

Appendix I

Databases in Electronic Commerce

Preview

Electronic commerce (e-commerce) enables organizations—whether they are public or private, for profit or not for profit—to market and sell products and services to a global market of millions of users. Intranets (networks that use Internet technology but operate within an organization) have likewise streamlined internal business operations.

E-commerce companies sell products or services not only to consumers and end users but also to other companies. The Internet has brought about new technologies that facilitate the exchange of business documents and data among business partners. Companies are using the Internet to create new types of systems that integrate their data to increase efficiency and reduce costs.

Online databases are critical components of many e-commerce applications. This appendix introduces the world of e-commerce and illustrates some special concerns that must be addressed in designing e-commerce databases.

Data Files and Available Formats

MS Access **Oracle** **MS SQL** **My SQL**

MS Access **Oracle** **MS SQL** **My SQL**

There are no data files for this appendix.

Data Files Available on cengagebrain.com

I-1 What Is Electronic Commerce?

The term *e-commerce*—short for *electronic commerce*—has had many definitions. The Webopedia online technology dictionary (webopedia.com) defines *e-commerce* as “conducting business online.” However, even a cursory examination of professional publications makes it obvious that the definition of *e-commerce* changes according to whom you ask—and the definitions appear to evolve as fast as the underlying technology. In this book, **electronic commerce (e-commerce)** is defined as the use of electronic networked computer-based technology to:

- Bring new products, services, or ideas to market.
- Support and enhance business operations (including sales of products/services over the web).

Although businesses have used many different types of electronic technology, e-commerce is mainly identified with the use of the Internet as a medium to transact business (buy, sell, and trade products and services) and to add value to an organization. Because the Internet—and, in particular, the web—plays a crucial role in enabling the development and execution of e-commerce, some experts argue that e-commerce should be called Internet commerce (I-commerce), instead.

Although it is easy to view e-commerce as just an online extension of common customer activities, most e-commerce transactions actually take place among businesses. Companies use the Internet and **intranets** (internal networks that use Internet technology but are used within organizations) to streamline their production and distribution processes and to enhance their internal and external operations. In fact, one of the main selling points of e-commerce is that it provides a competitive advantage to the organizations that use it. Because e-commerce operations have become so embedded in the business environment, many people refer to e-commerce as electronic business (e-business).

The external evidence of a company's e-commerce activities is the company's website. A website can be as simple as a few static pages that provide product line and contact information or as complex as a complete online database-driven product catalog with dynamic ordering and credit card payment processing.

E-commerce is now recognized as a prime revenue source. Putting products online makes them immediately available to millions of potential buyers. Companies are competing for a share of the online market by attracting customers and keeping them focused on their websites. But the Internet is a challenging place; many companies are discovering that competing in the online market is more difficult than just creating and using webpages. In short, e-commerce is more than just another marketing channel; e-commerce is the kernel of a new business model dedicated to bringing products, ideas, or services to large markets rapidly in relatively inexpensive ways through the use of Internet technology.

E-commerce is not an end in itself; it is a road that businesses travel to compete and survive in the twenty-first century. On this road, Internet technology has played—and will continue to play—a crucial role. To know where you are going, it is useful to know where you have been. Therefore, the next section provides a brief glimpse of major milestones on the e-commerce road.

I-2 The Road to Electronic Commerce

For many decades, businesses have been using technology to enhance their operations. For example, phones and fax machines are long-standing business uses of technology. Should such technologies be considered part of the e-commerce model? The short answer is no (assuming the phone is not connected to a computer modem). The just-mentioned

examples are not strictly e-commerce because they depend on human intervention for business transactions to take place. Phones and fax machines simply connect the sender with the receiver by transmitting sound or images. To complete the business transaction, a human at the receiving end of the transmission still has to process the information *manually*. The key to e-commerce is using computer networks, especially the Internet, to automate and streamline business transactions. The development of the Internet is closely allied with the development of e-commerce.

The Internet was born as an extension of the DARPA network, started in the early 1960s by the U.S. federal government as a military project to ensure computer communications in case of nuclear attack. Almost immediately after its creation, the Internet was extended to include higher education institutions to facilitate critical research. The Internet's reach did not extend into the business arena until many years later.

The following list summarizes a few of the major technological milestones in business. As you examine the list, note that all of the technological milestones share the common feature of drastically reducing human intervention,

- In the early 1960s, banks created a private telephone network to do electronic funds transfers (EFT). This service allowed two banks to exchange funds electronically in a fast, efficient, and secure manner. The service was restricted to the participating banks, and those banks were required to cover the costs associated with using and maintaining the system.
- In the early 1970s, banks created the automated teller machine (ATM) to provide after-hours services to their customers. In the beginning, ATMs were installed by a few banks nationwide and customers were allowed only a limited number of transactions. As the popularity of the ATMs grew, companies were created to provide ATM service to most banks.
- In the late 1970s and early 1980s, **Electronic Data Interchange (EDI)** emerged. EDI is a communications protocol that enabled companies to exchange business documents over private phone networks. The use of EDI facilitated the coordination of business operations between business partners. The use of EDI became especially well established in the automotive industry. For example, Nissan used EDI to send a request for parts (car seats, tires, or other components) to subcontractors as soon as a car entered the assembly line. The problem with EDI was that its maintenance and implementation costs were high and that the EDI formats varied from company to company. Given those drawbacks, EDI became a secondary (niche) player as Internet communications capabilities grew. However, more recently, EDI has been adapted to Internet technology and now rides the Internet wave, thereby drastically reducing the investment in the communication infrastructure required by previous generations of EDI.
- During the early 1980s and through the 1990s, the personal computer (PC) facilitated the rapid expansion of the Internet and ultimately provided the spark that led to the explosive use of the World Wide Web, usually referred to as “the web.” The web, perhaps the best-known of many Internet services, made the transfer of information among multiple organizations as simple as a mouse click. The web also became the basis for the exploration and exploitation of new Internet-based technologies that led to the enhancement of business processes within and between corporations.
- In the late 1990s and early 2000s, networking technologies blossomed and expanded the reach, the speed, and (in some cases) the security of Internet-based communications and transactions. Many companies began to take advantage of virtual private networks (VPNs), which are private, relatively secure networks that “tunnel” through the Internet, using Internet technology. Wide area networks (WANs) that incorporate

Electronic Data Interchange (EDI)

A communications protocol that enabled companies to exchange business documents over private phone networks.

satellite and microwave links and wireless technologies such as cell phones and wireless networks have also increased the scope and possibilities for businesses large and small. New developments such as **Extensible Markup Language (XML)** are being used to facilitate the dynamic exchange of data among geographically disperse applications. XML has introduced a new dimension in the provision of Internet-based services.

- In the early 2000s, cell phone and wireless technologies began to merge with computer and Internet technologies, creating a whole new arena for e-commerce via cell phones and other wireless devices.



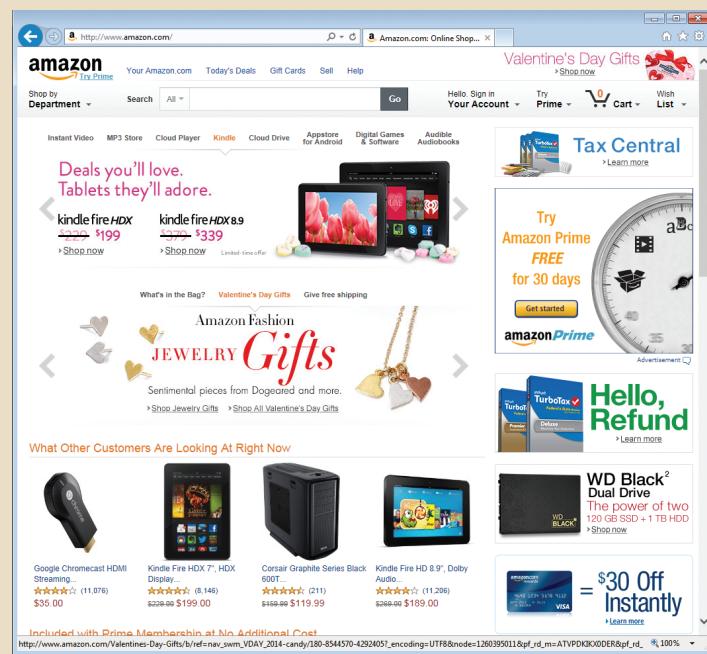
Note

If you want to examine a more detailed history of the Internet, visit the following website:

- www.zakon.org/robert/internet/timeline

As an example of how e-commerce has developed, it is worthwhile to take a look at one well-known e-commerce success story. In 1992, Jeff Bezos launched the website Amazon.com to sell books directly to consumers over the Internet. Five years later, sales exceeded \$131 million. Soon Amazon began expanding into other retailing areas, selling everything from baby goods to music and electronics to clothing and home goods. (See Figure I.1.) Amazon pioneered the “personalized” webpage based on tracking customers’ buying habits and preferences, and it established alliances and cross-links with other major retailers such as Target. In 2014, net sales were reported to be over \$89.9 billion. (For the most current data, visit *Amazon.com* and select *Investor Relations*.) In just a few years, Amazon.com had become one of the most successful retail websites and a model for many other Internet-based businesses.

FIGURE I.1 AMAZON.COM HOME PAGE



Extensible Markup Language (XML)

A metalanguage used to represent and manipulate data elements. Unlike other markup languages, XML permits the manipulation of a document’s data elements. XML facilitates the exchange of structured documents such as orders and invoices over the Internet.

Why did businesses jump on the Internet bandwagon with such abandon? Previous technologies took much longer to find a place at the business table. The next section examines why the web's acceptance was so broad and deep.

I-3 The Impact of E-Commerce

In the 1990s, economists coined the term *the new economy* to refer to the business marketplace based on computer technologies and delivered through the Internet. And although the “tech bubble burst” of 2000 scrubbed the luster off of some e-commerce businesses, many of those businesses quickly adapted to the new market realities and continued to expand. Today a majority of businesses, even traditional (or so-called brick-and-mortar) businesses, have a presence on the web. (Can you think of a major business that does not have a substantial web presence?)

Aside from the aspects of marketing that are enhanced by e-commerce, organizations have many other reasons for implementing e-commerce. The reasons—including rapid response to competitive pressures and customer service requirements, facilitation of transaction management, and inventory management—are given added urgency in today’s world of global markets, mergers, and acquisitions.

The Internet economy works within a global market of interconnected consumers and sellers. Businesses no longer compete only with businesses down the street, across town, or in the same country. Even small organizations have discovered that there is, at least potentially, a global market for their products, services, and ideas. This global market has attracted millions of businesses and organizations to the Internet and e-commerce. The Internet has reached critical mass with hundreds of millions of consumers worldwide, and it has become the new frontier for organizations in the quest for profits and enhanced public services.

For IS departments, the new frontier is the use of Internet technologies to provide services to customers, partners, employees, and the general public. The Internet is driving the development of a new generation of information systems. For many IS applications, the use of Internet technologies facilitates sharing heterogeneous information in an environment that provides multiple benefits at a fraction of the cost.

I-3a Advantages of E-Commerce

E-commerce has benefits for both buyers and sellers, including:

- *Easy comparison shopping.* Consumers can quickly compare prices for just about anything, using sites such as www.mysimon.com or www.pricewatch.com. Such sites have had a major impact on industries such as insurance (www.insure.com), automobiles (www.autobytel.com), and air travel (www.LowFares.com).
- *Reduced costs and increased competition.* Online comparison shopping means intense competition by the suppliers of goods and services, which means lower costs for consumers. For businesses, cost reductions are reflected in a lower cost per transaction. Even though initial Internet infrastructure and implementation costs are high, the cost per transaction tends to be lower because of the marginal cost of each additional transaction and the growing volume of customers using the Internet.
- *Convenience.* Online shoppers can purchase products from the convenience of their homes. By not having to drive to a store, shoppers save substantial time and transportation costs.

- *Operations 24/7/365.* Online stores, unlike their brick-and-mortar counterparts, remain open all year, including weekends and holidays. (Most transactions are automated to the extent that they do not require full-time staffing.) The benefit to businesses is clear, too—they can gain new customers day or night all year-round.
- *Global access.* Through the Internet, businesses have access to millions of users worldwide. Companies can develop national and international exposure. That exposure creates brand awareness and, with a bit of luck, customer loyalty.
- *Lower entry barriers.* An organization looking to establish an online presence expends less in physical location start-up costs; in the hiring and training of a large sales and managerial staff; and in expensive rental, utilities, and advertising fees. Because there is no need to build and furnish attractive offices and/or store interiors, the total time required to launch an online store is reduced. E-commerce has revolutionized the concepts of business time and place.
- *Increased market (customer) knowledge.* The Internet environment makes it relatively easy to compile and track customer information. Businesses can create extensive customer profiles that include purchasing preferences, demographic and geographic information, online behavior, and personal preferences. That information can be used to design websites that attract more users, target specific markets, and display features customized to individuals' interests. Businesses benefit by increasing customer loyalty and generating repeat sales.

I-3b Disadvantages of E-Commerce

Although the list of e-commerce advantages is long, the e-commerce environment is far from perfect. In fact, some disadvantages cause consumers and businesses to suffer considerable anxiety.

- *Hidden costs.* Online purchases are often accompanied by high shipping and restocking fees, a lack of warranty coverage, and unacceptable delivery times. In fact, excessive shipping fees is one of the most frequently cited reasons why shoppers choose not to buy online.
- *Vulnerability to technical failure.* When an e-commerce website cannot service customers because of a network failure, a software virus, or internal hardware failure, the organization loses sales, credibility, and customers.
- *Cost of staying in business.* Although getting into business is relatively easy in an e-commerce environment, staying in business may be more difficult. Increased competition means businesses operate with very thin profit margins. To be profitable, e-businesses must maintain high sales volumes, which means developing and maintaining large and loyal customer bases. Also, to survive and remain competitive, businesses must invest heavily in often costly technology.
- *Lack of security.* One of the main roadblocks to the wide acceptance of e-commerce by businesses and consumers alike is the perceived lack of adequate security for online transactions. For example, many consumers are wary of providing credit card information over the Internet. Several credit card companies are currently working on a set of standards to make online credit card transactions more secure.

- *Invasion of privacy.* The incredible capacity for online data collection is a mixed blessing to customers. Information about their purchases, purchasing habits, demographics, credit history, and so on is stored in databases connected to web servers, potentially exposing the information to cybercriminals. Another concern is that customer information is often sold to marketing companies who engage in email campaigns to attract new customers. The customer's email box is soon filled with unwanted and unsolicited email, or spam.
- *Low service levels.* Another common complaint about doing business online is the low level of customer service that online companies tend to provide. Although technology has automated business transactions to a large extent, a need for the human touch still remains. Therefore, customer service has become a major differentiating factor.
- *Legal issues.* Legal problems encountered in the e-commerce environment include software and copyright infringements, credit card fraud and stolen identities, and online fraud (failure to deliver products and/or services to the customers who paid for them).

I-4 E-Commerce Styles

E-commerce transactions can be grouped according to whom the sellers and the buyers are. Using that distinction, the principal e-commerce styles can be classified as:

- **Business to business (B2B):** Electronic commerce between businesses.
- **Business to consumer (B2C):** Electronic commerce between a business and consumers.
- **Intrabusiness:** Internal electronic commerce activities, most of which involve interactions between employers and their employees.

Although some may argue that **government to business (G2B)** and **government to consumer (G2C)** should be included as additional e-commerce styles, this book considers them to be special cases of B2B and B2C. Consumer-to-consumer (C2C) transactions, particularly C2C transactions facilitated by an intermediary business (C2B2C), are also growing, facilitated by websites, such as eBay and Amazon, that provide avenues for consumers to buy and sell from each other. Figure I.2 identifies the primary e-commerce players and their interactions.

I-4a Business to Business (B2B)

Although B2B transactions include intangibles such as transmitting contracts and moving accounts, most transactions involve sellers and buyers of products and/or services. Generally, the seller is any company that sells a product and/or service, using electronic exchanges such as the Internet or EDI. Examples of B2B transactions are as follows:

- A Nissan Corporation manufacturing plant issues an electronic order for a number of tires of a given model and size. One of the approved tire providers receives and fulfills the order. When Nissan receives the tires, it issues a payment electronically through a bank funds transfer.

business to business (B2B)

Electronic commerce between businesses.

business to consumer (B2C)

Electronic commerce between a business and consumers.

intrabusiness

A style of e-commerce that involves interactions internal to a company.

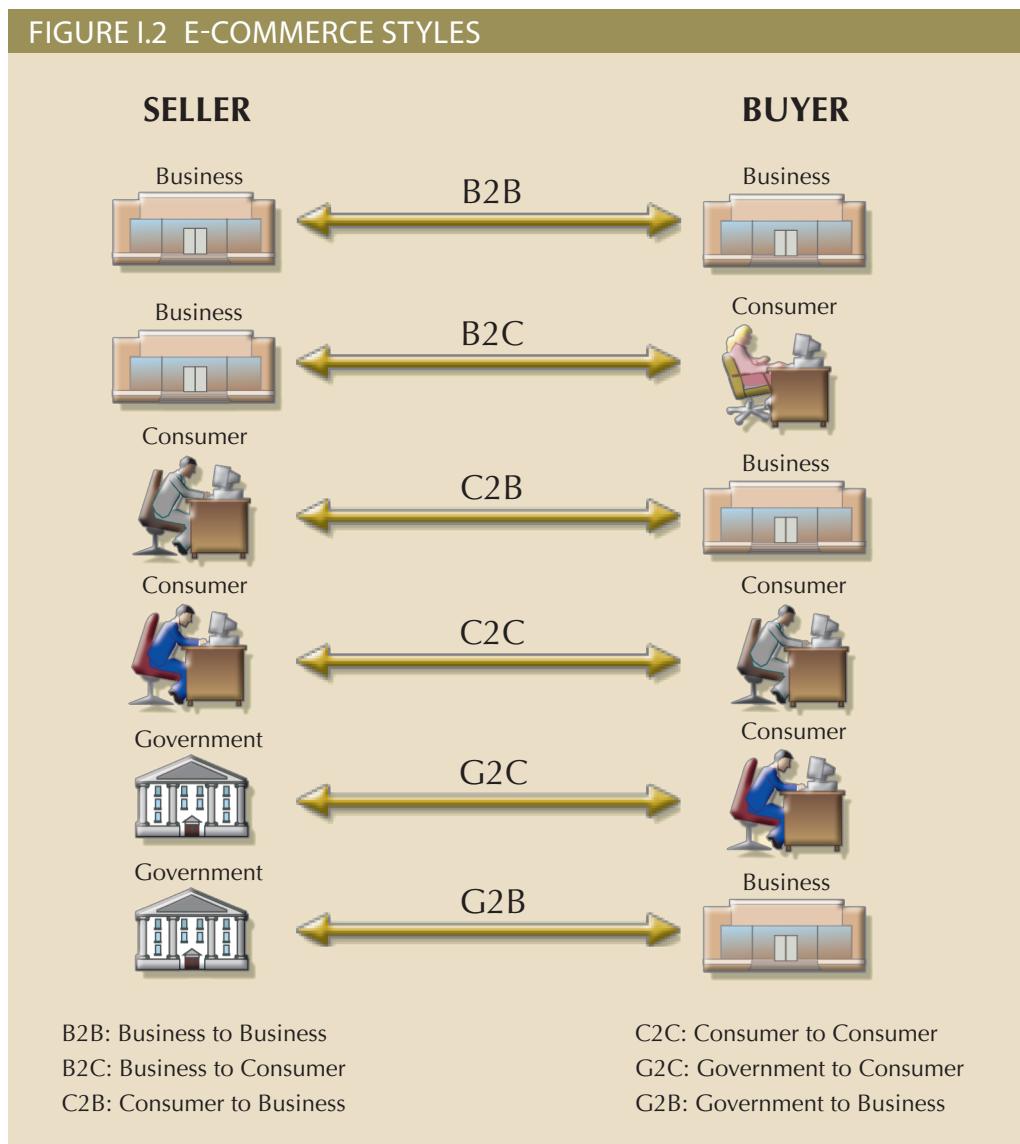
government to business (G2B)

Special case of the Business to Business and Business to Commerce e-commerce styles. See also *government to consumer (G2C)*.

government to consumer (G2C)

Special case of the Business to Business and Business to Commerce e-commerce styles. See also *government to business (G2B)*.

FIGURE I.2 E-COMMERCE STYLES



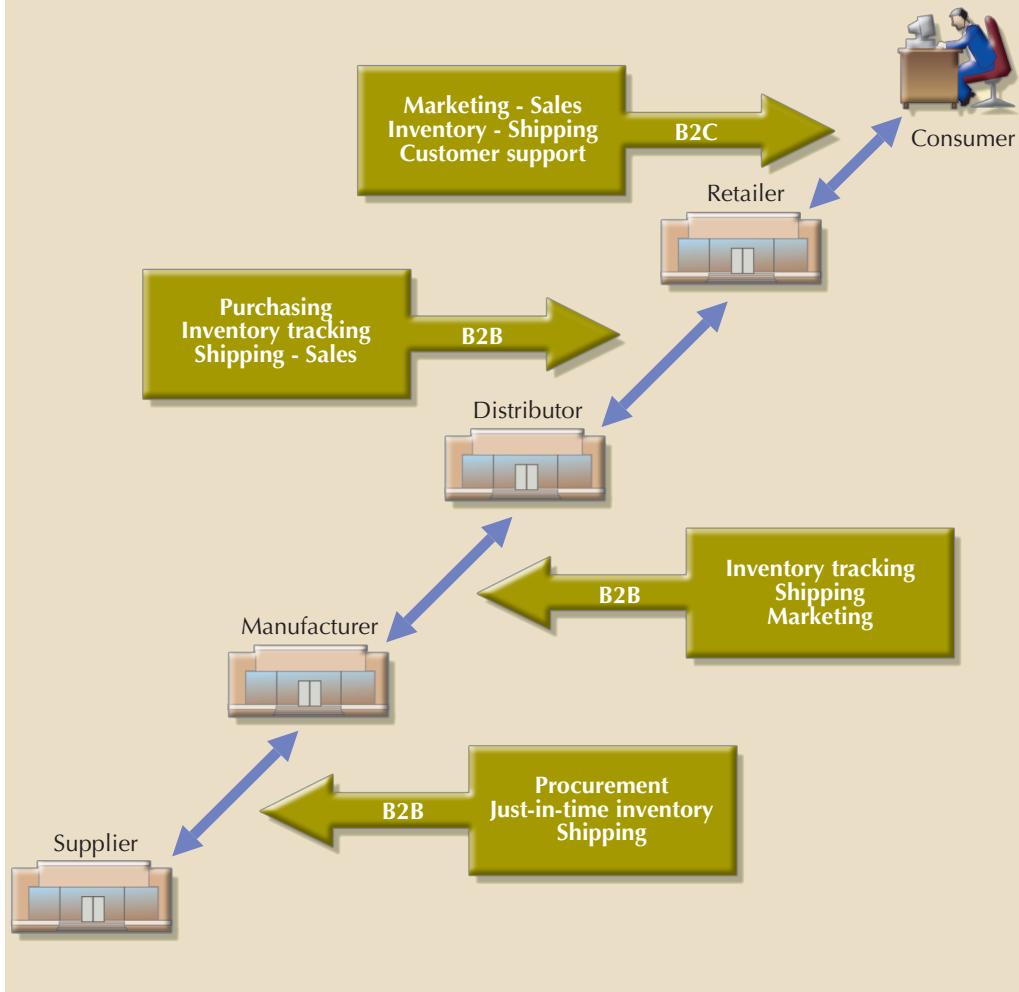
- Using the web, an assistant at the University of Tennessee makes hotel reservations for a group of researchers who will be conducting a seminar at the university.
- The Red Cross uses the web to compare hardware and software prices and subsequently orders hardware and software via the web.

B2B is the biggest and fastest-growing component of the e-commerce market, and the Internet is clearly a dominant player in the B2B economy. In that economy, the main focus is on the use of technology to automate the *value chain* of a business. The **value chain** refers to all activities required to design, plan, manufacture, market, sell, and support a product or service. By examining the value chain components with reference to Internet technologies, businesses can automate and enhance their operations. For example, many companies now use Enterprise Resource Planning (ERP) to manage and enhance all aspects of their value chain, from procuring raw materials to promoting customer satisfaction. Figure I.3 illustrates the use of the value chain to automate B2B transactions.

value chain

All activities required to design, plan, manufacture, market, sell, and support a product or service.

FIGURE I.3 E-COMMERCE AUTOMATION OF SUPPLY CHAINS



B2B transactions are subject to different types of implementation. The two most important versions are:

- **B2B integration.** In this scenario, companies establish partnerships to reduce costs and time and to increase business and competitiveness. For example, a company that manufactures computers will partner with suppliers for hard disks, memory, and other components. That partnership allows the company to automate its purchasing system, integrating that system with its suppliers' ordering systems, thereby linking their respective inventory systems. In that case, when a component in Company C gets below the minimum quantity-on-hand requirement, the system will automatically generate an order to Supplier S. Both systems would be integrated and would exchange business data, generally using XML through the Internet. In addition, the company may integrate its distribution system with that of its distributors. Finally, the distributors may integrate their activities with those of their retailers. And the retailers may, in turn, integrate their operations with those of their customers. Given such integration, sellers align their operations with those of buyers, thereby achieving levels of efficiency that make it difficult to switch to other buyers and/or sellers.

- *B2B marketplace.* In this scenario, the objective is to provide a way in which businesses can easily search, compare, and purchase products and services from other businesses. The web-based system basically works as an online broker to service both buyers and sellers. Within this system, the focus shifts to attracting new members, either sellers or buyers. The “broker” offers sellers a way to market their products or services to other businesses, while buyers are attracted by the fact that they can compare products from different buyers and get access to special deals offered only to members. In that scenario, the broker obtains revenue through membership and transaction fees. Figure I.4 shows the website of Tradekey.com, an example of B2B web marketplaces for the manufacturing sector.

FIGURE I.4 TRADEKEY.COM: B2B MARKETPLACE

The screenshot of the TradeKey.com homepage displays the following key features:

- Header:** Includes the logo "TRADEKEY® Your Key To Global Trade", navigation links (Home, Buy Offers, Products, Companies, Member Area), and user account links (Sign In, Join Free, Help, Community, Language).
- Top Bar:** Shows "5,724,620 Registered Users" and links to About TradeKey.com, Premium Services, Advertise, Site Map, and Contact Us.
- Search Bar:** Features "Search Products:" input, "Country/Region" dropdown, "Search" button, and "Advanced Search" link.
- Browse Categories:** A sidebar listing various product categories such as Agriculture, Apparel & Clothing, Automobiles, Beauty & Personal Ca..., Business Services, Chemicals, Computer Hardware & ..., Construction & Real ... , Consumer Electronics, Electrical & Electro..., Energy Products, Environment, Excess Inventory, Fashion Accessories, Food & Beverage, Furniture, Gifts & Crafts, and Hardware & Mechanica... . Some categories have an "Updated!" badge.
- Discover Section:** Headline "Discover New Markets and Reach Global Traders Instantly" with four sub-points: "Discover New Markets", "Faster Than Ever", "Maximize Your Profits", and "Trade More with Better Prices".
- Trade Globally:** Section showing "Latest Buy Offers" and "Latest Sell Offers" with examples like "Buy Parboiled Rice" and "Sell Sterile Water".
- Premium Memberships:** Offers "GoldKey" and "SilverKey" options, highlighting benefits like 300% more buyer inquiries and high priority listing.
- Success Stories:** A box featuring a testimonial from Ms. Helen Zheng about becoming a Goldkey member.
- Featured Products:** A grid of six products: Studio Headphones, Conference Microphone, White Long Grain Rice, Santa Beads, LED Underwater Lights, and Printing Plates.

One important aspect involved in implementing B2B solutions is integrating the *databases* to support information (data) exchanges with other database systems.

I-4b Business to Consumers (B2C)

A business-to-consumer (B2C) operation is one that uses the Internet to sell products and/or services directly to consumers and/or end users. In B2C e-commerce, the Internet—and, in particular, the web—is the marketing, sales, and postsales support channel. B2C is oriented toward attracting customers to the websites and offering products and services in new and innovative ways. Table I.1 lists a sample of B2C e-commerce websites.

TABLE I.1

SAMPLE B2C WEBSITES

INDUSTRY	B2C WEBSITES	INDUSTRY	B2C WEBSITES
Travel	<i>Travelocity.com</i> <i>Expedia.com</i> <i>CheapTickets.com</i>	Computer	<i>Dell.com</i> <i>IBM.com</i> <i>Bestbuy.com</i>
Retailing	<i>Landsend.com</i> <i>Spiegel.com</i> <i>Amazon.com</i>	Health Services	<i>HealthNet.com</i> <i>WebMD.com</i>
Financial	<i>Fidelity.com</i> <i>Etrade.com</i>	Auctions	<i>eBay.com</i>
Banking	<i>WellsFargo.com</i> <i>www.hsbcdirect.com</i>	Reverse Auctions	<i>Priceline.com</i> <i>LendingTree.com</i>
Music	<i>www.itunes.com</i>	Insurance	<i>insure.com</i>
Government	Internal Revenue Service (<i>www.irs.com</i>)	Education	<i>www.elearners.com</i>

Two variations of the B2C marketplace are as follows:

- *Consumer to Business to Consumer (C2B2C)*. A consumer offers items for sale to other consumers through a third-party website. The web's many auction sites, such as *www.ebay.com*, are good examples.
- *Business to Business to Consumer (B2B2C)*. A business offers products or services to consumers through a third-party website. A typical example of B2B2C is a reverse auction such as *www.LendingTree.com* where consumers request bids for loans and financial institutions compete for consumers' business.

I-5 E-Commerce Architecture

Companies embracing e-commerce must deal with both managerial and technological issues. Managerial issues range from establishing partnerships with suppliers, distributors, and vendors to designing and developing well-orchestrated business plans. (Although managerial issues are critical to the success of an e-commerce initiative, they are beyond the scope of this book.) Technological issues include the hardware and software components that provide the backbone for reliable and secure e-commerce transactions. Regardless of the type and extent of an organization's information structure prior to the company's decision to embrace e-commerce, there is an obvious need for the proper design, development, and deployment of a well-planned architecture to support e-commerce business transactions, both internal and external. How those issues are confronted depends on whether the information systems architecture is already established and what the e-commerce style is.

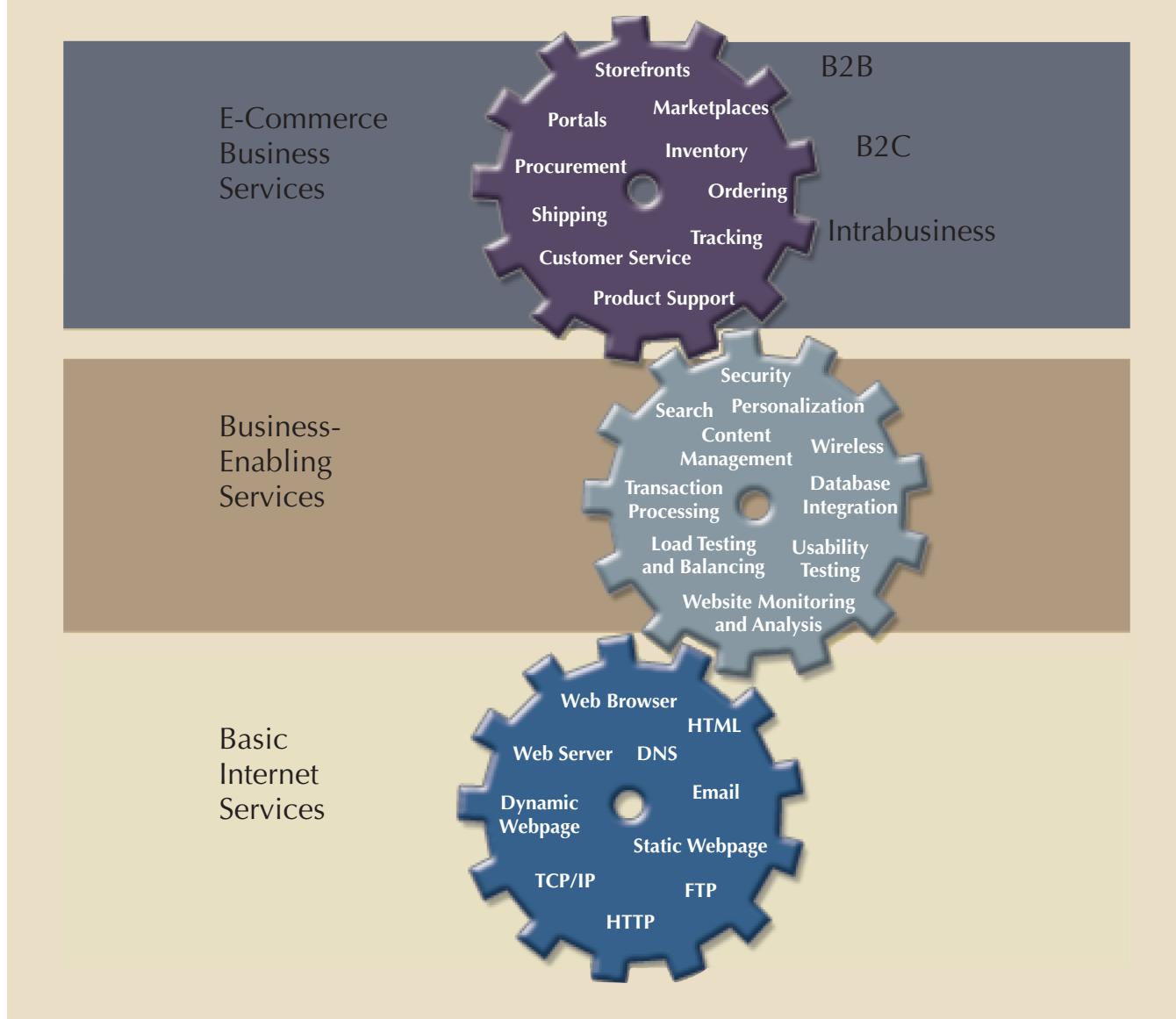
This section describes the basic architectural components that must exist to support e-commerce transactions.

To ensure better understanding of e-commerce architecture, it can be divided into a series of layers. Each layer provides services to the layer below it. Those layers are:

- Basic Internet services.
- Business-enabling services.
- E-commerce business services.

Figure I.5 offers a bird's-eye view of e-commerce architecture.

FIGURE I.5 E-COMMERCE ARCHITECTURE



I-5a Basic Internet Services

The Internet provides the basic services that facilitate the transmission of data and information between computers. The terms *Internet* and *World Wide Web* are often used interchangeably, but they are not synonyms. The World Wide Web functions as one of the many services of the Internet. Table I.2 describes the basic building blocks and services provided by both the Internet and the World Wide Web.

TABLE I.2

INTERNET BUILDING BLOCKS AND BASIC SERVICES

BASIC SERVICE	DESCRIPTION
Internet	A worldwide network of networks. The Internet acts as a “supernetwork” that connects thousands of smaller networks around the world. You can think of the Internet as the “highway” on which data travel, as in the phrase the information superhighway. To connect thousands of heterogeneous networks, the Internet uses a standard network protocol known as TCP/IP and devices known as routers.
TCP/IP	Transmission Control Protocol/Internet Protocol. The basic network protocol that determines the rules used to create and route “packets” of data between computers in the same network or in different networks. Each computer connected to the Internet has a unique TCP/IP address. The TCP/IP address is divided into two parts used to identify the network and the computer (or host).
Router	Special hardware/software equipment that connects multiple and diverse networks. The router is in charge of delivering packets of data from a local network to a remote network. Routers are the traffic cops of the Internet, monitoring all traffic and moving data from one network to another.
World Wide Web (WWW or the web)	A worldwide network collection of specially formatted and interconnected documents known as webpages. The web is just one of many services provided by the Internet.
Webpage	A document containing text and special commands (or tags) written in Hypertext Markup Language (HTML). A webpage can contain text, graphics, video, audio, and other elements.
Hypertext Markup Language (HTML)	The standard document-formatting language for webpages. HTML allows documents to be presented in a web browser in a standard manner.
Hyperlink	Webpages are linked to each other—that is, each webpage calls other webpages creating the effect of a “web.” Because a link can connect to different types of documents, such as text, graphics, animated graphics, video, and audio, it is known as a hyperlink. A hyperlink is generally expressed as an URL in an HTML-formatted webpage.
Uniform Resource Locator (URL) or web address	A URL identifies the address of a resource on the Internet. The URL is an abbreviation (ideally easily remembered) that uniquely identifies an Internet resource. Examples of URLs include www.dell.com , www.ford.com , www.amazon.com , www.faa.gov , and www.mtsu.edu .
Hypertext Transfer Protocol (HTTP)	The standard protocol used by the web browser and web server to communicate—that is, to send requests and replies between servers and browsers. HTTP uses TCP/IP to transmit the data between computers on the Internet.
Domain Name System (Service)	The DNS service translates the “English-like” domain names (such as whitehouse.org and ebay.com) to the appropriate TCP/IP addresses. The DNS service lies at the heart of the Internet because most hyperlinks use URLs to refer to other webpages.
Web browser	The end-user application used to browse or navigate (move from page to page) through the Internet. The browser is a graphical application that runs on the client computer, and its main function is to display webpages. A client uses the web browser (for example, Google Chrome, Microsoft Internet Explorer, or Apple Safari) to request webpages from a web server.
Web server	A specialized application whose only function is to “listen” for client requests, process them, and send the requested webpage back to the client browser. The web server and the web client communicate using a special protocol known as Hypertext Transfer Protocol, or HTTP.
Website	The term used to refer to the web server and the collection of webpages stored on the local hard disk of the server computer or an accessible shared directory.
Static webpage	A webpage whose contents remain the same (when viewed in a browser) unless the page is manually edited. An example of a static webpage is a standard price list posted by a manufacturer for inspection by the manufacturer’s customers.

TABLE I.2

INTERNET BUILDING BLOCKS AND BASIC SERVICES (CONTINUED)

BASIC SERVICE	DESCRIPTION
Dynamic webpage	A webpage whose contents are automatically created and tailored to an end user's needs each time the end user requests the page. For example, an end user can access a webpage that displays the latest stock prices for the companies (s)he selects.
File Transfer Protocol (FTP)	The protocol used to provide file transfer capabilities among computers on the Internet. An FTP client requests a file to an FTP server. The FTP server listens for client's requests, processes them, and sends the requested files back to the client.
Electronic mail (email)	Messages transmitted electronically among computers on the Internet. A mail server stores email messages in end users' mailboxes. Mail clients retrieve email from the mail server. When a client sends an email, it is temporarily stored on the mail server, which then delivers the email to the correct destination.
News and discussion group services	Specialized services that allow the creation of "virtual communities" in which users exchange messages regarding specific topics; for example, aviation, sports, or computers. This service allows end users to post information on shared bulletin boards for public access.

Figure I.6 shows the relationships among the components defined in Table I.2.

As you examine Figure I.6, note that the client enters a web address, or URL, in the web browser. In turn, the web browser issues an HTTP page request to the web server. The request is handled through TCP/IP for transmission over the network. TCP/IP transforms the request into packets and sends them to the router, which, in turn, routes them to the Internet. Once on the Internet, the TCP/IP packets travel across several routers until they reach the destination server. The server receives the webpage request, fetches the page, and sends it to the client's web browser in the same way. The client receives the HTML-formatted webpage and displays it on the screen.

The client and the server can be located in the same building or across the globe, which makes the web a great medium for delivering information across geographic boundaries. The web browser integrates all of the services provided by the website. The end user does not care or know about all of the different applications running on the server side.

Webpages are either static or dynamic. Static webpages display information that does not change much over time or is not time-critical. The content of dynamic webpages change over time and cannot be anticipated, for example, an online ordering system. Static webpages are adequate to display information such as product catalogs or contact information; dynamic webpages are better suited to e-commerce applications such as online ordering with product customization options. For example, at Dell's e-commerce site (www.dell.com), you can dynamically configure your computer. Dynamic webpages are at the heart of most B2B and B2C web transactions.

I-5b Business-Enabling Services

The Internet services described in the previous section are sufficient to operate a basic website. However, they do not provide the support required to conduct even rudimentary business transactions. Business-enabling services are implemented by hardware and software components that work together to provide the additional functionality not provided by basic Internet services. Table I.3 describes the services that are used to enhance websites by providing the ability to perform searches, authenticate and secure business data, manage website contents, and more. The list in Table I.3 is not comprehensive; technological advances continue to enable new services, which are used to bring about even more services.

FIGURE I.6 BASIC INTERNET SERVICES

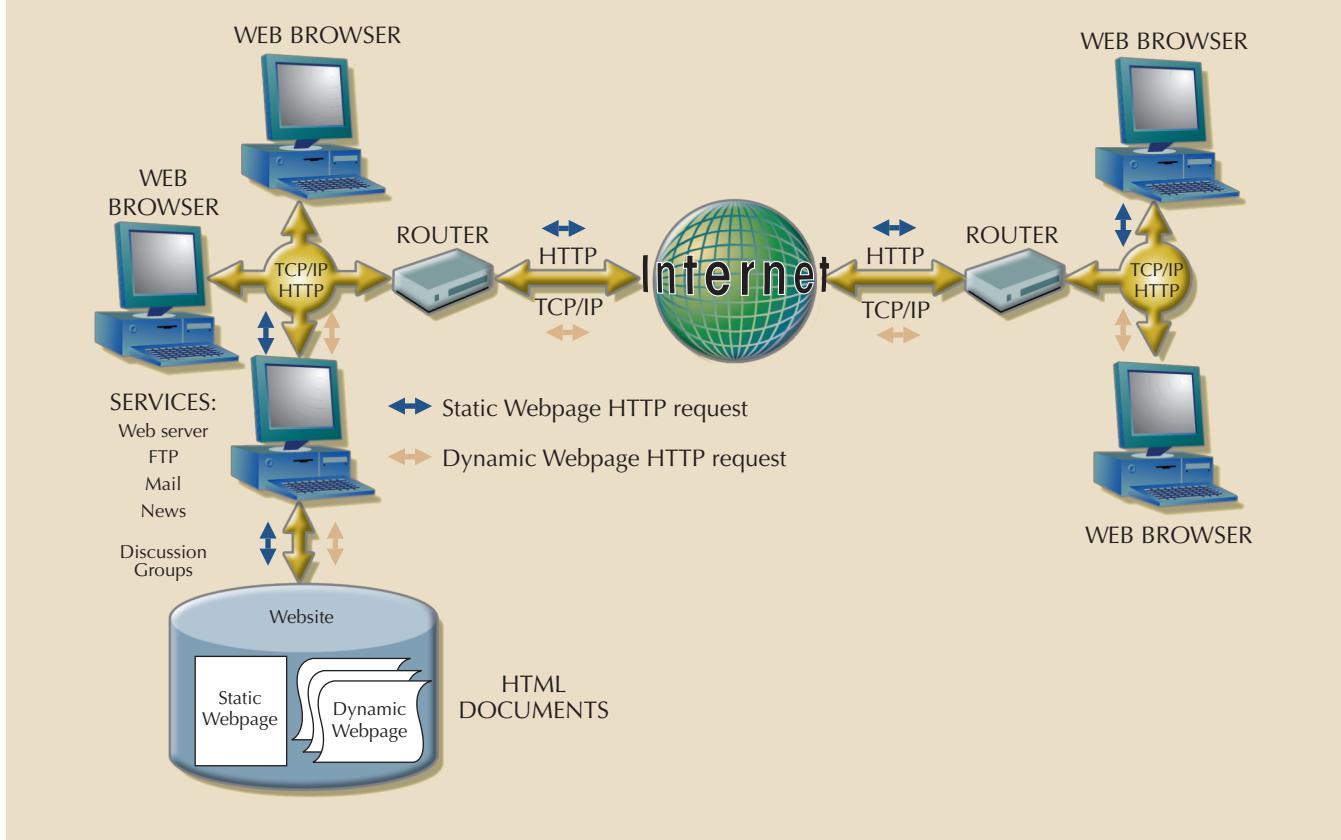


TABLE I.3

BUSINESS-ENABLING SERVICES

SERVICE	DESCRIPTION
Search services	Search services provide websites with the ability to perform searches on their contents. These services can be used in intranets to search for payroll information, benefits, vacation time, contract information, and so on. A B2C website can use this feature to search for product return information or customer support data. Search services are a must-have for all e-commerce websites.
Security	Services that ensure the security and privacy of data by providing encryption, digital certificates, SSL, S-HTTP, firewalls, and proxy servers. Those services are covered in greater detail in Section I.6.
Site monitoring and data analysis	Ensures that the website is performing at an optimal level. Monitors the main indicators of system and network performance. This service also includes the identification of network bottlenecks, often noticed by the end user when webpages load very slowly. Analysis features study network traffic to determine which pages are attracting visitors and which are not. This feedback provides answers to questions about the effectiveness of the pages.
Load testing, balancing, and web caching	Load testing is performed before an e-commerce site goes online. The main objective is to test the website to ensure that it can support the load imposed by thousands of users accessing it. When the expected transaction load is too much for a single server to handle, multiple servers are required. Load balancing ensures that the processing load is distributed evenly among multiple servers. Web caching technologies increase the performance of web servers by creating a "caching" layer between the web server and web client sessions and servicing selected requests directly from the cache without taxing the web server. These services provide performance-enhancing techniques to operate the system at optimum speed.

TABLE I.3

BUSINESS-ENABLING SERVICES (CONTINUED)	
SERVICE	DESCRIPTION
Usability testing	In an e-commerce environment, not having a website is bad enough, but having a badly designed website may be even worse. Usability testing ensures that website features and services are presented in a user-friendly manner. Is the search function hard to find? Are the colors chosen for the website difficult to read on laptop computers? Are the options presented logically?
Personalization	Personalization features allow for the customization of webpages for individual users. The idea behind personalization is making the site user-friendly to attract more users and to keep users coming back. To see personalization in action, go to www.yahoo.com and click on "My Yahoo." You can then specify your interests and your zip code to get a personalized webpage tailored for your local weather, news, and so on.
Web development	E-commerce applications require business logic to be integrated into the website. Web development tools provide the means by which to add business logic to webpages. HTML is not a programming language; it is a document-formatting specification created to present documents properly in a web browser. Business logic can be added to websites by using one of many web-based programming environments, such as Java, JavaScript, JScript, or VBScript. Such programming environments allow the creation of dynamic webpages that form the basis of e-commerce websites.
Database integration	Business transaction data are normally stored in databases. The integration of enterprise databases with the web is a requirement for e-commerce success. Many DBMSs, such as Oracle and Microsoft SQL Server, already come with web development environments that integrate the database with the Internet. Third-party vendors provide solutions that allow corporate databases (including legacy data) to be integrated into a company's website.
Transaction processing	As you might imagine, transaction processing services are very important in e-commerce. Chapter 10, Transaction Management and Concurrency Control, examined the importance of transaction management. In an e-commerce environment, the problem is vastly magnified because transactions often originate from customers around the world.
Content management	Content management automates the creation and management of a website's contents and provides a flexible and consistent way for many different individuals and departments to create webpages. Content management is critical for companies in the business of providing information.
Messaging	The Internet is a "highway" through which applications communicate. An e-commerce application sends messages from a client to a server, and vice versa. Messaging ensures the proper routing and delivery of applications-oriented messages among multiple services.
Wireless device support	Wireless and mobile devices have become big players in e-commerce. Services to support wireless communication have become increasingly important in e-commerce.

I-5c E-Commerce Business Services

E-commerce business services form the top layer of the e-commerce architecture. (See Figure I.5.) That layer uses the services of the two layers below it to map business logic and to automate business processes. Automating business processes enhances the business unit, department, and intrabusiness operations. At the top layer, business-enabling services (layer 2) interact with basic Internet services (layer 1) to provide support for the front-end e-commerce services. Note that it is the business functions that drive the operations of the services below it—not the other way around. The top layer takes

longer to implement because care must be taken to develop a thorough understanding of the business, to establish business partnerships, and to understand customer behavior.

When the web front end is designed and implemented, a decision must be made about what business services to provide and how to provide them. For B2C e-commerce sites, the front end could be as simple as an online product catalog or as sophisticated as a database-based “storefront” with three-dimensional (3D) views of the available products, in addition to a shopping cart application that enables users to order items while they browse the products.

Common services provided by e-commerce websites include automation of the supply chain for B2B purposes. That automation covers online procurement, just-in-time inventory, online ordering, order tracking, product delivery, product support, customer satisfaction management, and so on.

The next two sections introduce two essential features of e-commerce that enable complete online transactions: security and payment processing.

I-6 Security

For e-commerce to be successful, it must ensure the security and privacy of all business transactions and the data associated with those transactions. In an e-commerce context, **security** encompasses all of the activities related to protecting data and other e-commerce components against accidental or intentional (usually illegal) access or use by unauthorized users. **Privacy** deals with the rights of individuals and organizations to determine the “who, what, when, where, and how” of data use.

Even before the emergence of e-commerce, information privacy and security was a major concern in business organizations. In some cases, those concerns merited the hiring of a data security officer to oversee data security and privacy standards and procedures. Integrating databases with the web and using the Internet as a transmission medium for business transactions have made the need for security even greater.

The World Wide Web was originally created with the objective of sharing data easily, rather than securely. For that purpose, the web is a good fit for nonprofit organizations and business/consumer advocacy groups that are more concerned with information distribution than with secure transactions. However, private for-profit organizations require security and privacy to engage in e-commerce business transactions. For example, who would use a credit card to pay online if there were no measures to protect the credit card information from being stolen? How can messages traveling over the Internet be protected against modifications? How can the identity of the sender be verified? How can the web storefront be protected against attacks from cybervandals? Although there is no foolproof way to protect against all possible threats, several technologies do address security problems. Although Internet security is a vast topic, the focus here is on the principal mechanisms used to protect electronic business transactions, web-store front ends, and associated data.

E-commerce data must be secured from the beginning of a transaction to its end. Let's examine the following online purchasing scenario, illustrated in Figure I.7:

1. A customer orders products online, entering order and credit card information on a merchant's webpage.
2. The information travels from the customer's computer over the Internet to the merchant's web server.

security

Activities and measures to ensure the confidentiality, integrity, and availability of an information system and its main asset, data.

privacy

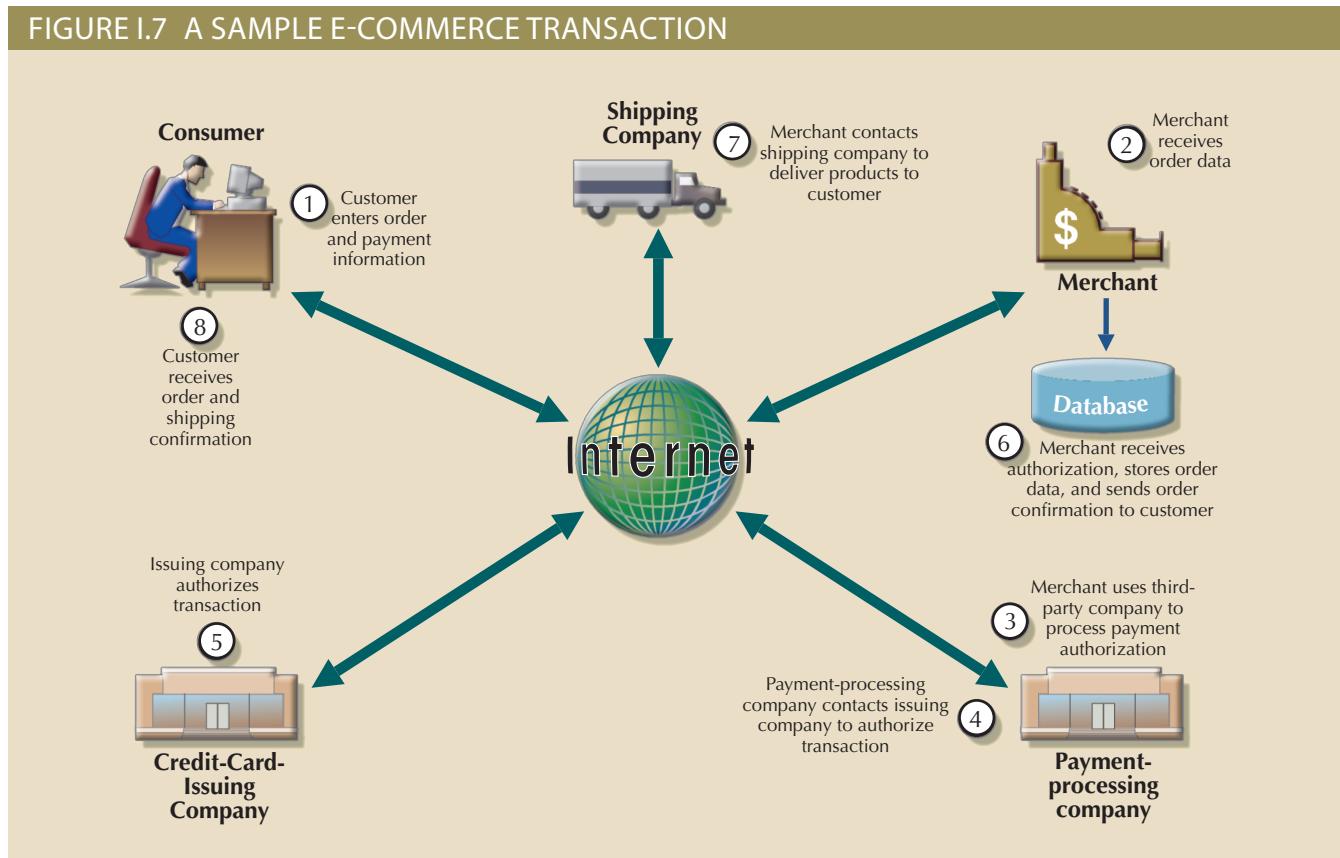
The rights of individuals and organizations to determine access to data about them-selves.

3. The merchant uses a third-party company to process payment authorization.
4. The payment processing company contacts the customer's credit card-issuing company to authorize the transaction.
5. The customer's credit card issuer authorizes the transaction.
6. The merchant receives authorization, stores the order and payment data in a database, and sends order confirmation to the customer.
7. The seller uses a third-party shipping company to deliver the products.
8. The customer receives order and shipping confirmation.

Given the just-described scenario, security (procedures and technology) must be maintained to:

- *Authenticate the identity of the transaction's participants* by ensuring that both the buyer and the seller are who they say they are. In other words, there needs to be a secure way to properly identify transaction participants and the authenticity of their messages.
- *Protect the transaction data from unauthorized modifications* while it travels over the Internet. The Internet is formed by millions of interconnected networks. E-commerce data must pass through several different networks when traveling from the client to the server, thereby increasing the risks of data being stolen, modified, or forged.

FIGURE I.7 A SAMPLE E-COMMERCE TRANSACTION



- *Protect the resources (data and computers).* This includes protecting the end user and the business data stored on the web server and in the databases from unauthorized access. It also includes securing the web server against attacks from hackers wanting to break into the system to modify or steal data or to impair normal operations by limiting resource availability.

I-6a Authentication

Authentication refers to the process of properly and uniquely identifying entities. Such an entity could be a user in a computer system or a database, a computer in a network, or participants in an e-commerce transaction. You probably are familiar with the authentication used in local area network systems in which you are given a unique user ID and password. For example, on most systems that use Microsoft Windows, you must enter your user ID and password to log on. In that way, Windows authenticates who you are. Based on your user ID (identity), Windows assigns you access rights (read, write, and so on) to resources such as printers and files.

In the case of e-commerce, authentication concerns properly identifying a user on the Internet. Suppose that you have placed an online order for a Sony STR-DE525 receiver. After a week, your order still has not arrived. But when you call the merchant, you are informed that the item was shipped several days ago to an address that is not yours. Apparently, somebody changed the shipping address while the order traveled over the Internet prior to being delivered to the merchant's website. From this admittedly simplified scenario, you can see why verifying the identity of participants and hiding the contents of communications from intruders are important.

Internet authentication is a bit more complicated than the Windows scenario. On the Internet, digital certificates issued by a certification authority (CA) are used to authenticate both users and vendors. A **certification authority (CA)** is a private entity or company that certifies that the user or vendor is who (s)he claims to be. Certification authority companies work with credit card verification companies and other financial institutions to verify the identity of the certificate's requesters. When a user registers with a CA such as VeriSign (acquired by Symantec), (s)he will be asked to provide appropriate verification information. (See Figure I.8.) Using the end-user data provided, the CA verifies the identity of the requester and issues a digital certificate to the end user. A **digital certificate** is a unique identifier given to an entity. The holder of the certificate may be an end user, a website, a computer, a webpage, or even a program. Digital certificates are used in combination with encryption to provide security and authentication.

authentication

The process through which a DBMS verifies that only registered users can access the database.

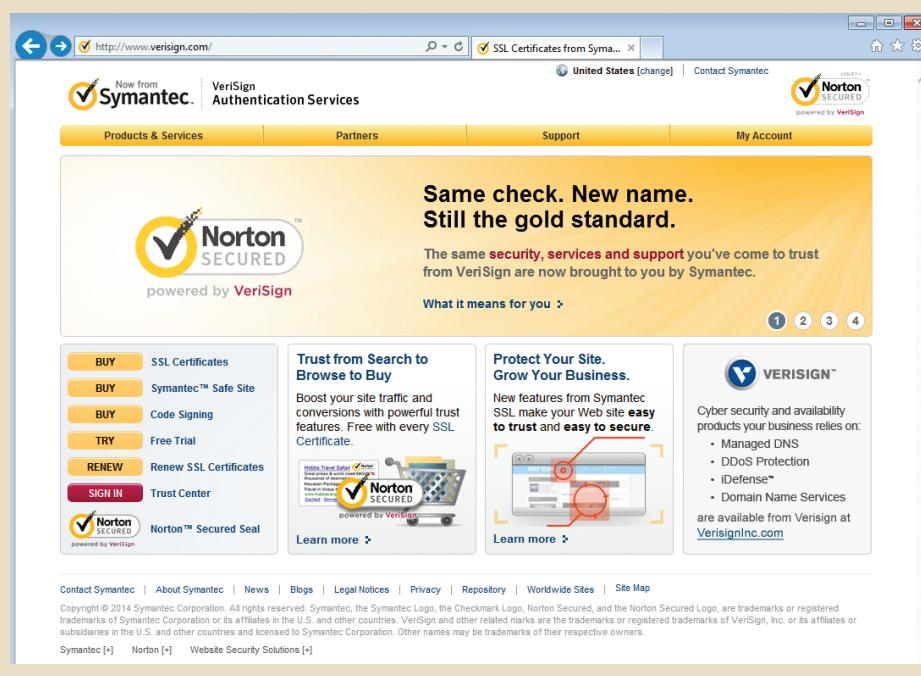
certification authority (CA)

A private entity or company that certifies the user or vendor is who (s)he claims to be.

digital certificate

A unique identifier given to an entity. The certificate holder may be an end user, a website, a computer, a webpage, or even a program. Digital certificates are used in combination with encryption to provide security and authentication.

FIGURE I.8 REGISTERING WITH A CERTIFICATION AUTHORITY



encryption

A process of inputting data in “plain text” to yield an output “encoded” version of the data, making the data unintelligible to unauthorized users.

encryption key

Used by encryption algorithms to encode data. The encryption key is a very large number used to encrypt and decrypt data.

symmetric encryption

Encryption that uses a single numeric key to encode and decode data. Both sender and receiver must know the encryption key. See also *private-key encryption*.

private-key encryption

Encryption that uses a single numeric key to encode and decode data. Both sender and receiver must know the encryption key. See also *symmetric encryption*.

Data Encryption Standard (DES)

The most widely used standard for private-key encryption. DES is used by the U.S. government.

asymmetric encryption

A form of encryption that uses two numeric keys—the public key and the private key. Both keys are able to encrypt and decrypt each other’s messages. See also *public-key encryption*.

public-key encryption

A form of encryption that uses two numeric keys—the public key and the private key. Both keys are able to encrypt and decrypt each other’s messages. See also *asymmetric encryption*.

public key

A key that is available to anyone wanting to communicate securely with the key’s owner.

I-6b Encryption

Digital certification does not totally guard against improper use of data. So what further assurances can be made that the original sender sent the document and that it has not been forged? That is where encryption comes into the picture. **Encryption** is a process of inputting data in “plain text” to yield an “encoded” output of the data, making the data unintelligible to unauthorized users. To secure e-commerce transactions on the web, the client web browser must encrypt the data before sending it over the Internet to the merchant’s web server. The merchant’s web server receives the encrypted transaction data and decrypts it. All sensitive communications between client and server must be encrypted. Encryption works to promote:

- Data privacy to ensure that the data cannot be understood if intercepted.
- Data authenticity to ensure that the data were not forged.

Most encryption algorithms use mathematical formulas and an encryption key to encode the data. The **encryption key** is a very large number used to encrypt and decrypt the data. The length of the key—that is, the number of digits in it—determines how secure the data will be. The longer the key, the more secure the data. Most encryption algorithms use key lengths that range from 40 bits to 128 bits or more. Most modern web browsers such as Firefox and Internet Explorer support either 40-bit or 128-bit encryption.

Encryption algorithms are of two types: symmetric (private-key) or asymmetric (public-key). **Symmetric** or **private-key encryption** uses a *single* numeric key to encode and decode data. Both sender and receiver must know the encryption key. The most widely used standard for private-key encryption is **Data Encryption Standard (DES)** used by the U.S. government. Because each client/server combination requires a different key, this type of encryption is usually used by government entities only and is not used for e-commerce transactions over the Internet.

Asymmetric or **public-key encryption** uses two numeric keys.

- The **public key** is available to anyone wanting to communicate securely with the key’s owner.
- The **private key** is available only to the owner.

Both keys can encrypt and decrypt each other’s messages.

An example of public-key encryption is **Pretty Good Privacy (PGP)** by Pretty Good Privacy, Inc. PGP is a fairly popular and inexpensive method for encrypting email messages on the Internet. The most commonly used public-key encryption technology is RSA encryption by RSA Data Security Inc. RSA has become the de facto standard for Internet encryption. Figure I.9 shows security settings for the most common web browsers.

Digital certificates use public-key encryption techniques to create digital signatures. A **digital signature** is an encrypted attachment added to the electronic message to verify the sender’s identity. The digital certificate received by the user includes a copy of its public key. The owner of the digital certificate makes its public key available to anyone wanting to send encrypted documents to the certificate’s owner.

I-6c Transaction Security

As you know, webpages are plain-text documents created through the use of HTML. In fact, the vast majority of webpages that travel the web are transferred in plain text. Those plain-text transmissions are acceptable for many applications, but they are clearly unacceptable when sensitive e-commerce data such as credit card and bank account information are transmitted. This section examines protocols that are used to transmit HTML documents securely over the Internet.

Secure Sockets Layer (SSL) is a protocol used to implement secure communication channels between client and server computers on the Internet. SSL was originally created by a group of companies led by Netscape Communications, IBM, and Microsoft. The SSL protocol requires that the following conditions be met:

- The client accesses a merchant's web server that supports SSL.
- The server sends its digital certificate, including the server's public key, to the client.
- The client uses the certificate to verify the server with the certification authority (CA).
- The client generates a private key for the session, encrypts the key using the server's public key, and sends it over the Internet to the server.
- The server receives the data, decrypts the data with its private key, and extracts the SSL session private key.

Once the client and the server each have the SSL session private key, they communicate by sending encrypted data back and forth. Transport Layer Security (TLS) is a more recent version of SSL that is even more secure.

The advantage of SSL and TLS is that they can be used with many different Internet services (FTP, Telnet, and HTTP), which means they are widely supported on the Internet.

private key

"A key that is known only to the owner of the key."

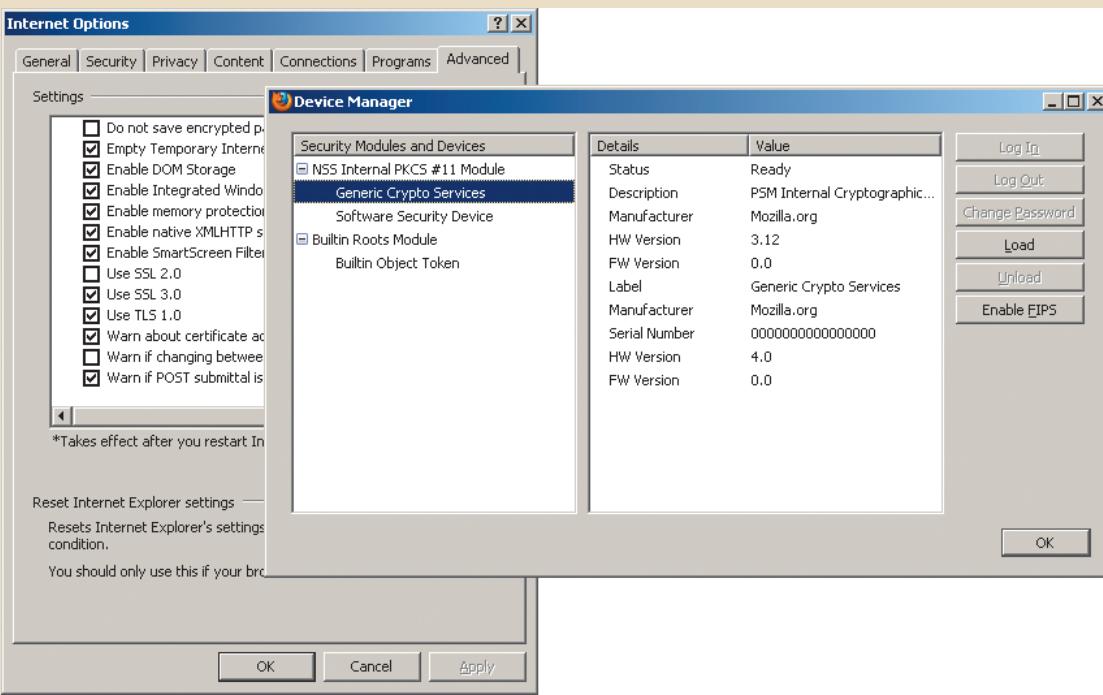
Pretty Good Privacy (PGP)

An example of public-key encryption by Pretty Good Privacy Inc. PGP is a fairly popular and inexpensive method for encrypting e-mail messages on the Internet.

digital signature

An encrypted attachment added to an electronic message to verify the sender's identity.

FIGURE I.9 WEB BROWSER SECURITY SETTINGS



Note

Secure Sockets Layer (SSL) is now being superseded by its successor **Transport Layer Security (TLS)**. TLS uses the same principles as SSL and includes some improvements that are beyond the scope of this discussion.

Secure Sockets Layer (SSL)

A protocol used to implement secure communication channels between client and server computers on the Internet.

Transport Layer Security (TLS)

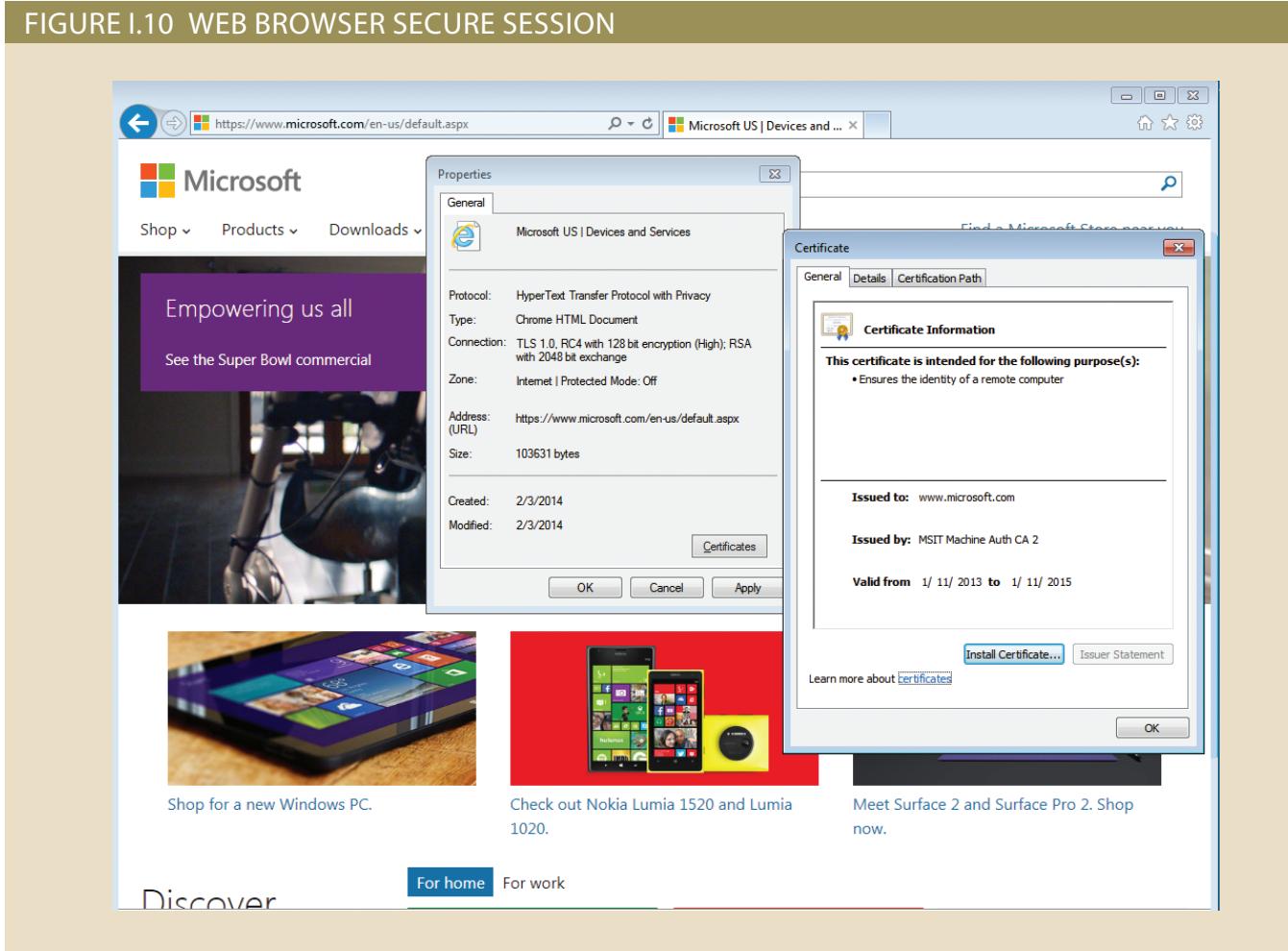
An updated version of Secure Sockets Layer (SSL) that supports more secure encrypted communication between a client and server on the Internet.

To request a secure connection, just add an *https* prefix to the server's web address. For example, to access a secure connection to Microsoft, enter *https://www.microsoft.com* in your browser to generate the screen shown in Figure I.10. (To see the Properties window, right-click the webpage and select "Properties." Note that the Properties window shows a secure connection based on 128-bit encryption.)

Secure Hypertext Transfer Protocol (S-HTTP) is used to transfer web documents securely over the Internet. S-HTTP supports use of private and public keys for authentication and encryption. S-HTTP has not been widely used because it supports only encrypted HTTP data, not other Internet protocols as SSL does.

The next section looks at the technologies that are used to protect the integrity of the resources that are connected to the Internet.

FIGURE I.10 WEB BROWSER SECURE SESSION



I-6d Resource Security

Resource security refers to the protection of the resource(s) connected to the Internet from external and internal threats. Specifically, resource security means protecting the computers connected to the Internet from viruses, intrusion by hackers, and denial-of-service attacks.

The most common threat is probably the **virus**. A virus is a malicious program that affects the normal operation of a computer system. Both client and server computers must be protected against this threat by use of a virus protection program. Virus protection programs must be constantly updated with the latest signature files to identify

new viruses. For more information about viruses, visit the websites of vendors such as Symantec (www.symantec.com) and McAfee (<http://www.mcafee.com>).

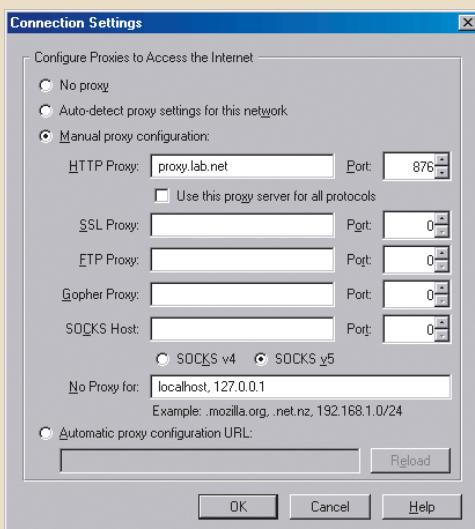
A **hacker** is a person who maliciously and illegally accesses a website with the intention of stealing data, changing webpages, or impairing website operations. Illegally accessing websites with the intention of defacing or changing webpage contents is very common. Because e-commerce web servers connect directly to the Internet, they are prime targets for hackers. One of the most common activities of hackers is to render websites unusable with a denial-of-service attack. A **denial-of-service** attack overloads web servers and routers with millions of requests for service, rendering the services unavailable to legitimate users. A distributed denial-of-service attack originates from many different computers at the same time. Currently, no methodology is totally effective in protecting websites against distributed denial-of-service attacks. However, one of the most effective and commonly used defenses against viruses and hacker attacks is a *firewall*.

A **firewall** is used to protect the network from unauthorized access by the outside world (public Internet). Specifically, a firewall is a hardware and/or software component that is used to limit and control Internet traffic that goes into the company's network infrastructure and data that are allowed to be moved outside the company's network.

Firewalls can be classified as follows:

- **Packet filter firewall.** It works at the TCP/IP packet level, examining every packet that moves into and out of the company's private network.
- **Gateway server firewall.** It works at the application level, examining every application request (HTTP, FTP, Telnet, and so on) that moves into or out of the company's network.
- **Proxy server firewall.** A proxy server is an intermediary between client computers inside a private network and the Internet. The proxy server accepts requests from clients and forwards them to the Internet. When replies come back from the Internet, the proxy server sends the data back to the client that made the request. The client computer application must be configured to work with the proxy server. (Figure I.11 shows an example of the Internet Explorer proxy settings.)
- **State inspection firewall.¹** This new firewall technology compares only parts of incoming packets to parts of the related outgoing packets.

FIGURE I.11 WEB BROWSER PROXY SETTINGS



Secure Hypertext Transfer Protocol (S-HTTP)

Protocol used to securely transfer web documents over the Internet. S-HTTP supports use of private and public keys for authentication and encryption. S-HTTP has not been widely used, because it only supports encrypted HTTP data and does not support other Internet protocols as does SSL.

resource security

The protection of the resource(s) from external and internal threats. Specifically, resource security means protecting the resource from viruses, unauthorized access by hackers, or denial of service attacks.

virus

A malicious program that affects the normal operation of a computer system.

hacker

A person who maliciously and illegally accesses a website with the intention of stealing data, changing webpages, or impairing website operations.

denial-of-service

One of the most common hacker activities. This attack overloads web servers and routers with millions of requests for service, rendering the services unavailable to legitimate users.

¹For additional information about this type of firewall, visit Check Point Software at www.checkpoint.com.

Firewalls, proxy servers, and virus protection programs are just a few of the technologies used to secure and protect e-commerce sites. No single technology can protect an e-commerce web server against viruses, hacker intrusions, and denial-of-service attacks. Implementing resource security includes a mixture of the technologies examined in this section, in addition to others that are not within the scope of this book (for example, intrusion detection systems, vulnerability assessment tools, and secure operating systems).

I-7 Web Payment Processing

A key function of e-commerce websites is their ability to process online payments for products and/or services. In a traditional business transaction such as buying a CD at a music store, you pay for your purchase using cash, a check, a money order, or a credit card. On the web, the most common method of payment is credit card, but there are some less common alternatives. This section briefly introduces two technologies that aid in the processing of electronic payments: digital cash and online credit card processing.

I-7a Digital Cash

One of the risks of paying with credit cards is theft. If your credit card information is stolen, you may find extra charges on your next credit card bill. If somebody steals a \$5 bill from your wallet, you lose only \$5. Thus, the use of cash has certain advantages. **Digital cash** is the digital equivalent of hard currency (coins or bills). Digital cash uses digital certificates to verify the identity of the transaction's participants and requires the existence of a bank or financial institution from which the user will buy digital cash. When the user buys digital cash, (s)he receives digital bills or coins backed by a financial institution and represented by binary IDs. The user will later transfer the digital cash to a merchant to pay for products and/or services. The merchant submits the digital cash to the bank to credit the account. Digital cash remains an evolving technology, with a number of competing companies and few standards.

One of the main advantages of digital cash is its lower cost per transaction when compared to bank checks and credit cards. In fact, given relatively high transaction cost, some online merchants have imposed a minimum purchase for credit card transactions. Nevertheless, digital cash usage pales in comparison to credit card transactions. Reasons for the reluctance to embrace digital cash include the following:

- Difficulty in getting merchants, banks, and customers to change the way they do business.
- Regulatory obstacles.
- Customers' acceptance of credit cards as the most convenient way to pay for online purchases.

Given the current lack of general acceptance, the future of digital cash providers is uncertain.

A more successful approach to web payment processing has been undertaken by companies such as PayPal. PayPal sets up secure transfers from and to users' credit cards or bank accounts. Registered PayPal users can shop at thousands of PayPal-enabled sites. In addition, users can safely send money to or request money from anyone with an email address. PayPal has been popular because it offers business services and is widely used as a payment system for online auctions. eBay acquired PayPal in 2002. By 2013, it had more than 137 million active members in 193 markets. (You can get more up-to-date figures by visiting www.paypal.com and clicking "About.")

firewall

Used to protect a network from unauthorized access from the outside world (public Internet). Specifically, a firewall is a hardware and/or software component that is used to limit and control Internet traffic going into a company's network infrastructure and data that are allowed to be moved outside a company's network.

packet filter firewall

A type of firewall that works at the TCP/IP packet level.

gateway server firewall

A type of firewall that operates at the application level.

proxy server firewall

A firewall that operates as an intermediary between client computers inside a private network and the Internet.

state inspection firewall

A type of firewall that compares parts of incoming packets and related outgoing packets.

digital cash

The digital equivalent of hard currency (coins or bills of a given denomination).

I-7b Online Credit Card Processing

Most online purchases are made with a credit card. Although web merchants accept credit cards as a form of payment, not all merchants use identical methods to process credit card payments. In previous sections, you learned about different security techniques used to protect credit card information. This section briefly explores some of the ways in which merchants can process credit card payments.

The simplest payment processing method is manual processing. In this scenario, a seller collects credit card information from the customer via the website, using a secure connection. (In some cases, the buyer must place the actual order by phone.) The seller then contacts the credit card issuer—by phone or through a credit card verification device—to get authorization information. If problems arise (such as insufficient credit, a wrong card number, or a stolen card), the merchant emails the customer to inform him/her about the problem. Although this multistep manual process continues to survive, thanks to the existence of many small web companies, its inefficiency has caused most sellers to modify or abandon it.

A more efficient variation of the manual method is for the merchant to use third-party credit-card-processing software such as PayEezy (www.payeezy.com) or to employ the services of a third-party processing company such as Converge (www.myvirtualmerchant.com/VirtualMerchant/). In this scenario, the client customer's computer, the merchant's web server, the payment-processing company's server, the customer, and the merchant's bank work together to process the payment. In its simplest form, the procedure requires the following steps:

1. The customer sends credit card information via the web to the seller's web server.
2. The seller's web server verifies the order and sends the credit card information to the credit-card-processing company.
3. The credit-card-processing company verifies the credit card with the customer's bank and obtains authorization information.
4. The merchant's web server receives confirmation of the transaction.
5. The merchant's web server emails the purchase order confirmation to the client.
6. When the merchandise is delivered, the seller and the credit card company settle the payment.

One important feature of all credit card payment processing systems is that the charge is issued only after the seller ships the products and/or services to the client.

Two of the major credit card companies, Visa and MasterCard, have created a system known as *Secure Electronic Transactions*. The **Secure Electronic Transaction (SET)** standard provides for security and privacy of credit card information through the use of digital certificates, digital signatures, and public-key encryption. Security is automatically enforced for all communications between customer, merchant, and financial institutions. One of the main advantages of SET is that it provides a way for the buyer to transfer his/her credit card information to the credit card issuer *without the seller being able to see the credit card information*—by requiring merchants to encrypt all credit card information. SET has been widely accepted by the most prominent Internet companies and vendors, such as Microsoft, IBM, and GTE. SET also defines the minimum network and security infrastructure requirements for companies that want to perform electronic payment verification on the web. That standard includes the use of firewalls, encryption, digital signatures, encrypted database data, antivirus software, operating system patches, end-user authentication, auditing, and other security policies.

Secure Electronic Transaction (SET)

Initiative to provide a standard for secure credit card transactions over the Internet.

Now that you've had an overview of the world of electronic commerce, let's turn to database design for e-commerce applications.

I-8 Database Design for E-Commerce Applications

Through experience, you know that reinventing a heat source is not necessary each time you want hot water for a cup of coffee. Similarly, to design e-commerce databases, you do not need to invent "new" design techniques. To the contrary, the design techniques you have learned in this book (ER modeling, normalization, SDLC, DBLC, transaction management, and so on) provide the basic tools and the knowledge required to build successful e-commerce databases. However, e-commerce databases have a few requirements that you have not encountered yet. That is why this section illustrates a basic database design for an e-commerce application. In Chapter 15, Database Connectivity and Web Technologies, you learned how to set up a web-enabled database and you learned about web database development.

Let's start by defining the scope of the database. The simple e-commerce website must include at least the core features that facilitate the sale of products and/or services. Therefore, the database must support the website's ability to show the available products and/or services and to conduct basic sales transactions. In addition, the e-commerce website should offer features that focus on customer service, product returns, and web customer profiling, which make the customer's web experience a pleasant one. To accomplish that end, an e-commerce database design must include a few additional support tables. However, the focus here is mainly on the database entities that directly support the sale of products in an e-commerce database.

To start the design process, let's establish some basic business rules and their effect(s) on the design.

- The objective of the e-commerce design is to sell products to customers. Therefore, the database's first two tables will be PRODUCT and CUSTOMER.
- Each customer may place one or more orders. Each order is placed by one customer. Therefore, there is a 1:M relationship between CUSTOMER and ORDER.
- Each order contains one or more order lines. Each order line is contained within an order. Therefore, there is a 1:M relationship between ORDER and ORDLINE.
- Each order line references one product. Each product may appear on many order lines. (The company can sell more than one HP ink-jet printer.) Therefore, there is a 1:M relationship between PRODUCT and ORDLINE.
- Customers who browse the product catalog would like to see products grouped by category or type. (For example, customers would find it useful to see product lists broken down as computers, printers, application software, operating systems, and so on.) Therefore, each PRODUCT belongs to one PRODTYPE, and each PRODTYPE has one or many PRODUCTS associated with it.
- Customers who browse the web catalog must be able to select products and store them in an electronic shopping cart. The shopping cart temporarily holds the products until the customer checks out. Therefore, the next entity is SHOPCART. Each SHOPCART belongs to one CUSTOMER and references one or more PRODUCTS.
- When the customer checks out, (s)he enters credit card and shipping information. That information is added to the ORDER. (Note that the business rule identifies required attributes.)

- When the credit card authorization is received, an order is placed for the products found in the shopping cart. The SHOPCART information is used to create an ORDER, which contains one or more ORDLINES. *After the order is placed and the customer leaves the website, the shopping cart data are deleted.*
- Because the merchant offers many shipping options, a SHIPOPTION table is created to store the details of each shipping option, that is, Land, 2-day, Next day, UPS, FedEx, and so on.
- Because the merchant offers many payment options, a PMTOPTION table is created to store the details of each payment option, that is, MasterCard, Visa, American Express, and so on.
- Because each state may have a different tax rate, two tables are created, (STATE and TAXRATE) to keep track of the states (and countries) and the tax rate for each.

Given that brief summary of business rules and their effect(s) on the design, a summary of the entities are shown in Table I.4.

TABLE I.4

MAIN TABLES FOR E-COMMERCE DATABASE

TABLE NAME	TABLE DESCRIPTIONS
CUSTOMER	Contains details for each registered customer. This table contains general customer data, shipping preference, credit card data, and billing data (for customer accounts). Some customers may prefer not to register; if so, they will have to enter the customer details each time they place an order.
PRODUCT	Contains product details such as stock IDs, prices, and quantity on hand.
PRODTYPE	Identifies the main product type classifications.
ORDER	Contains details about general orders, such as date, number, and customer.
ORDLINE	Contains the products ordered for each order.
SUPPORT TABLES	
SHOPCART	Contains the purchase quantity for each product selected by the customer. This is a “working” table—whose contents are deleted when the customer exits the website or closes the browser.
PMTTYPE	Contains the different payment options offered by the merchant.
SHIPTYPE	Contains the different shipping options offered by the merchant.
TAXRATE	Contains the tax rate for each state and/or country.
STATE	Contains the list of each state and/or country for which the tax is charged.
PROMOTION	Includes special promotions such as vouchers and sales discounts.
PRICEWATCH	Includes customers who want to be notified if a product’s price reaches a certain level.
PRODPRIICE	Is an optional table used to manage multiple price levels.



Note

To save space and to recognize your ability to translate the business rules into an ERD, which you learned in Chapter 4, Entity Relationship (ER) Modeling, and Chapter 6, Normalization of Database Tables, you will not develop the ERD for this design.

After defining the tables that are required to support the e-commerce activities, the basic attributes for each table are identified. Note that the following attribute summary is only a sample of the most important—and most commonly used—attributes; it is not meant to be comprehensive. (Your specific environment will determine what attributes are relevant and/or what attributes might be added.)



Note

The discussion will mention some programming and design practices that may be used to build e-commerce websites. For example, because the data stored in the tables exist to support web transactions, it would be advisable to define some fields—such as product names or descriptions—for webpage display purposes. Also, fields such as credit card numbers and passwords should be stored in an encrypted format. The fields themselves also may be encrypted, thus making it unlikely that even a field's contents would be improperly accessed. (Databases such as Oracle and IBM's DB2 support field level encryption.)

I-8a The CUSTOMER Table

The CUSTOMER table contains the details for each registered customer. Keep in mind that some customers may prefer not to register. They may feel uncomfortable providing registration information. Therefore, a decision will have to be made about whether to require registration for all purchases.

- With mandatory registration, the website needs a form for registering new customers. Also, a login form is required for returning customers before they start browsing the product catalog. Given the registration data, the customer's shipping and credit card data can be automatically placed in the order when the customer checks out. (One of the benefits of registration is that customers may be rewarded with discounted prices.)
- With optional registration, there is no need to generate a registration or login form for each sale or visit. The customer must enter all shipping and credit card information with each order.

Obviously, the simplest option is not to require registration. Therefore, the decision has been made here to make registration optional. The main CUSTOMER table attributes are shown in Table I.5.

TABLE I.5

CUSTOMER TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
CUST_ID	Customer ID—automatically generated	PK
CUST_DATEIN	Date the customer was added to the table	
CUST_LNAME	Last name	
CUST_FNAME	First name	
CUST_ADDR1	Address line 1	
CUST_ADDR2	Address line 2	
CUST_CITY	City	

TABLE I.5

CUSTOMER TABLE (CONTINUED)

ATTRIBUTE NAME	DESCRIPTION	PK/FK
CUST_STATE	State or region if international customer	FK
CUST_ZIP	Zip code	
CUST_CNTRY	Country	
CUST_PHONE	Phone	
CUST_EMAIL	Email address	
CUST_LOGINID	Login ID for registered customers	
CUST_PASSWD	Password for login—encrypted field	
CUST_CCNAME	Name as it appears on credit card	
CUST_CCNUM	Credit card number—encrypted field	
CUST_CCEXDATE	Credit card expiration date in mm/yy format	
CUST_ACRNUM	Accounts Receivable number—to interface with the internal accounts receivable system or a reference PO number for clients set up for net 30 terms	
CUST_BLLADDR1	Billing address line 1	
CUST_BLLADDR2	Billing address line 2	
CUST_BLLCITY	Billing address city	
CUST_BLLSTATE	Billing address state	FK
CUST_BLLZIP	Billing address zip	
CUST_BLLCNTRY	Billing address country	
SHIP_ID	Favorite shipping type	FK
CUST_SHPADDR1	Shipping address line 1	
CUST_SHPADDR2	Shipping address line 2	
CUST_SHPCITY	Shipping address city	
CUST_SHPSTATE	Shipping address state	FK
CUST_SHPZIP	Shipping address zip	
CUST_SHPCNTRY	Shipping address country	
CUST_TAXID	Tax ID for tax-exempt customers	
CUST_MBRTYPE	Membership type—used to identify special promotions and to determine product pricing according to membership level; for example, regular price, member price, or gold member price	

I-8b The PRODUCT Table

The PRODUCT table is the central entity in the database. The PRODUCT table contains the relevant product information about all of the products offered on the website. This table (see Table I.6) is related to the PRODTYPE, ORDLINE, and PROMOTION tables.

TABLE I.6

PRODUCT TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
PROD_ID	Product ID—automatically generated.	PK
PROD_NAME	Product short name—shown in promotions, invoices, and so on; for example, Verbatim CD-R.	
PROD_DESCR	Product description—a long description of the product; used in webpages for product information.	
PROD_OPTIONS	Product options; for example, color, size, and style. (There are many ways to handle sizes or colors for apparel and shoe industries; several of them require separate product entries or the creation of other tables in 1:M relationships.)	
PROD_IMAGE_1	URL of the product's image file; could occur many times (front view, back view, side view, top view).	
PROD_SKU	Stock number used by the vendor or supplier.	
PROD_PARTNUM	Part number from manufacturer; for example, VBTM 34563.	
VEND_ID	Vendor—the vendor ID for the product; for example, Global Suppliers.	FK
PTYPE_ID	Product type (category); for example, Storage.	FK
PROD_UNIT_SIZE	Unit size of the product: box, case, each.	
PROD_UNIT_QTY	Unit quantity in unit size: 12, 6, 1.	
PROD_QOH	Quantity on hand in the warehouse per each product.	
PROD_QORDER	Quantity on order—items that have been ordered but not yet shipped. To determine if an item is in stock, subtract the quantity on order from the quantity on hand.	
PROD_REORD_LEVEL	Reorder level—When the quantity on hand is equal to this amount, the product is reordered.	
PROD_REORD_QTY	How much to reorder from the vendor.	
PROD_REORD_DATE	Estimated date the order will arrive from the vendor.	
PROD_PRICE	Regular price per unit quantity (each); for example, \$1.05 per CD-R.	
PROD_MSRP	Manufacturer's suggested retail price—to show savings.	
PROD_PRICE_D1	Price discount 1—for members or order quantity level; for example, 3%.	
PROD_PRICE_D2	Price discount 2—for gold members or order quantity level; for example, 6%.	
PROD_TAX	Yes or No—Is the product taxable?	
PROD_ALTER_1	Alternative product if not in stock. Could occur many times. This is a foreign key to the same product table. Again, this could be implemented by creating another separate table in a 1:M relationship.	FK
PROD_PROMO	Yes/No. Product participates in promotions? Default Yes.	
PROD_WEIGHT	Weight of product, used for shipping purposes.	
PROD_DIMEN	Product dimensions, used for shipping purposes.	
PROD_NOTES	Notes about the product, shipping, handling instructions, and so on.	
PROD_ACTIVE	Yes/No. If not active, the product is not available to customers. Useful to recall products or to stop sales of a given product.	

Generally, there is one row for each product. The exception is those products that come in various sizes, colors, or styles, such as shoes and shirts. In those cases, there are three options, as follows:

- Enter the product's size, color, and style as additional attributes in the order.
- Create unique product entries for each product size, color, and style combination.
- Create a new product option (PRODOPT) table in a 1:M relationship with the PRODUCT table. This table will have one record for each combination of color, size, and style for a given product.

I-8c The PRODTYPE Table

This table describes the different product categories. The categories could be limited to just one level or could be multiple levels. In this example, two levels are used. This will permit the use of categories such as “printer”; within that category, subcategories such as “laser” or “inkjet” could be referenced. (See Table I.7.)

TABLE I.7		
PRODTYPE TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
PTYPE_ID	Product Type ID—automatically generated	PK
PTYPE_NAME	Product Type Name—“Inkjet Printer”	
PTYPE_PARENT	Product Type Parent—“Printer”	FK

I-8d The ORDER Table

This table contains all of the customer orders. After the credit card company approves the transaction, the order is added to the ORDER table. If the credit card is rejected (invalid number, expired, or stolen), the order is not added. There will be one ORDER row for each new customer order, regardless of the number of products ordered. If a registered customer places an order, the credit card and shipping information could be automatically entered in the ORDER table. The ORDER table is in a 1:M relationship with ORDLINE table. (See Table I.8.)

TABLE I.8		
ORDER TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
ORD_ID	Order ID—automatically generated.	PK
ORD_DATE	Date the order was added.	
CUST_ID	Customer ID (optional)—some customers will not register. If this were a registered customer, the CUS_ID would be automatically added by the web system.	FK
PMT_ID	Payment type ID—selected by the customer.	FK
ORD_CCNAME	Name as it appears on credit card—copied from CUSTOMER data; manually entered by an unregistered customer or by electronic wallet software.	
ORD_CCNUM	Credit card number (encrypted field)—copied from CUSTOMER data; manually entered by an unregistered customer or by electronic wallet software.	
ORD_CCEXDATE	Credit card expiration date in mm/yy format—copied from CUSTOMER data; manually entered by an unregistered customer or by electronic wallet software.	
SHIP_ID	Selected shipping type—automatically or manually entered; used when only one company or shipment is used to fulfill the order.	FK
ORD_SHIPADDR1	Shipping address line 1—automatically or manually entered.	
ORD_SHIPADDR2	Shipping address line 2—automatically or manually entered.	
ORD_SHIPCITY	Shipping address city—automatically or manually entered.	
ORD_SHIPSTATE	Shipping address state—automatically or manually entered.	FK

TABLE I.8

ORDER TABLE (CONTINUED)

ATTRIBUTE NAME	DESCRIPTION	PK/FK
ORD_SHIPZIP	Shipping address zip—automatically or manually entered.	
ORD_SHIPCTRY	Shipping address country—automatically or manually entered.	
ORD_SHIPDATE	Date the order shipped if complete shipment. If partial shipment, see ORDLINE for shipment dates for each product line.	
ORD_SHIPCOST	Total shipment cost—estimated shipment cost for order. This is the result of applying a given shipment cost formula according to the shipment method.	
ORD_PROD COST	Total product cost—the sum of all product prices * quantity ordered.	
ORD_TAXCOST	Total cost of sales tax—computed by adding the taxes for each individual product ORDLINE table.	
PROM_ID	Promotion ID applied to order (optional).	
ORD_TOTCOST	Total cost of order: PRODCOST + SHIPCOST + TAXCOST – PRO_AMT (from promotion table).	
ORD_TRXNUM	Transaction confirmation number from credit card company.	
ORD_STATUS	Status of the order: Open, Shipped, or Paid.	

I-8e The ORDLINE Table

This table contains one or more products related to each order. Each ORDLINE row is related to one PRODUCT row and to one ORDER row. The ORDLINE contains the quantity and price for each product ordered. The ORDLINE table gets the PROD_ID and ORL_QTY from the SHOPCART table. (See Table I.9.)

TABLE I.9

ORDLINE TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
ORL_ID	Order line ID—automatically generated.	PK
ORD_ID	Order ID from ORDER table.	FK
PROD_ID	Product ID.	FK
ORL_QTY	Quantity ordered.	
ORL_PRICE	Product price—after all promotions and discounts.	
ORL_TAX	Percentage tax rate applied to this product. Some products or customers may be tax-exempt. If the product/customer is taxable, the tax rate is obtained according to the STATE in the shipping address.	
SHIP_ID	Shipping company and type used to ship this product—for cases in which partial shipment is required.	FK
ORL_SHIPDATE	Date this product shipped.	

I-8f The SHOPCART Table

The SHOPCART table is a special table used by the website to store the products temporarily during the customer's shopping activities. To understand how the SHOPCART table works, you need to understand the online ordering process.

- When a customer first visits the website, (s)he may or may not log in. If (s)he logs in, the web server keeps his/her customer ID (CUST_ID) in memory.
- The customer browses the product catalog. If the customer is registered, (s)he sees the member prices; otherwise, (s)he sees regular prices (PROD_PRICE minus the respective discount percentage, PROD_PRICE_D1 or PROD_PRICE_D2).
- A shopping cart is automatically assigned to the user the first time (s)he orders a product by clicking on the “Add to Shopping Cart” or the “Order Now” button. A unique shopping cart ID is negotiated between the client’s browser and the merchant’s web server through use of a secure session. This ID lasts only until the customer successfully checks out, cancels the order, exits the website, or closes the browser.
- The shopping cart stores the PROD_ID and the quantity for each product selected by the customer.
- When the customer clicks the “Check Out” button, an Order confirmation screen is shown. This screen shows all of the product details for the product(s) placed in the shopping cart.
- When the customer accepts the order, (s)he is shown another screen in which to enter the shipping and payment information. The customer then confirms the order.
- After the customer has confirmed the order, the web server requests a transaction confirmation from the credit card company. The completion of this process may take from 10 to 60 seconds.
- Once the confirmation has been received, the ORDER data and the ORDLINE data are saved.
- The SHOPCART data are deleted.

The SHOPCART structure is shown in Table I.10.

TABLE I.10		
SHOPCART TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
CART_ID	Shopping cart unique ID—automatically generated.	PK
CART_PROD_ID	Product ID—a copy of the PROD_ID value. Because the SHOPCART table has the potential of becoming a high-traffic table with many add and delete operations, you do not want to relate it to the PRODUCT table for performance reasons. Remember, these values will be automatically copied to the ORDLINE table when the customer transaction is processed. However, a relationship could be established if so desired.	
CART_QTY	Quantity ordered.	

I-8g The PMTTYPE Table

This table contains one row for each payment method accepted by the merchant. (See Table I.11.)

TABLE I.11

PMTTYPE TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
PMT_ID	Payment type ID—automatically generated.	PK
PMT_NAME	Name: Visa, MasterCard, American Excess, Net30.	
PMT_MCHNT_ID	Merchant ID—used by payment processing systems; given to the merchant when it registers with a credit card company.	
PMT_NOTES	Additional notes.	

I-8h The SHIPTYPE Table

This table contains one row for each shipping method supported by the merchant. (See Table I.12.)

TABLE I.12

SHIPTYPE TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
SHIP_ID	Shipping type ID—automatically generated.	PK
SHIP_NAME	Name: UPS Next Day, UPS Three Days, FedEx Overnight, and so on.	
SHIP_COST	Shipping cost per weight unit—is dependent on the formula used by the shipping company. Most are based on the shipping zip code and the size and weight of the products being shipped. Therefore, it's very likely that you are going to need additional attributes in this table as you develop the design.	
SHIP_NOTES	Additional shipping notes.	

I-8i The TAXRATE Table

This table contains the different sales tax rates used in each state. Note that the sales tax is not applied to every order, only to orders in those states in which the merchant is required by the state to collect taxes on products sold in the state. How is the sales tax requirement determined? Federal and state regulations determine the requirement. Normally, the sales tax determination could be based on the shipping address. However, the customer's billing address or the credit card billing address may also be used for this purpose. This table is related to the STATE table. Also, tax-exempt institutions are not charged tax. (See Table I.13.)

TABLE I.13

TAXRATE TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
STATE_ID	State ID from the STATE table—required.	PK, FK
TAX_RATE	Percent sales tax rate applied—required.	
TAX_NOTES	Additional notes, such as reason for the tax charge.	

I-8j The STATE Table

This table contains one entry for each state or country. This table is related to the TAX-RATE table. The table may contain modified entries for countries that use postal regions or other identifiers. This table can also contain a COUNTRY field for businesses that have multinational offices. (See Table I.14.)

TABLE I.14		
STATE TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
STATE_ID	State ID—automatically generated.	PK
STATE_NAME	Name of the state—required.	

I-8k The PROMOTION Table

This table is used to represent special sales promotions. It contains one entry for each sale or promotion offered by the merchant. All promotions have a start and end date. Some promotions apply to one product line or to a specific product. Some promotions offer a percent discount; other promotions, such as vouchers, have a specific face amount. You could combine the attributes shown in Table I.15 in many ways to represent different promotions.

TABLE I.15		
PROMOTION TABLE		
ATTRIBUTE NAME	DESCRIPTION	PK/FK
PROMO_ID	Promotion ID—automatically generated.	PK
PROMO_NAME	Name of the promotion: Summer sale, Christmas sale, Voucher.	
PROMO_DATE	Date the promotion was introduced.	
PROMO_BEGDATE	Date promotion begins.	
PROD_ENDDATE	Date promotion ends.	
PTYPE_ID	Product type ID—optional. Type of product(s) affected by the promotion.	FK
PROD_ID	Product(s) affected by the promotion—optional.	FK
PROMO_MINQTY	Minimum purchase quantity required for promotion—optional.	
PROMO_MAXQTY	Maximum purchase quantity to which the promotion applies.	
PROMO_MINPUR	Minimum total purchase cost required for promotion—optional.	
PROMO_PCTDISC	Percent discount of promotion—optional.	
PROMO_DOLLAR	Dollar amount of promotion—optional.	
PROMO_CEILING	Maximum value of promotion (if percentage)—optional.	

I-8l The PRICEWATCH Table

Many e-commerce websites offer a “pricewatch” service. This service sends an email to a customer when the price of a product is below or equal to a price that was preselected by the customer. The PRICEWATCH table implements this feature. (See Table I.16.) A variation of this table can also be used for reverse bids.

TABLE I.16

PRICEWATCH TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
PW_ID	Pricewatch ID—automatically generated.	PK
PW_DATE	Date and time when the row was inserted in the table.	
CUST_ID	Customer ID—optional; service is to be offered to all prospective visitors as well as registered customers.	FK
PW_CUST_NAME	Name of customer—required; manually entered or automatically copied from CUSTOMER data.	
PW_CUST_EMAIL	Customer email—required; email address to send email notification.	
PW_ENDDATE	Date the pricewatch stops—optional; customer has the option of entering this date.	
PROD_ID	The product for which the pricewatch is done—required.	FK
PW_LOWPRICE	The price at which the customer wants to be informed; if the product price is equal to or less than this value, the system will send an email to the customer.	

I-8m The PRODPRIICE Table

The PRODPRIICE table is used to manage multilevel pricing. Some e-commerce sites offer multiple prices depending on the order quantity. For example, if you purchase one to five (inclusive) pairs of shoes, the price per pair might be \$39.95. However, if you purchase six or more pairs, the price per pair might drop to \$35.95. This table is in a 1:M relationship with the PRODUCT table. (See Table I.17.) If multilevel pricing is used, the PROD_PRICE in the PRODUCT table is not used.

TABLE I.17

PRODPRIICE TABLE

ATTRIBUTE NAME	DESCRIPTION	PK/FK
PROD_ID	Product ID from the PRODUCT table.	PK, FK
PROD_QTYFROM	Product purchase quantity minimum value—required; for example, 1 or 6 or 11.	PK
PROD_QTYTO	Product purchase quantity maximum revalue—required; for example, 5 or 10 or 9999.	PK
PROD_PRICE	Price for the quantity range—required.	

Key Terms

asymmetric or public-key encryption, I-20	encryption, I-20	proxy server firewall, I-23
authentication, I-19	encryption key, I-20	public key, I-20
business to business (B2B), I-7	Extensible Markup Language (XML), I-4	resource security, I-22
business to consumer (B2C), I-7	firewall, I-23	Secure Electronic Transaction (SET), I-25
certification authority (CA), I-19	gateway server	Secure Hypertext Transfer Protocol (S-HTTP), I-22
Data Encryption Standard (DES), I-20	firewall, I-23	Secure Sockets Layer (SSL), I-21
denial-of-service, I-23	government to business (G2B), I-7	security, I-17
digital cash, I-24	government to consumer (G2C), I-7	state inspection firewall, I-23
digital certificate, I-19	hacker, I-23	symmetric or private-key encryption, I-20
digital signature, I-20	intrabusiness, I-7	Transport Layer Security (TLS), I-21
Domain Name Service (DNS), I-13	intranets, I-2	value chain, I-8
electronic commerce (e-commerce), I-2	packet filter firewall, I-23	virus, I-22
Electronic Data Interchange (EDI), I-3	Pretty Good Privacy (PGP), I-20	
	privacy, I-17	
	private key, I-20	

Review Questions

1. What does e-commerce mean, and how did it evolve?
2. Identify and briefly explain five advantages and five disadvantages of e-commerce.
3. Define and contrast B2B and B2C e-commerce styles.
4. Describe and give an example of each of the two principal B2B forms.
5. Describe e-commerce architecture, then briefly describe each of its components.
6. What types of services are provided by the bottom layer of the e-commerce architecture?
7. Name and explain the operation of the main building blocks of the Internet and its basic services.
8. What does business enabling do? What services layer does it provide? Give six examples of business-enabling services.
9. What is the definition of *security*? Explain why security is so important for e-commerce transactions.
10. Give an example of an e-commerce transaction scenario. What three things should security be concerned with in this e-commerce transaction?
11. You are hired as a resource security officer for an e-commerce company. Briefly discuss what technical issues you must address in your security plan.

Problems

1. Use the Internet at your university computer lab or home to research the scenarios described in Problems 1–10. Then work through the following problems:
 - b. What websites did you visit?
 - c. Classify each site (B2B, B2C, and so on).
 - d. What information did you collect? Was the information useful? Why or why not?
 - e. What decision(s) did you make based on the information you collected?
2. Research—and document—the purchase of a new car. Based on your research, explain why you plan to buy this car.
3. Research—and document—the purchase of a new house.
4. You are in the market for a new job. Search the web for your ideal job. Document your job search and your job selection.
5. You need to do your taxes. Download IRS form 1040 and look for online tax processing help, documenting your search.
6. Research the purchase of a 20-year level term life insurance policy and report your findings.
7. Research—and document—the purchase of a new computer.
8. Vacation time is almost here! Research—and document—the destination(s) and activities of next summer's vacation.
9. You have some money to invest. Research—and document—mutual funds information for investment purposes. Report your investment decision(s) based on the research you conduct.