of billions of private and tax dollars will fund the integration of the different (and often incompatible) communications systems and the creation of new software and hardware navigation tools for improved information access. How the majority of users will access e-commerce applications, as yet unknown, is heavily linked to the access device they opt to use. A myriad of devices can provide access to information: videophones, PCs capable of handling multimedia, personal digital assistants like Apple's Newton, televisions capable of two-way transmission, cellular phones, mobile and portable computers. (See Table 1.3.)

Of all these devices, interactive TV has been touted as the information access device of the future. The argument is simple: Almost everyone has a TV, and everyone is far more comfortable using a TV than a PC. Does this sound like the argument advanced by radio manufacturers after TV was introduced fifty years ago? Just as improvements in TV made it far more appealing and affordable, advances in computers are making it much easier to operate, much more useful, and much less expensive. The newest genera-

Table 1.3 Information Access Devices

Information Consumers	*Access Devices*
Computers with audio and video capabilities	Personal/desktop computing (workstations, multimedia PC) Mobile computing (laptop and notebook) CD-ROM-equipped computers
Telephonic devices	Videophone
Consumer electronics	Television + set-top box Game systems
Personal digital assistants (PDAs)	Pen-based computing Voice-driven computing Software agents

tion of PCs, for example, operates microprocessors powerful enough to run video with the resolution of a television picture. All access devices need not be hardware based, moreover. A new breed of software-based devices called software agents is being created that will act as the consumer's personal digital assistants (see Chapter 16).

Some issues remain unresolved. For instance, which operating system will be the dominant player on these access devices? Who will define the user interface (and earn the staggering royalties likely to accrue from it)? The operating system of choice will depend to some extent on which transport highway consumers ride and the user interface they prefer. If on-line services are used, then there is high probability that PC-based access may predominate. Here, Microsoft is well positioned with its Windows 95 operating system.

Adding to the realm of uncertainty about the future configuration of various access devices is the nature of the interface between the consumer and the content. Having access to a veritable cornucopia of interactive information and entertainment is useless to the average consumer who is petrified by technology. A common joke in movies and late night talk shows concerns "flashing twelves," a reference to consumers' inability to program VCRs.

To illustrate difficulties in interface design in e-commerce applications, let's look at some specifics, beginning with on-line newspapers and magazines. Stories abound about *Time*, *The New York Times*, and many other publications going on-line. Clearly, these offerings have a long way to go. At this point they are best used for looking up specific information they are known to contain rather than browsing or skimming as done with normal reading.

One major drawback is readers' inability to decide which stories to read. Readers of printed magazines can browse the headline, the subheads, the photos, the captions, or perhaps read three paragraphs and then hop to another story, all within a few seconds.

On-line browsing is not easy. Often, users are confronted with a menu of brief headlines, each describing a story. One selects the story by typing a number at the keyboard, or if confronted with a graphical user interface, by clicking on a mouse pointer. Often, the menu doesn't yield enough information to make an informed decision, so time is wasted opening up stories and then finding that they are not relevant. Even if the material is relevant, it is not that much fun reading copy on a screen because the colors and layout are often not attractive.

On the positive side, these early systems represent the first generation of on-line publications, and in another few years things probably won't be the same. Eventually, we will figure out how to design effective interface with pictures, text, probably sound, movies (and smell!). In other words, at this point the whole area is nascent with tremendous potential.

Home shopping, video on-demand, or other services present similar challenges. Bell Atlantic estimates that, to make these applications attractive, the consumer must be in a position to make a purchase decision within four "clicks" of the remote control. A number of firms are tackling the challenge of making life easy for the confused consumer in a world of many choices, using software agents that act on the consumer's behalf through voice commands. Some of the most recent thinking in this area suggests that the set-top box will actually have to become a broker, a machine that delivers the consumer's typical preferences to a number of other computer systems in the networks. This raises two issues: The need for additional computer systems to track consumer preferences will boost application and network costs; and the increasingly feature-rich software content will present a vast variety of choices and increase the chance of major software bugs, which will damage the attractiveness of the products in consumers' eyes.

A *Wall Street Journal* survey of the complexity of user interface design illustrates the gap between what seems obvious to application developers but makes no sense to the user. The newspaper presented a random selection of all but meaningless icons from popular desktop software in "what do these mean?" quiz form. The respondents understood only 30 percent of the icons, on the average. Detailed analysis of the results reveals that icons have to be extremely obvious to be of any use to the consumer.

To delve into interface design further, consider video on-demand. It is clear that simply presenting the consumer with 500 films (about the size of the selection found at a combined corner convenience/video store) without any clips would be a highly ineffective marketing method. On the other

hand, playing a continuous cycle of 15-second clips for 500 movies would require almost two hours and would be just as ineffective as a list of 500 titles sorted by category. Currently, companies are bypassing the entire issue of effective user interface design and focusing on getting the basics to work, as evidenced in the early on-demand trial services being conducted. Time Warner's Quantum system, for instance, asks the user to choose a film and responds to the user's selection by giving the time of the next screening; to watch a film, the user pushes a button on the remote control and is charged a fee between two and four dollars. Special events such as major sporting events or concerts cost up to thirty dollars to watch. This is by no means a complete video on-demand service, but it does provide some experience in this emerging market and allows companies to assess the potential demand.

In the meantime, Blockbuster Video, Disney, and others are actively researching customer-technology interfaces. Both companies have done studies that demonstrate some interesting aspects of consumer behavior: 65 percent of customers cannot accurately remember the name of the video they rented a week or two before, and consumers like to hold the video boxes in their hands and read the labels when choosing viewing material. Both observations indicate the need for facilitating better recall. In other words, the interfaces will have to be very effective at re-creating the experience of browsing an electronic shelf to provide some sort of memory by association. In the end, many of these issues may be overcome, but it does seem premature to assume that they will not be sorted out without a number of costly experiments in terms of both time and money. This does not condemn interactive multimedia to death, but it does suggest a slower-than-expected scenario for widespread adoption.

1.4 ELECTRONIC COMMERCE CONSUMER APPLICATIONS

Businesses looking to get involved in the electronic marketplace want fast answers to some very basic questions. What type of services do consumers really want or are willing to pay for? Do they want applications that bring about social change, that entertain, that are educational, or that educate as well as entertain? What amount is the consumer willing to pay for these services? How should the product be priced so that firms are competitive as well as profitable? We address these questions in the following sections.

Consumer desires are very hard to predict, pinpoint, or decipher in electronic markets whose shape, structure, and population are still in the early stages. Needs envisioned include entertainment on-demand, including 500-channel TV, video on-demand, games on-demand, and news on-demand;

electronic retailing via catalogs and kiosks and home shopping networks; interactive distance education; collaboration through desktop videoconferencing; medical consultations, and many more. Predicting which applications will be the winners and which will be "duds" resulting in huge losses will not be easy until experiments are done, but those experiments require an infrastructure. To plan the infrastructure, however, hard choices about a winning application have to be made--a classic chicken/egg problem.

Currently, the application of choice among the cable and telecom providers who are developing the infrastructure is video on-demand. Why are most companies betting heavily on this? Let's look at some statistics from the United States:

- Ninety-three million homes have television. That's 98 percent of households. About two-thirds of the homes have more than one television, and about the same number are connected to cable.
- Americans spend nearly half their free time watching television. According to Nielsen, the market research firm, the average television is on about seven hours a day, and the average American watches television between three to four and a half hours a day. The only other activities that take up more time than watching television are work and sleep.
- At almost any moment every evening, more than one-third of the population is in front of a television—not all watching the same channel, of course. This huge TV audience is made up of a multitude of moving targets, namely, consumers wielding remotes.
- Sight, sound, and motion combine to make television a powerful means of marketing. As proven by the success of home shopping networks, television can move mountains of merchandise.

Video on-demand is seen as part of an overall long-term trend from the passive delivery vehicles of movies, radio, and TV to "consumer-interactive" platforms. How will it work? To see a video, consumers would pick one from a wide selection and would be billed later. As currently envisioned, video on-demand is merely a cheaper or more convenient replacement for the corner video store.

In the future, viewers will decide what they want to see and when they want to participate. Consumers will be given greater control over scheduling these activities. The changing trends in consumer choice can be seen in other areas of entertainment besides movies, namely, in the consumption of sports, TV shows, and educational programs. This movement is evident in the popularity of CNN, whose 24-hour newscast frees the consumer from having to watch the six or eleven o'clock news. However, video on-demand is not a

sure bet by any means (or a killer application for e-commerce), as we will see in later sections.

Consumer Applications and Social Interaction

In the long run, the e-commerce application winners will be those that can change the way consumers think and the way they do business. One example might be applications oriented toward social interaction. Lessons from history indicate that the most successful technologies are those that make their mark socially.

Television, the most successful technological miracle since the automobile, quickly became so vital that people, even those who couldn't even afford shoes, bought sets in the millions. In 1945 almost no one in the U.S. had a TV; by 1960 about 86 percent of households did. Now contrast this with the telephone. Bell invented the telephone in 1876 and by 1940, 40 percent of U.S. households and by 1980 about 95–98 percent of households were connected.

Penetration was slower for the telephone than for TV because of the effort needed to set up the wiring infrastructure. Nevertheless, both technologies are equally significant in their impact. The impact of the telephone on business and social communications is without doubt one of the most significant events of the twentieth century. The same is true of the influence of television on consumer behavior and entertainment habits.

Other social revolutions have bearing on the e-commerce applications. For instance, the current trends in radio and television talk shows can be seen replicated in the on-line news groups. All-talk radio began in 1960 at KABC in Los Angeles, and by 1989, almost three decades later, just 319 radio stations followed the news and mostly chat format. In 1994, their numbers exceeded 1000, and virtually every one of the nearly 12,000 radio stations in the United States had a talk show. Incidentally, talk shows began on TV by serendipity, when Phil Donahue leapt into the audience of his new talk show to let a woman ask his guest a question. Since then, talk shows have become a national pastime. But it was the presidential campaign of 1992 that enlarged the conversation by pulling even the presidency down to street level. While his opponents flew from primary to primary, independent billionaire Ross Perot popped up on "Donahue," "Larry King Live," and C-SPAN. Soon, Bill Clinton was answering questions on MTV and taking calls. The newly elected Bill Clinton was then responding to questions from the e-mail address president@whitehouse.gov.

Social interactions were also promoted by the introduction of the 800 toll-free service around 1968. By 1993, AT&T's 800-number business represented

40 percent of total calls made—some 12 billion 800 calls. Providing contrast to the toll-free services is the caller-paid 900 service known as audiotext, which allows callers to access a live, prerecorded, or interactive program. The four major 900 services are fax-back, interactive, recorded—sports scores, financial services and weather, opinion polling, and conferencing or simultaneous conversation using Group Access Bridging (GAB). In the corporate world, marketers are exploring 900 services as a way to offset costs in areas like customer service by getting callers to pay. The nature of these audiotext services may change as computers are used to access the information with modems doing the dialing.

In sum, the most successful marketplaces are expected to be those that cater to consumers' loneliness, boredom, education, and career. For instance, look at the success of on-line chat services and home shopping channels. In a highly competitive society, where neighbors seldom talk to one another, these outlets give consumers someone to talk to after going home. One can add video on-demand, adult entertainment (sports, sex, and gambling), electronic malls, grocery shopping, and local news to that list. Newspaper publishers with on-line services have already found a successful niche: the personal ads. But turf battles emerge as debates rage over whether interactive TV or on-line computer services will become the pivotal medium for solving consumer loneliness.

What Do Consumers Really Want?

Two key questions still need to be addressed: Do consumers want new services and will they pay for them? Having set out the proposition that the e-commerce applications cannot be built overnight and probably will emerge more slowly than many now assume, we now analyze how the consumer will react to the promised multimedia cornucopia.

Some cable TV and telecommunication network operators seem to be taking a "build it and they will come" attitude. Plans for video on-demand and other applications are predicated on imaginary customers who are expected to buy multimedia services. If history has taught us anything about imaginary customers, it is that they have a way of doing unexpected things.

To accurately gauge consumer intentions with respect to services they do not yet understand is very difficult. Interestingly, focus groups and limited-market tests suggest consumers show no pressing demand for additional services or for a 500-channel interactive TV. Nonetheless, several very successful businessmen are convinced that the public will gobble up interactive services if they are made available.

It would be to the peril of e-commerce application creators to forget that people always gravitate toward doing things in the easiest possible way. The February 1994 issue of *Direct Marketing* [JS94] featured a speech on the challenges facing marketers in electronic markets made by Joseph Segel, founder of both QVC Network and the Franklin Mint. Some of the key comments from the transcript of his speech are summarized here:

- Consumers are generally satisfied with the range of choices (approximately 50 channels) now available on cable television. The main complaint is not lack of choices, but quality and cost of service.
- Many of the concepts being promoted are solutions in search of a problem. Most successful present-day systems are about as simple as they can be. People, for instance, are comfortable with the way televisions and telephones work. If a new system requires more steps to do essentially the same things, consumers may resist it.
- Television viewers are passive by nature. Some system developers and their software programmers assume that consumers are itching to be converted from passive to interactive television watchers. Certainly, some people fit that mold, but most of the public prefers to lay back and just watch television and let someone else do the work of figuring out the sequence of television programming.

The convenience factor is also critical. In 1993 Americans bought $60 billion worth of goods through catalogs, TV shopping networks, and other direct marketing alternatives. Although only 2.8 percent of the $2.1-trillion-a-year retail marketplace (which includes supermarkets, drugstores, mall outlets, car dealerships, department stores, warehouse clubs, boutiques), direct marketing represents the fastest growing segment of retailing [JS94].

The bottom line seems to be that new interactive services must be easy to use, inexpensive, and appealing in terms of satisfying a need before consumers will use them and buy them.

What Are Consumers Willing to Spend?

As in all commerce, economics is a key issue. How much are consumers willing to spend and how should products be priced? Right now, the $3.50 charge for a rental video is a cash, out-of-pocket item. Video on-demand, in contrast, would necessitate monthly billing, raising the question of "sticker shock." Consider the following projected cable subscriber bill projected for the year 2000 [ABS94], for example:

Recurring fees:

Standard service channels	$9.75
Expanded basic video	7.00
Premium channels	8.00
Audio music broadcasts	0.25
Converter boxes	8.75
	Subtotal: $33.75

Usage fees:

Pay-per-view	$0.75
Movies-on-demand	13.00
Time-shifted television	2.75
Music videos-on-demand	2.50
Interactive games	5.50
Educational programs	2.75
	Total monthly charges: $61.00

Contrast this charge with a current cable bill for basic service of about $30. Discretionary spending on cable in the United States has been flat for ten years, at an adjusted $124 per annum per subscriber line. This raises some interesting questions about the affordability of video on-demand, particularly if the cable bill is doubled from $30 to $65 a month. Now look at the economics for the service provider: (1) the cost to the network operator to run fiber to the home is around $1000; (2) the cost of a intelligent set-top box is around $1000; and (3) the cost of network enhancements per subscriber is around $1000. A GTE Corporation study showed that, above $4 a film, video on-demand's popularity decreases very rapidly. Even if we assume that the economic cost projected for the year 2000 can be halved, and the technological cost per subscriber is $1000, will the consumer be willing to spend (assuming rapid depreciation at 30 percent to allow for technological obsolescence) the $400-plus per annum needed to recover these costs? At $120 access charges, that is at least 70 films a year!

If consumers are unwilling to spend the amounts needed to fully recover the costs of bringing entertainment to their homes, then network operators might look to advertisers to fill the gap. A study by *The Economist* noted that consumers already absorb $30 a month in built-in advertising costs to pay for supposedly "free" television. Television is truly a broadcast medium; however, interactive multimedia is anything but that. In theory, network operators could target consumers with advertising, but this would raise technical and privacy issues not easily resolved. The issues of how customer data will be collected, stored, and who will have access to it are enough to keep the

courts busy for the foreseeable future. Our conclusion: Don't bet too heavily on video on-demand being the dominant application.

Delivering Products to Customers

In addition to developing e-commerce applications, packaging and distribution must be considered. Blockbuster Video, for instance, believing that its traditional distribution through stores could become obsolete, is actively exploring electronic media as a distribution channel. Clearly, Blockbuster knows what consumers want in entertainment: It has the rental and purchase history on its 40 million members and is adding 300,000 new members each week. While positioning itself to be the provider of new media, the company is collecting extensive information about this emerging market. Blockbuster's research shows that the typical consumer: (1) spends $12 a month on home video expenditures; (2) wants to go to the video store to select a video; (3) is on a limited budget; (4) has time to kill; and (5) only periodically expends a large sum of money on entertainment. If we compare this profile with that presented earlier, of a $200-a-month home entertainment delivery wherein users needn't leave their couch, the two approaches seem quite contradictory.

Clearly, then, extenuating factors such as the attraction of video stores and the ability to browse are sometimes overlooked. Until user interfaces become sophisticated, the process of scrolling through dozens of menus to select a video may prove to be as time consuming as, and substantially more frustrating than, going to the video store. Most current thinking ignores the actual "excursion" element of choosing a video, for children and adults alike. Cocooning may be a very valid concept, but it does not mean that people will never want to leave their homes.

Consumer Research and Electronic Commerce

Evaluating customer preference is the main uncertainty facing application designers. What mix of voice, data, video, entertainment, education, information, geographic coverage, mobility, and interactivity will consumers demand? How much time and money will they be willing to spend to use these networks? How much will regional or cultural differences influence application architectures? The answers to these questions lie in consumer research.

Many businesses are navigating the electronic marketplace without proper consumer and market research. This can be disastrous, given that even preliminary research shows some surprising results. Let's look at one specific

example: interactive television. Surveys by Chilton Research Services and *CBS News/New York Times* suggest some degree of consumer interest and perhaps a willingness to pay less than $20 a month for a selection of interactive television services. Movies on-demand attract the most interest, followed by news, which fares relatively well. A Chilton poll of 1000 adults found 63 percent at least somewhat interested in interactive television services. Of that group, 68 percent said they would probably or definitely use "a news channel that allows you to pick the topic" [QUILL94].

A CNN/Gallup poll of consumer opinion about interactive TV yielded the following results [SBS94]:

- 46 percent would be "willing to pay for personalized news summaries" on an interactive television service.
- 39 percent want video phone calls.
- 63 percent would pay for movies on-demand.
- 57 percent would pay for television shows on-demand.
- 78 percent said their greatest worry about interactive TV is that they will have to pay for something that they previously received free of charge.
- 64 percent are concerned that interactive television will make it harder for viewers to protect their privacy.
- 41 percent are concerned that it will be too confusing to use.

On a similar note, *Macworld* magazine (October 1994) reported a telephone survey of consumer interests that showed people are more interested in facts than in the growing number of entertainment services envisioned for the electronic marketplace. The eight-month investigation showed that in the sample of 600 adults (375 randomly selected and 225 *Macworld* subscribers) consumers rate high-tech entertainment and shopping networks lower than information access, community involvement, self-improvement, and communication computer services. Only 28 percent rated a video on-demand service as highly desirable. The most desirable on-line capability was voting in elections, with half the sample in favor. The public also favors taking part in on-line public opinion polls and interactive electronic townhall political meetings. The poll dramatically demonstrates that gaining access to reference and government information and educational courses is preferable to entertainment services. Movies and television-on-demand services were ranked only tenth among 26 possible on-line capabilities [MW94].

These results contradict the directions of most companies. These companies argue that surveys are misleading in that they indicate consumers don't

yet know what interactive television is and so can't be sure they will pay for it or use it. These polls do reveal a split between commercial applications being promoted by business and the public's needs and interests. If the corporate world is wrong, some spectacular failures could result. The history of home interactive services has already been marked by several multimillion-dollar failures. Most notable among these:

- The QUBE Cable Network, offered by Warner Communications and American Express from 1977 to 1984, was a $20-million investment offering polling services, games, viewer conferencing, and limited access to data banks. Although drawing plenty of publicity, the system attracted few users.
- In the early 1980s, the Times-Mirror Company introduced teletext services, called Gateway, with much fanfare. Teletext offered news and other information using television sets as display terminals. The Times-Mirror Company lost an estimated $30 million on this service.
- In 1983, the Knight-Ridder newspaper chain introduced Viewtron, which was the first attempt at delivering news, banking, shopping, and other interactive services via computer. It offered data over a telephone line, complete with graphics and color. The videotext technology, crude by today's standards, was based on a $600 terminal that plugged into television sets. The menus were unwieldy, the scrolling too slow, and the dedicated terminals too expensive. Three years and $50 million later, the service was discontinued.

Why did these services fail? The people did not seem to need videotext services. As the novelty wore off, usage of most services except on-line games and electronic mail dropped off. In sum, the consumer discredited expert predictions that "videotext" would transform society.

1.5 ELECTRONIC COMMERCE ORGANIZATION APPLICATIONS

Just as consumer appeal is not certain, it is not clear which e-commerce applications corporations will use internally. Corporations do not buy information and communications technology simply because it is new or because it is interesting to writers in the press. Companies adopt technology to save money and improve the bottom line. Managers are asking: How can electronic markets be utilized to further such organizational goals as better internal coordination, faster problem solving, and improved decision making?

How can it help us better serve our customers? How can we use it to better interact with our suppliers and distributors? How will these new applications impact business processes currently established internally? Developers of organizational electronic commerce applications must address these questions if they are to be successful.

Changing Business Environment

The traditional business environment is changing rapidly as customers and businesses seek the flexibility to change trading partners, platforms, carriers, and networks at will. Many companies are looking outside their organization as well as within when shaping their business strategies. These activities include establishing private electronic connections to customers, suppliers, distributors, industry groups, and even competitors, to increase the efficiency of business communications, to help expand market share, and to maintain long-term viability in today's business environment. The Information Superhighway will expand this trend to another level all together: It will allow business to exchange information among constantly changing sets of customers, suppliers, and research collaborators in government and academia on a global basis. It will indeed become a powerful business tool that no organization can do without.

This trend has been reinforced in George Salk's interesting *Harvard Business Review* (HBR) article "Time—The Next Source of Competitive Advantage" (July/August 1988) and, more recently, in the March/April 1992 HBR (Salk, Evans, and Shulman) article, "Competing on Capabilities: The New Rules of Corporate Strategy." According to Salk, "competitive strategies based on flexible manufacturing, rapid response, expanding variety, and increasing innovation are time-based. Inter-networking, whether internally or externally with customers and business partners, can be a useful tool to facilitate time-based competitive strategies." Internetworking via a public network infrastructure provides a firm with the pathways to conduct e-commerce between trading partners, support collaboration with partners who can supply needed capabilities, and stay close to the customer.

Interestingly, traditional firms and financial institutions such as banks and credit institutions view electronic commerce with a mix of eagerness, fear, and confusion. Many large and successful organizations fear that their vision of business no longer seems to apply. The story is a familiar one: A company doing well suddenly finds itself stagnating and frustrated as fleet-footed competitors take away market share. The root cause of these crises is not that things are being done poorly. It is not even that the wrong things are being done very well. Indeed, in most cases, the right things are being done—but

fruitlessly. What accounts for this paradox is that the assumptions on which the organization was founded and according to which it is being run no longer fit reality. Take, for instance, the classic cases of IBM and Digital Equipment Corporation (DEC) in the computer industry. IBM based its philosophy on the success of mainframe computers, and DEC clung to its VAX line of minicomputers for close to a decade. Much painful surgery befell before these companies' managements finally changed their theory of business and shifted to new foundations based on the PC revolution, which began around 1981 and which these companies had missed exploiting for almost a decade. Now, e-commerce is bringing about another revolution that no company can afford to miss.

In general, firms utilize consumer and market research to form the assumptions that shape its strategy, dictate its decisions about what to do and what not to do, and define what it considers meaningful results. These assumptions are what Peter Drucker [PD94] calls a company's theory of the business. This raises interesting issues: Which assumptions of e-commerce may force you to develop a new theory of business? If you are a computer company, what should you change to adapt? Likewise, if you are a bank, what should you do? These are tricky but fundamental questions that every company must address with candor and thoroughness. Finding the right answers will mean survival in the twenty-first century, and not answering them adequately will lead to chapter 11 filings for bankruptcy protection.

On the issue of developing a theory of business in the electronic marketplace, the *Washington Post* carried a series of articles dealing with economic growth and the structure of what they term the *New Economy*. It stated that new growth is coming from thousands of small, fleet-footed companies. At the same time, the old giants are reshaping to be in the vanguard of a productivity revolution that is refashioning the economy. The article went on to state that "with the aid of new technology and new forms of corporate organization, firms are finding ways to do things faster, better and cheaper, revitalizing entire industries and redefining the terms of economic competition at the same time" [WP94].

The reaction to numerous business pressures are depicted in Fig. 1.6. Companies are restructuring. Lean and mean is the battle cry of companies seeking increased market share to offset decreasing profit margins and to gain competitive global positioning through reduced operational costs. Organizations see major work force reductions or "downsizings" as the way to gain operational efficiency and agility. The need for faster reaction times to environmental events (customer requests, competitive new products) typically results in a decrease in middle management and line employees, whom top management visualizes as hampering organizational flexibility and not contributing directly to the bottom line.

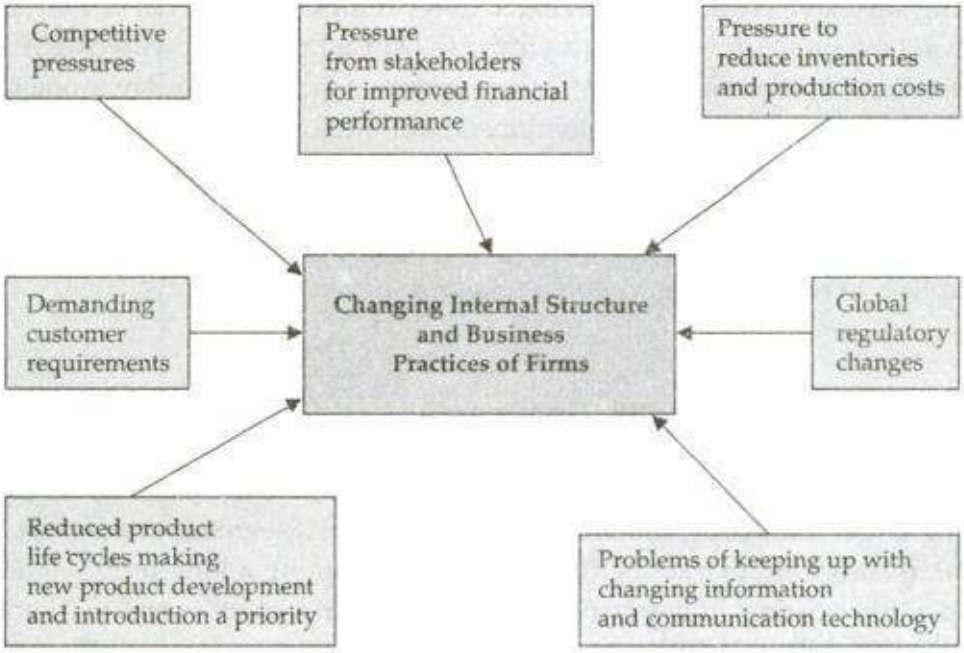

Figure 1.6 Pressures influencing business

Electronic Commerce and the Retail Industry

Let's take a look at the changing conditions in the "new economy" with respect to the retail industry. Consumers are pushing retailers to the wall, demanding lower prices, better quality, a large selection of in-season goods. Retailers are scrambling to fill the order. They are slashing back-office costs, reducing profit margins, reducing cycle times, buying more wisely, and making huge investments in technology. They are revamping distribution channels to make sure that warehouse costs are down by reducing their average inventory levels and coordinating the consumer demand and supply patterns. In the push to reduce prices, more and more retailers are turning to overseas suppliers, in part because of cheaper labor costs. For example, apparel retailers in the U.S. buy roughly half their merchandise overseas each year. In 1993, they increased the amount of merchandise purchased abroad by about 7 percent while holding the line on total purchasing.

Retailers are in the immediate line of fire and were first to bear the brunt of cost cutting. They are putting that pressure on the manufacturing and supplier end of the pipeline. At the same time, the quest for efficiencies has led to turmoil and consolidation within the retail industry. The pressure experienced by retailers and suppliers can be seen in the disappearance of jobs, in mergers, and in the increase in business failures in the manufacturing sector. During the past ten years in the United States, 2.5 million apparel manufac-

turing jobs have evaporated and bankruptcy filings have soared. In 1989, 204 apparel manufacturers failed, according to Dun & Bradstreet, with combined liabilities of $148 million. By 1993 the number of failed apparel manufacturers had increased to 566, with combined liabilities of $1.6 billion.

The problems are indeed serious. As we will see in the following sections, electronic markets could provide a partial solution by promising customers more convenience and merchants greater efficiency and interactivity with suppliers to revitalize the troubled retailing sector.

Marketing and Electronic Commerce

Electronic commerce is forcing companies to rethink the existing ways of doing target marketing (isolating and focusing on a segment of the population), relationship marketing (building and sustaining a long-term relationship with existing and potential customers), and even event marketing (setting up a virtual booth where interested people come and visit). Consider the case of conventional direct marketers, who devote some 25 percent of their revenues to such costs as printing and postage for catalogs. Interactive marketing could help cut such expenses and may even deliver better results.

Interactive marketing is accomplished in electronic markets via interactive multimedia catalogs that give the same look and feel as a shopping channel. Users find moving images more appealing than still images and listening more appealing than reading text on a screen. Those are two powerful reasons why every text-based and still-picture-based interactive experiment like videotext has failed in the past. It is also why no computer terminal–based service has ever generated anywhere near the volume of retail merchandise orders that televised shopping channels have achieved. Maximum public acceptance will require that interactive catalog services have a more entertaining visual appearance than traditional text-intensive catalogs have had. Ideally, an interactive shopping program should produce full-motion demonstrations of the selected products, but such a practical and economical technology has yet to be developed.

Consumer information services are a new type of catalog business. An example is CUC International, of Stamford, Connecticut, whose Comp-U-Card shopping service produces annual revenues of some $850 million. The company's primary mission is not to sell products but to provide the information people need to comparison shop. CUC maintains databases with detailed information on some 250,000 products, such as cars, TV sets, and air conditioners. In return for a $49 annual fee, each of the service's 30 million subscribers gets unlimited access to the information—usually by dialing an 800 number and speaking to a live person who consults the computer data-

base. Those who wish to order products through CUC can do so by phone or computer; the company relays the order to the manufacturer. According to CEO Walter Forbes (*Fortune*, April 18, 1994): "This is virtual-reality inventory. We stock nothing, but we sell everything."

Inventory Management and Organizational Applications

With borders opening up and companies facing stiff global competition for the first time in decades, managers know they need to catch on quickly to better ways of doing international business. Adaptation would include moving toward computerized, "paperless" operations, to reduce trading costs and facilitate the adoption of new business processes.

One often-targeted business process is inventory management. Solutions for these processes go by different names. In the manufacturing industry, they're known as just-in-time inventory systems, in the retail industry as quick response programs, and in the transportation industry as consignment tracking systems. Inventory reduction is often a target as it averages 2 percent of sales; and when the cost of inbound warehousing of raw materials or the cost of warehousing work-in-process inventory is included, the total often reaches 6 percent to 30 percent of sales. Electronic commerce projects seek to reduce this cost by as much as 90 percent [TD95].

Just-in-Time Manufacturing

Just-in-time (JIT) is viewed as an integrated management system consisting of a number of different management practices dependent on the characteristics of specific plants. The JIT management system, an evolution of the Japanese approach to manufacturing and initially introduced for the Toyota production system, is based on two principles: elimination of waste and empowering workers. The first principle refers to the elimination of all waste (time, materials, labor, and equipment) in the production cycle. The following management practices are typically associated with JIT systems: focused factory, reduced set-up times, group technology, total productive maintenance, multifunction employees, uniform workloads, JIT purchasing, *kanban*, total quality control, and quality circles.

JIT purchasing, considered an integral part of JIT, has received considerable attention in electronic commerce. It allows a manufacturer to incorporate its suppliers' efforts toward eliminating waste in the upstream portion of the manufacturing cycle. JIT purchasing focuses on the reduction of inventories throughout the logistical systems of the manufacturing firms involved

and provides a careful audit of the production process. Basically, it optimizes supplier and customer relations. In a production plant the needed materials are to be supplied just in time, no earlier or later than is demanded for processing. Production costs will decrease as the required level of stock is reduced. Materials from the supplier will be ordered only if the production plant can sell its product. Market risks are therefore passed on through the supplier chain. Furthermore, quality control of production is considerably enhanced. All stages of production are closely monitored, enabling an adequate assessment of imperfections. Such close collaboration between suppliers and customers has introduced the concept of co-makership. The companies involved in overall production are integrated and combine their efforts through long-term trade relations as evident in the Japanese system of *kieretsu*.

To achieve JIT savings, many large corporations have installed private communications networks. The I-way makes this practice more affordable and easily available to a number of small firms..

Quick Response Retailing

Quick response (QR) is a version of JIT purchasing tailored for retailing. Most often, keeping a store filled with merchandise is a task most shoppers never consider—until the product they want is out of stock. The frustration that shoppers experience sometimes gives way to thoughts of "How do retailers buy and stock products anyway?" The process is quite complex, given that a single retailer may purchase merchandise from thousands of vendors in a global market. The failure to stock merchandise that matches customer demand can be extremely costly. For example, in the soft goods industry alone, excess inventories, inadequate information, and related inefficiencies resulted in lost sales of more than $25 billion in 1994 [IBD95].

To reduce the risk of being out of stock, retailers are implementing QR systems. QR provides for a flexible response to product ordering and lowers costly inventory levels. QR retailing focuses on market responsiveness while maintaining low levels of stocks. It creates a closed loop encompassing the retailer, vendor, and consumer chain, and as consumers make purchases the vendor automatically orders new deliveries from the retailer through its computer network. The bar-coded articles are logged by the cash registers at the point of sale, the inventory system of the store then determines the needed supply, and the system transmits an order message to the retailer. The availability of accurate information with respect to the current sales enables sophisticated marketing capable of responding to consumers' preferences. Figure 1.7 illustrates the various steps of the quick response chain.

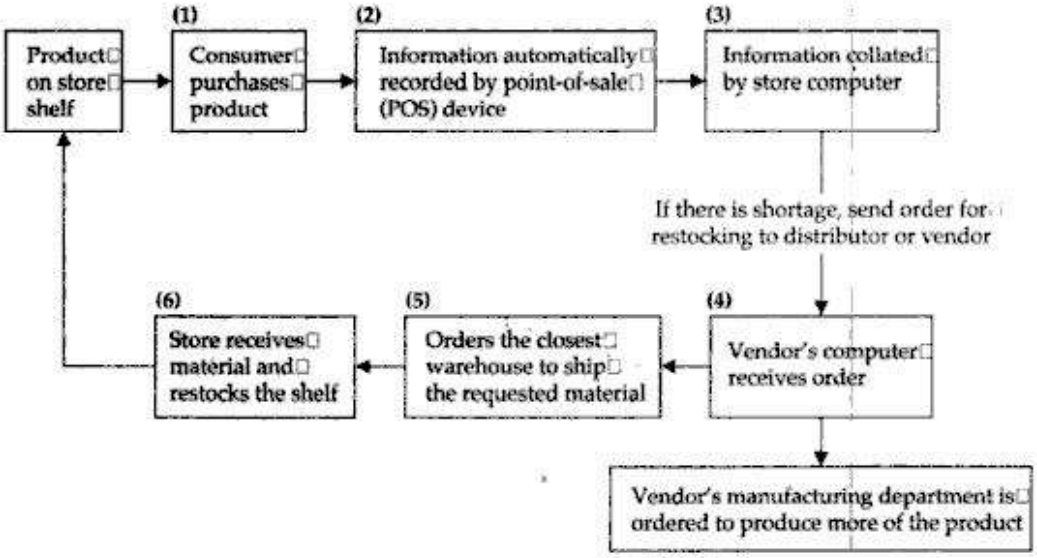

Figure 1.7 The quick response chain

One of the famous examples of QR systems was implemented in the 1980s by Wal-Mart. Wal-Mart invested half a billion dollars in computer and satellite communications networks, bar-code systems, scanners, and other QR equipment linking each point-of-sale terminal to distribution centers and headquarters in Bentonville, Arkansas. Many believe that it was this system that enabled Wal-Mart to manage the explosive retail sales growth that catapulted the company to number one position in the U.S. retail business. The system enabled the company to maintain high service levels and increase sales while reducing the inventory costs to one-fourth of previous levels. Also by empowering its individual stores to order directly from suppliers, even overseas, individual Wal-Mart stores reduced inventory restocking time from an industry average of six weeks to thirty-six hours. Moreover, by tracking every sale through the point-of-sales devices to see what product was selling in large quantities, Wal-Mart stores were better able to keep their stores well stocked while maintaining tight inventories and low prices [MN94].

Supply Chain Management

Until recently, these inventory management strategies were implemented through very expensive computer systems and private networks. The cost was an insurmountable barrier for many small businesses, and these new business strategies created many side effects. For instance, because of the vast investments needed to implement JIT/QR, the manufacturer/retailer tended

to reduce the number of its suppliers and move toward single sourcing—an undesirable outcome. What the manufacturer/retailer needs is a larger supplier base in order to be more competitive. How is this done? One solution is to implement these strategies using a common network infrastructure such as the proposed Information Superhighway as the enabling technology.

Inventory management solutions (QR and JIT) address only part of the overall picture. Using QR or JIT may not be feasible if a company depends on an unresponsive supplier for key components. For example, a manufacturing company may develop the capability to assemble products quickly in response to customers' orders but may find that this ability is constrained by suppliers' long lead times. Hence, what is required is a technique for managing unanticipated problems (or perturbations) in the supply chain.

Supply chain management (SCM) is also called "extending," which means integrating the internal and external partners on the supply and process chains to get raw materials to the manufacturer and finished products to the consumer. Most companies fail to integrate their supply chain strategies for a number of reasons, among them a lack of system integration due to fragmented supply chain responsibilities. But in neglecting integration and the broader concept of supply chain management, firms might be missing an opportunity to cut costs and boost customer service. SCM rests on the premise that product excellence alone fails to guarantee corporate success. In fact, customers expect many services, including the prompt delivery of products to precise locations with near-perfect administrative and physical quality (see Chapter 11).

Supply chain management includes the following functions:

- *Supplier management.* The goal is to reduce the number of suppliers and get them to become partners in business in a win/win relationship. The benefits are seen in reduced purchase order (PO) processing costs, increased numbers of POs processed by fewer employees, and reduced order processing cycle times.
- *Inventory management.* The goal is to shorten the order-ship-bill cycle. When a majority of partners are electronically linked, information faxed or mailed in the past can now be sent instantly. Documents can be tracked to ensure they were received, thus improving auditing capabilities. The inventory management solution should enable the reduction of inventory levels, improve inventory turns, and eliminate out-of-stock occurrences.
- *Distribution management.* The goal is to move documents related to shipping (bills of lading, purchase orders, advanced ship notices, and manifest claims). Paperwork that typically took days to cycle in the past can now be

sent in moments and contain more accurate data, thus allowing improved resources planning.

- *Channel management.* The goal is to quickly disseminate information about changing operational conditions to trading partners. In other words, technical, product, and pricing information that once required repeated telephone calls and countless labor hours to provide can now be posted to electronic bulletin boards, thus allowing instant access. Thus electronically linking production with their international distributor and reseller networks eliminates thousands of labor hours per week in the process.
- *Payment management.* The goal is to link the company and the suppliers and distributors so that payments can be sent and received electronically. This process increases the speed at which companies can compute invoices, reducing clerical errors and lowering transaction fees and costs while increasing the number of invoices processed (productivity).
- *Financial management.* The goal is to enable global companies to manage their money in various foreign exchange accounts. Companies must work with financial institutions to boost their ability to deal on a global basis. They need to assess their risk and exposure in global financial markets and deal with global information as opposed to local market information.
- *Sales force productivity.* The goal is to improve the communication and flow of information among the sales, customer, and production functions. Linking the sales force with regional and corporate offices establishes greater access to market intelligence and competitor information that can be funneled into better customer service and service quality. Companies need to collect market intelligence quickly and analyze it more thoroughly. They also need to help their customers (relationship management) introduce their products to market faster, giving them a competitive edge.

In sum, the supply chain management process increasingly depends on electronic markets because of global sourcing of products and services to reduce costs, short product life cycles, and increasingly flexible manufacturing systems resulting in an variety of customizable products.

Work Group Collaboration Applications

For work group applications, e-commerce represents the holy grail of connectivity: a ubiquitous internetwork that enables easy and inexpensive connection of various organizational segments to improve communications and

information sharing among employees and to gather and analyze competitive data in real-time. E-commerce also facilitates sales force automation by enabling salespeople to carry product and reference information in one portable device. Other applications, such as videoconferencing, document sharing, and multimedia e-mail, are expected to reduce travel and encourage telecommuting. Businesses might also save big on reduced processing costs by improving the distribution channel for documents and records to suppliers, collaborators, and distributors.

Video conferencing is now the best-established application, and is expected to grow in the coming years. Video conferencing allows distant business colleagues to communicate without the expense, time, and inconvenience of traveling. Already in hospitals and health clinics, video conferencing allows surgeons to examine computerized video x-rays and CAT scans of distant patients whose doctors need a second opinion. Because video conferencing still requires significant investments in equipment and often entails the use of dedicated facilities with special communications lines, its applicability and appeal to small businesses have been limited.

Video conferencing is beginning to penetrate the desktop PC market, although technical limitations will limit that growth. What is needed are faster chips for processing video—namely, compressing and decompressing. In the past, high video conferencing start-up costs—at least $25,000—have kept it a product for large corporations. This could change dramatically with the introduction of cheaper video conferencing for less than $500. A small camera mounted on the top of the computer monitor and two add-on boards can transform a PC into a video-phone. Also, as the price of point-to-point or point-to-multipoint video conferencing drops, video conferencing is expected to continue its penetration into the corporate marketplace (see Chapter 18).

In sum, organizational applications of electronic commerce have to meet the challenges of the new business environment where the emphasis is on service quality, flexibility, and customization of production to meet customer needs.

1.6 SUMMARY

Broadly speaking, electronic commerce is a new way of conducting, managing, and executing business transactions using computer and telecommunications networks. Electronic commerce is expected to improve the productivity and competitiveness of participating businesses by providing unprecedented access to an on-line global marketplace with millions of customers and thousands of products and services. Another goal is to provide participating companies with new, more cost- and time-efficient means for working with

customers, suppliers, and development partners. For instance, if everything works as planned, network-based e-commerce will enable companies to (1) shorten procurement cycles through on-line catalogs, ordering, and payment; (2) cut costs on both stock and manufactured parts through efficient JIT and QR systems that reduce inventory and facilitate automatic replenishment; and (3) shrink product development cycles and accelerate time-to-market through collaborative engineering and product customization.

The emerging electronic marketplace is expected to support all business services that normally depend on paper-based transactions. Buyers can browse multimedia catalogs, solicit bids, and place orders. Sellers will respond to bids, schedule production, and coordinate deliveries. A wide array of value-added information services will spring up and bring buyers and sellers together. These services will include specialized directories, broker and referral services, vendor certification and credit reporting, network notaries and repositories, and financial and transportation services. Although many of these transactions and services already occur electronically, they require dedicated lines or prior arrangements. The use of a network-based infrastructure reduces the cost and levels the playing field for both small and large businesses.