23

Electronic Commerce and Security

Objectives

- To review the history of electronic commerce.
- To study popular e-business models, including those of Amazon, eBay, CyberCash and VeriSign.
- To understand the issues of billing, credit and cash transfers on the Internet.
- To understand Internet security technologies such as public-key/private-key cryptography, digital signatures and digital certificates.
- To understand the core technologies that underlie Internet Commerce.

O Gold! I still prefer thee unto paper,
Which makes bank credit like a bark of vapour.
Lord Byron

It is an immutable law in business that words are words, explanations are explanations, promises are promises—but only performance is reality.
Harold S. Green

My name is Sherlock Holmes. It is my business to know what other people don't know.
Sir Arthur Conan Doyle

When you stop talking, you've lost your customer.
Estée Lauder

So long as you are secure you will count many friends.
Ovid [Publius Ovidius Naso]

Outline

23.1 Introduction

In this chapter we introduce popular e-business models and the underlying technologies on which these models are based (such as database, Internet security and Web-based client/server computing). In the next several chapters, we build systems that employ several of these technologies. We will put additional historical and technical information about e-commerce on our Web site, **`http://www.deitel.com`**.

To conduct e-commerce, merchants need to organize an online catalog of products, take orders through their Web sites, accept payments in a secure environment, send merchandise to customers and manage customer data (such as customer profiles). They must also market their sites to potential customers. We present case studies of successful e-businesses and show the steps you can use to set up your own e-commerce Web sites by using popular approaches such as Yahoo! Store and Microsoft Site Server Commerce Edition.

Although the term e-commerce is fairly new, large corporations have been conducting e-commerce for decades, by networking systems together with those of business partners and clients. For example, the banking industry uses *Electronic Funds Transfer (EFT)* to transfer money between accounts. Many companies also use *Electronic Data Interchange (EDI),* in which business forms, such as purchase orders and invoices, are standardized so that companies can share information with customers, vendors and business partners electronically.

Until recently, e-commerce was feasible only for large companies. The Internet and the World Wide Web make it possible for even small businesses to compete with large companies. E-commerce allows companies to conduct business 24 hours a day, seven days a week, worldwide.

One problem with conducting business over the Web is that the Internet is an inherently insecure medium comprised of vast networks and millions of computers. It is important to secure the network transactions, to protect such private information as credit card numbers transferred between merchants and clients. We discuss several popular security protocols and demonstrate how such transactions as cash transfers and credit-card payments, are handled online.

The chapter includes an extensive Bibliography section listing many books and papers on e-commerce. We include a substantial collection of Internet and World Wide Web resources in Section 23.11.

23.2 Shopping-Cart Technology

One of the most common e-commerce models is the *shopping cart*. This order-processing technology allows customers to accumulate and store lists of items they wish to buy as they continue to shop. Supporting the shopping cart is the product catalog, which is hosted on the *merchant server* in the form of a *database*. The database is a collection of information. For example, a database for an online clothing retailer would typically include such product specifications as item description, size, availability, shipping information, stock levels and on-order information. Databases also store customer information, such as names, addresses, credit-card information and past purchases. Database programming is discussed in Chapter 25, and in additional case studies including Chapter 26, “Active Server Pages,” Chapter 27, “Perl/CGI Programming” and Chapter 29, “Java Servlets.”

23.2.1 Case Study: Amazon

Perhaps the most widely recognized example of an e-business that uses shopping cart technology is **`Amazon.com`** (Ha99) (Hi99). The company opened its “electronic doors” in 1994 and has rapidly grown to become one of the world's largest online retailers. Amazon offers millions of different products to more than 10 million customers.

In its first few years, **`Amazon.com`** served as a mail-order book retailer with a rather small inventory. **`Amazon.com`** has since expanded to include music, videos, DVDs, elec-

tronic cards, consumer electronics and toys. The online catalog allows you to navigate quickly among millions of product offerings. **Amazon.com** uses a sophisticated database on the server side that allows customers on the client side to search for millions of products in a variety of ways. This is an example of a *client/server application*.

The database that is used is a collection of product specifications, availability, shipping information, stock levels, on-order information and other data. Book titles, authors, prices, sales histories, publishers, reviews and in-depth descriptions are stored in the database. The database makes it possible to cross-reference products. For example, a novel may be listed under various categories, including fiction, best-sellers and recommended titles.

Amazon.com personalizes its site to service returning customers; this capability suggests that the database keeps a record of all previous transactions, including items purchased, shipping and credit-card information. Upon returning to the site, customers are greeted by name and a list of recommended titles is presented, based on the customer's previous purchases. The list of recommended titles suggests that Amazon searches the customer database for patterns and trends among its clientele. By monitoring such customer data, Amazon provides a service that would otherwise need to be handled by sales representatives. Amazon's computer system drives sales of additional items without human interaction.

Buying a product at Amazon is simple. You begin at the **Amazon.com** home page and decide the type of product you would like to purchase. For example, if you are looking for *C++ How to Program: Second Edition*, you can find the book by using the search box in the top-left corner of the home page. Select **Books** in the **Search Box**, then type the title of the book into the window. This takes you directly to the product page for the book. To purchase the item, select **Add to Shopping Cart** on the top right corner of the page. The shopping cart technology processes the information and displays a list of the products you have placed in the shopping cart. You then have the option to change the quantity of each item, remove an item from the shopping cart, check out or continue shopping.

When you are ready to place your order, you proceed to checkout. As a first-time visitor, you will be prompted to fill out a personal identification form including name, billing address, shipping address, shipping preference and credit-card information. You are also asked to enter a password that you will use to access your account data for all future transactions. Once you confirm your information, you proceed to place your order.

Customers returning to Amazon can use its *1-click*^{SM} *system*. This allows the customer to reuse previously entered payment and shipping information to place an order with just one click of the mouse. This is an excellent example of how an intelligently designed database application can make online business transactions faster and easier.

When your order is placed, Amazon sends a confirmation to you by email. A second email is sent to confirm when the order is shipped.

A database monitors the status of all shipments. You can track the status of your purchase until it leaves the **Amazon.com** shipping center by selecting the **Your Account** link at the bottom of the page and entering your password. This will bring you to an **Account Maintenance** page. You can cancel your order at any time before the product is shipped. Products are usually shipped within 24 hours.

Amazon.com operates on a secure server that protects your personal information. If you feel uncomfortable using your credit card on the Web, you can place your order through their Web site using the last five digits of your credit card, then you can call

Amazon's Customer Service Department to provide the remaining numbers to complete your order. But is using a telephone really any more secure than sending your information over the Web? Security is discussed in section 23.6.

In 1996, Amazon innovated a unique e-commerce marketing strategy to bring new customers to their Web site. Companies and individuals can create an income stream in exchange for posting Amazon links on their Web sites, thus sending their visitors to Amazon. This is known as the *Amazon.com Associates Program*. In industry, these programs are commonly called *affiliate programs*. Associates post links to **Amazon.com** from their Web sites. If a customer uses the link to click over to Amazon and then purchases a product, the associate receives a percentage of the sale as a referral fee. Higher referral fees may be paid for products sold through direct links to a specific item. **Amazon.com** sends weekly activity reports to associates, detailing click-throughs, sales and accrued referral fees.

This Associates Program is an example of how the Internet and the Web are profoundly changing the way business is done. Without the Internet and the Web, this type of program would not be feasible.

23.3 Online-Auction Case Study: eBay

I will buy with you, sell with you, talk with you, walk with you, and so following;...
William Shakespeare

Online auctions have become enormously successful on the Web. The leading company in this business is *eBay* (Pi99) (Hi99). At the time of publication, eBay was one of the most profitable e-businesses. The successful online auction house has its roots in a 50-year old novelty item—Pez® candy dispensers. Linda Omidyar, an avid collector of Pez® dispensers, came up with the idea of trading them over the Internet. When she expressed this idea to her boyfriend, Pierre Omidyar (now her husband), he was instantly struck with the soon-to-be-famous business concept. In 1995, the Omidyars created a company called AuctionWeb. The company was renamed eBay and it has become the premier online auction house (Fig. 23.1). The company posts as many as 2 million unique auctions and 250,000 new items each day.

The impact of eBay on e-business has been profound. The founders took a business model that was restrictive offline and brought it to the desktops of consumers worldwide. The business model is one of few that generates a profit on the World Wide Web. A recent article in *Business Week* (Hi99) states, "The bidding and close interaction between buyers and sellers promotes a sense of community—a near addiction that keeps them coming back." By implementing traditional marketing strategies and keeping the process simple, eBay has offered a clear alternative to storefront-style e-commerce.

On eBay, people can buy and sell just about anything. The company collects a submission fee plus a percentage of the sale amount. The final fee is multitiered. For example, if your product sells for $1500, then you would have a three-tiered final fee. As of this writing, you would be charged 5% on the first $25.00 of the selling price, 2.5% on the difference between $25 and $1000 and 1.25% on anything above $1000. Thus, if you were to sell a product for $1500, you would pay $31.86 in fees. The submission fee is based on the amount of exposure you want your item to receive. For instance, if you would like to be among the "featured auctions" in your specific product category, you can pay $14.95 for

the auction period. For $99.95, your item will be listed on the eBay home page under **Featured Items**. This listing will not appear every time you go to the home page, but it will be shown on the site periodically. Another means of getting people to notice your auction is to publish the product listing in a bold-face font. This option costs $2.00.

eBay uses a database to manage the millions of auctions that it offers. The database evolves dynamically as sellers and buyers enter personal identification and product information. When a seller enters a product to be auctioned, the seller provides a description of the product, keywords, initial price, date, and personal information. This data is used to produce the product listings that the buyer sees (Fig. 23.2).

The auction process begins when the seller posts a description of the item for sale and fills in the appropriate registration information. The seller must specify a minimum opening bid. If potential buyers feel this price is too high, the item may not get any bids. In many cases, a *reserve price* is set. A reserve price is the lowest price that the seller will accept. Sellers can set the reserve price higher than the minimum bid. However, if no bid meets the reserve price, the auction is unsuccessful. For instance, if a classic automobile is auctioned with a starting bid of $15,000 and a reserve price of $20,000 and the highest bid reaches only $17,500, the auction is unsuccessful and the product is not sold. Therefore, it is best to set the reserve price at the same price as the minimum starting bid. Sellers might set the opening bid lower than the reserve price to generate bidding activity.

Fig. 23.1 eBay home page. (Courtesy of eBay.)

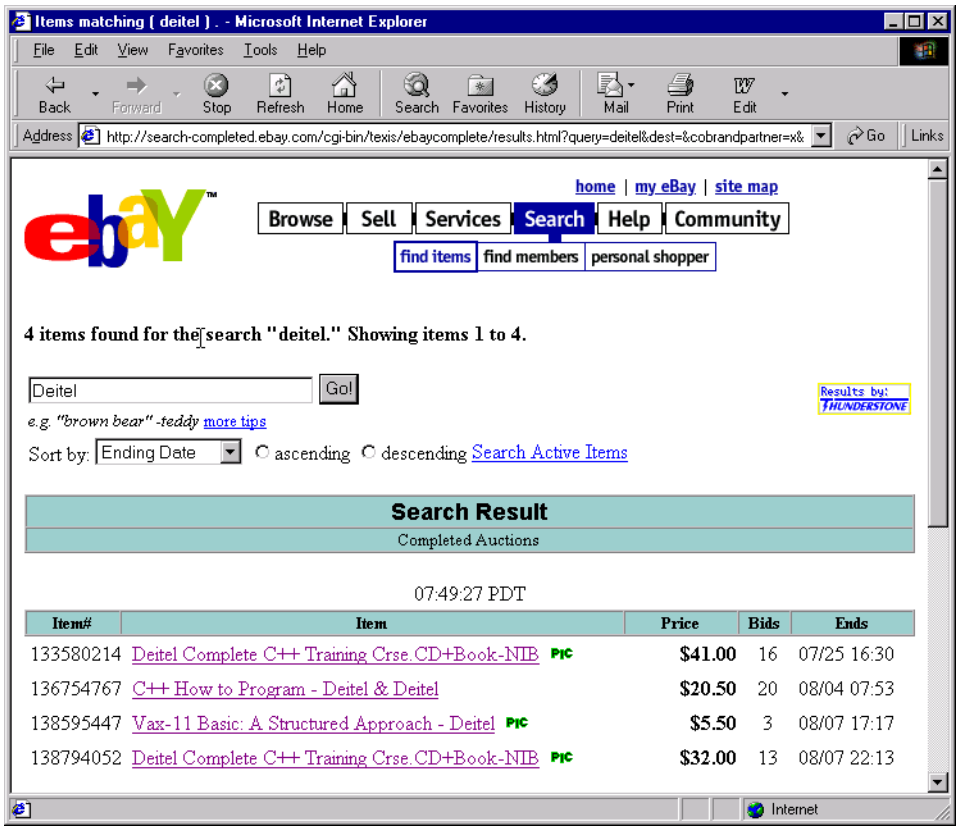

Fig. 23.2 Searching **http://www.ebay.com** for specific items up for auction. (Courtesy of eBay.)

If a successful bid is made, the seller and the buyer negotiate the shipping details, warranty and other particulars. eBay serves as a liaison between the parties—it is the interface through which sellers and buyers can conduct business. eBay does not maintain a costly physical inventory or deal with shipping, handling or other services that businesses such as Amazon and other retailers must provide.

eBay has spawned a number of new businesses that use the site as their means of selling products. These businesses depend on eBay to remain up and running continuously. To avoid down time, companies make investments in *high-availability computing* and *continuous-availability computing*. High-availability computing attempts to minimize down time; continuous-availability computing attempts to eliminate it completely. One key to such technologies is *fault-tolerant systems* that use *redundancy*. For example, every crucial piece of hardware—such as the processor, the disk and the communications channel—has one or more levels of backup, so, in a failure, the system simply shifts from a failed component to a backup component. The system keeps running while the failed component is fixed or replaced. The same is true of data. Companies cannot afford to lose their business data, so the data, too, is maintained redundantly.

Failure to keep businesses up and running can be costly, if not fatal. Companies such as Tandem and Stratus (and others) have based their businesses on continuous-availability and high-availability computing, respectively. For more information about these technologies, visit the Tandem Web site at **http://www.tandem.com** and the Stratus Web site at **http://www.stratus.com**.

There are several other online auction sites. A few of the largest auctions sites are Yahoo! Auctions at **http://auctions.yahoo.com**, Amazon Auctions at **http://www.amazon.com** and FairMarket, Inc. at **http://www.fairmarket.com**.

23.4 Online Trading

Another fast-growing area of e-commerce is online securities trading (Ho99) (We99). According to U.S. Bancorp Piper Jaffray, Company and Industry Sources (**http://www.piperjaffray.com/re/re_ne2.asp?id=188**), "online trading volumes accounted for 37 percent of all retail trades for the first half of 1999, up from 30 percent in the second half of 1998." The recent growth in online trading has put pressure on the major Wall Street firms to go online. Companies such as Charles Schwab, Merrill Lynch and many others have joined the online trading community.

Stock trades used to be handled only through brokers who were paid commissions for their services. Merrill Lynch, for example, has almost 15,000 brokers. As more people execute their trades on the Web without brokers, the number of brokers is likely to shrink dramatically. Online trading fees are nominal compared to traditional broker commissions.

For more information about e-commerce and online trading, check out the latest news reports and back issues of *Business Week* at **http://www.businessweek.com** and of *The Industry Standard* at **http://www.thestandard.com**.

23.4.1 Case Study: E*TRADE

One of the leaders in online trading is *E*TRADE* (Fig. 23.3). The company was founded in 1982 to offer online stock quotes to the nation's major investment firms. With the development of the Web, E*TRADE created a Web site (**http://www.etrade.com**) where individual investors could manage their own investments without the need for brokers.

Online trading is fast and cheap. Online trading companies such as E*TRADE and Ameritrade have made investing in stocks and options accessible to a larger audience.

At E*TRADE, you can buy, sell and research stocks, bonds and other securities. If you have little knowledge about buying and selling stocks, E*TRADE offers two games in which you use fake "game money" to carry out stock trades or stock and options trades. Each player is given $100,000 in virtual trading dollars to start. Game players have access to charts, graphs and recent news articles to help them choose their investments. There is no risk of losing real money, so the players can feel free to experiment with different trading strategies. Each trade takes approximately one minute to process. The goal of each game is, of course, to increase the value of your portfolio. The E*TRADE games are a friendly way for beginners to experiment with online trading. Players compete for real cash prizes. The two players with the highest-valued portfolios at the end of each trading game receive $1000 each. The trading games last one month. To play the E*TRADE games and to learn more about online trading, visit **http://www.etrade.com**. An exercise at the end of the chapter encourages the reader to play the E*TRADE game. If you win the prize, please let us know!

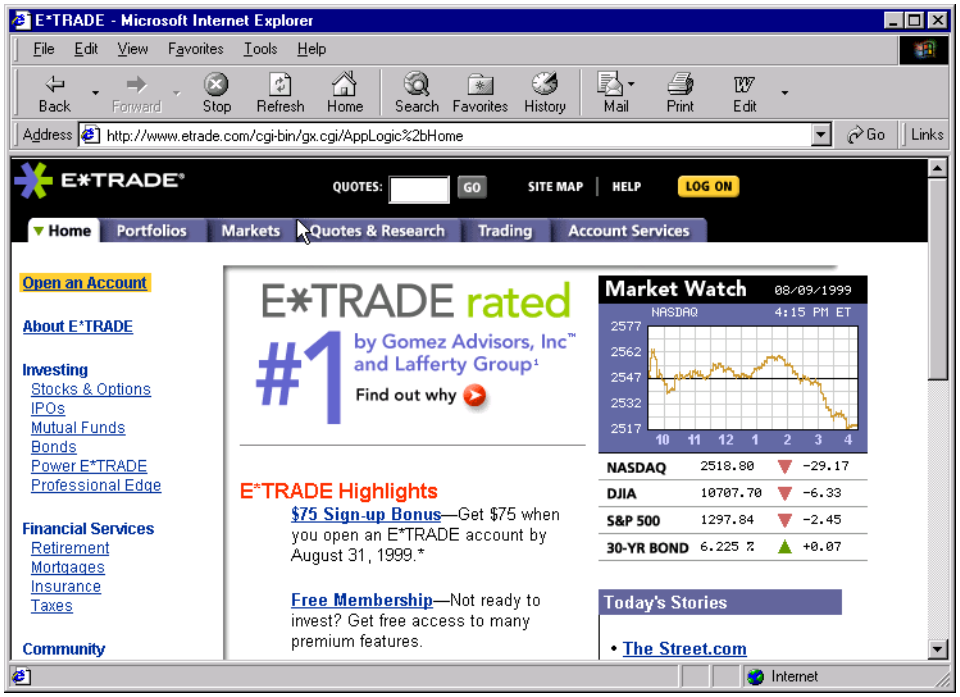

Fig. 23.3 E*TRADE[1] home page. (All images from **http://www.etrade.com** are copyright 1999 E*TRADE Securities, Inc. Used with permission. All rights reserved.)

23.5 Other E-Businesses

E-commerce is forcing traditional offline companies to transform into e-businesses or else they risk losing market share to competitors, including fast-moving Internet start-ups. One of the best e-business successes is *Dell Computer Corporation*. Dell took their thriving offline business and turned it into an e-business phenomenon, generating more than $30 million in sales through their Web site each day. Founded in 1984 as a mail-order catalog business, Dell's business model was to sell made-to-order computers directly to the customer. Their Web site is logically organized by customer category and easy to use. For more information about Dell, visit their Web site at **http://www.dell.com**.

Approximately two thirds of Dell's online sales are business-to-business transactions. Business-to-business e-commerce is growing exponentially. By one estimate, business-to-business transactions could reach $1 trillion by 2004. Manufacturers, service companies and wholesalers that sell their products to other businesses are finding tremendous success online. Established companies that delay shifting to e-commerce risk losing market share to fast-moving Internet start-up companies.

1. E*TRADE is a registered trademark of E*TRADE Securities, Inc. Other marks of E*TRADE that appear on its Web site are owned worldwide exclusively by E*TRADE Group, Inc. or its subsidiaries.

E-commerce is also creating opportunities for many new types of businesses. People are turning their hobbies into profitable businesses on the Web. There are companies, such as **ebates.com**, that do not even have a product. **ebates.com** is simply an affiliate of many online retailers. Here is how it works. **ebates.com** signs up with online merchants to be an affiliate, thus earning referral fees each time a customer clicks from **ebates.com** to the merchant's site and makes a purchase. Customers sign up to become members. Each member is given an **ebates.com** email address that they must use for purchases. When a customer follows a link from **ebates.com** to one of the affiliated merchant sites and makes a purchase, the merchant sends back an email confirming the amount of the purchase to the customer's **ebates.com** address. **ebates.com** uses the purchase information to update the customer's account with the amount of rebates owed. The company passes the referral fees it earns from its affiliates on to the individual consumer. **ebates.com** makes money by selling banner ads on their site. For more information, visit **http://www.ebates.com**.

The possibilities on the Web are vast. In the exercises at the end of this chapter, we encourage students to design your own e-business.

23.6 Security

Privacy issue: Would you want to transmit your credit-card number if you knew unauthorized parties might tap this information? *Integrity issue*: How can you determine whether information sent to you has been altered by a hacker? *Authentication issue*: How do you confirm that the company receiving your information is a reputable business? *Non-repudiation issue*: How do you legally prove that a message was sent? These questions address four of the fundamental requirements of a successful, secure transaction. In this section, we will discuss how these requirements are achieved by using various popular e-commerce security mechanisms.

Everyone using the Web for e-commerce needs to be concerned about the security of their personal information. There are several protocols that provide transaction security, such as *Secure Sockets Layer (SSL)* and *Secure Electronic Transfers™ (SET™)*. In the next several sections we will discuss these security protocols, plus *public-key cryptography*, *digital signatures* and *digital certificates*. We will also present case studies on companies such as VeriSign and CyberCash that employ these technologies to help e-businesses meet security challenges.

23.6.1 Public-Key Cryptography

The channels through which data passes over the Internet are not secure; therefore, any private information that is being passed must be protected (De90) (Di98) (Ko97). To secure information, data can be encrypted. *Cryptography* transforms data by using a *key* to make the data incomprehensible to all except its intended receivers. Unencrypted data is called *plaintext*; encrypted data is called *ciphertext*. Only the intended receivers should have the corresponding key to decrypt the ciphertext into plaintext.

In the past, organizations wishing to maintain a secure computing environment used *symmetric cryptography*, also known as *secret-key cryptography*, in which the same secret key is used both to encrypt and to decrypt a message. In this case, the sender encrypts a message using the secret key, then sends the encrypted message and the secret key to the

intended recipient. There are flaws in this system. First, the privacy and integrity of the message could be compromised if the key is intercepted as it is passed between the sender and the receiver over insecure channels. Also, since both parties in the transaction use the same key to encipher and decipher a message, you cannot authenticate which party created the message. Finally, a different key is required for each person to whom messages are to be sent, so organizations could have huge numbers of secret keys to maintain.

A much higher degree of security is needed to make electronic commerce feasible. Public-key cryptography, which is *asymmetric*, is a more secure method. It uses two related keys—a *public key* and a *private key*. The private key is kept secret by its owner. The public key is freely distributed. If the public key is used to encrypt a message, only the corresponding private key can decrypt it, and vice versa. Each party in a transaction has both a public and a private key. To transmit a message securely, the sender uses the receiver's public key to encrypt the message. The receiver decrypts the message using the receiver's unique private key. No one else knows the private key, so the message cannot be read by anyone other than the intended receiver; this ensures the privacy of the message.

A digital signature, the electronic equivalent of a written signature, was developed to be used in public-key cryptography, to solve the problems of authentication and integrity. Authentication provides the receiver with proof of the sender's identity. A digital signature is legal proof of the sender's identity, and, like a written signature, it is difficult to forge. To create a digital signature, the sender takes the original plaintext message and runs it through a *hash function*, which is a mathematical calculation, to give the message a *hash value*. The hash function could be as simple as adding up all the 1s in a message, though it is usually more complex. The hash value is also known as a *message digest*. The chance that two different messages will have the same message digest is statistically insignificant. The sender uses its private key to encrypt the message digest, thus creating the digital signature and authenticating the sender, because only the owner of that private key could encrypt it. The original message encrypted with the receiver's public key, the digital signature and the hash function are sent to the receiver. The receiver uses the sender's public key to decipher the digital signature, and reveal the message digest. The receiver then uses its own private key to decipher the original message. Finally, the receiver applies the hash function to the original message. If the hash value of the original message matches the message digest included in the signature, then the message has integrity—it has not been altered in transmission.

One problem with public-key cryptography is that anyone with a set of keys could potentially pose as the sender. For example, say a customer wants to place an order with an online merchant. How does the customer know that the Web site being accessed, indeed belongs to that merchant and not to a third party that posted a site and is masquerading as that merchant to steal credit card information? *Public Key Infrastructure (PKI)* adds *digital certificates* to this process for authentication. A digital certificate is issued by a *certification authority (CA)* and signed using the CA's private key. A digital certificate includes the name of the subject (the company or individual being certified), the subject's public key, a serial number, an expiration date, the authorization of the trusted certification authority and any other relevant information (Fig. 23.4). A CA is a financial institution or other third party, such as *VeriSign*, that issues certificates to its customers to authenticate the subject's identity and bind the identity to a public key. The CA takes responsibility for authentication, so it must carefully check information before issuing a digital certificate. Digital cer-

tificates are publicly available and are held by the certification authority in certificate repositories.

VeriSign, Inc. is one of the leaders in online security. VeriSign develops PKI and digital certificate solutions. For more information about VeriSign, visit **`http://www.verisign.com`**. For a listing of other digital certificate vendors, please see the Internet and World Wide Web Resources section at the end of the chapter.

Many people still perceive e-commerce to be insecure. In fact, transactions using PKI and digital certificates are more secure than the exchanging of private information over phone lines, through the mail or even paying by credit card. The key algorithms used in most transactions are nearly impossible to compromise. By some estimates, the key algorithms used in public-key cryptography are so secure that even millions of computers working in parallel could not possibly break the code in a century.

RSA Security Inc. is the leader in online security. RSA was founded in 1982 by three MIT professors, Rivest, Shamir and Adleman, the inventors of the *RSA Public Key Cryptosystem*. Their encryption and authentication technologies are used by most Fortune 100 companies and leading e-commerce businesses. With the emergence of the Internet and the World Wide Web, their work related to security has become even more significant and plays a crucial role in e-commerce transactions. Their encryption products are built into more than 450 million copies of the most popular Internet applications, including Web browsers, commerce servers and email systems. Most secure e-commerce transactions and communication on the Internet use RSA products. For more information about RSA, cryptography and security, visit **`http://www.rsasecurity.com`**.

Fig. 23.4 VeriSign digital certificate. (Courtesy of VeriSign.)

23.6.2 Secure Sockets Layer (SSL)

The SSL protocol, developed by Netscape Communications, is a non-proprietary protocol commonly used to secure communication on the Internet and the Web (Ab99) (Ws99). SSL is built into many Web browsers, including Netscape Communicator, Microsoft Internet Explorer and numerous other software products. It operates at the network level, between the Internet's TCP/IP communications protocol and the application software.

In a standard correspondence over the Internet, a sender's message is passed to a socket that interprets the message to TCP/IP. TCP/IP (Transmission Control Protocol/Internet Protocol) is the standard set of protocols used for communication between computers on the Internet. Most Internet transmissions are sent as a (possibly large) set of individual message pieces, called *packets*. At the sending side, the packets of one (possibly long) message are numbered sequentially, and error-control information is attached. TCP routes packets to avoid traffic jams, so each packet might travel a different route over the Internet. At the receiving end, TCP makes sure that all of the packets have arrived, puts them in sequential order and determines if the packets have arrived with integrity and without alterations. If the packets have been altered, TCP/IP will re-transmit the packets. TCP/IP then passes the message to the socket at the receiver end. The socket translates the message back into a form that can be read by the receiver's application. In a transaction using SSL, the sockets are secured using public-key cryptography.

SSL uses public-key technology and digital certificates to authenticate the server in a transaction and to protect information as it passes from one party to another over the Internet. SSL transactions do not require client authentication. To begin, a client sends a message to a server. The server responds and sends its digital certificate for authentication. The client and server negotiate *session keys* to continue the transaction. Session keys are symmetric secret keys that are used for the duration of that particular transaction. Once the keys have been established, the communication proceeds between the client and the server by using the session keys and digital certificates.

Although SSL protects information as it is passed over the Internet, it does not protect private information, such as credit-card numbers, stored on the merchant's server. When a merchant receives credit-card information with an order, the information is often decrypted and stored on the merchant's server until the order is placed. If the server is not secure and the data is not encrypted, an unauthorized party could access the information.

For more information about SSL, check out the Netscape SSL tutorial at **`http://developer.netscape.com/tech/security/ssl/protocol.html`** and the Netscape Security Center Web site at **`http://www.netscape.com/security/index.html`**.

23.6.3 Secure Electronic Transaction™ (SET™)

Credit is a system whereby a person who can't pay gets another person who can't pay to guarantee that he can pay.
Charles Dickens

The Secure Electronic Transaction (SET) protocol, developed by Visa International and MasterCard, was designed specifically to protect e-commerce payment transactions (Ma98) (Me97) (Mk98). SET uses digital certificates to authenticate each party in an e-

commerce transaction, including the customer, the merchant and the merchant's bank. Public-key cryptography is used to secure information as it is passed over the Web.

Merchants must have a digital certificate and special SET software to process transactions. Customers must have a digital certificate and *digital wallet* software. A digital wallet is similar to a real wallet. It stores credit (or debit) card information for multiple cards, as well as a digital certificate verifying the cardholders' identity. Digital wallets add convenience to online shopping; customers no longer need to re-enter their credit card information at each different site (An99).

Here is how an e-commerce transaction using SET works. When a customer is ready to place an order, the merchant's SET software sends the order information and the merchant's digital certificate to the customer's digital wallet, thus activating the wallet software. The customer selects the card for the transaction. The credit card and order information are encrypted by using the merchant's bank's public key and sent to the merchant along with the customer's digital certificate. The merchant then forwards the information to the merchant's bank to process the payment. Only the bank can decrypt the message. The merchant's bank then sends the amount of the purchase and its own digital certificate to the customer's bank to get approval to process the transaction. If the customer's charge is approved, the customer's bank sends an authorization back to the merchant's bank. The merchant's bank then sends a credit-card authorization to the merchant. Finally, the merchant sends a confirmation of the order to the customer.

In the SET protocol, the merchant never actually sees the client's proprietary information. Therefore, the client's credit-card number is not stored on the merchant's server, so this method reduces the risk of fraud.

Although SET is designed specifically for e-commerce transactions and provides a high level of security, it has yet to become the standard protocol used in the majority of transactions. Part of the problem is that SET requires special software on both the client and server side; that requirement creates additional costs. Also, the transactions are more time-consuming than transactions using other protocols, such as SSL.

SET Secure Electronic Transaction LLC is an organization formed by Visa and MasterCard to manage and promote the SET protocol. For more information about SET, visit these organizations online at **`http://www.setco.org`**, **`http://www.visa.com`** and **`http://www.mastercard.com`**. Visa has a demonstration of an online shopping transaction using SET at **`http://www.visa.com/nt/ecomm/security/main.html`**. GlobeSet, a digital-wallet software vendor, also offers a tutorial of a SET transaction that uses a digital wallet at **`http://www.globeset.com/`**.

23.6.4 Case Study: Microsoft Authenticode

How do you know the software you ordered online is safe and has not been altered? How can you be sure that you are not downloading a computer virus that could wipe out your computer? Do you trust the source of the software? With the emergence of e-commerce, software companies are offering their products online so that customers can download directly onto their computers. As a result, security is required to ensure that the downloaded software is trustworthy and has not been altered. *Microsoft Authenticode*, combined with VeriSign digital certificates (or *digital IDs*), authenticates the publisher of the software and detects whether the software has been altered (Mi96). Authenticode is a security feature built into Microsoft Internet Explorer.

Software publishers must obtain a digital certificate specifically designed for the purpose of publishing software. Certificates may be obtained through certificate authorities, such as VeriSign, as we described in section 23.6.1. To obtain a certificate, software publishers must provide their public key and identifying information and sign an agreement that they will not distribute harmful software. This gives customers legal recourse if any downloaded software from certified publishers causes harm.

Microsoft Authenticode uses digital-signature technology to sign software. Digital signatures are described in section 23.6.1. The signed software and the publisher's digital certificate provide proof that the software is safe and has not been altered.

When a customer attempts to download a file, a dialog box appears on the screen displaying the digital certificate and the name of the certificate authority. Links to the publisher and the certificate authority are provided, so that customers can learn more about each party before they agree to download the software. If Microsoft Authenticode determines that the software has been compromised, the transaction is terminated.

To learn more about Microsoft Authenticode and to read the white paper, visit **`http://msdn.microsoft.com/workshop/security/authcode/authwp.asp`**.

23.6.5 Online Payments; Case Study: CyberCash™

Ah, take the Cash, and let the Credit go,
Nor heed the rumble of a distant Drum!
Edward FitzGerald

No man's credit is as good as his money.
Edgar Watson Howe

To conduct e-commerce, businesses need to be able to accept payments through their Web sites a process that requires a high level of security and service. *CyberCash* is one of the leaders in secure-payment-processing solutions for e-businesses of all sizes (Fig. 23.5) (In99). In this section, we will outline a few of the payment-processing products.

CyberCash *CashRegister* enables e-businesses to accept credit-card payments. Businesses must first establish a *merchant account* with a financial institution. Once an account is in place, merchants can accept payments through their Web sites and transfer the funds directly into their merchant accounts. One of the benefits of using CashRegister is that CyberCash maintains all of the secure servers, so merchants are not responsible for storing customers' private credit-card information on their own servers. CashRegister uses the SSL and SET protocols to secure online transactions.

Digital wallets are making online shopping even more convenient for customers. There is no need to keep reentering your credit-card information at each site. *Instabuy*™ is the CyberCash digital wallet service. Customers can sign up for Instabuy and use their wallet at hundreds of participating merchant sites worldwide. Customers just click on the Instabuy logo at participating merchant sites and their order is placed. For more information about Instabuy, visit **`http://www.instabuy.com`**.

Throughout the chapter, we have commented on how e-commerce is changing the way business is done. Advancements in online payment systems are now making it possible for companies to send bills and collect payments over the Internet. CyberCash offers the

PayNow™ service, which gives merchants the ability to bill and collect payments online. Online billing can reduce costs for merchants by automating the billing process and eliminating the cost of postage. For more information about CyberCash products and services, visit **`http://www.cybercash.com`**.

23.7 XML and E-Commerce

We have studied HTML, which is a markup language used for publishing information on the Web. Content developers use a fixed set of HTML tags to describe the elements of online documents, such as headers, paragraphs, bold-face text, italicized text, etc.

XML (*Extensible Markup Language*) is not actually a markup language like HTML. Rather, it allows you to create customized tags unique to specific applications, so that you are not limited to using HTML's fixed set of publishing-industry-specific tags. For example, developers can make industry-specific (or even organization-specific) tags to categorize data more effectively within their communities. Some industries have already developed standardized XML tags for publishing documents online. For example, MathML (Math Markup Language) is a standardized XML-based language for marking up mathematical formulas in documents, and ChemML (Chemistry Markup Language) is a standardized XML-based language for marking up the molecular structure of chemicals.

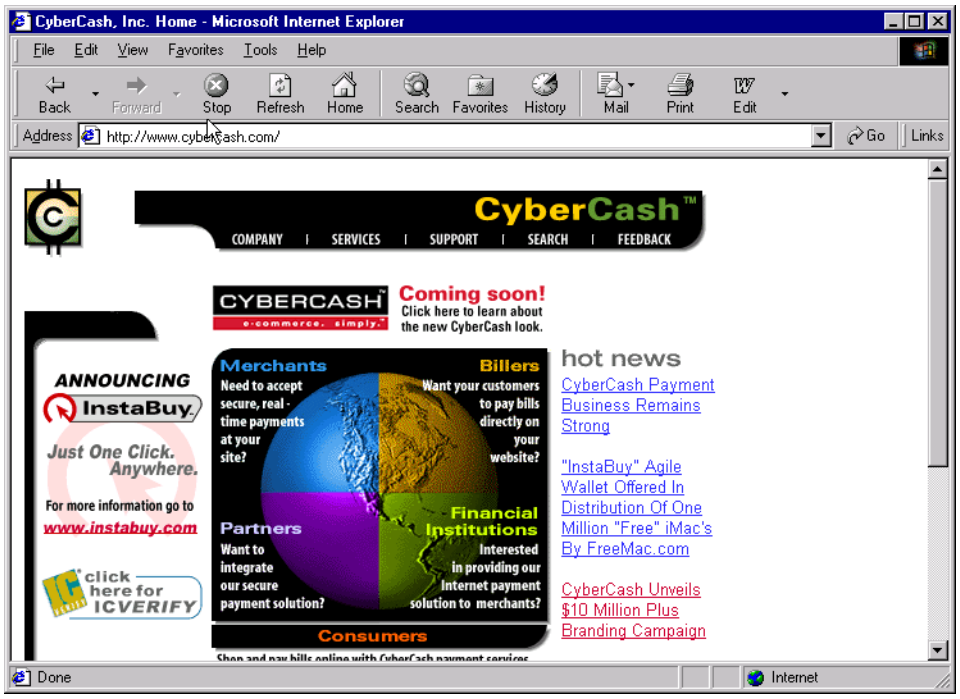

Fig. 23.5 CyberCash home page. (Copyright 1996-1999 CyberCash, Inc. Used with permission.)

The use of XML is growing quickly and is changing the way business is conducted over the Internet (Lv99) (Mr98) (Ud99) (Ba98). The ability to customize tags will allow business data to be used worldwide. For example, businesses could create XML tags specifically for invoices, electronic funds transfers or purchase orders. They could standardize tags for prices, the parties in the transaction, etc. XML will be used to define business transactions. In order to be used effectively, an industry's customized tags must be standardized across that industry.

Once tags are standardized, the browser must be able to recognize them. Either the tags can be built into the browser, or plug-ins could be downloaded. A customized XML tag could actually be used as a command for a browser to download the plug-in for the corresponding set of standardized tags.

The impact of XML on e-commerce is profound. XML gives online merchants a better means of tracking product information. By using standardized tags for data, bots and search engines are able to find products faster online.

Many industries are using XML to improve EDI. The health care industry, for example, uses XML to share patient information (even CAT scans) among health care-oriented applications. This helps doctors access information and make decisions faster, which can improve the care patients receive (Kw98).

The *Health Level Seven (HL7)* organization's *Application Protocol for Electronic Data Exchange in Healthcare Environments* uses XML. This standard enables health care-oriented applications to exchange data electronically by specifying the layout and order of information. Patient names, addresses, insurance providers, etc. are tagged so that they can be shared electronically among applications. Once a patient's identification information is entered, that information can be shared over the hospital's intranet with the labs and the accounting department, for example, thus eliminating the need to re-enter the same data. HL7 is a non-profit, ANSI (American National Standards Institute)-accredited Standards Developing Organization that focuses on clinical and administrative data. For more information on HL7, visit their Web site at **`http://www.HL7.org`**. The ANSI Web site is **`http://www.ansi.org`**.

The *XML Metadata Interchange Format (XMI)* is a standard that combines XML with UML (Unified Modeling Language). Software developers use UML to design object-oriented systems. XMI allows developers using object technology to tag design data. Using standardized XMI tags allows developers to exchange design data over the Internet and interact with multiple vendors using a variety of tools and applications. Thus, with XMI people worldwide can collaborate on the designs of object-oriented software systems. For more information about XMI, visit **`http://www-4.ibm.com/software/ad/features/xmi.html`**.

Software companies sell their products over the Web. The *Open Software Description Format* is an XML specification that enables the distribution of software over the Internet. Using OSD, developers tag the structure of an application and its files. The tags describe each component of the software and its relationship to the other components in the application. The ability to download software from the Web means vendors can save the time, resources and money previously required for creating boxed products and shipping them to customers.

Chapter 28 is a detailed introduction to XML. We have included many live-code examples to show you how XML is used to create customized markup languages.

23.8 Data Mining, Bots and Intelligent Agents

Searching through large amounts of data can be like searching for a needle in a haystack. *Data mining*, *shopping bots* and *intelligent agents* are tools that can help businesses and individuals dig through enormous amounts of information (Db95) (Id99) (Pa99). In this section, we describe how e-businesses and consumers benefit from these technologies.

Just as in mining for gold or rare gems, in data mining massive amounts of information are sifted through to find the few worthwhile "nuggets" or "gems" of information. Collected data is stored in a *data warehouse*. Information in a data warehouse may include sales data, customer profiles, demographic data or any other information a company needs to maintain.

Businesses are "data rich"; however, they often do not use their data to their best advantage. It would be extremely costly and time consuming to go through large amounts of data manually. Data mining uses a series of searches to find specific patterns and relationships within data. Businesses can use this information to analyze trends within their company or in the marketplace, information that in turn helps them market their products and run their businesses more effectively.

Data mining is expensive. The tools can cost millions of dollars. Despite the cost, data mining can often improve the bottom-line profitability of business. Bots make data mining even more effective. A bot allows you to make specific queries, thus eliminating the need for multiple searches. For example, individuals can use shopping bots to find specific products available through online retailers.

Intelligent agents are having a profound impact on e-commerce. Intelligent agents are smart bots that learn about customers over time by recording their preferences, actions and buying patterns. Intelligent agents enable e-businesses to offer a level of customer service similar to person-to-person interaction. For example, suppose a customer in Boston, Massachusetts is shopping for a new CD player and is looking at 5-disk CD players. In the past, this customer has bought a receiver and a dual-cassette player, both top-of-the-line. The customer has also bought a large number of CD-ROMs, including three different Rolling Stones CDs. An intelligent agent could recommend, based on the customer's buying history, a variety of top-of-the-line 5-disk CD players. It could also suggest a 100-disk CD changer that has just gone on sale and is now the same price as the 5-disk CD changer. Since the customer seems to be a Rolling Stones fan and the Stones have just announced they are playing in Boston in a few months, the intelligent agent could inform the customer and provide an option for buying tickets to the show.

Data mining provides a company with the information it needs to operate more effectively. Intelligent agents and bots allow the company to add a higher level of service and personalization to a Web site. These technologies can strongly differentiate a company from its competitors.

The following sections present case studies on some well known e-businesses using these technologies to change the way business is done. For more information on data mining, visit **`http://www.datamining.com/`**.

23.8.1 Case Study: `Priceline.com`

Employing the *name-your-price business model* has catapulted ***`Priceline.com`*** into the spotlight (Fig. 23.6). You can name-your-price by placing bids for airline tickets, hotel

rooms, rental cars and mortgages. Their patented business mechanism, called the *demand-collection system*, is a shopping bot that takes customers' bids to the Priceline partners to see whether any of them will accept the price for the requested product or service.

The buying process is easy at **Priceline.com**. Let us use purchasing an airline ticket as an example. When looking for a domestic flight, you first enter your departure location, destination, bid price and the number of tickets you would like to purchase (Fig. 23.7). You then select the travel dates and airports in or near the departure or arrival cities (Fig. 23.8). The more flexible you are with your travel arrangements, the greater is your chance of winning a bid.

The **Priceline.com** bot presents the bid to the airlines and attempts to negotiate a fare below the customer's bid price. If the bid is accepted, **Priceline.com** retains the difference between the customer's bid and the actual fare price. The markup percentage varies with the price that is accepted by the airline. For domestic flights, the whole process takes one hour from the time the bid is placed.

Priceline.com is another excellent example of how the Internet and Web are profoundly changing the way business is conducted. In the case of airlines, hundreds of thousands of airline seats go empty each day. **Priceline.com** helps airlines sell these seats. **Priceline.com** sells the excess inventory at a discount, the airlines realize increased revenue and passengers save money.

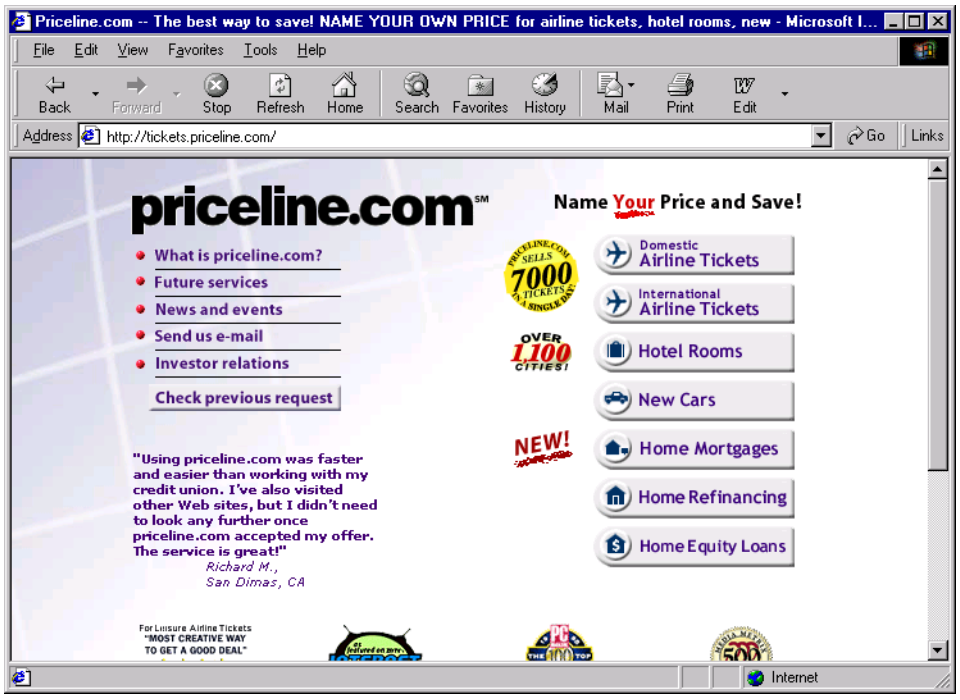

Fig. 23.6 **Priceline.com** home page. (Courtesy of **Priceline.com**.)

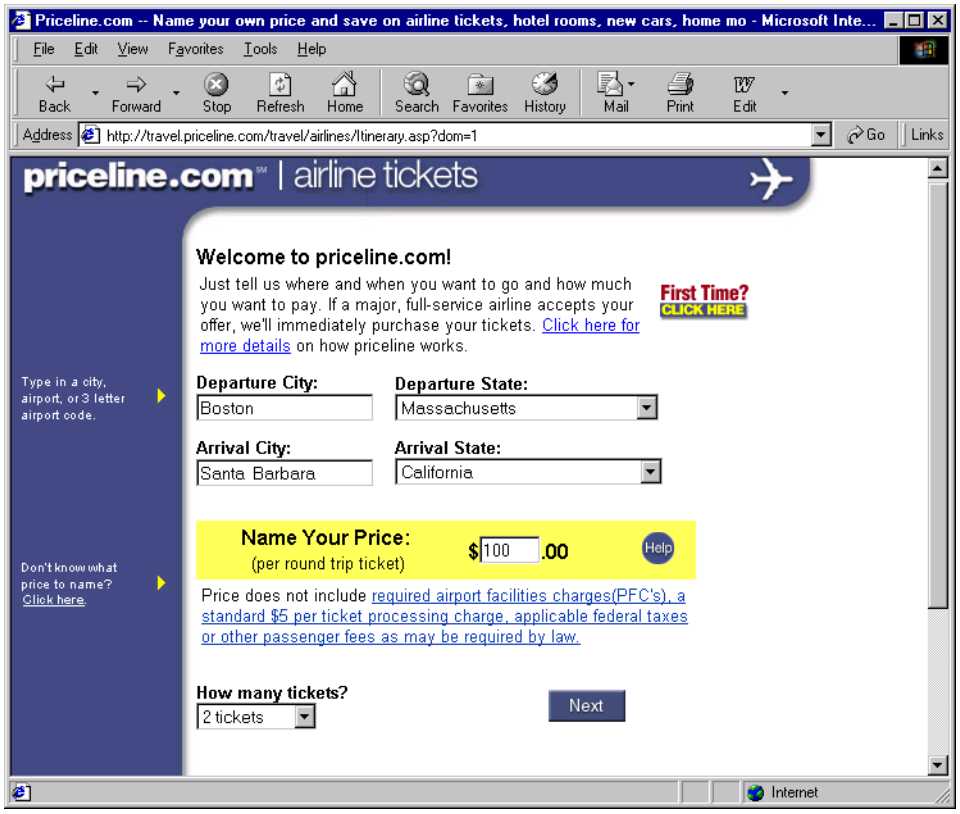

Fig. 23.7 Selecting a route and entering a bid for tickets with **Priceline.com**. (Courtesy of **Priceline.com**.)

23.8.2 Case Study: Travelocity.com

The travel service industry has achieved tremendous success on the Web in the past few years. Consumers are booking their travel itineraries online, often at lower prices than those available through travel agents. **Travelocity.com** is an online travel service that enables you to make all of your travel arrangements with a single visit to their Web site. You can book flights, rental cars, hotel rooms and vacation packages without involving a travel agent.

Travelocity.com also uses shopping-bot technology. For example, a customer who wishes to fly from New York to Los Angeles enters a time frame for the trip and airport codes to receive up-to-date fare information. The bot scans airline rate and scheduling databases for potential matches. The site then displays a list of flights that fit the submitted criteria, rate information and a ticket purchase option.

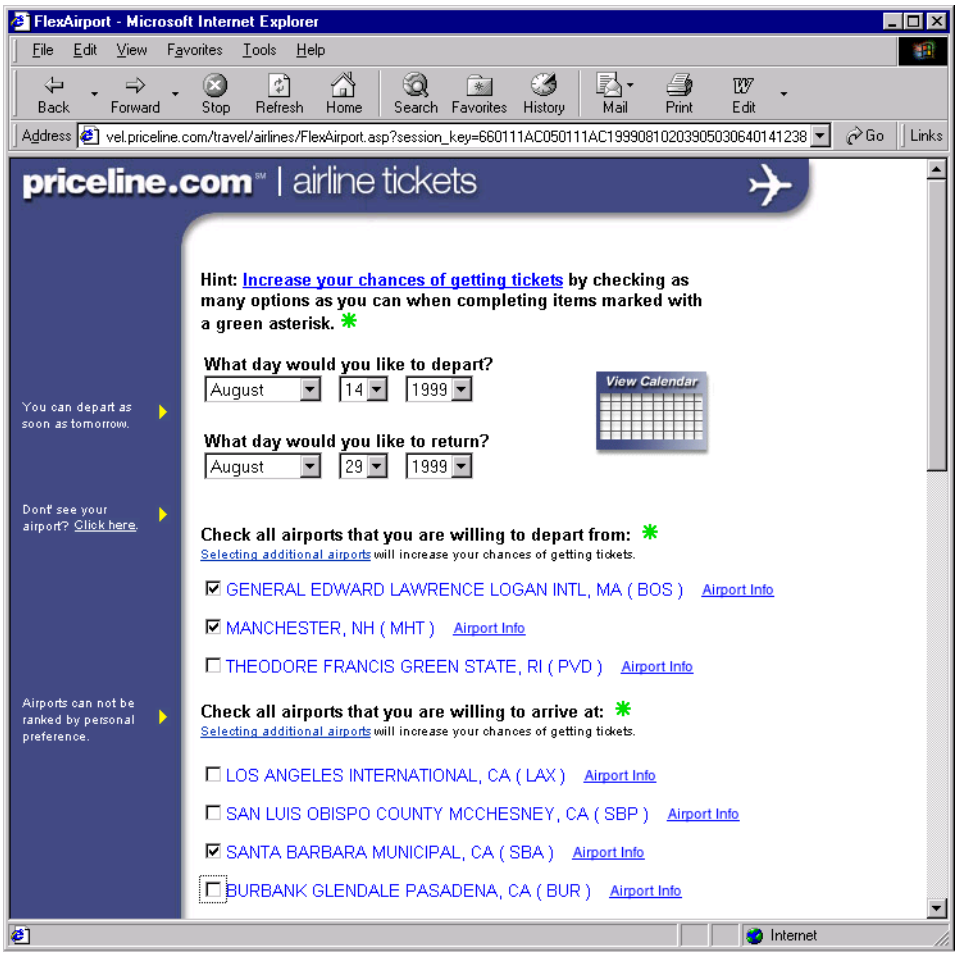

Fig. 23.8 Customers select multiple options to increase the chance of a successful bid on **Priceline.com**. (Courtesy of **Priceline.com**.)

23.8.3 Case Study: Scour.net

Scour.net uses bot technology to locate multimedia files on the Web. Users can find video clips, audio, images, live radio broadcasts and breaking news. In an instant, the bot "scours" the Web in search of the multimedia that the user specifies. **Scour.net** uses its SmartMatch intelligent agent to respond to customer queries, even if only partial names are entered and words are misspelled. It searches for specific file types, such as **.mpg** files for video and **.au** files for audio. Such searches would be difficult to conduct offline. Imagine trying to find multiple images of the Empire State building. Searching print resources or the Web would be time consuming. **Scour.net** automates the process and delivers the images you need in a matter of mouse clicks.

Currently, **Scour.net** (**http://www.scour.net**) is the most comprehensive multimedia search site available. Lycos offers a search for sounds and images within their

search engine at **http://www.lycos.com**. Alta Vista also offers a multimedia search capability at **http://www.altavista.com**.

23.8.4 Case study: Bottomdollar.com

Have you ever gone comparison shopping to find the best price for a particular product? Chances are that you checked a few local stores or a handful of Web sites. Comparison shopping is time consuming, and customers are generally limited to a small number of resources. The Web gives customers access to a large number of stores worldwide. Shopping bots such as **Bottomdollar.com** can do comparison shopping for you (Mt99).

Bottomdollar.com uses intelligent-agent technology to search the Web to find the products you want at the best available prices. A customer can use **Bottomdollar.com** to search for a product or to browse the various categories on the site (Fig. 23.9). The service actually scans the catalogs of over 1000 online retailers to find the products you want at the best available prices. The search usually takes less than a minute. Imagine trying to visit 1000 different stores one-by-one to find the best price! **Bottomdollar.com** can save shoppers time and money.

Shopping bots and intelligent agents are changing the way people shop. Rather than going directly to the stores with established brand names, customers are using services like **Bottomdollar.com** to get the best available prices. Online retailers need to keep their prices competitive.

To check out **Bottomdollar.com**, visit **http://www.bottomdollar.com**. Similar shopping-bot services include **http://www.shopper.com**, **http://dealtime.com** and **http://www.mysimon.com**.

23.9 Case Study: Using Yahoo! Store to Set up an Online Store

Keep thy shop, and thy shop will keep thee.
George Chapman

There are many online *store-builder* solutions that allow merchants to set up online storefronts, complete with catalogs, shopping carts and order-processing capabilities. These fixed-price options are available to businesses of all sizes and are ideal for small businesses that cannot afford custom solutions or do not have secure merchant servers. *Yahoo! Store* is one of the most popular e-commerce store-builder solutions (Wi99) (Ne97). Yahoo! Store is available at **http://store.Yahoo.com** (Fig. 23.10).

Yahoo! Store charges a monthly fee based on the number of items you want to sell. This prepackaged product is designed to simplify setting up an online store. All of the features you need to set up a complete e-commerce site are included.

To set up your own demo store, go to **http://store.yahoo.com** and click the **Create a Store** link. Under **I'm a New User** click **Sign me up!** You will need to enter the address and name for your site. Click **Create**. You will be presented with the Yahoo! Store Merchant Service Agreement which you must accept before you can proceed to build your demo store. Your online demo store will be hosted for several days. Setting up a demo store is free, but you cannot accept orders through a demo store. After accepting the agreement, Yahoo! Store provides detailed directions to help merchants set up active online storefronts.

Fig. 23.9 **Bottomdollar.com** searches the Web for products and the best available prices. (Courtesy of WebCentric, Inc.—Owners and Operators of **Bottomdollar.com**.)

Yahoo! Store automatically sets up the front page with the name of your store. Then, you must create a name and a caption for the first product section of your store. Click **Update** when you are done. In Fig. 23.11, the name of the store is **The Deitel Book Shop**, the first product section is called **Books** and the caption appears below the section name.

After creating a product section, you may enter products to be listed in that section. First, click **Up** to get back to your home page, then click the **Books** product section button on the left side of the page. Click **New Item** to enter your first product. Each item must have a name, a product code, a price and any specific comments about the product. This information may be edited later. To add a picture to your product page, click **Image**. Select your own image from your computer and click **Send** to upload the image to your Yahoo! Store product page. The Web site in Fig. 23.12 is an example of a complete product page with an image. After all the products have been entered, you can click **Special** to feature any of the products on your home page. When your site is complete, click **Publish**.

Fig. 23.10 Setting up an e-commerce site with Yahoo! Store. (Courtesy of Yahoo!)

You can change the style of your Web site by clicking on the **Look** button. There are several style templates. If you do not like the templates, you can select **Random** to change the colors and fonts. Yahoo! Store automatically sets up the shopping cart and secure order forms so customers can purchase products through your new Web site (Fig. 23.13).

To set up a working storefront where you can accept orders, you must sign on with Yahoo! Store and set up a merchant account, so that your site can accept credit-card payments. Generally, merchant banks and/or credit-card companies collect a small percentage of each transaction as their fee.

Yahoo! Store e-commerce sites are hosted on Yahoo! secure servers. Yahoo! maintains the servers on a *24-by-7 basis*—they keep your store up and running 24 hours per day and seven days per week. Yahoo! backs up all the information and provides SSL technology to encrypt all credit-card transactions handled through their stores.

There are many additional benefits to setting up a Yahoo! Store. Yahoo! Store merchants can track sales, see how customers are getting to their site, and use the Yahoo! wallet. Also, each Yahoo! Store is included in Yahoo! Shopping, so customers can access your store through a link at the Yahoo! Web site.

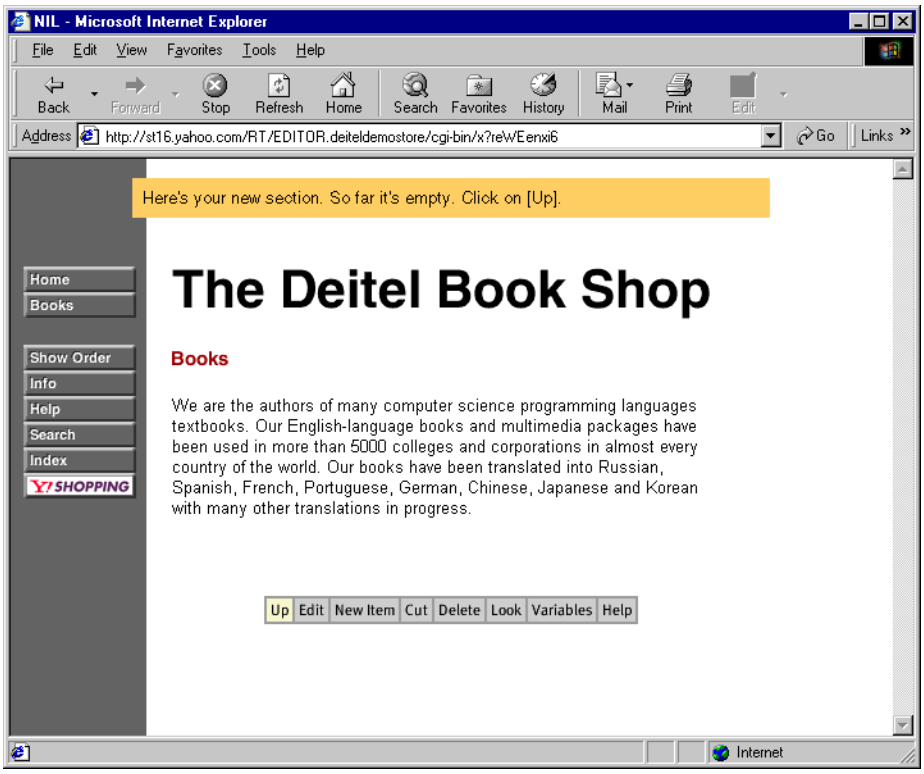

Fig. 23.11 Setting up the first product segment in our demo Yahoo! Store. (Courtesy of Yahoo!)

An exercise at the end of the chapter encourages you to set up a demo Yahoo! Store. There are several other store-builder solutions, such as SecureCC, Virtual Spin and iCat Web Store. ***Freemerchant.com*** is a free store-builder solution. They offer all the services you need to set up your own e-commerce site, including free hosting, Internet access, banking and a secure shopping cart. The free services are limited to basic functions. Most of the services they offer can be upgraded for a price. Other services are free for a trial period and can be purchased at a discount when the trial expires. For more information, visit **`http://www.freemerchant.com`**. URLs for additional information on store-builder solutions are listed in Section 23.14.

23.10 Commerce Server Case Study: Microsoft Site Server Commerce Edition

Large companies that need custom solutions can choose to build and maintain their own e-commerce sites. *Microsoft Site Server Commerce Edition* is a popular software package that allows companies to manage transactions, offer secure payment services using both the SSL and SET security protocols, support a large catalog of products, keep records of online

transactions and even help design Web sites (Be98) (Dr98) (Sy98). Site Server Commerce Edition offers more options for an online business than pre-packaged e-commerce solutions such as Yahoo! Store or iCat Web Store. Site Server Commerce Edition is installed on a company's internal merchant servers.

Site Server Commerce Edition is designed for use with Microsoft Windows NT and Microsoft SQL Server. Microsoft Windows NT is an operating system that allows companies to build secure computer networks. Microsoft SQL Server is a powerful database product designed for large organizations. Microsoft SQL Server is a commercial-quality, business-critical database application that allows you to store massive amounts of such information as consumer profiles, employee information, etc. Microsoft Site Server Commerce Edition also includes Visual InterDev, which is Microsoft's high-end Web-site development software.

Microsoft Site Server Commerce Edition is more powerful than most of the prepackaged store-builder solutions, but is also more costly to license, manage and support. Initial licensing fees, at the time of publication, start at just under $5,000. Also, to run successful online stores, merchants must maintain their own 24-by-7 support. This is a tremendous commitment and is essential to e-commerce success.

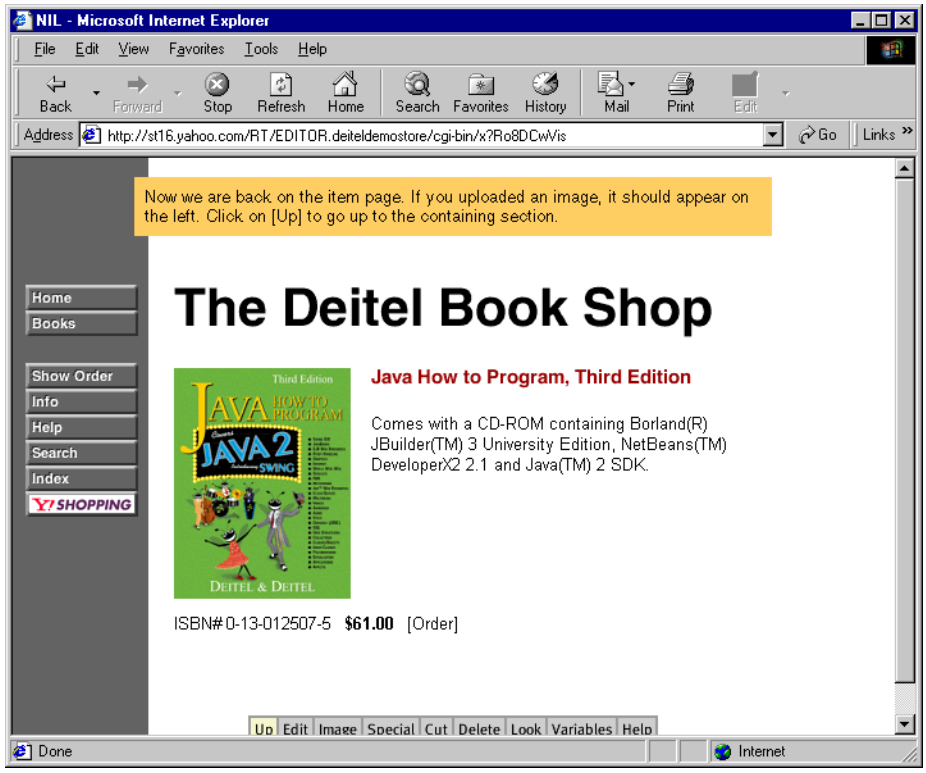

Fig. 23.12 A sample catalog page in our demo Yahoo! Store. (Courtesy of Yahoo!)

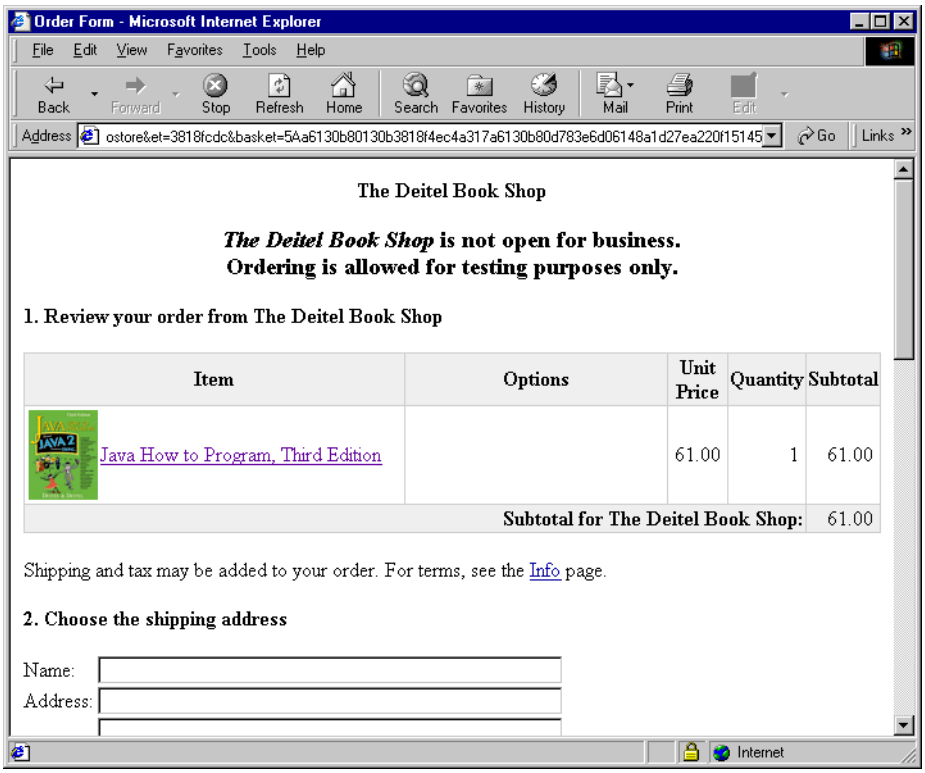

Fig. 23.13 Yahoo! Store shopping cart. (Courtesy of Yahoo!)

For more information, visit **`http://www.microsoft.com/siteserver/commerce/`**. Similar products include Netscape's CommerceXpert, available at **`http://home.netscape.com/commapps/solutions/index.html`**, IBM's Net.Commerce, available at **`http://www.software.ibm.com/commerce/net.commerce/`**, and Art Technology Group's Dynamo Commerce Server, available at **`http://www.atg.com/products/dcs/commerce_station.html`**.

23.11 E-Commerce Core Technologies

Time is the measure of business, as money is of wares.
Francis Bacon

In this section, we summarize the core technologies required to build e-commerce Web sites. We have mentioned how profoundly e-commerce is changing the way business is conducted. We have presented many case studies of well-known e-businesses, to familiarize you with their operation and their key business premises. Now, we focus our attention on enumerating the common technologies at the core of these businesses. In Chapters 24 through 29, we employ several of these technologies as we demonstrate how to implement several Web-based applications.

One of the most common e-commerce technologies is the shopping cart. Shopping-cart technology enables order-processing through a Web site. It is supported by the database of products that is hosted on the merchant server. We discuss databases in depth in Chapter 25 and then implement systems that use database technology in Chapters 26, 27 and 29.

Public-key cryptography ensures the privacy of messages transmitted over the Internet. It uses asymmetric key pairs to encrypt and decrypt messages, so that they may be read only by the intended receiver(s).

A digital signature, the electronic equivalent of a written signature, is used with public-key cryptography to solve the problem of authentication. A digital signature provides the receiver of a message with legal proof of the sender's identity. A digital signature is created by applying a hash function to a message to create a message digest and then encrypting the message digest with the sender's private key.

A digital certificate is issued by a certification authority (CA) and signed by using the CA's private key. A digital certificate typically includes the name of the subject (the company or individual being certified), the subject's public key, a serial number, an expiration date, the authorization of the trusted certification authority and any other relevant information. A CA is a financial institution or other third party that issues certificates to its customers to authenticate the subject's identity. Digital certificates are publicly available and are held by the certification authority in certificate repositories.

Secure Sockets Layer (SSL) uses public-key technology and digital certificates to authenticate the server in a transaction and to protect information as it passes from one party to another over the Internet. SSL transactions do not require client authentication. Once a secure connection is made, SSL uses symmetric secret keys (called session keys) to continue the transaction.

The Secure Electronic Transaction (SET) protocol uses digital certificates to authenticate each party in an e-commerce transaction, including the customer, the merchant and the merchant's bank. Public-key encryption is used to secure information as it is passed over the Web.

High-availability computing minimizes down time; continuous-availability computing attempts to eliminate down time completely. Redundant hardware, software, network connections and data are crucial to these kinds of computing.

Shopping bots and agents are giving consumers the ability to search the Web more effectively. Currently, bots and intelligent agents are commonly used for comparison shopping. In the future, more e-businesses will use intelligent agents to offer personalized customer service on the Web without human interaction with the customer. Intelligent agents are bots that learn about a customer over time by recording preferences, browsing patterns and purchases, to service the customer better in the future.

A popular way to customize Web pages is via *cookies* (En97). Cookies are small files sent from an e-business's server to a customer's client computer. Cookies store information on the user's computer for retrieval later in the same browsing session or in future browsing sessions. Cookies can be used, for example, in a shopping application, to indicate the client's identity, personal information and preferences. In a subsequent communication, the merchant can examine the cookie(s) it sent to the client in a previous communication, identify the client and the client's preferences and immediately display products of interest to the client. We discuss cookies in detail and show how to program with them in Chapters 26 and 27.

The *Unicode* standard can be used to encode the symbols of the world's "commercially viable" languages. Even third-world countries can now communicate more effectively with the rest of the world, and vice versa. Character sets for specific industries and specialized occupations have also been included in the standard. For instance, mathematicians now use specialized characters in their research documentation.

The Internet and advancements in e-commerce have made standard character-encoding methods even more important. As internationalization increases, Unicode will support the flow of information by providing a universal standard for character communication. For more information on the Unicode character set, visit the Web site **`http://www.unicode.org`**.

23.12 Future of E-Commerce

There are several key technology trends that will affect the future of e-business. Technology is evolving so rapidly that, literally every week, computer manufacturers advertise more powerful computers for less money. The physical size of memory has decreased so much that you can buy 12GB (i.e., 12 billion characters of memory) hard drives on notebook computers. Our ability to access bits is getting easier. The number of bits available on disks and in main memories is growing and the cost per bit is declining. Communication is getting faster and cheaper. Increased competition has prompted companies to provide greater bandwidth. As a result, we are able to transmit a larger number of bits per second and at a lower cost, than we could just a year ago.

The ability to transmit more information more cheaply will lead to increased ability to use the Internet for *streaming audio and video*, so that it will be easy to transmit sounds, voices, images, animations and videos. Also, advances in technology are making it possible for individuals to afford the computer power that was once available only to large organizations. This combination will make it possible for individuals to run their own radio and television stations right on the Web. Imagine the possibilities!

The Web is also making it worthwhile for companies to conduct smaller transactions—even micro-payments (measured in millicents—thousandths of a penny). For example, consider pay-per-view movies. Currently, many cable operators charge about $3.95 for a movie, which is generally several hours in length. But what about a four-minute music video? It probably is not worthwhile for cable companies to offer short videos because they could not charge more than a small fraction of the cost of a feature film; but with the Web and the increased bandwidth, streaming audio and video on demand to an individual will generate loads of new business based on smaller transactions. We can already see it happening with MP3. Now you can download a single song right off the Web, rather than going to your local music store to purchase the CD.

The Internet is creating opportunities for many new types of businesses. It is greatly impacting existing businesses. Egghead Software, for example, closed its retail stores in 1998 to become an Internet-only business. People are turning their lifelong hobbies into lucrative e-businesses by selling and trading goods over the Web. People are also creating businesses based on e-businesses that already exist. For example, there are people who are using eBay and other on-line auction sites as their Internet store fronts to sell or trade goods and services.

People are becoming more comfortable with purchasing over the Internet as the general public is becoming more Web-savvy. As the number of households with Internet

access continues to grow significantly, experts predict that e-commerce will grow from under $10 billion in 1999 to over $100 billion by 2003. The Web is becoming the world's store front, and even small businesses are competing globally rather than just locally. Diverse cultures are doing business together. It is truly a small world, and the Web is making it even smaller.

23.13 Internet Marketing: Increasing Traffic at Your Web Site

How do you get people to visit your site? As the number of Web sites increases, marketing your site becomes more important. There are a number of inexpensive ways to increase traffic to your site. There are also several free Internet marketing resources available. We include URLs for Internet marketing resources in Section 23.14.

Traffic on Web sites is measured by hits. A *hit* is recorded for every file transfer from the server to the browser. For example, a Web page containing three images generates four hits—one for the text and one for each image. Therefore, you can only estimate the number of visitors to a site based on the number of hits. It is nearly impossible with current technology to get an exact count of visitors to a site.

Banner advertising is one means of marketing your site online. A banner ad is similar to the billboards you see along the side of the highway. Microsoft's LinkExchange, for example, posts your banner ad for free on thousands of Web sites, in exchange for your posting a LinkExchange banner on your own site. For more information on LinkExchange, visit **`http://www.linkexchange.com/`**.

Companies such as **`Adsmart.net`**, **`Valueclick.com`** and **`Doubleclick.com`** also offer banner-hosting services. Some companies charge you based on the number of times your banner ad is viewed on a page. Other companies charge you based on the number of click-throughs generated by your banner ad; you only pay when a viewer clicks on the banner ad and goes to your Web site. For more information, visit **`http://www.adsmart.net`**, **`http://www.valueclick.com`** and **`http://www.doubleclick.com`**.

You can help search engines by providing specific key information about your site in ***`META`*** *tags*. **`META`** tags are hidden tags on your Web site that allow you to specify keywords to describe your site. Using **`META`** tags correctly and effectively can help search engines find your site and categorize it properly. We described how to use **`META`** tags in Section 4.10.

Affiliate programs can also increase traffic at your site. We described the **`Amazon.com`** Associates Program is Section 23.2.1. Affiliates post links to your site in exchange for referral fees. Many affiliate programs offer a percentage of each sale or a fixed fee for click-throughs that result in sales. **`Befree.com`** is a fee-based service that helps you set up an affiliate program. For more information, visit **`http://www.befree.com`**.

Contests, promotional giveaways and games add value to a customer's browsing experience—these may keep people coming back to your site, though not always for the right reasons. You can also include an optional registration form on your Web site for people who are interested in receiving email newsletters about your e-business.

"Offline" marketing is an important and effective means of increasing traffic at your site, but it can be expensive. Companies use television, radio, newspaper and other "conventional" forms of advertising to create interest and awareness. Exhibiting at professional

conferences and trade shows can help you meet potential customers, build mailing lists and create strategic alliances with other vendors.

23.14 E-Commerce Internet and World Wide Web Resources

Resources

`http://www.allec.com`
At the *All Electronic Commerce* Web site, you will find e-commerce news and general information. The site provides information on security, financial issues, reports, surveys, trends, corporate and product information, marketing news and links to other Web sites. They describe themselves as the "Navigational Hub of Electronic Commerce."

`http://ecommerce.internet.com/`
The *Electronic Commerce Guide* is a complete resource for e-commerce information including news, product reviews, an "Ask the Experts" section and library.

`http://www.cnet.com`
Cnet is an excellent source for technology news. You will find loads of articles, tutorials, resources and software reviews related to e-commerce.

`http://cism.bus.utexas.edu/`
The Center for Research in Electronic Commerce is a complete resource for e-commerce information. This site includes news, book lists, product information, FAQs, conferences, jobs and links to other e-commerce resources.

`http://www.tandem.com`
Visit the *Tandem* Web site for information on continuous-availability computing.

`http://www.stratus.com`
Visit the *Stratus* Web site for information on high-availability and continuous-availability computing.

`http://www.netscape.com/security/index.html`
The Netscape Security Center is an extensive resource for e-commerce security news, products and information.

Tutorials

`http://builder.cnet.com/Business/Tutorial/`
This on-line e-commerce tutorial walks you through the steps of creating an on-line store.

`http://developer.netscape.com/tech/security/ssl/protocol.html`
This is a tutorial on Secure Sockets Layer (SSL) from Netscape. There is also a FAQ with links to other SSL-related sites.

`http://webopedia.internet.com/Internet_and_Online_Services/Electronic_Commerce/`
Electronic Commerce from PCWebopedia is an encyclopedia of key e-commerce terms.

FAQs

`http://builder.cnet.com/Business/Ecommerce20/`
The *10 Questions on E-Commerce* site answers such key questions about E-commerce as "Are there any technology Standards for e-commerce?" and "What are the biggest barriers to e-commerce?"

Setting up an Online Store

`http://store.yahoo.com/`
Yahoo! Store is an easy way to set up your own online storefront.

http://www.freemerchant.com
Freemerchant.com offers a comprehensive, free e-commerce solution. Their free services include hosting, a secure shopping cart, a store-builder solution and auction tools.

http://www.securecc.com/
SecureCC is an e-commerce solution provider. Their software will allow you to set up a complete Internet storefront that uses the shopping-cart technology.

http://www.virtualspin.com/
Virtual Spin specializes in e-commerce software. Their Virtual Spin Internet Store™ allows you to set up your own storefront.

http://www.cybercash.com
CyberCash allows merchants to accept secure credit-card payments online.

http://www.2deg.com/
The Merchant Helper software helps you create Internet storefronts with shopping-cart technology.

http://www.clearcommerce.com/
ClearCommerce Merchant and Hosting Engine provides credit-card authorizations, order and payment processing, automated tax and shipping calculations, order tracking and Internet fraud detection.

http://www.microsoft.com/siteserver/commerce/default2.htm
The *Microsoft Site Server Commerce* site has the latest product information and downloads.

http://home.netscape.com/commapps/solutions/index.html
Visit *Netscape's Commerce Solutions* site for more information about CommerceXpert.

http://www.software.ibm.com/commerce/net.commerce/
IBM's Net.Commerce is a customizable solution that allows you to build secure e-commerce sites.

http://www.atg.com/products/dcs/commerce_station.html
The *Art Technology Group* Dynamo Commerce Server is a complete online storefront solution that allows you to build e-commerce sites.

SSL and SET

http://www.rsa.com/ssl/
Planet SSL, an RSA Data Security Web site, is an excellent resource for learning about SSL. You will find links to the latest news, FAQs and other SSL resources.

http://developer.netscape.com/tech/security/ssl/protocol.html
This Netscape page has a brief description of SSL, plus links to an SSL tutorial and FAQ.

http://www.netscape.com/security/index.html
The Netscape Security Center is an extensive resource for Internet and Web security. You will find news, tutorials, products and services.

http://psych.psy.uq.oz.au/~ftp/Crypto/
This FAQ has an extensive list of questions and answers about SSL technology.

http://www.setco.org/
The Secure Electronic Transaction LLC was formed through Visa and MasterCard to work on the SET specification. Visit this Web site to learn more about SET and the companies using SET in their products, and check out the brief FAQ and glossary.

http://www.visa.com/nt/ecomm/security/main.html
The *Visa International* security page includes information on SSL and SET. There is a demonstration of an online shopping transaction, which explains how SET works.

http://www.mastercard.com/shoponline/set/
The *MasterCard SET* Web site includes information about the SET protocol, a glossary of SET-related terms, the latest developments and a demonstration walking you through the steps of a purchase using SET technology.

Public-Key Cryptography

http://www.rsa.com/ie.html
RSA Data Security is a company that specializes in cryptography. Check out their detailed FAQ about cryptography.

http://www.entrust.com/
Entrust produces effective security software products using Public Key Infrastructure (PKI).

http://www.cse.dnd.ca/
The Communication Security Establishment has a short tutorial on Public Key Infrastructure (PKI) that defines PKI, public-key cryptography and digital signatures.

http://www.magnet.state.ma.us/itd/legal/pki.htm
The Commonwealth of Massachusetts Information Technology page has loads of links to sites related to PKI that contain information about standards, vendors, trade groups and government organizations.

Digital Signatures

http://www.ietf.org/html.charters/xmldsig-charter.html
The *XML Digital Signatures* site was created by a group working to develop digital signatures using XML. You can view the group's goals and drafts of their work.

http://www.elock.com/
E-Lock Technologies is a vendor of digital signature products used in Public Key Infrastructure. This site has a FAQ covering cryptography, keys, certificates and signatures.

http://www.digsigtrust.com
The Digital Signature Trust Co. is a vendor of Digital Signature and Public Key Infrastructure products. They have a tutorial titled "Digital Signatures and Public Key Infrastructure (PKI) 101."

Digital Certificates

http://www.verisign.com/
VeriSign creates digital IDs for individuals, small businesses and large corporations. Check out their Web site for product information, news and downloads.

http://www.thawte.com
Thawte Digital Certificate Services offers SSL certificates, developer certificates and personal certificates.

http://www.silanis.com/index.htm
Silanis Technology is a vendor of digital certificate software.

http://www.belsign.be/
Belsign issues digital certificates in Europe. They are the European authority for digital certificates.

http://www.certco.com/
Certco issues digital certificates to financial institutions.

Digital Wallets

http://www.globeset.com/
GlobeSet is a vendor of digital-wallet software. They have an animated tutorial demonstrating the use of an electronic wallet in an SET transaction.

http://www.trintech.com
Trintech digital wallets handle SSL and SET transactions.

http://wallet.yahoo.com
The *Yahoo! Wallet* is a digital wallet that can be used at thousands of Yahoo! Stores worldwide.

Data Mining

http://www.datamining.com/
Information Discovery, Inc. specializes in data-mining products. Check out their "Perspective on Data Mining" and the brief FAQ.

http://www.kdnuggets.com/
KDNuggets publishes a free biweekly newsletter for data mining. This site also has links to many data-mining tools, companies offering data-mining products, a list of related Web sites, a list of books, articles and other resources.

http://www.software.ibm.com/data/db2/
Visit this site for more information about IBM's DB2 data mining and data warehouse products.

Internet Marketing

http://www.adsmart.net
Adsmart sells online banner advertising. They post banner ads on hundreds of top Web sites. Advertisers can select from a variety of audiences to target specific markets.

http://www.valueclick.com
Value Click is a pay-per-click advertising solution. Advertisers pay for a fixed number of "click-throughs," where browsers click on the banner ad over the advertiser's Web site.

http://www.doubleclick.com
DoubleClick is a banner advertising network. Advertisers can select target audiences and run regional advertising campaigns.

http://www.linkexchange.com/
Microsoft's *LinkExchange* allows you to post your own banner ads in exchange for hosting LinkExchange banner ads on your Web site.

http://wwww.net-mercial.com
Net-mercial creates Internet commercials used to fill the time while a Web site is downloading or while a customer is browsing a site.

http://www.atWebsites.com/startaffiliate/index.html
This site is a step-by-step walkthrough explaining how to set up an affiliate program and to create your own affiliate program.

http://www.befree.com
beFree.com is an affiliate-program solution. Customers pay $5000 to set up a fully functional affiliate program. This site also has an explanation of affiliate marketing programs.

http://www.submiturl.com/metatags.htm
This site has a brief tutorial on **META** tags.

http://www.webdeveloper.com/html/html_metatags.html
The *Webdeveloper* **META** tag tutorial provides a detailed explanation of **META** tags.

http://companynewsletters.com/index.html
CompanyNewsletters.com will write your newsletter for you. Professional writers will research the topic, design the layout and write the newsletter. They specialize in both online and offline newsletters.

http://www.newsletters.com
This site is also a collection of newsletters. These newsletters are available on a 30-day free trial basis. You can publish your newsletters on Newsletter.com.

Organizations and Consortia

http://www.commerce.net/
CommerceNet is an international, non-profit organization supporting companies doing electronic commerce. This is an excellent resource for news, e-commerce resources, events and product listings.

http://icec.net/
The International Center for Electronic Commerce is a complete resource for e-commerce information.

http://www.crimson.com/market/
Dual-Use Marketplace is a forum for technologies and partnering ideas.

http://www.gbd.org/
Global Business Dialogue on Electronic Commerce is a collaboration among dozens of the world's top companies to promote more effective international e-commerce.

http://www.ecrc.ctc.com/
The Electronic Commerce Research Center site facilitates government efforts to become active in e-commerce. This organization offers training to the government in e-commerce strategy and technology. It offers links to e-commerce publications and to government Web sites focusing on e-commerce.

Online Magazines and News Sites

http://www.businessweek.com/ebiz/index.html
Check out the *Business Week* e.biz section for the latest news in online business. The e.biz section includes articles on the state of e-business, the leaders and key players in the industry and the hot (and not so hot) e-business stocks. It is an excellent resource for the latest news, and you can also read back issues to learn more about e-business as it has developed over the last few years.

http://www.thestandard.com
The Industry Standard is "the news magazine of the Internet economy." The site has an e-commerce section with the latest industry news, plus an archive of past articles. This is one of our favorite sources at Deitel & Associates, Inc.

http://www.ecommercetimes.com/
The E-Commerce Times is an excellent resource for e-commerce news. The site includes the latest headlines, success stories, product information, the "Small Business Advisor," job opportunities and links to related sites. The "Small Business Advisor" has information about starting up your own site, such as cost and selling strategies.

http://www.allec.com/Default.htm
At the *All Electronic Commerce* Web site, you will find e-commerce news and general information on the latest in e-commerce.

http://www.ecomworld.com/
Electronic Commerce World is a comprehensive online magazine featuring the latest e-commerce information.

http://www.internetnews.com/ec-news/
InternetNews online magazine has an e-commerce section with the latest e-commerce news stories.

http://www.internetworld.com/
Internet World magazine is a resource for Internet news. It has a section dedicated to e-commerce.

http://ecommerce.internet.com/opinions/merkow/
The *WebReference E-Commerce Watch* site provides recent news and past articles on e-commerce and technology.

http://www.iw.com/daily/stats/index.html
Internet World runs the *E-Commerce Statistics Toolbox* site, which offers statistical data on businesses and consumers participating in e-business. You will find statistics on anything from customers' perceptions of security in e-commerce to a forecast of the number of users who will be participating in e-commerce over the next few years.

http://www.arraydev.com/commerce/JIBC/
Journal of Internet Banking and Commerce is a free online journal dedicated to e-commerce news and information.

http://www.computerworld.com/home/emmerce.nsf/all/index
Computerworld E-Commerce is a biweekly publication dedicated to e-commerce.

http://www.online-commerce.com/
The eCommerce Guidebook site offers a step-by-step guide to help you set up your own e-commerce Web site. The site includes links to the vendors that provide e-commerce solutions.

http://www.eretail.net/
The *E-Retail Magazine* Web site includes news regarding online retailing.

http://www.techweb.com/netbiz/
The *NetBusiness* provides information you need to set up an e-commerce Web site. You will find helpful articles, links and even an ask-the-experts section.

SUMMARY

- To conduct e-commerce, merchants need to be able to organize an online catalog of products, take orders through their Web sites, accept payments in a secure environment and send merchandise to customers.
- The Internet and the World Wide Web have made it possible for even small businesses to compete with large companies.
- E-commerce allows companies to operate 24 hours a day, seven days a week, worldwide.
- One problem with conducting business over the Web is that the Internet is an inherently insecure medium.
- A shopping cart is an order-processing technology that allows customers to accumulate and store a list of items they wish to buy as they continue to shop.
- Supporting the shopping cart is the product catalog, which is hosted on the merchant server in the form of a database.
- Perhaps the most widely recognized example of an e-business using shopping cart technology is **Amazon.com**.
- The **Amazon.com** Associates Program, which is similar to what are commonly called affiliate programs in industry, allows Associates to post links to **Amazon.com** from their Web sites. If a customer uses the link to click over to Amazon and purchase a product, the associate receives a percentage of the sale as a referral fee.
- On-line auctions have become enormously successful on the Web. The leading company in this business is *eBay*, which at the time of publication was one of the most profitable e-businesses.
- eBay collects a percentage of the sale amount plus a small submission fee. The final fee is multi-tiered.

- eBay uses a database to manage the millions of auctions that it offers. The database evolves dynamically as sellers and buyers enter personal identification and product information.
- To avoid down time, companies make investments in high-availability computing and continuous-availability computing. The first attempts to minimize down time, the second attempts to eliminate it completely.
- Online trading is making it easier for people who might not otherwise buy and sell securities to do so at a low cost.
- One of the leaders in online trading is E*TRADE.
- The fundamental requirements of a successful, secure transaction are privacy, integrity, authentication and non-repudiation.
- Cryptography transforms data by using a key, which is a mathematical algorithm, to make the data incomprehensible to all except its intended receivers.
- In the past, corporations wishing to maintain a secure computing environment used symmetric cryptography, also known as secret-key cryptography, in which the same secret key is used both to encrypt and to decrypt a message.
- Public-key cryptography, which is asymmetric, uses two related keys—a public key and a private key. If the public key is used to encrypt a message, only the corresponding private key can decrypt it, and vice versa.
- A digital signature was developed to be used in public key cryptography to solve the problems of authentication and integrity.
- Authentication provides the receiver with proof of the sender's identity.
- To create a digital signature, the sender takes the original plaintext message and runs it through a hash function to give the message a hash value. The hash value is also known as a message digest. The sender uses its private key to encrypt the message digest, thus creating the digital signature and authenticating the sender since only to owner of that private key could encrypt it.
- Public Key Infrastructure (PKI) adds digital certificates to this process for authentication. A digital certificate is issued by a certification authority (CA) and signed using the CA's private key.
- A digital certificate includes the name of the subject (the company or individual being certified), the subject's public key, a serial number, an expiration date, the authorization of the trusted certification authority and any other relevant information.
- A CA is a financial institution or other third party, such as VeriSign, that issues certificates to its customers to authenticate the subject's identity and bind the identity to a public key.
- Digital certificates are publicly available and are held by the certification authority.
- Transactions using PKI and digital certificates are more secure than exchanging private information over phone lines, through the mail or even paying in person by credit card.
- The key algorithms used in most transactions are nearly impossible to compromise.
- RSA Security Inc. is the leader in online security. Most secure e-commerce transactions and communications on the Internet use RSA products.
- The SSL protocol, developed by Netscape Communications, is a non-proprietary protocol commonly used to secure communication on the Internet and the Web.
- SSL uses public-key technology and digital certificates to authenticate the server in a transaction and protect information as it passes from one party to another over the Internet.
- SSL transactions do not require client authentication.
- The client and server negotiate *session keys* to continue the transaction. Session keys are key pairs that are used for the duration of that particular transaction. Once the keys have been established,

the communication proceeds between the client and the server by using public-key cryptography and digital certificates.

- Although SSL protects information as it is passed over the Internet, it does not protect private information, such as credit card numbers, stored on the merchant's server.
- The Secure Electronic Transaction (SET) protocol, developed by Visa International and MasterCard, was designed specifically to protect e-commerce payment transactions.
- SET uses digital certificates to automatically authenticate each party in an e-commerce transaction, including the customer, the merchant and the merchant's bank. Public-key encryption is used to secure information as it is passed over the Web.
- Merchants must have a digital certificate and special SET software to process transactions. Customers must have a digital certificate and digital-wallet software.
- A digital wallet is similar to a real wallet. It stores credit (or debit) card information for multiple cards, as well as a digital certificate verifying the cardholder's identity.
- In the SET protocol, the merchant never actually sees the client's proprietary information. The client's credit card number is not stored on the merchant's server, so the risk of fraud is reduced.
- Although SET is designed specifically for e-commerce transactions and provides a high level of security, it has yet to become the standard protocol used in the majority of transactions.
- Microsoft Authenticode, combined with VeriSign digital certificates (or digital IDs), authenticates the publisher of the software and confirms whether the software has remained unaltered.
- Software publishers must obtain a digital certificate specifically designed for the purpose of publishing software.
- Microsoft Authenticode uses digital signature technology to sign software. The signed software and the publisher's digital certificate provide proof that the software is safe and has not been altered.
- To conduct e-commerce, businesses need to be able to accept payments through their Web sites, and that capability requires a high level of security and service.
- *CyberCash* is one of the leaders in secure-payment-processing solutions for e-businesses of all sizes.
- CyberCash CashRegister enables e-businesses to accept credit-card payments.
- A benefit of using CashRegister is that CyberCash maintains the secure servers, so merchants are not responsible for storing customers' private credit-card information on their own servers.
- *Instabuy* is the CyberCash digital wallet service. CyberCash offers the *PayNow* service, which gives merchants the ability to bill and collect payments online.
- Extensible Markup Language (XML) is a free, platform-independent, nonproprietary markup language extension used to develop customized forms and procedures for online documents.
- XML allows you to create customized tags unique to specific applications, so that you are not limited to using HTML's publishing-industry-specific tags.
- Data mining, shopping bots and intelligent agents are tools that can help businesses and individuals dig through the enormous amounts of information on the Internet.
- Data mining sifts through massive amounts of information to find the few worthwhile "nuggets" or "gems" of information.
- Collected data is stored in a data warehouse.
- Data mining is expensive. The tools can cost hundreds of thousands, even millions, of dollars.
- A bot allows you to make specific queries, thus eliminating the need for multiple searches.
- Intelligent agents are smart bots that learn about customers over time, by recording their preferences, actions and buying patterns.

- Intelligent agents and bots allow the company to add a higher level of service and personalization to a Web site.
- The **Priceline.com** bot presents the bid to the airlines and attempts to negotiate a fare below the customer's bid price. If the bid is accepted, **Priceline.com** retains the difference between the customer's bid and the actual fare price.
- **Travelocity.com** uses shopping-bot technology to search for flights, car rentals and hotel accommodations.
- **Scour.net** uses bot technology to locate multimedia files on the Web. Users can find video clips, audio, images, live radio broadcasts and breaking news.
- **Bottomdollar.com** uses intelligent-agent technology to search the Web to find the products you want at the best available prices.
- Yahoo! maintains the servers on a *24-by-7 basis*, backs up all the information and provides SSL technology to encrypt all credit-card transactions handled through their stores.
- *Microsoft Site Server Commerce Edition* is a popular software package that allows companies to manage transactions, offer secure payment services using both the SSL and SET security protocols, support a large catalog of products, keep records of online transactions and design Web sites.
- A popular way to customize Web pages is via *cookies*. Cookies are small files sent from an e-business's server to a customer's client computer.
- Cookies store information on the user's computer for retrieval later in the same browsing session or in future browsing sessions.
- The Unicode standard can be used to encode the symbols of the world's "commercially viable" languages.
- As internationalization increases, Unicode will support the flow of information by providing a universal standard for character communication.
- The ability to transmit more information more cheaply will lead to increased ability to use the Internet for *streaming audio and video*, so that it will be easy to transmit sounds, voices, images, animations and videos.
- The Web is also making it worthwhile for companies to conduct smaller transactions, even micropayments (measured in millicents—thousandths of a penny).
- As the number of households with Internet access continues to grow significantly, experts predict e-commerce will grow from under $10 billion in 1999 to over $100 billion by 2003.

TERMINOLOGY

1-click
24-by-7 support
affiliate programs
Amazon Associates Program
Amazon.com
asymmetric encryption
auctions online
authentication
authorization code
Bottomdollar.com
ciphertext
client
client/server computing
CommerceXpert products from Netscape
continuous-availability computing
cookies
CyberCash
database
data mining
data warehouse
decryption
Dell Computer Corporation
demand-collection system
digital certificates
digital IDs
digital signature

digital wallet
downtime
eBay
e-business
electronic funds transfer (EFT)
electronic data interchange (EDI)
elements
encryption
entities
E*TRADE
extensible markup language (XML)
fault-tolerant systems
`Freemerchant.com`
hash function
hash value
Health Level Seven (HL7)
high-availability computing
hit
integrity
intelligent agent
Instabuy
key
merchant account
merchant server
message digest
META tags
Microsoft Authenticode
Microsoft Site Server
name-your-price business model
non-repudiation
online auctions
online store builder
online trading
Open Software Description Format (OSD)
packets
PayNow
personalization
plaintext
`Priceline.com`
privacy
private key
public key
public-key cryptosystem
Public Key Infrastructure (PKI)
redundancy
reserve price in an eBay auction
RSA
RSA Public Key Cryptosystem
`Scour.net`
secret-key cryptography
secure electronic transaction (SET)
Secure Sockets Layer (SSL)
secure server
server
session keys
shopping bot
shopping cart
Site Server Commerce Edition (from Microsoft)
Standard Generalized Markup Language (SGML)
store-builder software
streaming audio and video
symmetric encryption
`Travelocity.com`
Unicode
VeriSign
wallet software
XML
XML Metadata Interchange Format (XMI)
Yahoo! Store

SELF-REVIEW EXERCISES

23.1 State whether the following are *true* or *false*. If the answer is *false*, explain why.

a) To conduct electronic commerce, a company must implement storefront technology.
b) Electronic Data Interchange (EDI) is the system that uses standardized electronic forms to facilitate transactions between businesses and their customers, suppliers, and distributors.
c) In continuous-availability computing, every crucial piece of hardware—such as the processor, the disk and the communications channel—has one or more levels of backup.
d) Down-time is one of the biggest threats to e-commerce.
e) In public-key technology, the same key is used to both encrypt and to decrypt a message.
f) A digital signature is created when a sender encrypts a message by using the sender's private key.

g) High-availability computing provides a higher level of service than continuous-availability computing.
h) Cryptography protects data being transferred over the Internet by transforming it to the point where it is incomprehensible to everyone but the intended user.
i) Secure Sockets Layer protects data stored on the merchant server.
j) Secure Electronic Transaction is another name for Secure Sockets Layer.
k) A digital signature is extremely difficult to alter or reproduce.
l) A merchant account gives companies the ability to accept a customer's credit card as payment for their products.
m) A shopping bot is a shopping cart that allows you to buy items from different stores, all at the same time.
n) A digital certificate is created by encrypting a digital signature.
o) XML allows developers to create unique tags to define specialized data.

23.2 Answer each of the following questions.
a) Customers are able to store products they wish to purchase in a _____ while they continue to browse the online catalog.
b) Public Key Encryption uses two types of keys of keys, the _____ and the _____.
c) _____ learn more about a customer over time.
d) Companies search large amounts of data using _____ technology in order to find patterns and correlation in the data.
e) The type of cryptography in which the message sender and receiver both hold an identical key is called _____.
f) A _____ is a document that authenticates the identity of the author of a specific piece of code or message.
g) A customer can store purchase information and multiple credit cards in an electronic purchasing and storage device called a _____.
h) Merchants using _____ within their e-commerce sites can automatically suggest items to their customers, on the basis of their past purchasing behavior.
i) A Yahoo! Store comes with core technologies built in. Customers can use the _____ to purchase products, while gaining security with the _____ protocol.
j) _____ and _____ are the two major security protocols of e-commerce. Both of these protocols use _____ encryption.
k) A _____ stores information such as product specifications and customer profiles.

ANSWERS TO SELF-REVIEW EXERCISES

23.1 a) False. Companies have many options when it comes to the design of their e-business. A storefront is a popular method, but it is not the only method. b) True. c) True. d) True. e) False. Separate, inversely related public and private keys are used. f) False. A digital signature is created when the sender encrypts the message digest using the sender's private key. g) False. Continuous-availability computing eliminates down-time. High-availability computing only minimizes down-time. h) True. i) False. Secure Sockets Layer is an Internet security protocol, which secures the transfer of information in electronic communication. It does not protect data stored on a merchant server. j) False. Secure Electronic Transaction is a Security protocol designed by Visa and MasterCard as a more secure alternative to Secure Sockets Layer. k) True. l) True. m) False. A shopping bot can be used to search multiple Web sites for the best available prices and availability. n) False. A digital certificate is issued by a certificate authority and includes information such as company name, the companies public key, a serial number and expiration date. o) True.

23.2 a) Shopping Cart. b) Public Key, Private Key. c) Intelligent Agents. d) Data Mining. e) Secret-key encryption. f) Digital certificate. g) Electronic Wallet. h) Intelligent Agents. i) Shopping Cart, SSL. j) SSL, SET, Public Key. k) Database.

EXERCISES

23.3 Use the Yahoo! Store demo at **`http://store.yahoo.com`** to build a mock e-commerce Web site. Complete each of the following tasks when using the demo. The demo is free for your use.

a) Create at least two product segments.
b) Create at least three products for each product segment.
c) Add a three-line description of your products.
d) Designate at least two of your products as "special."
e) Add a description of your store and the products you sell, to be included under the **Info** button.
f) Use the layout option to center the products in the store.
g) Use the **Look** option to change the design of your site.
h) Publish your Web site.
i) Place two products in the shopping cart.
j) Proceed with the order. (Note: your order will not be fully processed.)
k) Would you use Yahoo! Store or a similar product if you were to start an e-business? Why or why not?

23.4 E*Trade offers a stock and options trading simulation at **`http://www.etrade.com`**. Each player is allocated an initial $100,000 in order to be able to make his or her trades. As the round progresses, a player's stocks will gain or lose value, reflecting the actual stock market activity. Players compete to earn the greatest return on their investment (i.e., profits) for the round. Each new round begins on the first day of each month. At the end of the month, all portfolios are compared, and the two highest finishers each receive a $1000 prize! The E*TRADE game is free for your use and gives potential investors a chance to see how their stock picks would perform without actually putting their money at risk.

For this exercise, the class will be divided into teams. Each team should decide on a name and use it to register for the "stock trading only" version of the game. This exercise will let the teams compete over a period of three days, to see which can create the most valuable stock portfolio. Each team should begin the game on the same day. Teams should be aware that investing all of the available funds is not necessarily give you a more profitable portfolio. A market downturn could spell disaster for a fully invested team! (Note: E*TRADE automatically resets the game at the end of each month. Be sure to start this exercise at least three days prior to the end of the month, so that you do not lose your data.)

In order to begin trading, you should complete the following tasks. Good luck! Please let us know if you win the prize!

a) Create a written log of your stock choices.
b) Record the initial purchase value of each stock.
c) If a stock is sold, make a note of its sale in the log. How much was it sold for?
d) Record the value of your portfolio at least twice a day. Include the time it was recorded.
e) Record the final value of each stock and of the overall portfolio at the end of three days.
f) How did your stocks perform?
g) What rank did your portfolio achieve in the competition?

23.5 Create a spreadsheet listing the e-businesses from the chapter horizontally along the top of the page. Along the vertical axis, list the core e-commerce technologies. Fill in the spreadsheet by ranking the technologies in order of perceived importance to each company.

23.6 Visit each of the Web sites featured in the case studies. These Web sites should be ranked in terms of ease of use, design, products offered and business model. Students should also give suggestions, based on the specified criteria, on how they would improve these sites.

23.7 Have a brainstorming session to discuss potential e-business concepts. List the technologies that would be necessary in order to implement these concepts.

23.8 Define each of the following security terms and give an example of how it is used.

a) cryptography
b) public key
c) private key
d) digital signature
e) digital certificate
f) message digest
g) hash function
h) secret key
i) ciphertext
j) SSL

23.9 Define each of the following terms and give an example of how each is used.

a) database
b) auction
c) data mining
d) personalization
e) digital wallet
f) shopping bot
g) intelligent agent
h) XML
i) continuous-availability computing
j) cookies

23.10 Write a brief description of intelligent agents, giving examples of how they are currently used. Describe other ways in which intelligent agents can be used.

23.11 Many companies are using shopping bots to improve the service they provide to their customers. How do shopping bots help clients have more effective online shopping experiences? How do companies benefit from using shopping bots within their Web sites?

23.12 The Visa International Web site includes an interactive demonstration of the Secure Electronic Transaction (SET) protocol that uses animation to explain this complicated protocol in a way that most people will understand. Visit Visa at **`http://www.visa.com/nt/sec/no_shock/intro_L.html`** to view the demo. Write a short summary of SET. How does SET differ from SSL? Why are digital wallets important? How are they used? If you were asked to choose between the two protocols, which would you choose and why?

23.13 Zenexpress is an e-commerce demo that allows you to see what an online storefront should look like and how an order should be processed. Visit **`http://gifts.zenexpress.com/`** and complete the demo. How does this Web store differ from the Yahoo! Store (**`http://store.yahoo.com`**) and the iCat Web store (**`http://www.icat.com/services/store`**)? Which of these do you prefer?

23.14 In this chapter, we discussed cookies. How are cookies used? What is their purpose? Many people consider cookies to be an invasion of privacy. Do you agree? Discuss these privacy issues.

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