Chapter 1

Internet Connection Concepts
You’re already on the Internet—or you would never have decided to tackle an 800-page book about it. However, to use the Internet effectively, it helps to learn how it works. This chapter looks under the hood and describes how the Internet connects millions of computers that share a communications protocol (TCP/IP) and a system of addresses and names (the domain naming system). We also talk about the types of Internet connections (from dial-up to DSL to satellite) that you can use, along with Internet-related security concerns such as passwords, viruses, and firewalls.

The rest of the chapters in Part I describe other Internet connection topics. Chapter 2 explains how domain names work (and how you can register your own), Chapter 3 contains configuration instructions for dial-up and broadband Internet accounts, and Chapter 4 tells you how to connect a LAN to the Internet to create your own intranet.

Internet Communications Protocols

Computers connected to the Internet communicate by using the Internet Protocol (IP), which slices information into packets (chunks of data to be transmitted separately) and routes them to their destination. Because the Internet was designed to operate even during a war, it uses dynamic routing, so that even if one part of the network is knocked out, packets can be rerouted around the problem. Warfare hasn’t been a problem for Internet communications (yet), but dynamic rerouting helps the Internet deal with other types of equipment failures. Along with IP, most computers on the Internet communicate with Transmission Control Protocol (TCP), and the combination is called TCP/IP.

Before Windows 95, Windows users had to get a separate TCP/IP communications program, and several free and commercial programs were available. All versions of Windows starting with Windows 95 come with TCP/IP connection software called Dial-Up Networking. A similar standard exists for the Macintosh: MacTCP. MacOS 7.6.1 or later come with MacTCP-compatible Internet connection software. In 7.1.1 through 9.2, it’s called Open Transport/PPP or Apple Remote Access. In Mac OS X, Internet connection software is built right into the underlying UNIX operating system.

Internet Hosts

Each computer on the Internet is called a host computer or host. The computers on the Internet—and there are now millions of Internet hosts—are connected by cables, phone lines, and satellite connections. They include large mainframe computers, smaller minicomputers, and personal computers. When your PC or Mac dials into an Internet account, your computer is an Internet host, too.

Internet Protocol (IP) Addresses

Each host computer on the Internet has a unique number, called its IP address. IP addresses are in the format xxx.xxx.xxx.xxx, where each xxx is a number from 0 to 255. IP addresses identify the host computers, so that packets of information reach the correct
computer. You may have to type IP addresses when you configure your computer for connection to the Internet.

If you connect to the Internet by using a dial-up account, your Internet service provider (ISP) assigns your computer an IP address each time that you connect. This system enables your ISP to get along with fewer IP addresses, because it needs only enough IP addresses for the number of users who are connected simultaneously (as opposed to assigning a permanent IP address to each customer of the ISP). If you use a high-speed DSL or cable Internet account, you may have a static (unchanging) IP address, or your ISP may assign you an address each time you connect. Static IP addresses get rarer every year and usually cost extra.

Computers on a local area network (LAN) usually have IP addresses that are reserved for use on LANs rather than on the Internet itself. These addresses are usually in the range 192.168.x.x or 169.254.x.x. A server on the LAN usually assigns them: the most common IP assignment server is called DHCP (Dynamic Host Configuration Protocol). For more information about IP addresses on LANs, see Chapter 4.

On Windows XP systems, you can find out your computer’s IP address by choosing Start | Control Panel | Network Connections to see your Internet and LAN connections. Right-click your Internet or LAN connection, choose Status from the menu that appears, and click the Support tab. You see a window like this:

If your computer connects to the Internet through a LAN, this IP address is probably not the one that appears on the Internet. (LAN-connected computers have LAN-only IP addresses.) To find out your IP address according to the Internet, go to www.whatsmyipaddress.com.
Domain and Host Names
So that people don’t have to remember strings of numbers, host computers also have names. The name of each host computer consists of a series of words separated by dots. The last part of the domain name is called the top-level domain (TLD). The TLDs of three or more letters are used mainly in the United States and indicate the type of organization that owns the domain. The original seven three-letter TLDs are the following:

- **com** Originally for commercial organizations, but now used by individuals, government agencies, and nonprofits as well
- **net** Internet service providers and other network-related companies
- **org** Noncommercial (often nonprofit) organizations
- **gov** U.S. government agencies
- **mil** U.S. military
- **edu** Educational domains
- **int** International organizations like NATO and the International Red Cross

More three-or-more-letter TLDs are coming into use, such as these:

- **aero** Airlines
- **arpa** Internet infrastructure (named after the U.S. government agency that originally created the Internet)
- **biz** Businesses
- **coop** Cooperatives
- **info** Anyone
- **museum** Museum
- **name** Individuals

Two-letter TLDs indicate the country in which the organization that owns the computer is located. U.S. organizations can register domains that end with **us**. Canadian organizations, for instance, usually have the TLD **ca**. You can find the full list of geographic TLDs on the Web at [net.gurus.com/countries](http://net.gurus.com/countries). A few countries are taking advantage of their two-letter TLDs (like **tv** for Tuvalu, **am** for Armenia, and **fm** for the Federation of Micronesia) to make some money on domain registrations: see the next chapter for details. The most recent two-letter TLD is **eu** for the European Union, added in mid-2002.

The last two parts of a host computer name constitute the domain. The second-to-last part of the name (the second-level domain) is chosen by the organization that owns the computer and is usually some variant of the organization’s name. For example, computers at the U.S. president’s offices at the White House have the domain **whitehouse.gov**.
Connecting to the Internet

Computers at Yale University have names that end with yale.edu because Yale is an educational institution. Computers at the McGraw-Hill publishing company are named with the domain mcgraw-hill.com.

Because most organizations own more than one computer on the Internet, most host computer names have at least one more part, preceding the domain name and called a third-level domain (or sometimes a subdomain). This additional part (or parts) is assigned by the organization itself. For example, the gurus.com domain (which is owned by one of the authors of this book) has several host names, including www.gurus.com (the main web site), net.gurus.com (the Internet Gurus web site), and wine.gurus.com (the web site of the Society of Wine Educators). By far, the most widely used addition to domain names is www, because it is frequently used for an organization’s web server (the computer that stores web pages). Some organizations name their computers using stars, planets, animals, or other themes, so don’t be surprised if e-mail from Middlebury College comes from panther.middlebury.edu.

Capitalization doesn’t matter in host names. Gurus.Com and gurus.com are both valid forms of the same name. Host names usually appear in lowercase.

One host computer can have many different names. For example, many ISPs also offer domain hosting, which means that they allow your domain name to be applied to one of their host computers. Domain hosting enables you to have your own domain name, even if you don’t have a host computer. See Chapter 2 for information on how to register a domain name.

Technically, gurus.com and net.gurus.com are both domains. However, most Internet users refer to second-level domains (like gurus.com) as “domains” and third-level (or more) domains (like net.gurus.com) as “subdomains.”

Servers and Clients

Many of the host computers on the Internet offer services to other computers on the Internet. For example, your ISP probably has a host computer that handles your incoming and outgoing mail. Computers that provide services for other computers to use are called servers. The software run by server computers to provide services is called server software.

Conversely, many of the computers on the Internet use servers to get information. For example, when your computer dials into an Internet account, your e-mail program downloads your incoming messages from your ISP’s mail server. Programs that ask servers for services are called clients. Your e-mail program is more properly called an e-mail client.

Here are some types of servers and clients that you may encounter:

- Mail servers handle incoming and outgoing e-mail. Specifically, Post Office Protocol (POP or POP3) and IMAP (Internet Message Access Protocol) servers store incoming e-mail, whereas Simple Mail Transfer Protocol (SMTP) servers relay outgoing e-mail. Mail clients get incoming messages from, and send outgoing messages to, a mail server, and enable you to read, write, save, and print messages. See Part II for how to use e-mail clients.
Web servers store web pages and transmit them in response to requests from web clients, which are usually called browsers. See Part IV for details about browsers and Part V for how to create web pages and store them on web servers.

FTP servers store files that you can transfer to or from your computer if you have an FTP client. See Chapter 33 for how to use FTP.

News servers store Usenet newsgroup articles that you can read and send if you have a news client or newsreader. See Chapters 11 and 12 for how to use newsreaders.

IRC servers act as a switchboard for Internet Relay Chat (IRC) channels. To participate, you use an IRC client. See Chapter 13 for how to use IRC.

### Ports and Port Numbers

One host computer can run more than one server program. For example, a small ISP might have one computer running a POP server, SMTP server, web server, and news server. To keep requests for information straight, each type of server responds to packets sent to specific ports (input for a specific Internet service). Ports are numbered, and standard port numbers used throughout the Internet. You almost never need to type port numbers, but here are some widely used port numbers in case you do:

<table>
<thead>
<tr>
<th>Port Number</th>
<th>Internet Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>FTP (file transfer)</td>
</tr>
<tr>
<td>23</td>
<td>Telnet (remote login)</td>
</tr>
<tr>
<td>25</td>
<td>SMTP (mail relaying)</td>
</tr>
<tr>
<td>80</td>
<td>World Wide Web</td>
</tr>
<tr>
<td>110</td>
<td>POP3 (storage of incoming mail)</td>
</tr>
<tr>
<td>194 (as well as 6667 and many others)</td>
<td>IRC (online chat)</td>
</tr>
<tr>
<td>532</td>
<td>Usenet newsgroups (discussion groups)</td>
</tr>
</tbody>
</table>

For a complete listing of port numbers, see the IANA web site at www.iana.org/assignments/port-numbers.

### The Domain Name System and DNS Servers

You use one other type of Internet server almost every time that you request information from an Internet host. A Domain Name System (DNS) server translates between the numeric IP addresses that identify each host computer on the Internet and the corresponding domain names. People prefer to use host names because they are easier to type and remember, but actual Internet communications use the numeric addresses. For example, if your browser requests a web page from the Yahoo! web site, which has the host
Connection Speeds

Everybody wants more speed. The moment that you get it, all the Internet content providers clog up the pipes with video and audio, applets, and animation. So it’s hard to generalize about how much speed is enough. It’s a moving target. It’s also a matter of individual preference and the size of your pocketbook. However, if you regularly do large downloads—such as software upgrades—you may be interested in the following comparison:

<table>
<thead>
<tr>
<th>Modem Speed</th>
<th>Time to Download a 10MB File</th>
</tr>
</thead>
<tbody>
<tr>
<td>28.8 Kbps</td>
<td>46 minutes</td>
</tr>
<tr>
<td>56 Kbps</td>
<td>24 minutes</td>
</tr>
<tr>
<td>128 Kbps</td>
<td>10 minutes</td>
</tr>
<tr>
<td>1.544 Mbps</td>
<td>52 seconds</td>
</tr>
<tr>
<td>4 Mbps</td>
<td>20 seconds</td>
</tr>
</tbody>
</table>

Don’t neglect your need for upstream speed, either. When you e-mail files, publish a web page, or have a video conference, you’re sending data. If you set up a computer as a server and make information on it available to others, upstream speed really matters.

name www.yahoo.com, a DNS server translates that name to 204.71.200.69, one of Yahoo’s web servers, and then sends the request to that IP address. Chapter 2 describes in more detail how the Domain Name System works.

Your ISP provides a DNS server to handle domain name translations. If the DNS server isn’t working properly, or you have configured your computer with the wrong IP address for the DNS server, your computer can’t find any of the computers on the Internet that you specify by host name. It has no way to translate host names to IP addresses. You may see error messages such as “Unable to locate host” or “Server does not have a DNS entry.” (Contact your ISP to fix the problem, or consult Chapter 3.)

Types of Internet Connections

To connect to the Internet, you connect your computer to a computer that is on the Internet, usually one run by an ISP. You can connect your computer by using a dial-up phone line, which is how most home users connected to the Internet during the 1990s. If you need to connect at higher speeds than a regular phone line allows, you can get a high-speed phone line, assuming that your phone company offers them. You may have three options, depending on what your phone company offers: DSL, ISDN, or a leased line (such as a T1).
If your cable TV company offers an Internet service, you can connect your computer to the Internet by using a cable TV connection. Rural users may consider installing a satellite dish for Internet connections, whereas urban users may have access to a wireless connection. In offices, most computers connect via a local area network (LAN), and many homes are beginning to connect their computers into Internet-connected LANs, too.

**Note**

High-speed Internet connections, including DSL, ISDN, leased lines, cable Internet, and satellite, are all called broadband connections.

The following sections describe each type of connection, and Chapter 3 contains information about how to set up and configure these connections.

### Dial-Up Connections

A dial-up connection to the Internet works over an ordinary phone line. Dial-up connections use the Point-to-Point Protocol (PPP) and are also called PPP accounts. Early dial-up connections used older protocols (SLIP and CSLIP), but these protocols are no longer used.

To use a dial-up account, you need a modem. (To distinguish dial-up modems from newer, high-speed modems, they are also called analog modems or dial-up modems.) Most computers come with an internal modem—check the back of the computer for a phone jack (RJ-11 jack). Most ISPs support modems at speeds of 28.8 kilobits per second (Kbps) and 56 Kbps. You connect only when you want to use Internet services and disconnect (hang up) when you are done.

To connect, you need a PPP-compatible communications program, such as Dial-Up Networking, which comes with all versions of Windows since Windows 95. This program dials the phone by using your modem, connects to your ISP, logs into your account by using your user name and password, and then establishes a PPP connection, thus connecting your computer to the Internet. While connected, you can use a variety of programs to read your e-mail, browse the Web, and access other information from the Internet. When you are done, you use your communications program to disconnect from your Internet account. (See Chapter 3 for how to set up and configure a dial-up connection.)

### DSL Connections

Digital Subscriber Line (DSL) is a family of all-digital, high-speed lines that use your normal phone wires with special modems on either end. Most DSL lines are actually ADSL (Asymmetric Digital Subscriber Line). ADSL is optimized for the way many people use the Internet: more downloads than uploads. The line is asymmetric, because it has more capacity for data received by your computer (such as graphics, video, audio, and software upgrades) than for data that you send (such as e-mail and browser commands).

Configurations and prices vary depending on your phone company. The downstream bandwidth (data transfer speed from the Internet to your computer) can range from...
384 Kbps to 8 megabits per second (Mbps). The **upstream bandwidth** (speed from your computer to the Internet) can range from 90 Kbps to 768 Kbps. In real life, however, speeds are usually much lower and depend on the distance between you and the phone company’s Central Office (CO) or wherever the DSL modem at their end is located.

With a DSL line, you can connect your computer to the Internet and talk on the phone at the same time on the same phone line. This feature means that if you currently have two phone lines, one for voice and one for Internet, you can get rid of one of them. However, the speed of your Internet connection may drop while you are talking on the phone.

Costs for DSL lines are higher than for regular phone lines, averaging $50 per month. There’s usually a sign-up fee of several hundred dollars. The price for the Internet connection is generally a flat rate, but you are usually charged extra for voice calls, including local calls.

You can order a DSL line through your ISP or directly from your phone company—talk to both before you place your order. Availability depends on your location; DSL lines can’t be more than 18,000 feet (5,460 meters) from the phone company’s central office (or switching point for your exchange).

The phone company or ISP usually provides the DSL modem, which must match the DSL modem installed at their end. Because there are several competing DSL modem standards, not all DSL modems work with all DSL lines. If you already have a DSL modem, check with your phone company to find out whether you can save some money by using your own modem.

DSL modems usually connect to your computer through an *Ethernet* or other network card in your computer. If you don’t have one, add another $20 (for a desktop computer) or $50 (for a laptop) to your cost. Many newer computers come with built-in...
Ethernet jacks, which look like oversized phone jacks. Some DSL modems connect to a USB port, although these modems limit your connection speed. If you plan to use a phone or fax machine on your ADSL line, make sure the modem has a phone jack. If possible, choose a model with a built-in telephone filter.

When you sign up for a DSL line, the phone company (or other DSL provider) comes to your location, installs the DSL modem, and configures your computer to use it. Some DSL lines are configured so that you are always connected—no more logging in. Others use PPPoE (PPP over Ethernet) to pretend that you are still dialing in, so you still have to log in, too.

**Note**
ADSL is just one of a family of DSL products on the drawing board. See the ADSL Forum ([www.adsl.com](http://www.adsl.com)), DSL Reports ([www.dslreports.com](http://www.dslreports.com)), and TeleChoice’s xDSL site ([www.xdsl.com](http://www.xdsl.com)) for more background.

### ISDN Connections

*Integrated Services Digital Network (ISDN)* lines are also available from many local telephone companies. ISDN is an upgraded phone line that can be used for faster Internet access and for regular voice calls. Using one line, you can talk on the phone while you’re surfing the Web. Like DSL, ISDN is all digital, which means that data doesn’t have to be converted to an *analog signal* (that funny noise you hear modems make) for transmission.

The ISDN service intended for residential use is *Basic Rate Interface (BRI)*. On one ISDN line, BRI provides two 64-Kbps channels, or *B channels*, and one 16-Kbps channel, or *D channel*. The D channel is mostly used for signaling—for instance, to indicate that the line is busy. The B channels are where the action is. When the two B channels are combined, you have a 128-Kbps line to the Internet. That’s roughly twice the speed of the fastest analog modem, 56 Kbps. If you want to talk on the phone or send a fax, your Internet access drops down to one 64-Kbps B channel, while the other B channel is used for voice. Integrated Services Digital Network (ISDN) lines, like DSL lines, are all-digital, high-speed phone lines that provide a faster way to connect to the Internet.

To connect your computer to an ISDN line, you need an *ISDN adapter*, which is like a modem. Your phone company or ISP usually provides the ISDN adapter as part of the sign-up fee. ISDN adapters may be internal or external: external adapters usually connect to your computer’s serial port, which, until recently, was limited to a top speed of 115.2 Kbps. (Newer serial interfaces have faster chips.) Internal adapters bypass any serial port bottleneck, so you can get a full 128 Kbps out of your ISDN line.

The cost of an ISDN line usually depends on the number of minutes of use. It may also depend on time of day, with higher rates for business hours. The cost of Internet service accessed through ISDN also goes up with use. A typical ISDN package gives you a certain number of minutes per month “free,” included in a base rate. Additional use is charged per minute. If you can stay within the base rate guidelines, you can get an ISDN line plus ISP access for about $60 per month. Look at your past usage patterns to see whether that’s a realistic figure for you. (For most heavy Internet users, it’s not.)
Clearly, ISDN is not intended to be left on all day. (DSL and cable modem service are.) However, with a new type of ISDN service, you’ll never have to dial up again: Always On/Dynamic ISDN (AO/DI) uses the D channel to provide a constant 9.6-Kbps connection to the Internet. E-mail is delivered, chat pals can find you, and your stock ticker stays up to date. When you need more capacity, AO/DI switches over to one or two of the B channels. If you are considering ISDN, ask whether AO/DI is available for your line—and compare its price.

An ISDN line shouldn’t be the only phone line in your house. Your regular analog phone will work only if it’s connected through the ISDN terminal adapter. If the power were to go out in an emergency, the adapter couldn’t power the phone, and you couldn’t make or receive any calls. Be sure to keep a regular analog line. The phone system can power a corded phone even if the rest of the power in your house is out. (DSL lines don’t have this problem. Phones can be plugged directly to the line and draw their power from it.)

To order an ISDN line, contact your phone company or ISP (better yet, contact both). The phone company usually provides the ISDN adapter, installs it at your site, and configures your computer to use the connection.

If you’re going to use a phone or fax machine on your ISDN line, make sure that your adapter has at least one analog phone jack on it. You plug in your existing equipment to the adapter. Also, check to see whether the adapter has full ringing support. That is, when a phone call comes in, does the phone actually ring, or do you just get some flashing lights on the front of the adapter? Flashing lights are easy to miss when you’re busy poring over your computer screen.

**Note**

*DSL is the most common in the United States; ISDN is widely used in Europe.*

### Leased Lines

If you (or more likely, your corporation) need to transfer very large amounts of data or run Internet server software, contact your telephone company for a leased line, the same type of phone line that organizations use to connect corporate offices. Leased lines come in various speeds, including T1 (1.5 megabits per second, or enough for 24 voice channels) and T3 (44 megabits per second, enough for 672 voice channels). If you don’t need quite that much speed, you can ask for a fractional-T1 (half or a quarter the speed of a T1 line). You also need to contact your ISP for a leased-line account, which costs more (usually a lot more) than a DSL or ISDN account. Unless you have a huge amount of data to transfer, or you want to provide Internet services that your DSL or cable company don’t allow over their lines, stick with DSL or cable Internet (or in Europe, ISDN).

### Cable TV Internet Connections

*Cable modem* service is the competitive threat that’s caused phone companies to accelerate their ADSL efforts. The same network that brings you dozens of TV channels can now...
bring you millions of web sites. The problem is that the cable network was designed to move information in one direction, from the broadcaster to you. Downstream speeds are impressive—the line can theoretically bring you data as fast as 30 Mbps, much faster than your computer can handle it—but upstream speed depends on line quality. Large cable companies are spending money to upgrade their networks to hybrid fiber-coaxial (HFC) to better handle two-way traffic. Smaller providers can’t afford the upgrade, so they have you use a phone line at 28.8 Kbps for upstream data.

From a large company with an HFC network, expect downstream speeds of 1 to 2 Mbps or more, and upstream speeds between 500 Kbps and 1 Mbps. These numbers aren’t exact, because you share digital cable capacity with your neighbors. If more of them are online, you compete with them for bandwidth.

Some major ISPs and online services, like EarthLink and AOL, are making deals with cable TV companies to provide cable Internet access. If you use AOL or a national ISP, check whether they offer cable access.

See www.cablemodeminfo.com for in-depth coverage of cable modem issues, as well as DSL resources.

**Satellite Internet Connections**

*Digital Satellite Systems (DSS)*, or direct broadcast satellite, lets you get Internet information by satellite. Two companies currently offer this service in the United States: Hughes DirecPC or DIRECWAY (www.direpc.com or www.direcway.com) and Microsoft/Radio Shack’s StarBand (www.starband.com). To connect, you use a 24-inch antenna, a coaxial cable, a PC adapter card, and Windows-based software. With early satellite systems, you received data from the Internet at a high speed via the satellite, but to send data to the Internet, you needed a dial-up connection and an ISP. (DirecPC still offers this option.) StarBand and DirecPC’s Two-Way System enable a connection that doesn’t use a phone line at all, with uploads and downloads by satellite. With StarBand, you can use the same satellite dish to get DISH Network television.

Setup can be difficult, and pricing has been controversial. (How much you pay used to depend on how much data you downloaded.) An installer comes to position the satellite dish, which needs an unobstructed view of the southern sky, and to connect the dish to your computer’s USB or Ethernet jack. Installation costs about $200, with additional equipment fees of up to $400. Download speeds can be as high as 500 Mbps, although there is a slight delay before the data begins flowing, which can affect highly interactive Internet applications like games.

If you can get DSL, ISDN, or cable Internet, connection will be simpler than with a satellite dish. However, if your phone and cable companies don’t offer high-speed Internet connections, satellite may be your best alternative.
Online Services

An online service is a commercial service that enables you to connect to and access its proprietary information system. Most online services also provide an Internet connection, e-mail, the World Wide Web, and, sometimes, other Internet services. Online services usually require special programs to connect to and use your account.

The three most popular online services are the following:

- **America Online** (AOL, at [www.aol.com](http://www.aol.com)) is the world’s most popular online service, with a wide range of AOL-only chat rooms. To connect to AOL, read AOL e-mail, browse the Web, and access other AOL servers, you use AOL’s proprietary program. AOL doesn’t provide a POP (mail) server, so you must read your AOL mail by using the AOL software, by accessing AOL’s web site, or by using Netscape 6’s Mail program. (AOL owns Netscape.) You can call AOL in the United States at 800-827-6364.

- **CompuServe** (at [www.compuserve.com](http://www.compuserve.com)) is one of the oldest online services, with an excellent selection of proprietary technical- and business-oriented discussion groups. AOL purchased CompuServe, so the two services may merge. CompuServe has access phone numbers in dozens of countries. To connect to CompuServe and access its services, you use CompuServe’s proprietary program. You can call CompuServe in the United States at 800-336-6823.

- **Microsoft Network** (MSN, at [www.msn.com](http://www.msn.com)) is Microsoft’s online service. You connect to MSN by using Dial-Up Networking, send and receive e-mail by using Outlook or Outlook Express, and browse the Web by using Internet Explorer. You can call MSN in the United States at 800-386-5550.

Other online services exist, but they aren’t nearly as popular as these three. Some computers come equipped with sign-up software for some online services: because Microsoft owns MSN, it bundles MSN sign-ups with all recent versions of Windows.

Wireless Internet Connections

In a few urban areas, you can use wireless Internet access. To set it up, you attach a radio modem, about the size of a deck of cards, to your laptop. Wireless service (also called WAP, or Wireless Application Protocol) made its debut at analog speeds (28.8 Kbps), but it is being upgraded to 128 Kbps, which is faster than dial-up but slower than most DSL. As of 2002, few companies offer wireless Internet access, but availability may expand.

Another way to connect to the Internet via wireless is by using a digital cell phone that includes Internet connectivity. Because these devices have tiny screens, limited keyboards, no mouse, and slow connection rates, Internet content must be tailored to
them and is usually limited to text. Check with your cell phone company to find out whether they offer cellular Internet access.

Some ISPs offer wireless connections to personal data assistants (PDAs) such as the BlackBerry, Palm, Compaq iPaq, or HandSpring Visor. These small devices have small screens, but you can use them to read your e-mail and browse the Web. Like cell phones, PDAs require web content to be tailored to their small screens and their slow connection rates. Check with your local ISPs to find out what they offer.

Connecting Local Area Networks to the Internet

Homes or organizations that have many PCs can connect the computers in a network and then connect that network to the Internet. This method is more efficient than connecting each PC to the Internet by using its own modem and phone line. Colleges, universities, and large corporations have used the Internet this way for a decade, and smaller offices and even homes increasingly do, too. Chapter 4 describes how it works.

Internet Service Providers (ISPs)

An Internet service provider (ISP) is an organization that provides Internet accounts, whether dial-in, DSL, ISDN, cable, satellite, or wireless. Thousands of ISPs exist in the United States, including dozens of ISPs with dial-up access phone numbers throughout the country, and many with phone numbers in limited regions. For example, EarthLink (www.earthlink.com) has access phone numbers in all major U.S. cities, whereas

How Do You Connect When You’re Away?

Do you use the Internet when you travel? If your laptop has a high-speed connection at home, what happens when you take it elsewhere? You’re unlikely to find DSL, ISDN, or cable modem access, although some business-oriented hotels offer high-speed access through an Ethernet jack (the same one you usually use to connect to a DSL, ISDN, or cable modem). Otherwise, you need to use your analog modem.

The issue is having an ISP that supports both your dial-up access and high-speed access. You’d think that getting dial-up access wouldn’t be a problem if you sign up for a DSL or ISDN account; chances are good that your ISP is either a branch of the local phone company or an independent ISP that has provided dial-up access for years. However, many ISPs have separated their DSL and dial-up divisions and don’t offer a package rate for both. And if you have a cable modem package, dial-up access to the cable company ISP is expensive—if it’s provided at all.

One solution is to keep your current ISP for dial-up access. Some ISPs offer lower monthly rates for a limited number of hours of usage. Be sure to choose a dial-up ISP with phone numbers everywhere you plan to travel.
Shoreham Internet (www.shoreham.net) has phone numbers only in central Vermont, but provides local access from towns that EarthLink doesn’t reach. Large ISPs provide both dial-up and DSL or ISDN connections.

**Caution**  If the ISP doesn’t have an access phone number that is a local phone call for you, you can spend more on long-distance charges than on your Internet account. Check with your phone company before you run up a horrendous phone bill.

In addition to connecting you to the Internet, here are some other features that your Internet account may provide:

- **E-mail mailboxes**  Your account almost certainly comes with at least one e-mail mailbox on a POP or IMAP server (described in Chapter 5). Many ISPs provide more than one mailbox, so that each member of your family can read his or her mail separately, either as part of the cost of the account or for an extra fee.

- **Web server space**  Most Internet accounts include a modest amount of disk space (perhaps 10MB) on a web server, so that you can make your own web pages accessible to the Internet. If you need more space, you can usually buy more for a small monthly fee.

- **Domain hosting**  If you want your own domain name (refer to “Domain and Host Names,” earlier in this chapter), most ISPs can host your domain, so that e-mail to the domain lands in your mailbox, and web addresses in your domain refer to pages that you store on your ISP’s web server.

If you plan to create a large web site or one that requires a secure server, shopping cart application, CGI scripts, or other advanced web server options, consider storing your web site on a web-hosting service rather than on your ISP’s server (see Chapter 23).

To find ISPs that have local phone numbers in your area, try The List (thelist.internet.com), which lists over 5,000 ISPs by state or province, country, or area code. For each ISP, you see the area code(s) that it serves, the modem speeds that it supports, the address of the ISP’s web site, its fees, and its sales telephone number. For other pointers about choosing an ISP, see our web site at net.gurus.com/isp.

### Security Issues on the Internet

The Internet was not designed to be secure. Security wasn’t built into the design (neither was billing), so as the Internet has become widely used by the public, many security issues have arisen, including viruses, cookies, and firewalls.

For information on web-based security issues, such as cookies and web filtering, see Chapter 20.
Protecting Your Computer from Viruses

A virus is a self-replicating program, frequently with destructive side effects. Viruses that spread via e-mail attachments are called worms. When the Internet was young (ten years ago), viruses were spread only in programs that were downloaded from FTP servers or passed around on floppy disks. Now your computer can catch a virus from an infected e-mail message, too.

Viruses can’t travel in plain text, like e-mail messages. They contain programming, so they need to be in binary (nontext) files. You can receive a virus as an e-mail attachment or in a file you download. Document and spreadsheet files can contain viruses, too—macro viruses are viruses that make use of a word processor’s or spreadsheet program’s ability to execute instructions (macros), as well as to display a file.

Always run a virus-checking program on all computers that connect to the Internet. For the most complete virus checking, obtain commercial virus-checking software such as McAfee VirusScan (www.mcafee.com) or Norton Anti-Virus (www.symantec.com/product). Don’t just install the program; you also need to sign up to receive updates as new viruses appear. (Your software license may come with the first year’s subscription free.)

Although virus-checking software cannot guarantee that it will find a virus that it is not specifically aware of, the better software contains heuristic capability that will alert you to files it deems suspicious. That can become annoying fast if the program is too conservatively designed, though, because a paranoid virus checker finds nearly everything suspicious.

Commercial virus-checking software does its job at various times, depending upon how you set it up—when you start your computer, at a particular time (such as every Friday), or continuously in the background. When it runs in the background, it checks whenever you download files through a specified browser or e-mail program or when you attempt to move them to a specified safe zone of your computer. You can determine how the software does its job when you install it or by setting your preferences from the program window when the program is running.

If a virus arrives attached to an e-mail message, your virus-checker should pop up a message asking what you want to do. You usually have the option of deleting the entire attachment, deleting the virus from the attachment but saving the rest of the file, or keeping the file in “quarantine” until you deal with it later.

Background virus checking has good and bad points. It is safest if you are forgetful and is convenient if you download often. Background checking also provides the best protection against the subtle (and rare) viruses that arrive, not as files, but as infections of your computer’s memory that can travel through your web browser. In some instances, however, background checking can slow down your system, cause conflict with other background programs, or cause other erratic behavior. Background checking may also not guard against viruses that arrive through Internet tools that are not specifically
checked by the software. For instance, your virus scanner may check only files that arrive through Netscape Navigator, and not check files that arrive through Microsoft Internet Explorer or an FTP client program. If you download programs (as described in Chapter 34), run your antivirus software manually after downloading files.

**Tip**  
Until you can buy a good virus scanner, a decent (and free) online scanner can be found at [www.antivirus.com/pc-cillin](http://www.antivirus.com/pc-cillin). However, this online scanner only works when you connect to it, and it does not check e-mail viruses for you.

You can’t catch a computer virus by reading the text of an e-mail message; you need to open (run) the attached virus program to infect your system. Some e-mail programs automatically “preview” e-mail attachments, which infects your computer automatically. Chapter 8 contains instructions for turning off e-mail program options that increase your risk of virus infection.

### Protecting Your Computer from Intruders with Firewalls

A *firewall* is a program that controls what information passes from one network to another. You can use a firewall between your PC and the Internet to stop outsiders from getting access to your PC via the Internet.

#### How Firewalls Work

Each packet on the Internet is addressed to a specific port number (described in the section “Ports and Port Numbers” earlier in this chapter), and you can control access by port. As a general rule, most people use only a few ports for Internet communication: port 21 (for FTP, or file transfer), port 25 (for outgoing e-mail), port 80 (for web pages), and port 110 (for incoming e-mail). If your computer is on a local area network, it may use port 139 for file and printer sharing. You do not want outsiders to be able to use this port, so you may want to block anyone on the Internet from accessing port 139.

A firewall controls which ports are open, refusing to respond to packets addressed to other ports. Some firewalls enable you to specify what types of packets can cross the firewall—for example, requests for web pages might be allowed outgoing, but not incoming.

Some firewalls control only incoming information. For example, Windows ME and XP come with the Internet Connection Firewall (ICF), described in Chapter 3. ICF prevents some types of incoming Internet traffic based on the port number, so that hackers can’t detect that your computer is there, much less access its files.

However, with the advent of *Trojan horse* programs, you also need to worry about outgoing Internet traffic. A Trojan horse is a program that installs itself on your computer (usually arriving as a virus). It then sends packets out from your computer, with information about your files or what you have been typing lately (including passwords). A Trojan horse program can allow hackers to log onto your computer and run programs on it, send e-mail (usually spam) through your computer, or cause your
computer to participate in a *denial-of-service attack*, in which many computers simultaneously bombard an Internet server with thousands of requests for information, overloading the server.

A good firewall program monitors both incoming and outgoing packets and makes sure that outgoing packets come from a program that you know about. If it doesn’t recognize a program, it alerts you and asks what to do, as shown here:

You can run a firewall program on your computer or on a router or hub that stands between your computer and the Internet. For example, if your computer connects to the Internet through a local area network, the LAN’s hub or router can run a firewall program to provide protection to the whole LAN.

**Popular Firewall Programs**

Popular firewall programs that you can run on your PC include ZoneLabs ZoneAlarm ([www.zonelabs.com](http://www.zonelabs.com)), BlackIce PC Protection ([www.iss.net](http://www.iss.net)), McAfee Firewall ([www.mcafee-at-home.com](http://www.mcafee-at-home.com)), and Norton Personal Firewall ([www.symantec.com/product](http://www.symantec.com/product)). ZoneAlarm has a version that is free for individuals and nonprofit corporations—try it if you’re not yet using a firewall.

**Tip**

*For Macs, the most popular firewall program is Norton Anti-Virus, which runs on OS 8 and later, including OS X. OS X has a built-in firewall. You can also download BrickHouse from [securemac.com/brickhouse.php](http://securemac.com/brickhouse.php) for a $25 shareware fee, to make OS X’s built-in firewall more user friendly.*
Microsoft’s Internet Connection Firewall

Windows XP comes with the Internet Connection Firewall, a firewall program that protects your incoming, but not outgoing, Internet traffic. You configure the Internet Connection Firewall when you create a dial-up connection, as described in Chapter 3. Your only configuration option is to turn the firewall on or off—there are no other settings.

Testing Your Firewall

A firewall is no good if you don’t test that it’s working. To test your firewall, follow these steps:

1. Go to the Gibson Research Corporation’s web site at grc.com and follow the links to the Shields Up pages.
2. Download the free IP Agent program (it’s small—only 16Kb) and run it. The program displays your computer’s IP address, like this:

   ![IP Agent](image)

3. Click the Test My Shields button. A web page appears with the results of the test, telling you how well your firewall is working.
4. To test whether your firewall monitors outgoing packets, download the free LeakTest program from the Shields Up site (at grc.com/lt/leaktest.htm) and run it. The program is tiny (25Kb) and downloads in an instant.
5. Click the Test For Leaks button. LeakTest tries to connect to the Shields Up site (using the FTP file transfer port), and your firewall program should alert you. If your firewall doesn’t say anything, it’s not effectively monitoring outgoing packets; a new and unknown program (LeakTest) is sending packets out from your computer, and your firewall should complain.

For more information on firewalls, see Steve Gibson’s Shields Up web site at grc.com/su-firewalls.htm, or the How Firewalls Work page at www.howstuffworks.com/firewall.htm.

Virtual Private Networks

Many large organizations have LANs that enable people within the organization to share files. Although the LAN is connected to the Internet, most organizations install a firewall to block Internet users from accessing information on the LAN. However, what if you
work for such an organization and you are on a business trip? You can connect to the Internet through an Internet provider, but how can you access your organization’s LAN?

**Virtual Private Networking (VPN)** provides a way for an authorized computer on the Internet to **tunnel** through a firewall and connect to a computer on a LAN. When you are on the road and you need to connect to a computer at your office, VPN is the way to make the connection.

To connect to a LAN through a firewall, the firewall must support **Point-to-Point Tunneling Protocol (PPTP)**, which lets VPN connect you through the firewall. Your organization’s LAN administrator sets up a **VPN server**, the program on the LAN that provides PPTP. Both the **VPN client** (the computer making the connection) and the VPN server must have Internet connections. See the section on connecting to an organization’s LAN using VPN in Chapter 3 for how to configure your computer to make the connection.

### Choosing Passwords

On the Internet, you need a password for your account (to get connected), a password for your e-mail mailbox (which may be the same as your connection password), and passwords for the many web sites with which you do business. What kind of passwords should you choose? A good password is easy to remember and hard to guess. It’s hard to find a password that has both properties. A very simple, easy-to-remember password (such as the name of the street that you live on, for example) is also easy for someone else to figure out. A really difficult password (a random collection of letters and numbers, such as “

Writing down your password solves some problems, but creates others. If you travel with a laptop and keep a file named Passwd.txt, then anyone who steals your laptop can get into your accounts. Using the same password for all of your accounts saves wear-and-tear on your memory, but it’s dangerous. If you tell someone how to use your **Wall Street Journal** account to read the news, the same password provides access to your brokerage account. In a nightmare scenario, someone could establish an attractive web site and ask people to register, simply to collect their favorite passwords and break into other accounts that they have.

You shouldn’t let security issues keep you from using the Internet, but you should remain just paranoid enough to take a few precautions, such as the following:

- **Have a different password for each kind of account.** If you’re the kind of person who likes to sign up for free things, you could easily wind up registering at dozens of web sites. Don’t try to create and remember a different password for each one. Choose three or four passwords at different levels of difficulty, and use the same password for all accounts of the same type.

- **Vary the difficulty of the passwords depending on what you’re trying to protect.** Some passwords are more for the web site’s protection than for yours. For example, if someone could guess your ESPN password, he or she could pretend to be you and read the members-only parts of the ESPN web site without paying the
subscription fee. That would annoy ESPN a lot more than it would annoy you. A password such as “LetMeIn” might be sufficient.

On the other hand, if you have an account with a retailer, and the retailer keeps your credit card number on file, someone who guesses your password can buy products with your credit card. Someone who guesses your online banking password may be able to write checks. Someone who guesses your online brokerage account password can buy and sell stocks for you. These accounts need very strong passwords.

Some passwords protect your private information. The password on an e-mail account, for example, prevents someone else from reading your e-mail and sending out messages that appear to be from you. Would that be a huge disaster, or merely a nuisance? Choose your password accordingly.

- **If you’re protecting anything important, don’t use any English word or common name.** Passwords are stored in an encrypted form that is very difficult to decrypt. However, password-cracking programs work by running through a large number of guesses, encrypting the guesses, and checking to see whether the encryption matches the encrypted password. Such a program can run through all the words in a dictionary within hours.

- **Use your brain sludge.** If you can’t use words or names, where are you going to get all of these passwords, especially the difficult ones? And how are you going to remember them? The best passwords take advantage of what humorist Dave Barry calls “brain sludge”—all those useless odds and ends that stick in your memory for no good reason. Maybe you still remember the phone number of a high school girlfriend. She doesn’t live there anymore and maybe you wouldn’t call her if she did, but that number is taking up space in your head. Use it in a password. Let the guy who steals your laptop try to figure that one out.

- **Use acronyms.** You can make up a lot of easy-to-remember but hard-to-guess passwords by taking the first letter from each word of a memorable phrase. Nathan Hale’s famous “I regret that I have but one life to give for my country” produces “IRTIHBIILTGFMC.” The famous Richard M. Nixon quote “I am not a crook” could give you the password “rmnimnac.” They look like random strings of characters, but they aren’t. Best of all is an acronym based on a quotation that isn’t even famous; maybe it’s just something that your Aunt Betty used to say all the time.

- **Stick a number in, spell it wrong (or backwards), or glue a few words together.** A friend used to use friends’ names spelled backward, with a digit in the middle (like “nas3uS”).

- **Don’t write down passwords, write down hints.** If you need to write something down, all you need is a hint that will activate the appropriate brain sludge. The notation “AOL-Tracy” might be enough to remind you that your America Online password has something to do with that high school girlfriend. Jotting down “watergate” or “Hale” might be all you need to remember the Nixon or Nathan Hale passwords.