chapter 24

The Internet

"The Internet is a great way to get on the Net."

—Bob Dole

In this chapter, you will learn how to

- Explain how the Internet works
- Connect to the Internet
- Use Internet application protocols
- Troubleshoot an Internet connection

Imagine coming home from a long day at work building and fixing PCs, sitting down in front of your shiny new computer, double-clicking the single icon that sits dead center on your monitor…and suddenly you're enveloped in an otherworldly scene, where 200-foot trees slope smoothly into snow-white beaches and rich blue ocean. Overhead, pterodactyls soar through the air while you talk to a small chap with pointy ears and a long robe about heading up the mountain in search of a giant monster…. A TV show from the Syfy channel? Spielberg's latest film offering? How about an interactive game played by millions of people all over the planet on a daily basis by connecting to the Internet? If you guessed the last one, you're right.

This chapter covers the skills you need as a PC tech to help people connect to the Internet. It starts with a brief section on how the Internet works, along with the concepts of connectivity, and then it goes into the specifics on hardware, protocols, and software that you use to make the Internet work for you (or for your client). Finally, you'll learn how to troubleshoot a bad Internet connection. Let's get started!

Historical/Conceptual

How the Internet Works

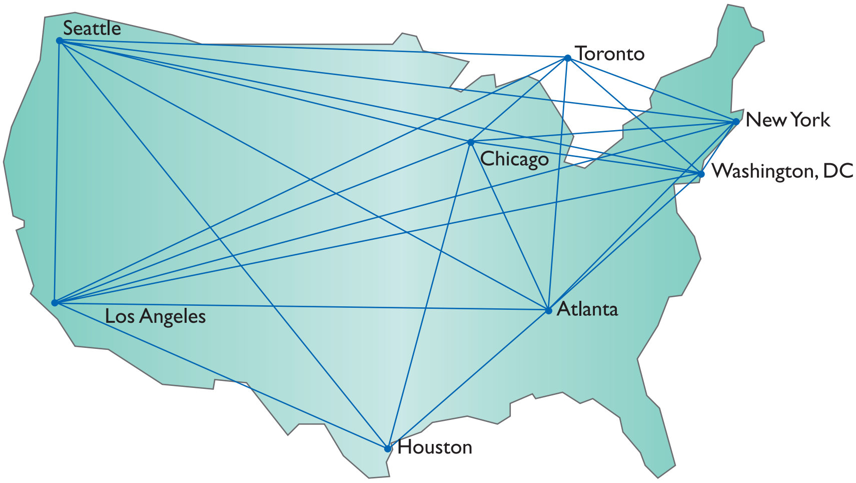
Thanks to the Internet, people can communicate with one another over vast distances, often in the blink of an eye. As a PC tech, you need to know how PCs communicate with the larger world for two reasons. First, knowing the process and pieces involved in the communication enables you to troubleshoot effectively when that communication goes away. Second, you need to be able to communicate knowledgeably with a network technician who comes in to solve a more complex issue.

Internet Tiers

You probably know that the Internet is millions and millions of computers all joined together to form the largest network on earth, but not many folks know much about how these computers are organized. To keep everything running smoothly, the Internet is broken down into groups called **tiers**. The main tier, called *Tier 1*, consists of nine companies called *Tier 1 providers*. The Tier 1 providers own long-distance, high-speed fiber-optic networks called *backbones*. These backbones span the major cities of the earth (not all Tier 1 backbones go to all cities) and interconnect at special locations called *network access points* (*NAPs*). Anyone wishing to connect to any of the Tier 1 providers must pay large sums of money. The Tier 1 providers do not charge each other to connect.

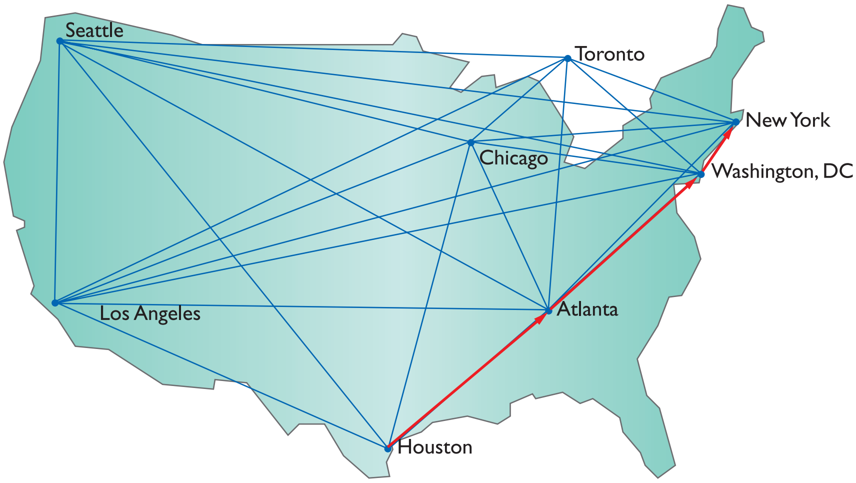
Tier 2 providers own smaller, regional networks and must pay the Tier 1 providers. Most of the famous companies that provide Internet access to the general public are Tier 2 providers. *Tier 3 providers* are even more regional and connect to Tier 2 providers.

The piece of equipment that makes this tiered Internet concept work is called a backbone router. *Backbone routers* connect to more than one other backbone router, creating a big, interwoven framework for communication. Figure 24.1 illustrates the decentralized and interwoven nature of the Internet. The key reason for interweaving the backbones of the Internet was to provide alternative pathways for data if one or more of the routers went down. If Jane in Houston sends a message to her friend Polly in New York City, for example, the shortest path between Jane and Polly in this hypothetical situation is this: Jane's message originates at Rice University in Houston, bounces to Emory University in Atlanta, flits through Virginia Commonwealth University in Richmond, and then zips into SUNY

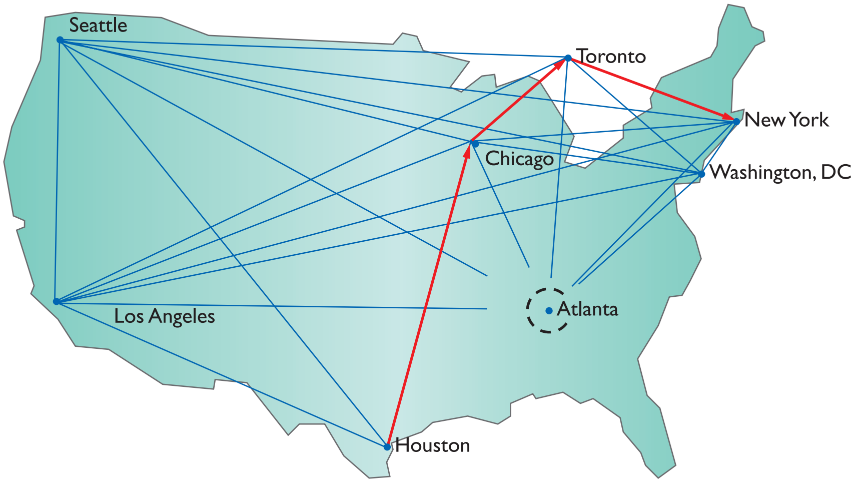


• Figure 24.1 Internet Tier 1 connections in New York City (see Figure 24.2). Polly happily reads the message and life is great. The Internet functions as planned.

But what happens if the entire southeastern United States experiences a huge power outage and Internet backbones in every state from Virginia to Florida go down? Jane's message would bounce back to Rice and the Rice computers. Being smart cookies, the routers would reroute the message to nodes that still functioned—say, Rice to University of Chicago, to University of Toronto, and then to SUNY (see Figure 24.3). It's all in a day's work for the highly redundant and adaptable Internet. At this point in the game, the Internet simply cannot go down fully—barring, of course, a catastrophe of Biblical proportions.



• **Figure 24.2** Message traveling from Houston to NYC



• **Figure 24.3** Rerouted message from Houston to NYC

TCP/IP—The Common Language of the Internet

As you know from all the earlier chapters in this book, hardware alone doesn't cut it in the world of computing. You need software to make the machines run and create an interface for humans. The Internet is no exception. TCP/IP provides the basic software structure for communication on the Internet.

Because you spent a good deal of Chapter 22 working with TCP/IP, you should have an appreciation for its adaptability and, perhaps more importantly, its extendibility. TCP/IP provides the addressing scheme for computers that communicate on the Internet through IP addresses, such as 192.168.4.1 or 16.45.123.7. As a protocol, though, TCP/IP is much more than just an addressing system. TCP/IP provides the framework and common language for the Internet. And it offers a phenomenally wide-open structure for creative purposes. Programmers can write applications built to take advantage of the TCP/IP structure and features, creating what are called TCP/IP services. The cool thing about TCP/IP services is that they're limited only by the imagination of the programmers.

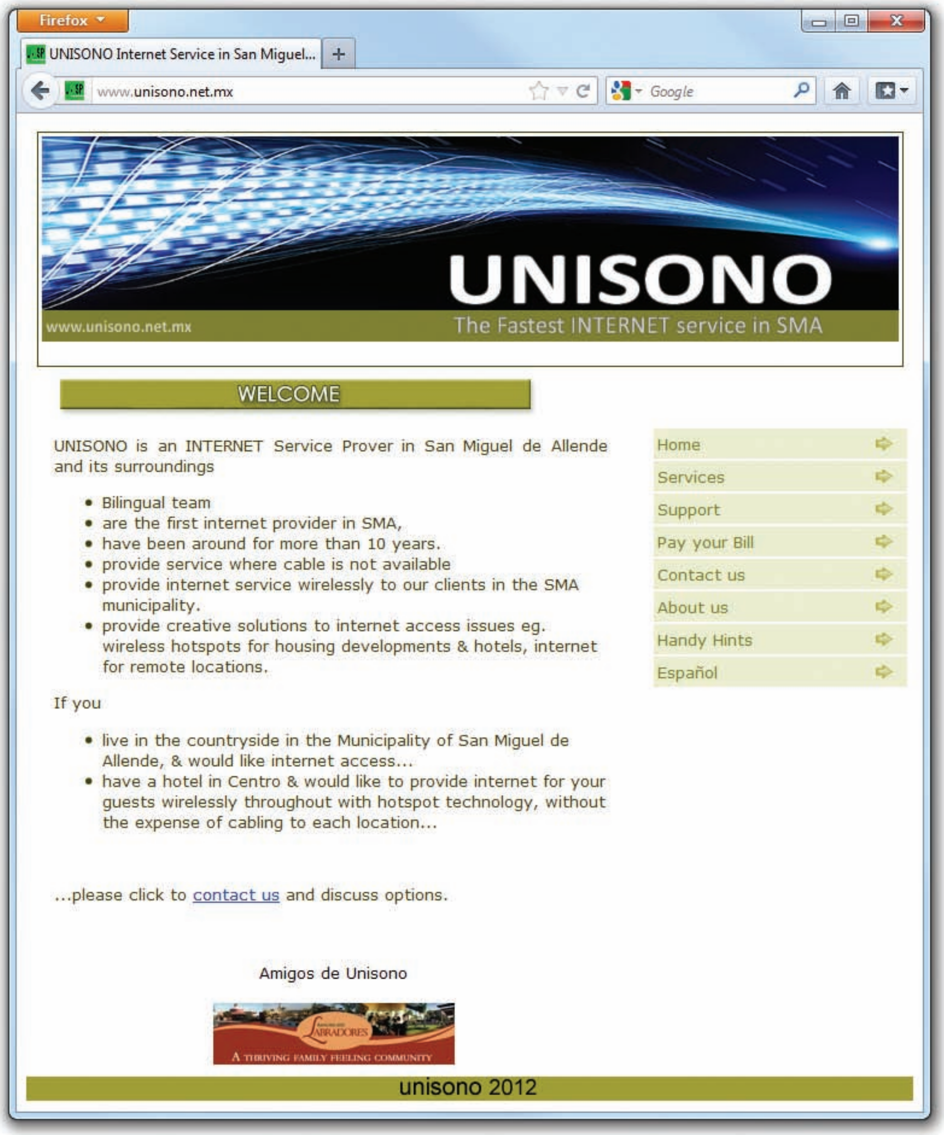
At this point, you have an enormous, beautifully functioning network. All the backbone routers connect with fiber and thick copper cabling backbones, and TCP/IP enables communication and services for building applications for humans to interface across the distances. What's left?

Oh, that's right: how do you tap into this great network and partake of its goodness?

Internet Service Providers

Every Tier 1 and Tier 2 provider leases connections to the Internet to companies called **Internet service providers (ISPs)**. ISPs essentially sit along the edges of the Tier 1 and Tier 2 Internet and tap into the flow. You can, in turn, lease some of the connections from the ISP and thus get on the Internet.

ISPs come in all sizes. Comcast, the cable television provider, has multiple, huge-capacity connections into the Internet, enabling its millions of customers to connect from their local machines and surf the Web. Contrast Comcast with Unisono, an ISP in San Miguel de Allende, Mexico (see Figure 24.4). Billed as the "the fastest Internet service" in San Miguel de



UNISONO is an INTERNET Service Prover in San Miguel de Allende and its surroundings

- Bilingual team
- are the first internet provider in SMA,
- have been around for more than 10 years.
- provide service where cable is not available
- provide internet service wirelessly to our clients in the SMA municipality.
- provide creative solutions to internet access issues eg. wireless hotspots for housing developments & hotels, internet for remote locations.

If you

- live in the countryside in the Municipality of San Miguel de Allende, & would like internet access...
- have a hotel in Centro & would like to provide internet for your guests wirelessly throughout with hotspot technology, without the expense of cabling to each location...

...please click to contact us and discuss options.

Amigos de Unisono

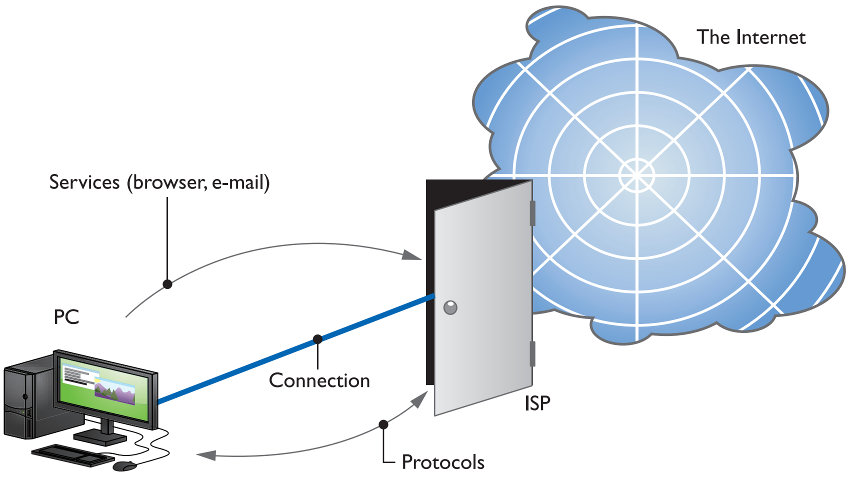
unisono 2012

• Figure 24.4 Unisono homepage

Allende, it services only a small (but delightful) community and the busy tourist crowd.

Connection Concepts

Connecting to an ISP requires two things to work perfectly: hardware for connectivity, such as a modem and a working cable line; and software, such as protocols to govern the connections and the data flow (all configured in Windows) and applications to take advantage of the various TCP/IP services. Once you have a contract with an ISP to grant you access to the Internet, a technician will often install your Internet connection device and any software you need. With most ISPs, a DHCP server will provide your PC with the proper TCP/IP information. As you know, the router to which you connect at the ISP is often referred to as the **default gateway**. Once your PC is configured, you can connect to the ISP and get to the greater Internet. Figure 24.5 shows a standard PC-to-ISP-to-Internet connection. Note that various protocols and other software manage the connectivity between your PC and the default gateway.



• **Figure 24.5** Simplified Internet connectivity

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Connecting to the Internet

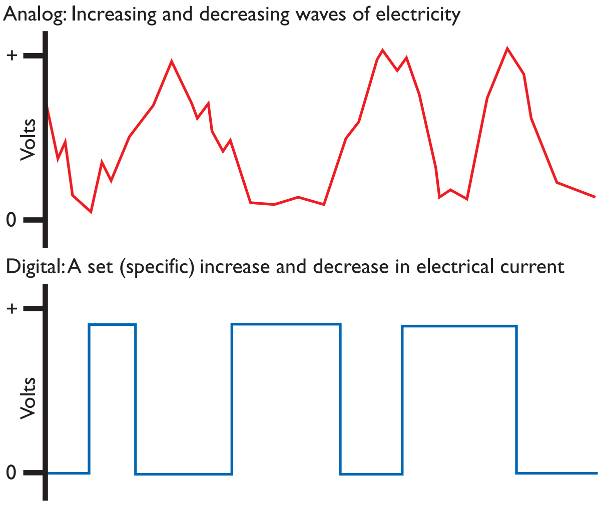
PCs commonly connect to an ISP by using one of nine technologies that fit into four categories: dial-up, both analog and ISDN; dedicated, such as DSL, cable, fiber, and LAN; wireless, including cellular and WiMAX; and satellite. Analog dial-up is the slowest of the bunch and requires a telephone line and a special networking device called a modem. ISDN uses digital dial-up and has much greater speed. Dedicated connections (cable and DSL) most often use a box that connects to a regular Ethernet NIC like you played with in Chapter 22. Wireless connections are a mixed bag, depending on the device and service you have. Some are built-in, while others use a box you attach to your LAN. Satellite is the odd one out here; it may use either a modem or a NIC, depending on the particular configuration you have, although most folks will use a NIC. Let's take a look at all these various connection options, and then finish this section by discussing basic router configuration and Internet Connection Sharing in Windows.

Dial-up

A dial-up connection to the Internet requires two pieces to work: hardware to dial the ISP, such as a modem or ISDN terminal adapter; and software to govern the connection, such as Microsoft's **Dial-up Networking (DUN)**. Let's look at the hardware first, and then we'll explore software configuration.

Modems

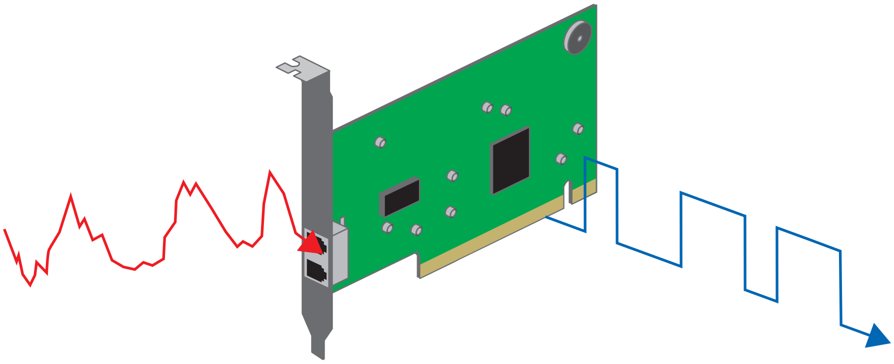
At some point in the early days of computing, some bright guy or gal noticed a colleague talking on a telephone, glanced down at a PC, and then put two and two together: why not use telephone lines for data communication? The basic problem with this idea is that traditional telephone lines use analog signals, while computers use digital signals (see Figure 24.6). Creating a dial-up network required equipment that could turn digital data into an analog signal to send it over the telephone line, and then turn it back into digital data when it reached the other end of the connection. A device called a modem solved this dilemma.


Analog: Increasing and decreasing waves of electricity

Digital: A set (specific) increase and decrease in electrical current

• **Figure 24.6** Analog signals used by a telephone line versus digital signals used by the computer

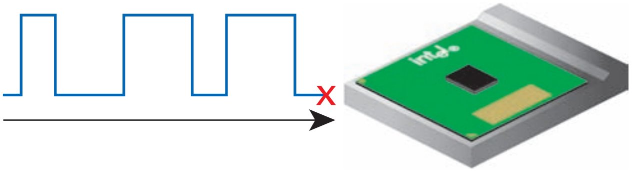
Modems enable computers to talk to each other via standard commercial telephone lines by converting analog signals to digital signals, and vice versa. The term *modem* is short for modulator/demodulator, a description of transforming the signals. Telephone wires transfer data via analog signals that continuously change voltages on a wire. Computers hate analog signals. Instead, they need digital signals, voltages that are either on or off, meaning the wire has voltage present or it does not. Computers, being binary by nature, use only two states of voltage: zero volts and positive volts. Modems take analog signals from telephone lines and turn them into digital signals that the PC can understand (see Figure 24.7). Modems also take digital signals from the PC and convert them into analog signals for the outgoing telephone line.



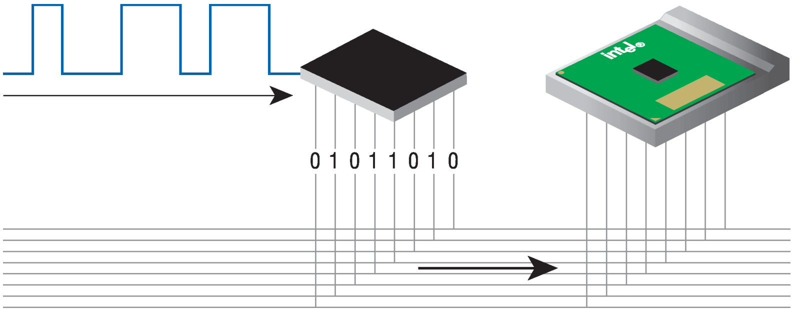
• **Figure 24.7** Modem converting analog signal to digital signal

A modem does what is called *serial communication*: It transmits data as a series of individual ones and zeros. The CPU can't process data this way. It needs parallel communication, transmitting and receiving data in discrete 8-bit chunks (see Figure 24.8). The individual serial bits of data are converted into 8-bit parallel data that the PC can understand through the **universal asynchronous receiver/transmitter (UART)** chip (see Figure 24.9).

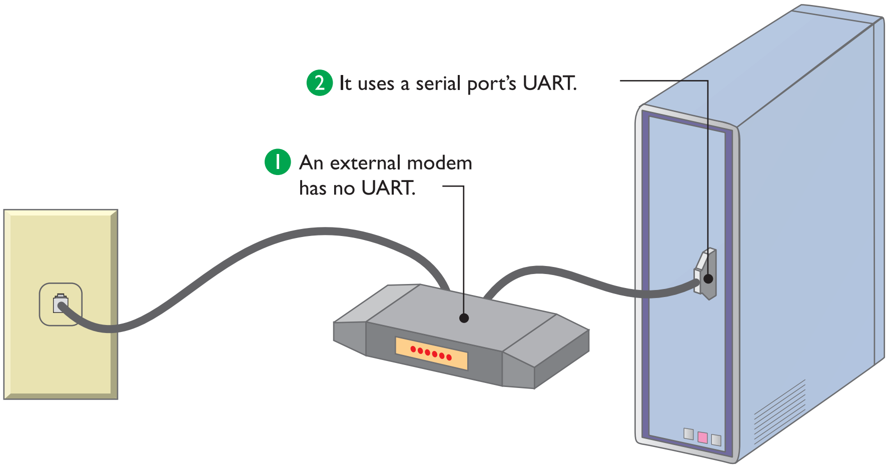
There are many types of UARTs, each with different functions. All serial communication devices are really



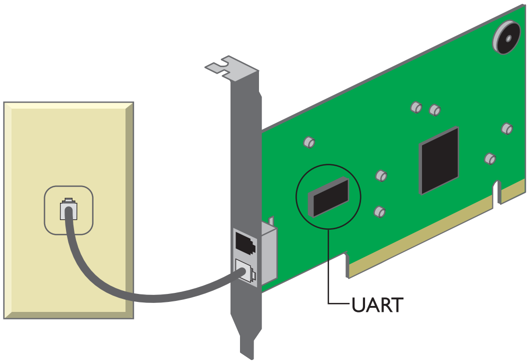
• **Figure 24.8** CPUs can't read serial data.



• **Figure 24.9** The UART chip converts serial data to parallel data that the CPU can read.


2 It uses a serial port's UART.
1 An external modem has no UART.

• **Figure 24.10** An external modem uses the PC's serial port.



• **Figure 24.11** An internal modem has UART built in.

little more than UARTs. *External* modems can convert analog signals to digital ones and vice versa, but they must rely on the serial ports to which they're connected for the job of converting between serial and parallel data (see Figure 24.10). Internal modems can handle both jobs because they have their own UART built in (see Figure 24.11).

Phone lines have a speed based on a unit called a **baud**, which is one cycle per second. The fastest rate that a phone line can achieve is 2400 baud. Modems can pack multiple bits of data into each baud; a 33.6 kilobits per second (Kbps) modem, for example, packs 14 bits into every baud: 2400 × 14 = 33.6 Kbps. Thus, it is technically incorrect to say, "I have a 56-K baud modem." The correct statement is, "I have a 56-Kbps modem." But don't bother; people have used the term "baud" instead of **bits per second (bps)** so often for so long that the terms have become functionally synonymous.

Modem Connections Internal modems connect to the PC very differently from how external modems connect. Almost all internal modems connect to a PCI or PCI Express expansion bus slot inside the PC, although cost-conscious manufacturers may use smaller modems that fit in special expansion slots designed to support multiple communications features such as modems, NICs, and sound cards (see Figure 24.12). Older AMD motherboards used Audio/Modem Riser (AMR) or Advanced Communication Riser (ACR) slots, while Intel motherboards used Communication and Networking Riser (CNR) slots.

External modems connect to the PC through an available serial port (the old way) or USB port (see Figure 24.13). USB offers simple plug and play and easy portability between machines, plus such modems require no external electrical source, getting all the power they need from the USB connection.

AMR, ACR, and CNR slots have gone away, though you'll still find them on older systems. Current systems use built-in components or PCIe ×1 slots for modems, sound, and NICs.

Cross Check

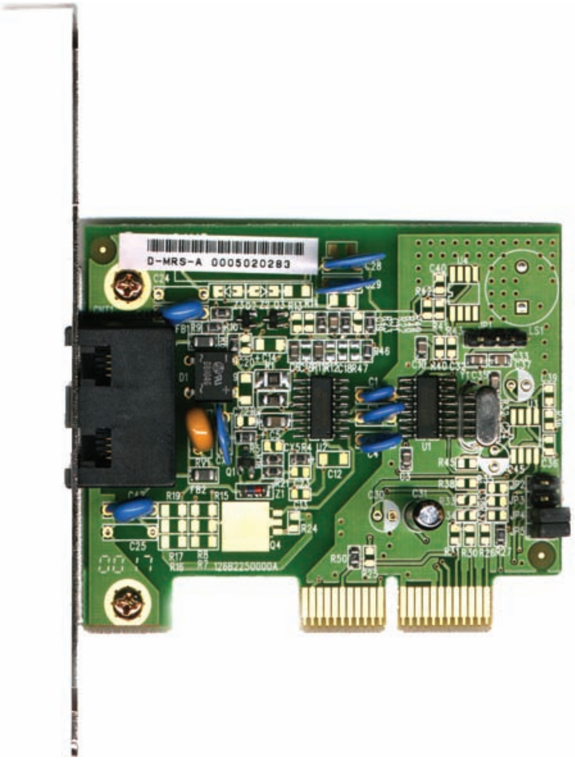
Installing a PCI\PCIe Modem

Installing a PCI or PCIe modem card involves pretty much the same process as installing any other PCI\PCIe card. Refer to Chapter 9 and cross check your knowledge of the process.

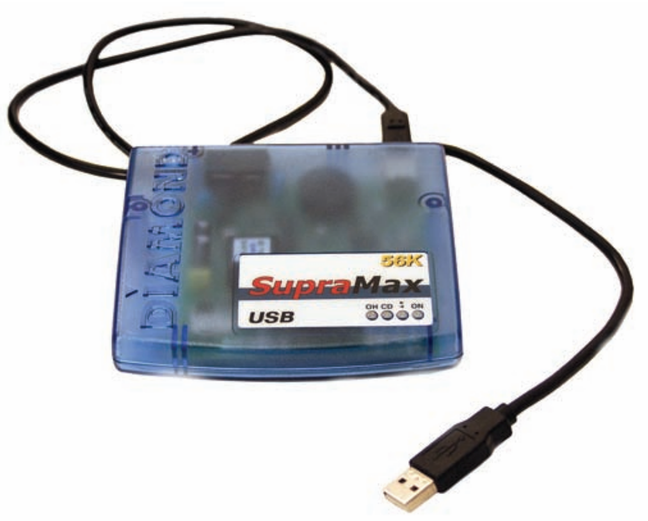
1. What do you need to guard against when installing a PCI\ PCIe card?
2. Any issues involving drivers, plug and play, or other hardware topics?

Dial-up Networking

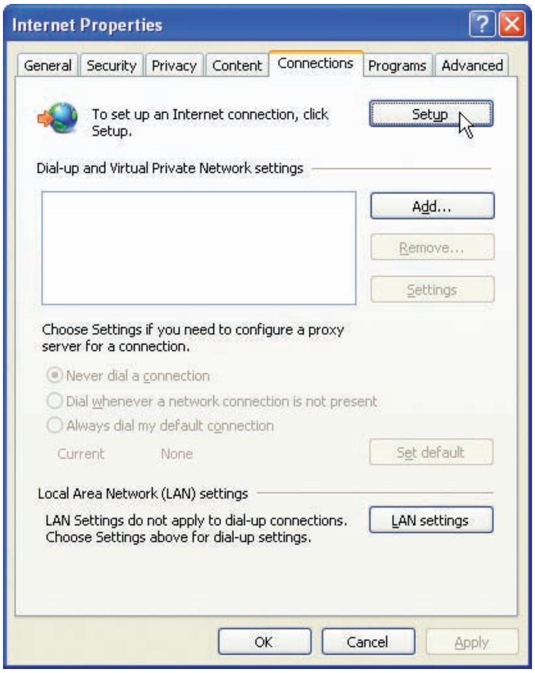
The software side of dial-up networks requires configuration within Windows to include information provided by your ISP. The ISP provides a dial-up telephone number or numbers, as well as your user name and initial password. In addition, the ISP will tell you about any special configuration options you need to specify in the software setup. The full configuration of dial-up networking is beyond the scope of this book, but you should at least know where to go to follow instructions from your ISP. Let's take a look at the Network and Internet Connections applet in Windows XP.



• **Figure 24.12** A CNR modem



• **Figure 24.13** A USB modem



To set up an Internet connection, click Setup.

Dial-up and Virtual Private Network settings

Choose Settings if you need to configure a proxy server for a connection.

◉ Never dial a connection
○ Dial whenever a network connection is not present
○ Always dial my default connection

Current None

Local Area Network (LAN) settings

LAN Settings do not apply to dial-up connections. Choose Settings above for dial-up settings.

• **Figure 24.14** The Connections tab in the Internet Properties dialog box

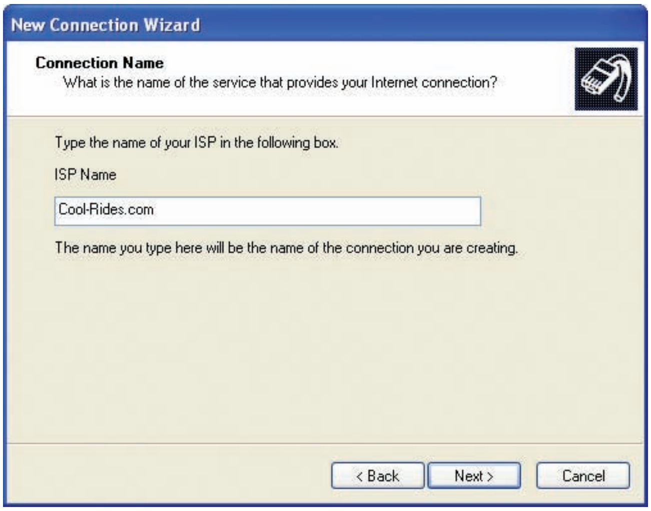
Configuring Dial-up To start configuring a dial-up connection in Windows XP, open the Control Panel. Select Network and Internet Connections from the Pick a category menu and then choose *Set up or change your Internet connection* from the Pick a task menu. The Internet Properties dialog box opens with the Connections tab displayed (see Figure 24.14). All your work will proceed from here.

Click the Setup button to run the New Connection Wizard (see Figure 24.15), and then work through the screens. At this point, you're going to need information provided by your ISP to configure your connection properly. When you finish the configuration, you'll see a new Connect To option on the Start menu if your system is set up that way. If not, open up Network Connections, and your new dial-up connection will be available. Figure 24.16 shows the option to connect to a fictitious ISP, Cool-Rides.com.

Windows Vista and 7 handle dial-up connections in the same way. Open the Network and Sharing Center and click on *Set up a new connection or network* (see Figure 24.17).

Select *Set up a dial-up connection* on the next screen and then enter your dial-up information, as shown in Figure 24.18.

PPP Dial-up links to the Internet have their own special hardware protocol called **Point-to-Point Protocol (PPP)**. PPP is a streaming protocol developed especially for dial-up Internet access. To Windows, a modem is nothing more than a special type of network adapter. You can configure a new dial-up connection in the Network and Sharing Center in Vista/7 or the Network Connections applet in XP.



Connection Name

What is the name of the service that provides your Internet connection?

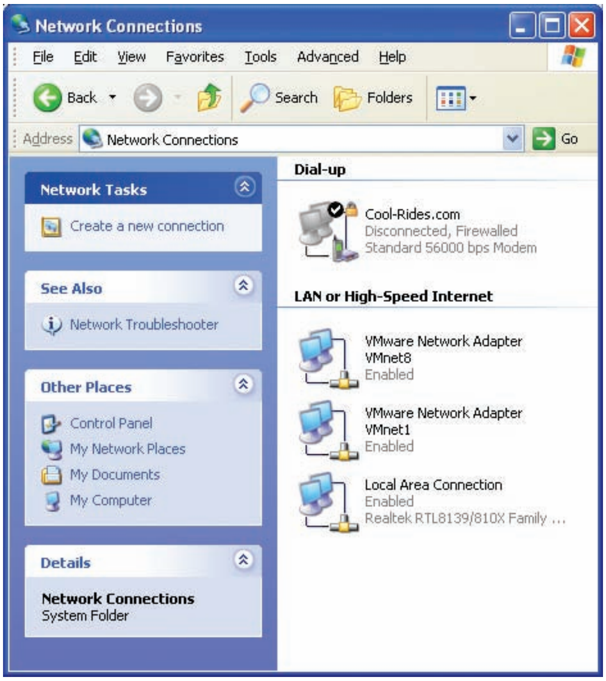
Type the name of your ISP in the following box.

ISP Name

Cool-Rides.com

The name you type here will be the name of the connection you are creating.

• **Figure 24.15** The New Connection Wizard



Network Connections
System Folder

Dial-up

Cool-Rides.com
Disconnected, Firewalled
Standard 56000 bps Modem

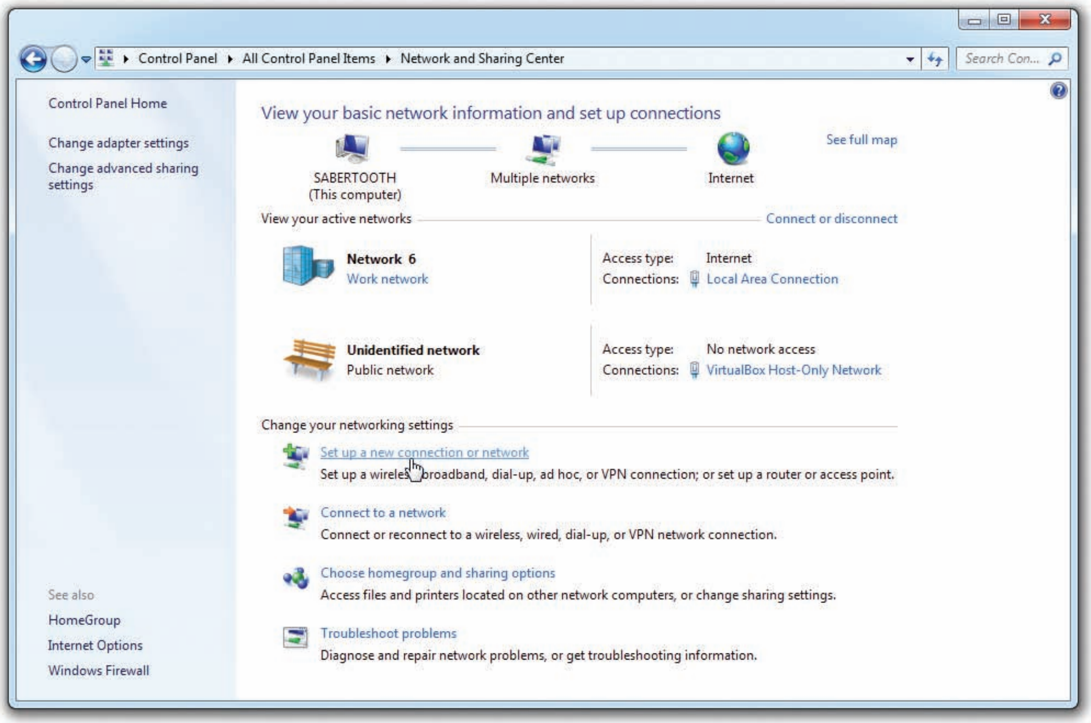
LAN or High-Speed Internet

VMware Network Adapter VMnet8
Enabled

VMware Network Adapter VMnet1
Enabled

Local Area Connection
Enabled
Realtek RTL8139/810X Family ...

• **Figure 24.16** Connection options in Network Connections



View your basic network information and set up connections

SABERTOOTH (This computer) — Multiple networks — Internet

See full map

View your active networks — Connect or disconnect

Network 6
Work network
Access type: Internet
Connections: Local Area Connection

Unidentified network
Public network
Access type: No network access
Connections: VirtualBox Host-Only Network

Change your networking settings

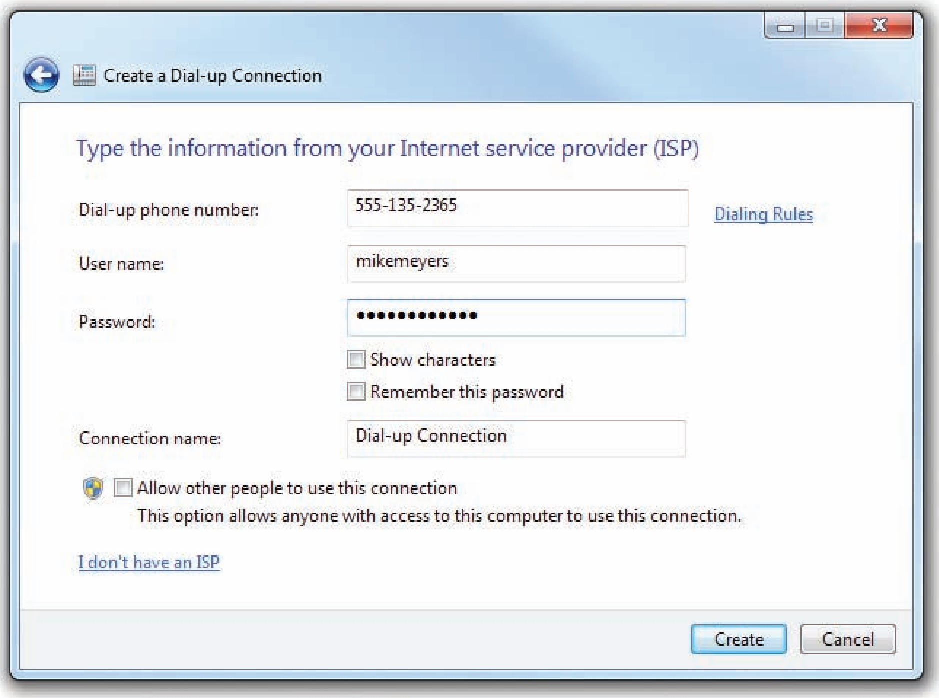
Set up a new connection or network
Set up a wireless, broadband, dial-up, ad hoc, or VPN connection; or set up a router or access point.

Connect to a network
Connect or reconnect to a wireless, wired, dial-up, or VPN network connection.

Choose homegroup and sharing options
Access files and printers located on other network computers, or change sharing settings.

Troubleshoot problems
Diagnose and repair network problems, or get troubleshooting information.

• **Figure 24.17** Set up a connection or network in Windows 7



Type the information from your Internet service provider (ISP)

Dial-up phone number: 555-135-2365 Dialing Rules

User name: mikemeyers

Password: ●●●●●●●●●●●●●

□ Show characters

□ Remember this password

Connection name: Dial-up Connection

□ Allow other people to use this connection
This option allows anyone with access to this computer to use this connection.

I don't have an ISP

• **Figure 24.18** Creating a dial-up connection in Windows 7

Most dial-up "I can't connect to the Internet"–type problems are user errors. Your first area of investigation is the modem itself. Use the modem's properties to make sure the volume is turned up. Have the user listen to the connection. Does she hear a dial tone? If she doesn't, make sure the modem's line is plugged into a good phone jack. Does she hear the modem dial and then hear someone saying, "Hello? Hello?" If so, she probably dialed the wrong number! Wrong password error messages are fairly straightforward—remember that the password may be correct but the user name may be wrong. If she still fails to connect, it's time to call the network folks to see what is not properly configured in her dial-up modem's Properties dialog box.

ISDN

A standard telephone connection comprises many pieces. First, the phone line runs from your phone out to a network interface box (the little box on the side of your house) and into a central switch belonging to the telephone company. (In some cases, intermediary steps are present.) Standard metropolitan areas have a large number of central offices, each with a central switch. Houston, Texas, for example, has nearly 100 offices in the general metro area. These central switches connect to each other through high-capacity *trunk lines*. Before 1970, the entire phone system was analog; over time, however, phone companies began to upgrade their trunk lines to digital systems. Today, the entire telephone system, with the exception of the line from your phone to the central office, and sometimes even that, is digital.

During this upgrade period, customers continued to demand higher throughput from their phone lines. The old telephone line was not expected to produce more than 28.8 Kbps (56-K modems, which were a *big* surprise to the phone companies, didn't appear until 1995). Needless to say, the phone companies were very motivated to come up with a way to generate higher capacities. Their answer was actually fairly straightforward: make the entire phone system digital. By adding special equipment at the central office and the user's location, phone companies can now achieve a throughput of up to 64 K per line (see the paragraphs following) over the same copper wires already used by telephone lines. This process of sending telephone transmission across fully digital lines end-to-end is called **integrated services digital network (ISDN)** service.

ISDN service consists of two types of channels: Bearer, or B, channels and Delta, or D, channels. B channels carry data and voice information at 64 Kbps. D channels carry setup and configuration information and carry data at 16 Kbps. Most providers of ISDN allow the user to choose either one or two B channels. The more common setup is two B/one D, usually called a *basic rate interface* (*BRI*) setup. A BRI setup uses only one physical line, but each B channel sends 64 Kbps, doubling the throughput total to 128 Kbps. ISDN also connects much faster than modems, eliminating that long, annoying, mating call you get with phone modems. The monthly cost per B channel is slightly more than a regular phone line, and usually a fairly steep initial fee is levied for the installation and equipment. The big limitation is that you usually need to be within about 18,000 feet of a central office to use ISDN.

Another type of ISDN, called a primary rate interface (PRI), is composed of twenty-three 64-Kbps B channels and one 64-Kbps D channel, giving it a total throughput of 1.544 megabits per second. PRI ISDN lines are also known as T1 lines.

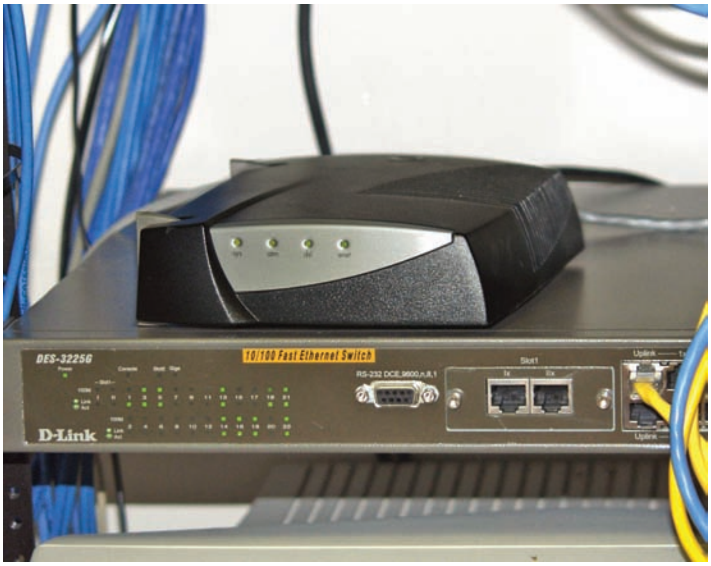
The physical connections for ISDN bear some similarity to analog modems. An ISDN wall socket usually looks something like a standard RJ-45 network jack. The most common interface for your computer is a device called a *terminal adapter* (*TA*). TAs look much like regular modems, and like modems, they come in external and internal variants. You can even get TAs that connect directly to your LAN.

DSL

Digital subscriber line (DSL) connections to ISPs use a standard telephone line but special equipment on each end to create always-on Internet connections at blindingly fast speeds, especially when compared with analog dial-up connections. Service levels vary around the United States, but the typical upload speed is ~768 Kbps, while download speed comes in at ~3+ Mbps.

The two most common forms of DSL you'll find are *asynchronous* (*ADSL*) and *synchronous* (*SDSL*). ADSL lines differ between slow upload speed (such as 384 Kbps, 768 Kbps, and 1 Mbps) and faster download speed (usually 3–15 Mbps). SDSL has the same upload and download speeds, but telecom companies charge a lot more for the privilege. DSL encompasses many such variations, so you'll often see it referred to as *x*DSL.

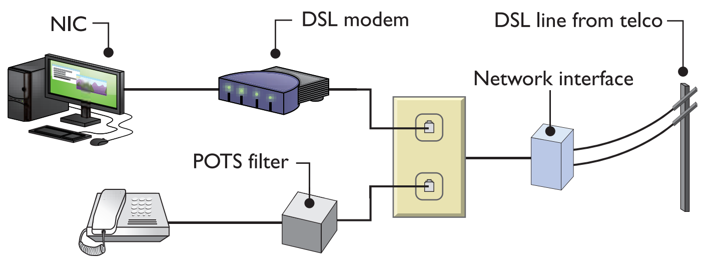
DSL requires little setup from a user standpoint. A tech comes to the house to install the DSL receiver, often called a DSL modem (see Figure 24.19), and possibly hook up a wireless router. The receiver connects to the telephone line and the PC (see Figure 24.20). The tech (or the user, if knowledgeable) then configures the DSL modem and router (if there is one) with the settings provided by the ISP, and that's about it! Within moments, you're surfing the Web. You don't need a second telephone line. You don't need to wear a special propeller hat or anything. The only kicker is that your house has to be within a fairly short distance from a main phone service switching center (central office), something like 18,000 feet.



• Figure 24.19 A DSL receiver

Cable

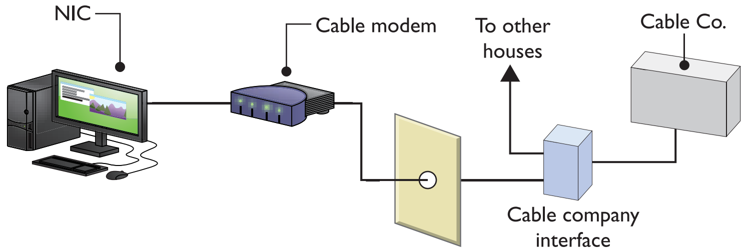
Cable offers a different approach to high-speed Internet access, using regular cable TV cables to serve up lightning-fast speeds. It offers faster service than most DSL connections, with a 1–10 Mbps upload and 6–100+ Mbps download. Cable Internet connections are theoretically available anywhere you can get cable TV.



• Figure 24.20 DSL connections

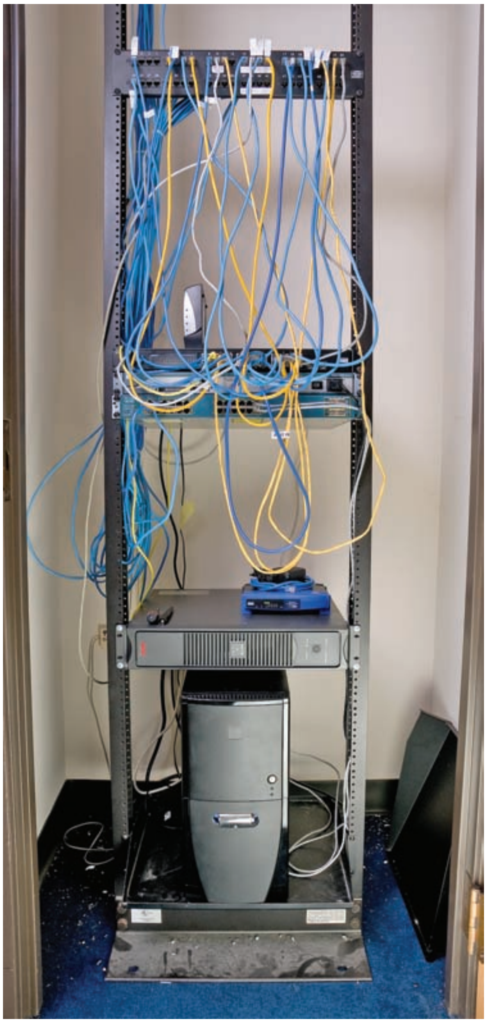
The term *modem* has been warped and changed beyond recognition in modern networking. Both DSL and cable—fully digital Internet connections—use the term *modem* to describe the box that takes the incoming signal from the Internet and translates it into something the PC can understand.

Secure your public hotspot Web browsing using HTTPS-secured sites. It's surprisingly easy to do. Instead of typing facebook.com, for example, type in https://facebook.com or use a service like the Electronic Freedom Federation's HTTPS Everywhere.



• Figure 24.21 Cable connections

Cable Internet connections start with an RG-6 or RG-59 cable coming into your house. The cable connects to a cable modem that then connects to a small home router or your NIC via Ethernet. Figure 24.21 shows a typical cable setup using a router.



• Figure 24.22 A wiring closet

LAN

Most businesses connect their internal local area network (LAN) to an ISP-supplied Ethernet network. Figure 24.22 shows a typical small-business wiring closet with routers that connect the LAN to the ISP's Ethernet. You learned all about wiring up a LAN in Chapter 22, so there's no need to go through any basics here. To complete a LAN connection to the Internet, you need a router to connect the ISP's network to your network. Most office buildings come with preinstalled Ethernet at varying speeds.

802.11 Wireless

802.11 Wireless is so prevalent that for many of us it's the way we get to the Internet. Wireless access points (WAPs) designed to serve the public abound in coffee shops, airports, fast-food chains, and bars. Even some cities provide partial to full 802.11 coverage.

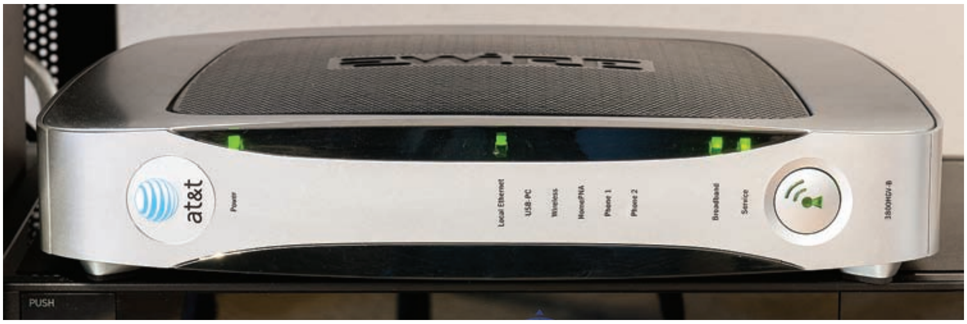
We covered 802.11 in detail in Chapter 23, so there's no reason to repeat the process of connecting to a hotspot. However, do remember that most hotspots do not provide any level of encryption, meaning it's a trivial task for a bad guy to monitor your connection and read everything you send or receive.

802.11 works well as an Internet access option for densely populated areas, but 802.11's short range makes it impractical in areas where it's not easy to place new access points.

An 802.11 network that covers a single city is an excellent example of a Metropolitan Area Network (MAN).

Fiber

Until recently, high costs meant that only those with money to burn could enjoy the super-fast speeds of a fiber connection. Now DSL providers have developed very popular fiber-to-the-node (FTTN) and fiber-to-the-premises (FTTP) services that provide Internet (and more), making them head-to-head competitors with the cable companies. With FTTN, the fiber connection runs from the provider to a box somewhere in your neighborhood. This box is connected to your home or office using



• **Figure 24.23** U-verse gateway

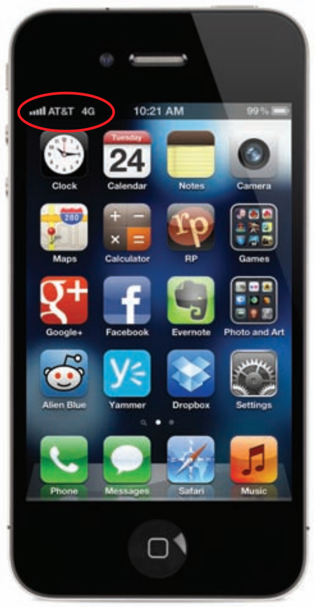
normal coaxial or Ethernet cabling. FTTP runs from the provider straight to a home or office, using fiber the whole way. Once inside the home or office, you can use any standard cabling (or wireless) to connect your PCs to the Internet. One popular FTTN service is AT&T's U-verse, which offers speeds up to 24 Mbps for downloads and 3 Mbps for uploads (see Figure 24.23). Verizon's FiOS service is the most popular and widely available FTTP service in the United States, providing download speeds up to 150 Mbps and upload speeds up to 50 Mbps (if you can afford it, of course).

Cellular

Who needs computers when you can get online with any number of mobile devices? Okay, there are plenty of things a smartphone or tablet can't do, but with the latest advances in cellular data services, your mobile Internet experience will feel a lot more like your home Internet experience than it ever has before.

Cellular data services have gone through a number of names over the years, so many that trying to keep track of them and place them in any order is extremely challenging. In an attempt to make organization somewhat clearer, the cellular industry developed a string of marketing terms using the idea of generations: first generation devices are called 1G, second generation are 2G, followed by 3G and 4G. On top of that, many technologies use G-names such as 2.5G to show they're not 2G but quite 3G. You'll see these terms all over the place, especially on your phones (see Figure 24.24). Marketing folks tend to bend and flex the definition of these terms in advertisements, so you should always read more about the device and not just its generation.

The first generation (1G) of cell phone data services was analog and not at all designed to carry packetized data. It wasn't until the early 1990s that two fully digital technologies called the Global System for Mobile Communications (GSM) and code division multiple access (CDMA) came into wide acceptance. GSM evolved into GPRS and EDGE, while CDMA introduced EV-DO. GPRS and EDGE were 2.5G technologies, while EV-DO was true 3G. Current standards, with names like UTMS, HSPA+, and HSDPA, have brought GSM-based networks into the world of 3G and 3.5G. Current mobile data services provide real-world download speeds around 3 or 4 Mbps.



• **Figure 24.24** iPhone with 4G showing

The CompTIA A+ will not ask you to define a G-level for a particular cellular technology.

You can share your smartphone's or tablet's connection to a cellular network using a process called *tethering*. You'll need to turn on the service on your device, then connect your phone to your computer, either wirelessly as a *mobile hotspot* or directly using a USB connection. Most carriers charge extra to enable tethering on your smartphone or tablet. Check with your carrier to see if your service plan supports tethering.

Just like LANs and WANs, we also have WLANs and WWANs. A wireless wide area network (WWAN) works similar to a WLAN, except it connects multiple networks like a WAN. WiMAX is an excellent example of a WWAN.

The current cutting-edge set of cellular technologies use the term 4G. The two biggest 4G technologies currently available are called **Worldwide Interoperability for Microwave Access (WiMAX)** and 3GPP **Long Term Evolution (LTE)**. With these networks, you'll see download speeds closer to 10 Mbps, though WiMAX lags behind LTE in the speed department. In fact, while the CompTIA A+ 220-801 exam objectives specifically cover WiMAX, the wireless technology has already been replaced as the 4G frontrunner. The only major U.S. WiMAX carrier, Clearwire, Inc., has declared their intentions to adopt LTE, along with every other major mobile phone network in the United States. But since CompTIA asked, and there are plenty of WiMAX users (for now), I'm more than happy to tell you a little more about WiMAX.

WiMAX runs at (depending on distance from a tower) a maximum speed of around 10 Mbps. The maximum range is 30 miles. There are two versions of WiMAX. Line-of-sight (LoS) WiMAX uses fixed antennas that point directly at a WiMAX transceiver. Non-LoS WiMAX (currently far more popular) uses base stations that are not visible to the WiMAX tower. As you might imagine, LoS WiMAX is far faster than non-LoS WiMAX.

Satellite

Satellite connections to the Internet get the data beamed to a satellite dish on your house or office; a receiver handles the flow of data, eventually sending it through an Ethernet cable to the NIC in your PC. I can already sense people's eyebrows raising. "Yeah, that's the download connection. But what about the upload connection?" Very astute, me hearties! The early days of satellite required you to connect via a modem. You would upload at the slow 26- to 48-Kbps modem speed, but then get super-fast downloads from the dish. It worked, so why complain? You really can move to that shack on the side of the Himalayas to write the great Tibetan novel and still have DSL-speed Internet connectivity. Sweet!

Satellite might be the most intriguing of all the technologies used to connect to the Internet today. As with satellite television, though, you need to have the satellite dish point at the satellites (toward the south if you live in the United States). The only significant issue to satellite is that the distance the signal must travel creates a small delay called the *satellite latency*. This latency is usually unnoticeable unless the signal degrades in foul weather such as rain and snow.

Satellite setup consists of a dish, professionally installed with line-of-sight to the satellite. A coax cable runs from the dish to your satellite modem. The satellite modem has an RJ-45 connection, which you may then connect directly to your computer or to a router.

Connection to the Internet

So you went out and signed up for an Internet connection. Well, now it's time to get connected. You basically have two choices:

1. Connect a single computer to your Internet connection
2. Connect a network of computers to your Internet connection

Connecting a single computer to the Internet is easy. If you're using wireless, you connect to the wireless box using the provided information, although a good tech will always go through the proper steps described in Chapter 23 to protect the wireless network. If you choose to go wired, you run a cable from whatever type of box is provided to the PC.

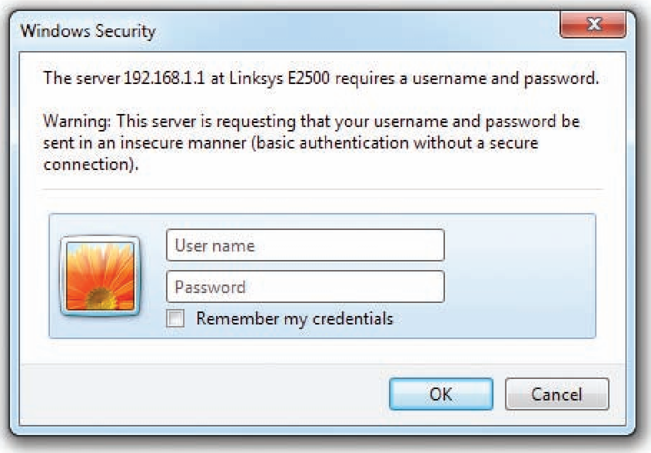
If you want to connect a number of computers using wired connections, you'll need to grab a router. Several manufacturers offer robust, easy-to-configure routers that enable multiple computers to connect to a single Internet connection. These boxes require very little configuration and provide firewall protection between the primary computer and the Internet, which you'll learn more about in Chapter 29. All it takes to install one of these routers is simply to plug your computer into any of the LAN ports on the back, and then to plug the cable from your Internet connection into the port labeled Internet or WAN.

• **Figure 24.25** Common home router with Wi-Fi

There are hundreds of perfectly fine choices for SOHO (small office/home office) routers, but the author's current favorite is the Cisco E2500 (see Figure 24.25). This little router has four 10/100 Ethernet ports for the LAN computers, and a Wi-Fi radio for any wireless computers you may have. The Cisco E2500, like all home routers, uses a technology called **Network Address Translation (NAT)**. NAT performs a little network subterfuge: It presents an entire LAN of computers to the Internet as a single machine. It effectively hides all of your computers and makes them appear invisible to other computers on the Internet. All anyone on the Internet sees is your *public* IP address. This is the address your ISP gives you, while all the computers in your LAN use private addresses that are invisible to the world. NAT therefore acts as a firewall, protecting your internal network from probing or malicious users from the outside.

Basic Router Configuration

SOHO routers require very little in the way of configuration and in many cases will work perfectly (if incredibly unsafely) right out of the box. In some cases, though, you may have to deal with a more complex network that requires changing the router's settings. The vast majority of these routers have built-in configuration Web pages that you access by typing the router's IP address into a browser. The address varies by manufacturer, so check the router's documentation. If you typed in the correct address, you should then receive a prompt for a user name and password, as in Figure 24.26. As with the IP address, the default user name and password change depending on the model/manufacturer. Once you enter the

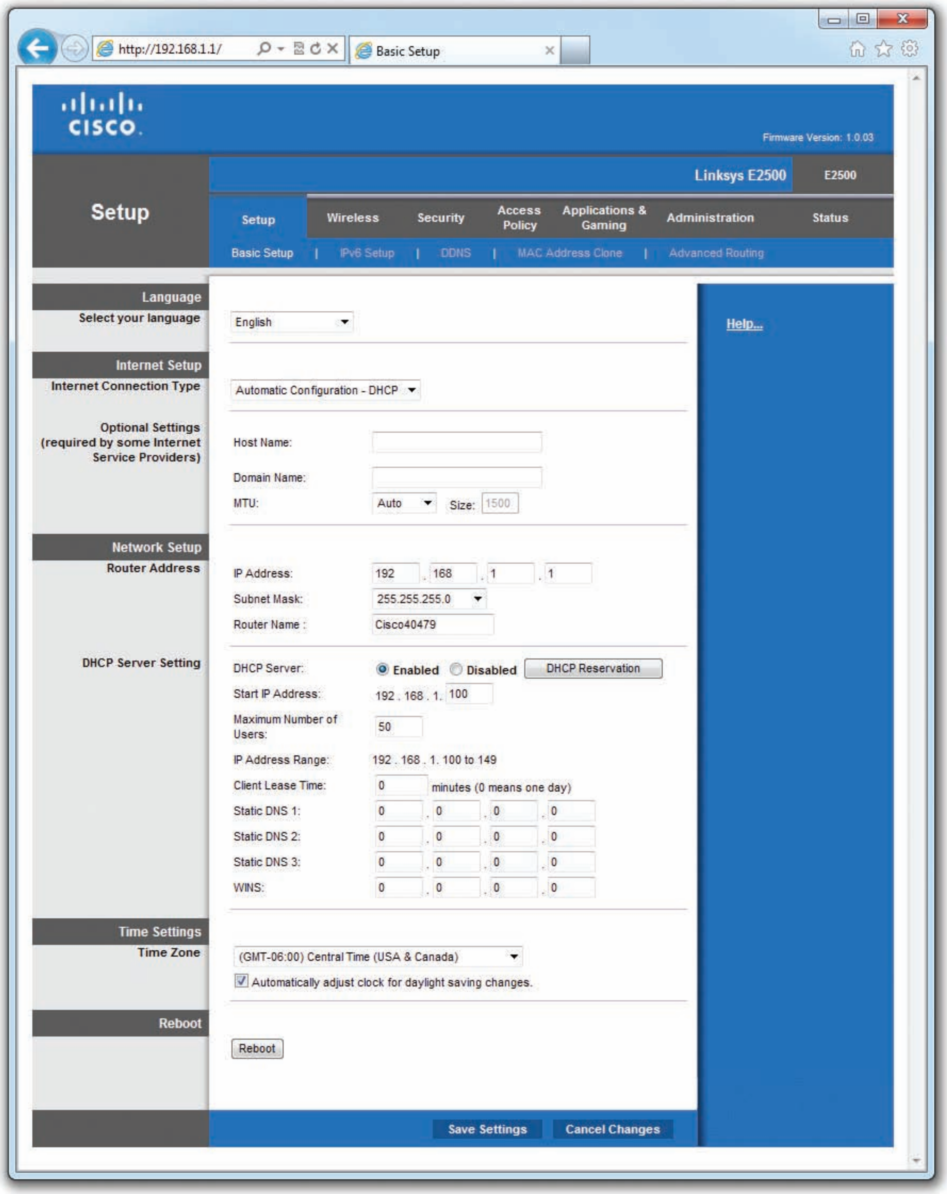


The server 192.168.1.1 at Linksys E2500 requires a username and password.

Warning: This server is requesting that your username and password be sent in an insecure manner (basic authentication without a secure connection).

• **Figure 24.26** Router asking for user name and password correct credentials, you will be greeted by the router's configuration pages (see Figure 24.27). From these pages, you can change any of the router's settings. Now look at a few of the basic settings that CompTIA wants you to be familiar with.

Changing User Name and Password All routers have a user name and password that gives you access to the configuration screen. One of the first changes you should make to your router after you have it working is to change the user name and password to something other than the default. This is especially important if you have open wireless turned on, which you'll recall from Chapter 23. If you leave the default user name and password, anyone who has access to your LAN can easily gain access to the router and change its settings. Fortunately, router manufacturers make it



Language
Select your language: English

Internet Setup
Internet Connection Type: Automatic Configuration - DHCP

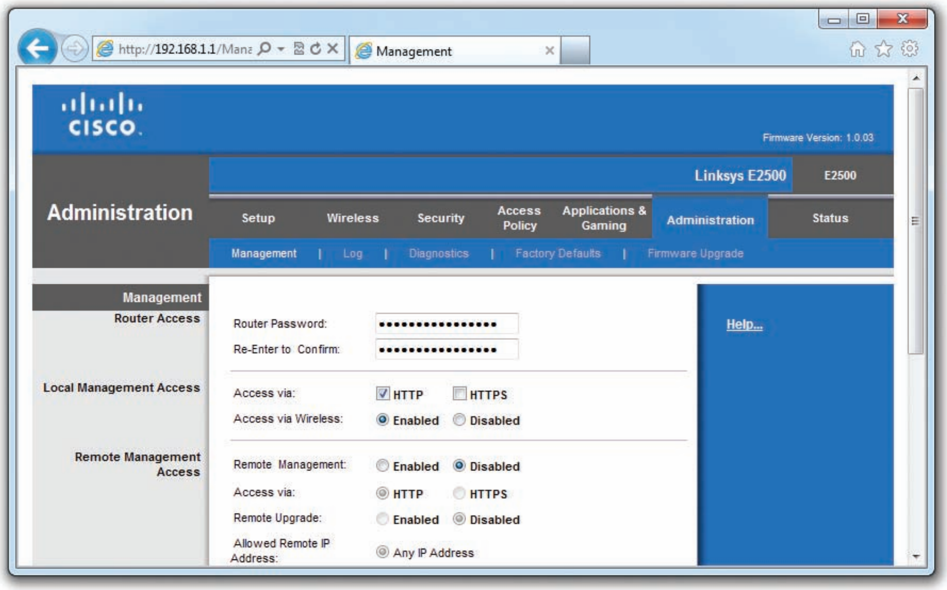
Optional Settings (required by some Internet Service Providers)
Host Name:
Domain Name:
MTU: Auto Size: 1500

Network Setup
Router Address
IP Address: 192 . 168 . 1 . 1
Subnet Mask: 255.255.255.0
Router Name : Cisco40479

DHCP Server Setting
DHCP Server: ● Enabled ○ Disabled
Start IP Address: 192 . 168 . 1. 100
Maximum Number of Users: 50
IP Address Range: 192 . 168 . 1. 100 to 149
Client Lease Time: 0 minutes (0 means one day)
Static DNS 1: 0 . 0 . 0 . 0
Static DNS 2: 0 . 0 . 0 . 0
Static DNS 3: 0 . 0 . 0 . 0
WINS: 0 . 0 . 0 . 0

Time Settings
Time Zone: (GMT-06:00) Central Time (USA & Canada)
☑ Automatically adjust clock for daylight saving changes.

• Figure 24.27 Configuration home page



Management

Router Access
Router Password: ••••••••••••••••
Re-Enter to Confirm: ••••••••••••••••

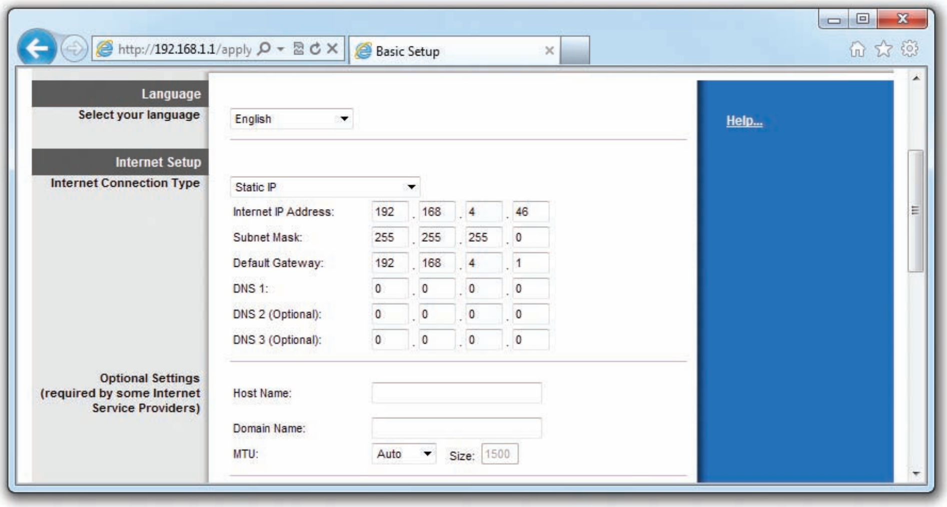
Local Management Access
Access via: ☑ HTTP □ HTTPS
Access via Wireless: ● Enabled ○ Disabled

Remote Management Access
Remote Management: ○ Enabled ● Disabled
Access via: ● HTTP ○ HTTPS
Remote Upgrade: ○ Enabled ● Disabled
Allowed Remote IP Address: ● Any IP Address

• Figure 24.28 Changing the password

easy to change a router's login credentials. On my E2500, for example, I just click on the Administration tab and fill in the appropriate boxes as shown in Figure 24.28.

Setting Static IP Addresses With the user name and password taken care of, let's look at setting up the router to use a static IP address for the Internet or WAN connection. In most cases, when you plug in the router's Internet connection, it receives an IP address using DHCP just like any other computer. Of course, this means that your Internet IP address will change from time to time, which can be a bit of a downside. This does not affect most people, but for some home users and businesses, it can present a problem. To solve this problem, most ISPs enable you to order a static IP (for an extra monthly charge). Once your ISP has allocated you a static IP address, you must manually enter it into your router. You do this the same way as the previous change you've just looked at. My router has an Internet Setup configuration section where I can enter all the settings that my ISP has provided me (see Figure 24.29). Remember, you must change your connection type from Automatic/DHCP to Static IP to enter the new addresses.

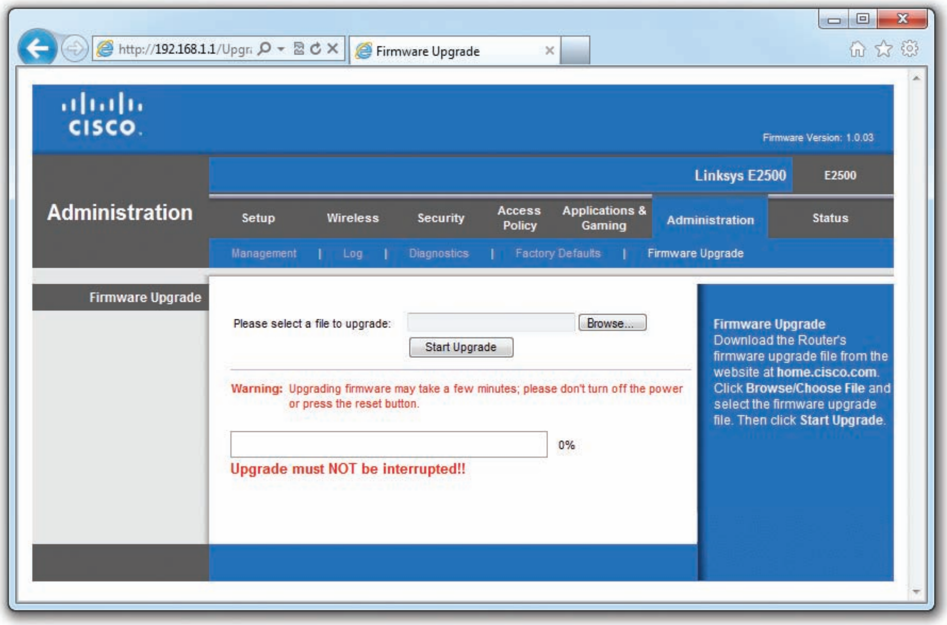


Language
Select your language: English

Internet Setup
Internet Connection Type: Static IP
Internet IP Address: 192 . 168 . 4 . 46
Subnet Mask: 255 . 255 . 255 . 0
Default Gateway: 192 . 168 . 4 . 1
DNS 1: 0 . 0 . 0 . 0
DNS 2 (Optional): 0 . 0 . 0 . 0
DNS 3 (Optional): 0 . 0 . 0 . 0

Optional Settings (required by some Internet Service Providers)
Host Name:
Domain Name:
MTU: Auto Size: 1500

• Figure 24.29 Entering a static IP address



Please select a file to upgrade:

Warning: Upgrading firmware may take a few minutes; please don't turn off the power or press the reset button.

Upgrade must NOT be interrupted!!

Firmware Upgrade
Download the Router's firmware upgrade file from the website at **home.cisco.com**. Click **Browse/Choose File** and select the firmware upgrade file. Then click **Start Upgrade**.

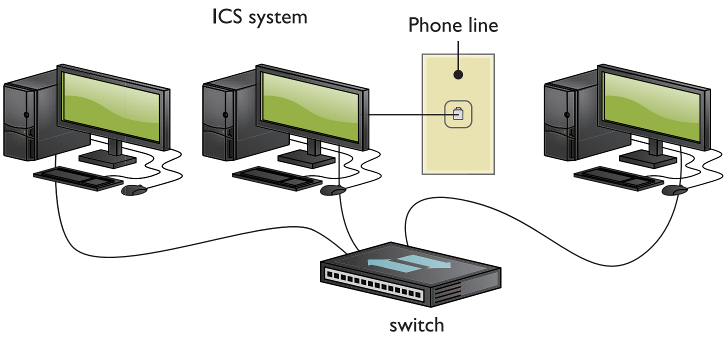
• Figure 24.30 Firmware update page

Updating Firmware

Routers are just like any other computer in that they run software—and software has bugs, vulnerabilities, and other issues that sometimes require updating. The router manufacturers call these "firmware updates" and make them available on their Web sites for easy download. To update a modern router, download the latest firmware from the manufacturer's Web site to your computer. Then you enter the router's configuration Web page and find the firmware update screen. On my router, it looks like Figure 24.30. From here, just follow the directions and click Upgrade (or your router's equivalent). A quick word of caution: Unlike a Windows update, a firmware update gone bad can *brick* your router. In other words, it can destroy the hardware and make it as useful as a brick sitting on your desk. This rarely happens, but you should keep it in mind when doing a firmware update.

Windows Internet Connection Sharing

Internet Connection Sharing (ICS) enables one system to share its Internet connection with other systems on the network, just like your router at home. Figure 24.31 shows a typical setup for ICS. Note the terminology used here. The PC that connects to the Internet and then shares that connection via ICS with other machines on a LAN is called the *ICS host* computer. PCs that connect via a LAN to the ICS host computer are simply called client computers.

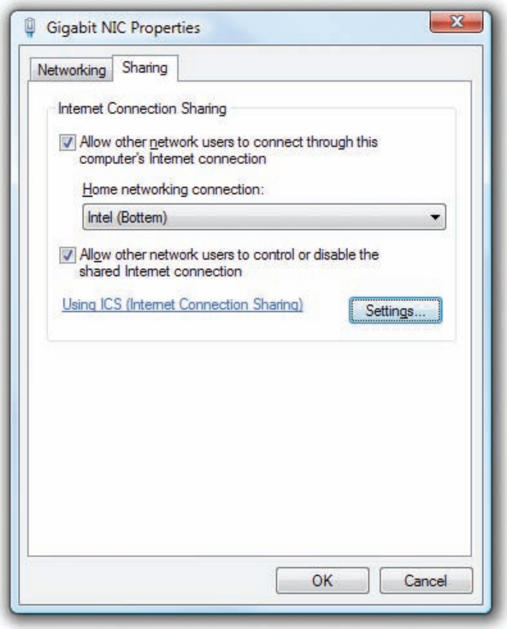


• Figure 24.31 Typical ICS setup

To connect multiple computers to a single ICS host computer requires several things in place. First, the ICS host computer has to have a NIC dedicated to the internal connections. If you connect via dial-up, for example, the ICS host computer uses a modem to connect to the Internet. It also has a NIC that plugs into a switch. Other PCs on the LAN likewise connect to the switch. If you connect via some faster service, such as DSL that uses a NIC cabled to the DSL receiver, you'll need a second NIC in the ICS host machine to connect to the LAN and the client computers.

Setting up ICS in Windows is very simple. If you are using Windows XP, right-click on My Network Places and select Properties. If you are using Windows Vista or 7, open the Network and Sharing Center and click on *Manage network connections* (Vista) or *Change adapter settings* (7) in the Task list. Then access the Properties dialog box of the connection you wish to share.

Click the the Advanced tab (Windows XP) or Sharing tab (Vista and 7) and select *Allow other network users to connect through this computer's Internet connection* (see Figure 24.32). Clients don't need any special configuration but should simply be set to DHCP for their IP address and other configurations.



Gigabit NIC Properties

Internet Connection Sharing

☑ Allow other network users to connect through this computer's Internet connection

Home networking connection:

Intel (Bottem)

☑ Allow other network users to control or disable the shared Internet connection

• **Figure 24.32** Enabling Internet Connection Sharing in Windows Vista

Internet Application Protocols

Once you've established a connection to the Internet, you need applications to get anything done. If you want to surf the Web, you need an application called a **Web browser**, such as Mozilla Firefox or Google Chrome. If you want to make a VoIP phone call, you need an application like Skype or Google Voice. These applications in turn use very clearly designed application protocols. All Web browsers use the **Hypertext Transfer Protocol (HTTP)**. All e-mail clients use Post Office Protocol 3 (POP3) or Internet Message Access Protocol 4 (IMAP4) to receive e-mail. All e-mail applications use Simple Mail Transfer Protocol (SMTP) to send their e-mails. Every Internet protocol has its own rules and its own port numbers. Though there are tens of thousands of application protocols in existence, lucky for you, CompTIA only wants you to understand the following commonly used application protocols:

- World Wide Web (HTTP and HTTPS)
- E-mail (POP3, IMAP4, and SMTP)
- Telnet
- SSH
- FTP/SFTP
- Remote Desktop (RDP)
- VoIP (SIP)

In addition to the application protocols we see and use daily, there are hundreds, maybe thousands, of application protocols that run behind the scenes, taking care of important jobs to ensure that the application protocols we do see run well. You've encountered a number of these hidden application protocols back in Chapter 22. Take DNS. Without DNS, you couldn't

Windows XP provides a tool called the *Network Setup Wizard* that enables you to configure computers on a LAN to share folders and printers. This tool is especially useful on networks that use Internet Connection Sharing with a Windows XP machine as the default gateway.

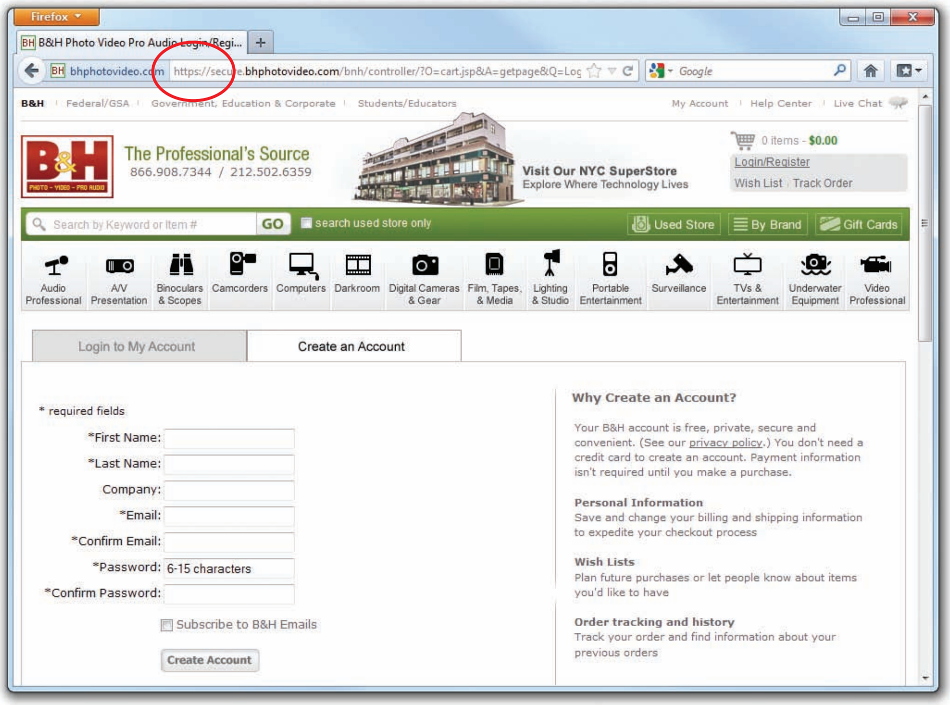
To run the Wizard, go to Start | Control Panel | Network and Internet Connections | Network Connections. Under Common Tasks, click Network Setup Wizard. Follow the steps in the Wizard to create a floppy disk with a small setup program used to configure other computers to share resources (folders, printers, and so on).

type www.google.com in your Web browser. DHCP is another great example. You don't see DHCP do its job, but without it, any computers relying on DHCP won't receive IP addresses.

Here's another one: People don't like to send credit card information, home phone numbers, or other personal information over the Web for fear this information might be intercepted by hackers. Fortunately, there are methods for encrypting this information, the most common being **Hypertext Transfer Protocol Secure (HTTPS)**. Although HTTPS looks a lot like HTTP from the point of view of a Web browser, HTTPS uses port 443. It's easy to tell if a Web site is using HTTPS because the Web address starts with *https*, as shown in Figure 24.33, instead of just *http*. But you don't deal with HTTPS directly; it just works in your browser automatically.

In order to differentiate the application protocols you see from the application protocols you don't see, I'm going to coin the term "utility protocol" to define any of the hidden application protocols. So, using your author's definition, HTTP is an application protocol and DNS is a utility protocol. All TCP/IP protocols use defined ports, require an application to run, and have special settings unique to that application. You'll look at several of these services and learn how to configure them. As a quick reference, Table 24.1 lists the names, functions, and port numbers of the application protocols CompTIA would like you to know. Table 24.2 does the same for utility protocols.

After you've read about these protocols, you'll learn about Virtual Private Networks and the protocols they use. I'll also tell you about a few more Internet support utilities that don't quite fit anywhere else.



* required fields

*First Name:

*Last Name:

Company:

*Email:

*Confirm Email:

*Password: 6-15 characters

*Confirm Password:

□ Subscribe to B&H Emails

Create Account

Why Create an Account?

Your B&H account is free, private, secure and convenient. (See our privacy policy.) You don't need a credit card to create an account. Payment information isn't required until you make a purchase.

Personal Information
Save and change your billing and shipping information to expedite your checkout process

Wish Lists
Plan future purchases or let people know about items you'd like to have

Order tracking and history
Track your order and find information about your previous orders

• **Figure 24.33** A secure Web page

Table 24.1 Application Protocol Port Numbers

Application Protocol	Function	Port Number
HTTP	Web pages	80
FTP	File transfer	20, 21
SFTP	Secure file transfer	22
IMAP4	Incoming e-mail	143
POP3	Incoming e-mail	110
SMTP	Outgoing e-mail	25
Telnet	Terminal emulation	23
SSH	Encrypted terminal emulation	22
RDP	Remote Desktop	3389
SIP	Voice over IP	5060

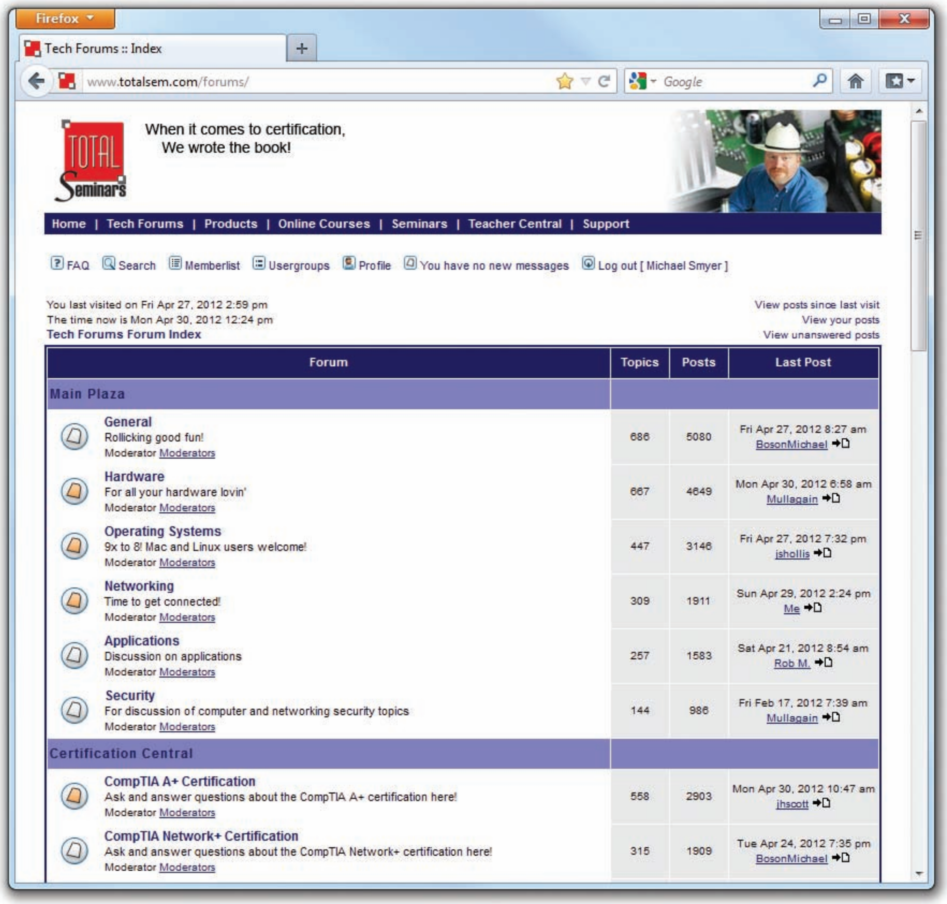
Table 24.2 Utility Protocol Port Numbers

HTTPS	Secure web pages	TCP	43
DNS	Allows the use of DNS naming	UDP	53
DHCP	Automatic IP addressing	UDP	67, 68
LDAP	Querying directories	TCP	389
SNMP	Remote management of network devices	UDP	161
SMB	Windows naming/folder sharing	TCP	445
		UDP	137, 138, 139

The World Wide Web

The Web provides a graphical face for the Internet. *Web servers* (servers running specialized software) provide Web sites that you access by using the HTTP protocol on port 80 and thus get more or less useful information. Using Web-browser software, such as Internet Explorer or Mozilla Firefox, you can click a link on a Web page and be instantly transported—not just to some Web server in your home town—to anywhere in the world. Figure 24.34 shows Firefox at the home page of my company's Web site, www.totalsem.com. Where is the server located? Does it matter? It could be in a closet in my office or in a huge data center in Houston. The great part about the Web is that you can get from here to there and access the information you need with a click or two of the mouse.

Although the Web is the most popular part of the Internet, setting up a Web browser takes almost no effort. As long as the Internet connection is working, Web browsers work automatically. This is not to say you can't make plenty of custom settings, but the default browser settings work almost every time. If you type in a Web address, such as that of the best search engine on the planet—www.google.com—and it doesn't work, check the line and your network settings and you'll figure out where the problem is.



When it comes to certification,
We wrote the book!

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Forum	Topics	Posts	Last Post
Main Plaza			
General Rollicking good fun! Moderator Moderators	686	5080	Fri Apr 27, 2012 8:27 am BosonMichael
Hardware For all your hardware lovin' Moderator Moderators	667	4649	Mon Apr 30, 2012 6:58 am Mullagain
Operating Systems 9x to 8! Mac and Linux users welcome! Moderator Moderators	447	3146	Fri Apr 27, 2012 7:32 pm jshollis
Networking Time to get connected! Moderator Moderators	309	1911	Sun Apr 29, 2012 2:24 pm Me
Applications Discussion on applications Moderator Moderators	257	1583	Sat Apr 21, 2012 8:54 am Rob M.
Security For discussion of computer and networking security topics Moderator Moderators	144	986	Fri Feb 17, 2012 7:39 am Mullagain
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CompTIA A+ Certification Ask and answer questions about the CompTIA A+ certification here! Moderator Moderators	558	2903	Mon Apr 30, 2012 10:47 am jhscott
CompTIA Network+ Certification Ask and answer questions about the CompTIA Network+ certification here! Moderator Moderators	315	1909	Tue Apr 24, 2012 7:35 pm BosonMichael

• Figure 24.34 Mozilla Firefox showing a Web page

Configuring Internet Explorer

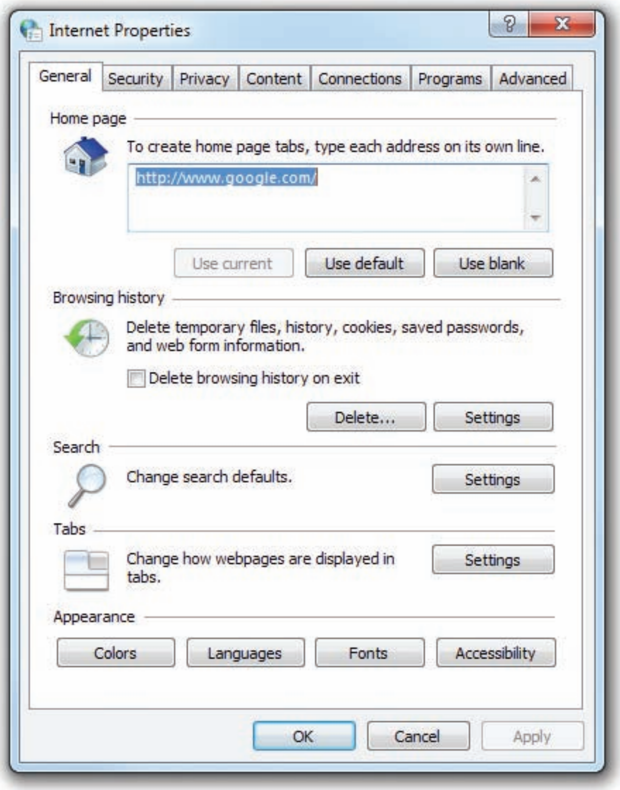
Web browsers are highly configurable. On most Web browsers, you can set the default font size, choose whether to display graphics, and adjust several other settings. Although all Web browsers support these settings, where you go to make these changes varies dramatically. If you are using the popular Internet Explorer that comes with Windows, you will find configuration tools in the Internet Options Control Panel applet or under the Tools menu in Internet Explorer (see Figure 24.35). Note that the applet is called Internet Options, but the window it launches is labeled Internet Properties.

The Internet Options Control Panel applet is only for the Internet Explorer Web browser. If you use any other browser (Firefox, Chrome, and so on), Internet Options has no effect.

I find it bizarre that CompTIA specifically lists Internet Options as an objective on the CompTIA A+ 220-802 exam. It's just so…Microsofty. There are obviously more browsers than just Internet Explorer, so I'll begin by explaining the options available to you in Internet Explorer, and then show you some of the common options found in other browsers, too.

When you open the Internet Options applet, you'll see seven tabs along the top. The first tab is the General tab. These settings control the most basic features of Internet Explorer: the home page, your browsing history, searching, and other appearance controls. If you want to delete or change how Internet Explorer stores the Web sites you've visited, use this tab.

The Security tab enables you to set how severely Internet Explorer safeguards your Web browsing (see Figure 24.36). Each setting can be adjusted



To create home page tabs, type each address on its own line.

http://www.google.com/

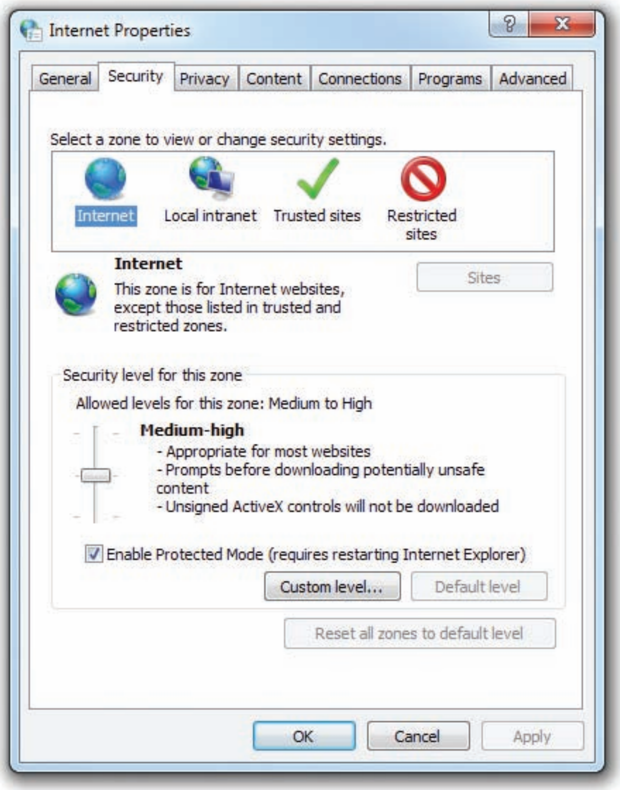
Delete temporary files, history, cookies, saved passwords, and web form information.

☐ Delete browsing history on exit

Change search defaults.

Change how webpages are displayed in tabs.

• **Figure 24.35** Internet Options applet



Select a zone to view or change security settings.

Internet

This zone is for Internet websites, except those listed in trusted and restricted zones.

Security level for this zone

Allowed levels for this zone: Medium to High

Medium-high

- Appropriate for most websites
- Prompts before downloading potentially unsafe content
- Unsigned ActiveX controls will not be downloaded

☑ Enable Protected Mode (requires restarting Internet Explorer)

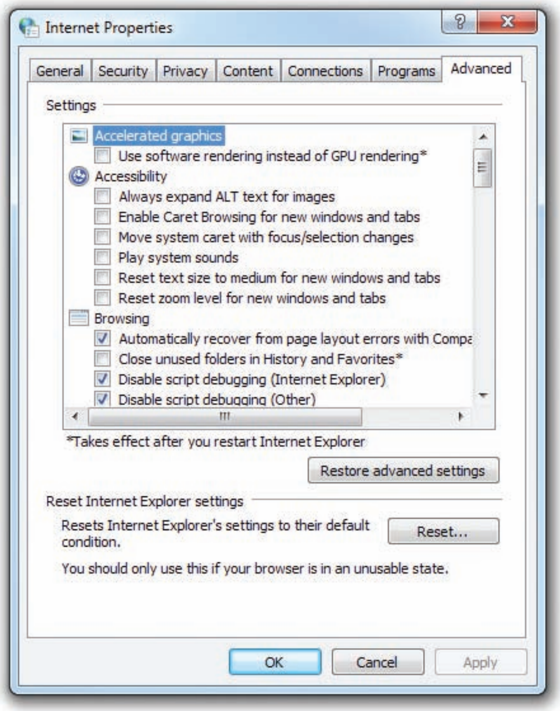
• **Figure 24.36** The Security tab in Internet Options

for a particular zone, such as the Internet, your local intranet, trusted sites, and restricted sites. You can configure which Web sites fall into which zones. Once you've picked a zone to control, you can set Internet Explorer's security level. The High security level blocks more Web sites and disables some plug-ins, while Medium-high and Medium allow less-secure Web sites and features to display and operate.

The Privacy tab works a lot like the Security tab, except it controls privacy matters, such as cookies and pop-ups. There is a slider that enables you to control what is blocked—everything is blocked on the highest setting; nothing is blocked on the lowest. Go here if you don't like the idea of Web sites tracking your browsing history (though cookies do other things, too, like authenticate users).

The Content tab also controls what your browser will and will not display. This time, however, it filters content using certificates and a tool called the Content Advisor, which uses ratings that consider language, gambling, substance abuse, and more. The Content tab also enables you to adjust the AutoComplete feature that fills in Web addresses for you, as well as control settings for RSS feeds and Web Slices.

The Connections tab enables you to do a lot of things. You can set up your connection to the Internet, via broadband or dial-up, connect to a VPN, configure a proxy server connection, or adjust some LAN settings (which you probably won't need to deal with). Because they're a little complicated, and CompTIA wants you to know about them, let's quickly talk about proxy servers.



Internet Properties

Settings

Accelerated graphics

□ Use software rendering instead of GPU rendering*

Accessibility

□ Always expand ALT text for images

□ Enable Caret Browsing for new windows and tabs

□ Move system caret with focus/selection changes

□ Play system sounds

□ Reset text size to medium for new windows and tabs

□ Reset zoom level for new windows and tabs

Browsing

☑ Automatically recover from page layout errors with Compa

□ Close unused folders in History and Favorites*

☑ Disable script debugging (Internet Explorer)

☑ Disable script debugging (Other)

*Takes effect after you restart Internet Explorer

Reset Internet Explorer settings

Resets Internet Explorer's settings to their default condition.

You should only use this if your browser is in an unusable state.

• **Figure 24.37** The Advanced tab in Internet Options

Many corporations use a proxy server to filter employee Internet access, and when you're on their corporate network, you need to set your proxy settings within the Web browser (and any other Internet software you want to use). A **proxy server** is software that enables multiple connections to the Internet to go through one protected PC. Applications that want to access Internet resources send requests to the proxy server instead of trying to access the Internet directly, which both protects the client PCs and enables the network administrator to monitor and restrict Internet access. Each application must therefore be configured to use the proxy server.

Moving on, the Programs tab in Internet Options contains settings for your default Web browser, any add-ons you use (like Java), and how other programs deal with HTML files and e-mail messages.

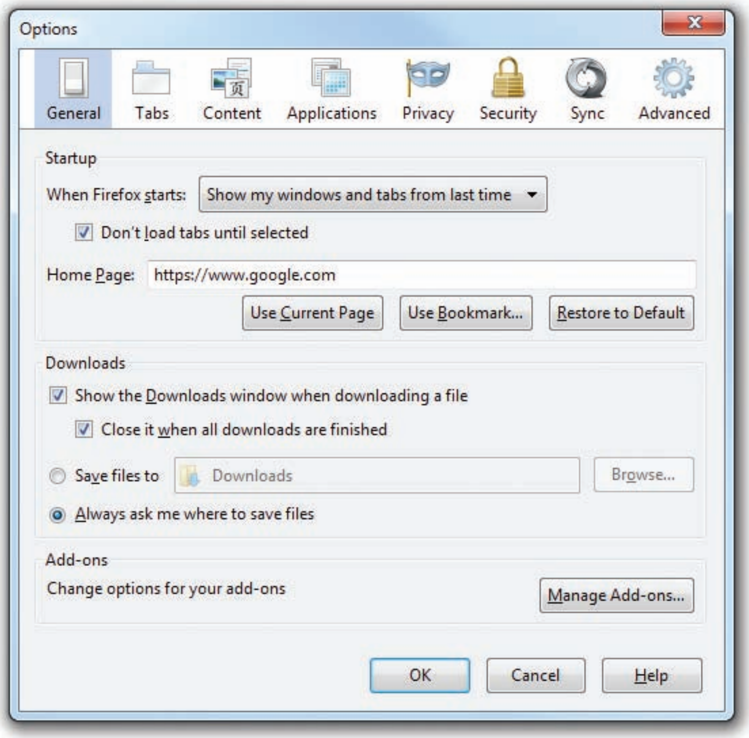
The Advanced tab does exactly what it sounds like: lists a bunch of advanced options that you can turn on and off with the check of a box (see Figure 24.37). The available options include accessibility, browsing, international, and, most importantly, security settings. From here, you can control how Internet Explorer checks Web site certificates, among many other settings.

Configuring Other Web Browsers

I don't want to stomp all over Internet Explorer and tell you how bad it is—okay, yes I do. You can download several other Web browsers that run faster and support more Web standards. Two of the big browser heavyweights that fit this description are Mozilla Firefox and Google Chrome.

You control their settings just like you do in Internet Explorer, though you won't find an applet tucked away in Control Panel. In Google Chrome, you can click on the wrench icon in the upper-right corner of the browser and select Settings. In Mozilla Firefox, click on the Firefox button in the upper-left corner and click on Options.

In these menus, you'll find a lot of settings very similar to the ones you find in Internet Options. In fact, Firefox's controls are laid out almost exactly the same, though you won't find everything in the same place (see Figure 24.38). Google Chrome's controls look more like a Web page, but it still controls the same features: home page, security, font size, cookies, and all your old favorites (see Figure 24.39). Take some time to use these browsers and explore their settings. You'll be surprised how your knowledge of one browser helps you set up another.



Options

Startup

When Firefox starts: Show my windows and tabs from last time

☑ Don't load tabs until selected

Home Page: https://www.google.com

Downloads

☑ Show the Downloads window when downloading a file

☑ Close it when all downloads are finished

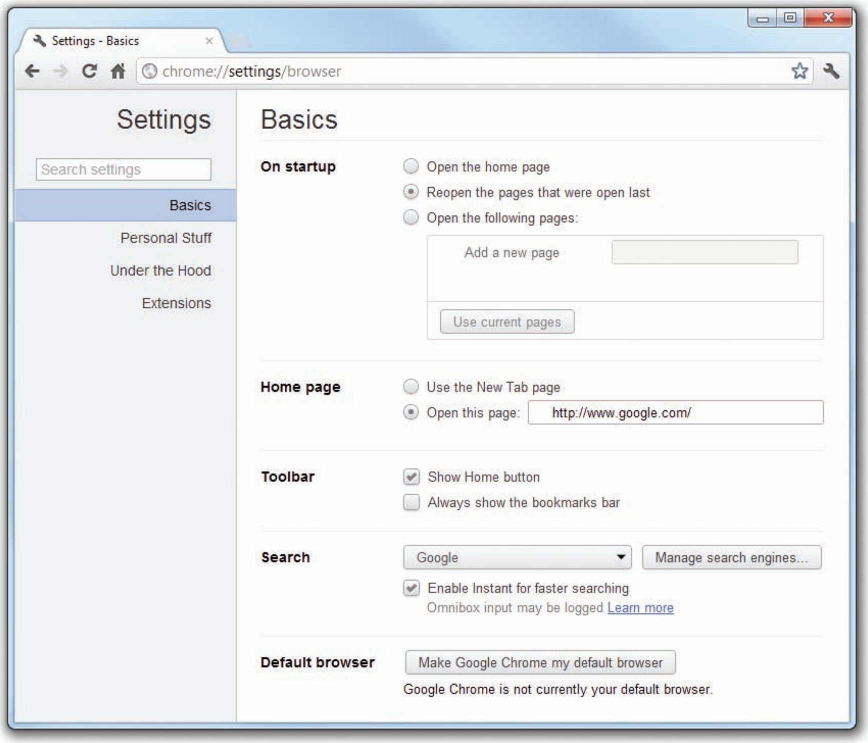
○ Save files to Downloads

● Always ask me where to save files

Add-ons

Change options for your add-ons

• **Figure 24.38** Mozilla Firefox options



Basics

On startup ○ Open the home page
● Reopen the pages that were open last
○ Open the following pages:

Home page ○ Use the New Tab page
● Open this page: http://www.google.com/

Toolbar ☑ Show Home button
☐ Always show the bookmarks bar

Search Google ▾
☑ Enable Instant for faster searching
Omnibox input may be logged

Default browser
Google Chrome is not currently your default browser.

• **Figure 24.39** Google Chrome settings

E-mail

You can use a desktop program to access e-mail. The most popular client by far is Microsoft Outlook. E-mail clients need a little more setup. First, you must provide your e-mail address and password. All e-mail addresses come in the now-famous *accountname@Internet domain* format. Figure 24.40 shows e-mail information entered into the Windows Live Mail account setup wizard.

Next you must add the names of the **Post Office Protocol version 3 (POP3)** or **Internet Message Access Protocol version 4 (IMAP4)** server and the **Simple Mail Transfer Protocol (SMTP)** server. The POP3 or IMAP4 server is the computer that handles incoming (to you) e-mail. POP3 is by far the most widely used standard, although IMAP4 supports some features POP3 doesn't. For example, IMAP4 enables you to search through messages on the mail server to find specific keywords and select the messages you want to download onto your machine. Even with the advantages of IMAP4 over POP3, the vast majority of incoming mail servers use POP3.

The SMTP server handles your outgoing e-mail. These two systems may often have the same name, or close to the same name, as shown in Figure 24.41. Your ISP should provide you with all these settings. If not, you should be comfortable knowing what to ask for. If one of these names is incorrect, you will either not get your e-mail or not be able to send e-mail. If an e-mail setup that has been working well for a while suddenly gives you

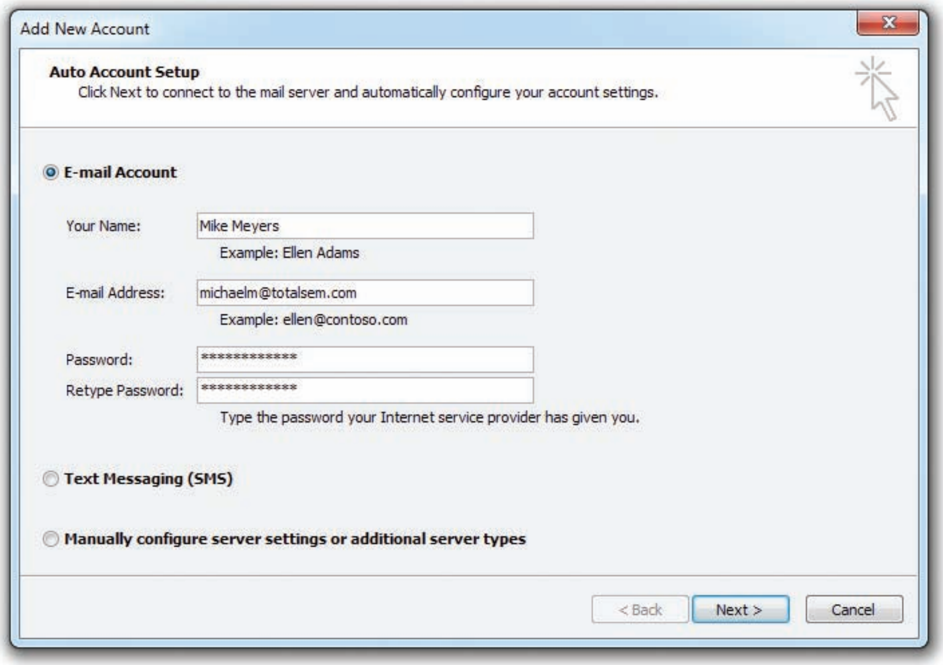
The term *Internet appliance* enjoyed some popularity in the 1990s to describe the first wave of consumer devices accessible via TCP/IP. You could use a Web browser to check on the status of an Internet-connected refrigerator, for example, or check to see if you'd left the stove on (and if so, shut it off remotely). Although the term is no longer in use, it might show up on the 220-801 exam.

Tech Tip

Web-based Mail

Most people use Web-based e-mail, such as Yahoo! Mail or Gmail from Google, to handle all of their e-mail needs. Web-based mail offers the convenience of having access to your e-mail from any Internet-connected computer, smartphone, tablet, or other Internet-connected device. The benefit to using a standalone program is that most offer a lot more control over what you can do with your e-mail, such as flagging messages for later review. Web-based mail services, especially Gmail, are catching up, though, and might surpass traditional e-mail programs in features and popularity.

Make sure you know your port numbers for these e-mail protocols! POP3 uses port 110, IMAP4 uses port 143, and SMTP uses port 25.



Add New Account

Auto Account Setup
Click Next to connect to the mail server and automatically configure your account settings.

● **E-mail Account**

Your Name: Mike Meyers
Example: Ellen Adams

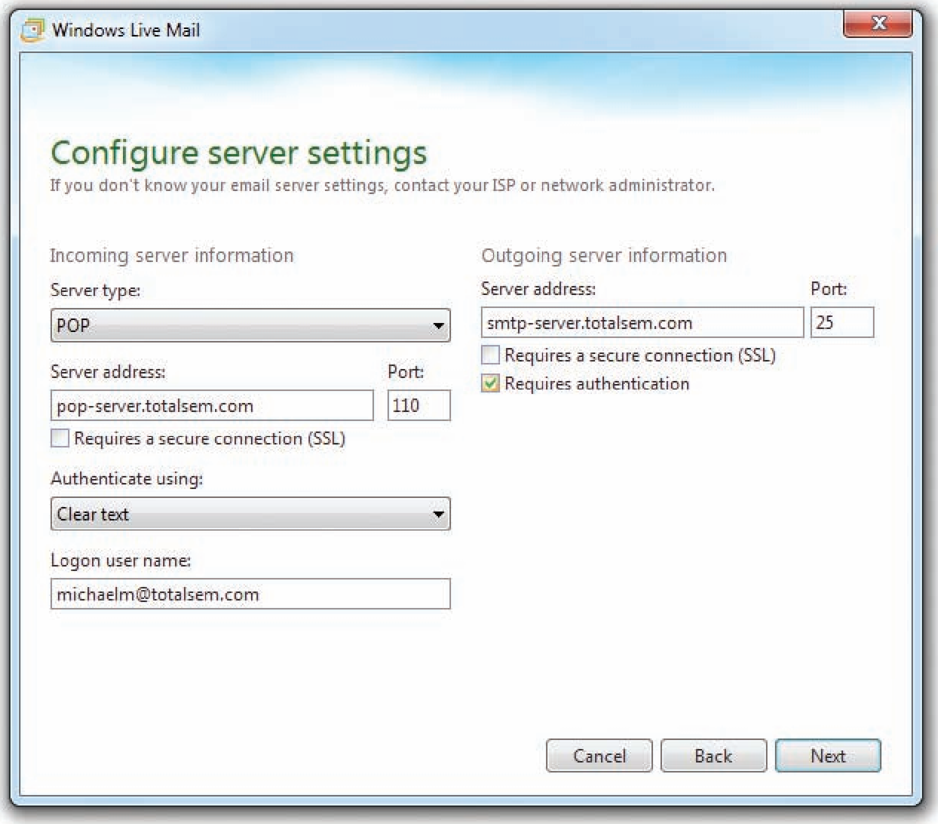
E-mail Address: michaelm@totalsem.com
Example: ellen@contoso.com

Password: *************
Retype Password: *************
Type the password your Internet service provider has given you.

○ **Text Messaging (SMS)**

○ **Manually configure server settings or additional server types**

• Figure 24.40 Adding an e-mail account to Windows Live Mail



Windows Live Mail

Configure server settings

If you don't know your email server settings, contact your ISP or network administrator.

Incoming server information

Server type: POP

Server address: pop-server.totalsem.com Port: 110

□ Requires a secure connection (SSL)

Authenticate using: Clear text

Logon user name: michaelm@totalsem.com

Outgoing server information

Server address: smtp-server.totalsem.com Port: 25

□ Requires a secure connection (SSL)

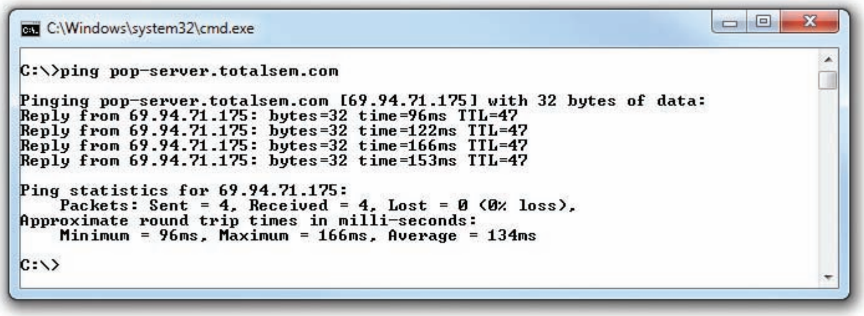
☑ Requires authentication

• Figure 24.41 Adding POP3 and SMTP information in Windows Live Mail errors, it is likely that either the POP3 or SMTP server is down or that the DNS server has quit working.

When I'm given the name of a POP3 or SMTP server, I use ping to determine the IP address for the device, as shown in Figure 24.42. I make a point to write this down. If I ever have a problem getting mail, I'll go into my SMTP or POP3 settings and type in the IP address (see Figure 24.43). If my mail starts to work, I know the DNS server is not working.

Microsoft provides a special type of e-mail server called an Exchange server. This is used mainly in large businesses so that employees can access their e-mail, calendars, and instant messages from a variety of locations. To set up an Exchange e-mail client, go to the Control Panel and run the Mail applet. Then click E-mail Accounts and then New. After that, click Next and fill in your e-mail address and password.

Some e-mail servers use SSL encryption for extra security. Every major e-mail client will have a setting called Connection security, or Security, or something like that. If your e-mail server uses encryption, change this setting to SSL.



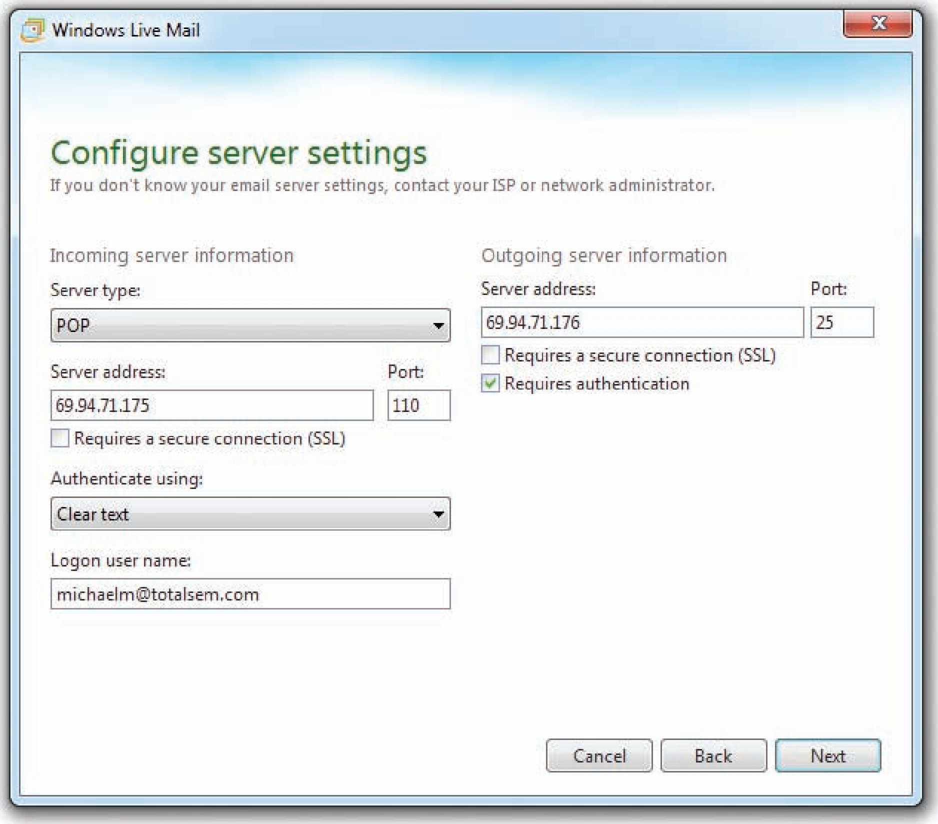
```
C:\>ping pop-server.totalsem.com

Pinging pop-server.totalsem.com [69.94.71.175] with 32 bytes of data:
Reply from 69.94.71.175: bytes=32 time=96ms TTL=47
Reply from 69.94.71.175: bytes=32 time=122ms TTL=47
Reply from 69.94.71.175: bytes=32 time=166ms TTL=47
Reply from 69.94.71.175: bytes=32 time=153ms TTL=47

Ping statistics for 69.94.71.175:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 96ms, Maximum = 166ms, Average = 134ms

C:\>
```

• **Figure 24.42** Using ping to determine the IP address



Configure server settings

If you don't know your email server settings, contact your ISP or network administrator.

Incoming server information

Server type: POP

Server address: 69.94.71.175 Port: 110

□ Requires a secure connection (SSL)

Authenticate using: Clear text

Logon user name: michaelm@totalsem.com

Outgoing server information

Server address: 69.94.71.176 Port: 25

□ Requires a secure connection (SSL)

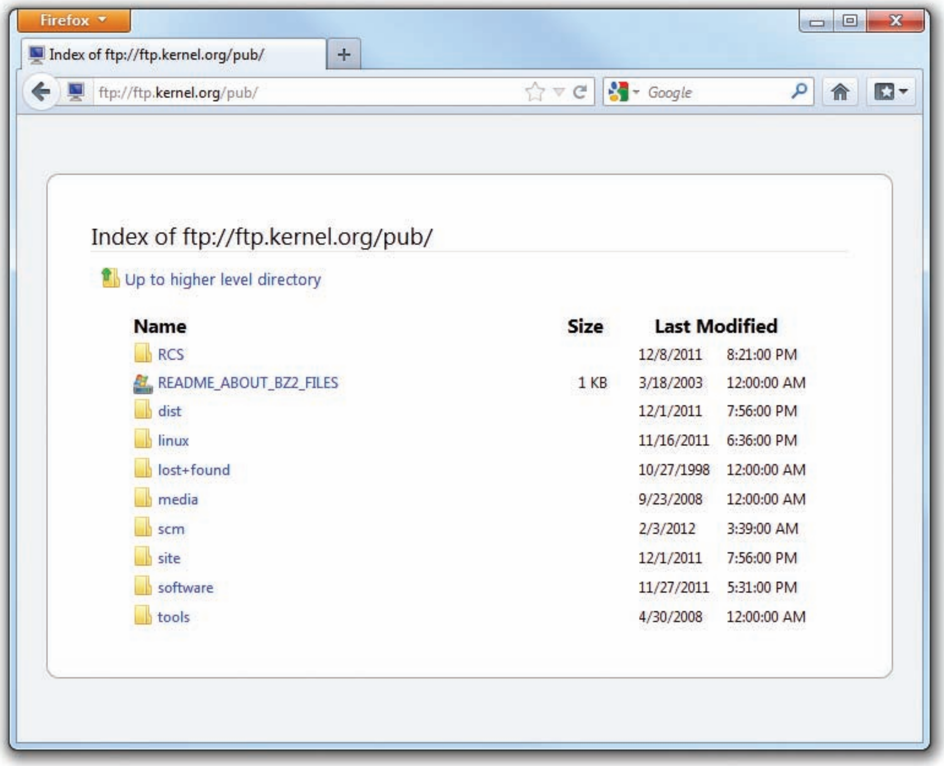
☑ Requires authentication

• **Figure 24.43** Entering IP addresses into POP3 and SMTP settings

File Transfer Protocol (FTP)

File transfer protocol (FTP), using ports 20 and 21, is a great way to share files between systems. FTP server software exists for most operating systems, so you can use FTP to transfer data between any two systems regardless of the operating system. To access an FTP site, you must use an FTP client such as FileZilla, although most Web browsers provide at least download support for FTP. Just type in the name of the FTP site. Figure 24.44 shows Firefox accessing ftp.kernel.org.

Although you can use a Web browser, all FTP sites require you to log on. Your Web browser will assume that you want to log on as "anonymous." If you want to log on as a specific user, you have to add your user name to the URL. (Instead of typing **ftp://ftp.example.com**, you would type **ftp://mikem@ftp.example.com**.) An anonymous logon works fine for most public FTP sites. Many techs prefer to use third-party programs such as the robust FileZilla (see Figure 24.45) for FTP access because these third-party applications can store user name and password settings. This enables you to access the FTP site more easily later. Keep in mind that FTP was developed during a more trusting time, and that whatever user name and password you send over the network is sent in clear text. Don't use the same password for an FTP site that you use for your domain logon at the office!

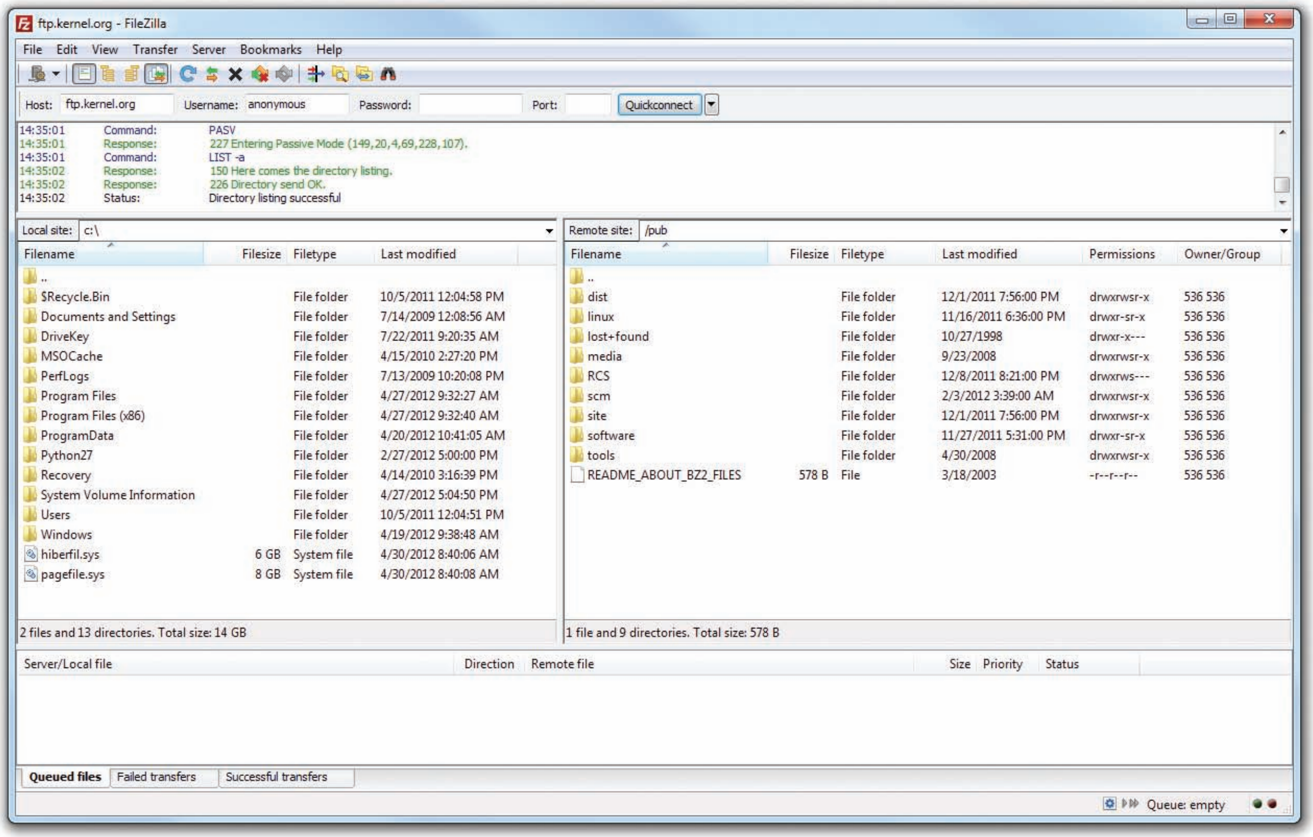


Index of ftp://ftp.kernel.org/pub/

Up to higher level directory

Name	Size	Last Modified	
RCS		12/8/2011	8:21:00 PM
README_ABOUT_BZ2_FILES	1 KB	3/18/2003	12:00:00 AM
dist		12/1/2011	7:56:00 PM
linux		11/16/2011	6:36:00 PM
lost+found		10/27/1998	12:00:00 AM
media		9/23/2008	12:00:00 AM
scm		2/3/2012	3:39:00 AM
site		12/1/2011	7:56:00 PM
software		11/27/2011	5:31:00 PM
tools		4/30/2008	12:00:00 AM

• Figure 24.44 Accessing an FTP site in Firefox



Host: ftp.kernel.org Username: anonymous Password: Port:

```
14:35:01	Command:	PASV
14:35:01	Response:	227 Entering Passive Mode (149,20,4,69,228,107).
14:35:01	Command:	LIST -a
14:35:02	Response:	150 Here comes the directory listing.
14:35:02	Response:	226 Directory send OK.
14:35:02	Status:	Directory listing successful
```

Local site: c:\

Filename	Filesize	Filetype	Last modified
..			
$Recycle.Bin		File folder	10/5/2011 12:04:58 PM
Documents and Settings		File folder	7/14/2009 12:08:56 AM
DriveKey		File folder	7/22/2011 9:20:35 AM
MSOCache		File folder	4/15/2010 2:27:20 PM
PerfLogs		File folder	7/13/2009 10:20:08 PM
Program Files		File folder	4/27/2012 9:32:27 AM
Program Files (x86)		File folder	4/27/2012 9:32:40 AM
ProgramData		File folder	4/20/2012 10:41:05 AM
Python27		File folder	2/27/2012 5:00:00 PM
Recovery		File folder	4/14/2010 3:16:39 PM
System Volume Information		File folder	4/27/2012 5:04:50 PM
Users		File folder	10/5/2011 12:04:51 PM
Windows		File folder	4/19/2012 9:38:48 AM
hiberfil.sys	6 GB	System file	4/30/2012 8:40:06 AM
pagefile.sys	8 GB	System file	4/30/2012 8:40:08 AM

2 files and 13 directories. Total size: 14 GB

Remote site: /pub

Filename	Filesize	Filetype	Last modified	Permissions	Owner/Group
..					
dist		File folder	12/1/2011 7:56:00 PM	drwxrwsr-x	536 536
linux		File folder	11/16/2011 6:36:00 PM	drwxr-sr-x	536 536
lost+found		File folder	10/27/1998	drwxr-x---	536 536
media		File folder	9/23/2008	drwxrwsr-x	536 536
RCS		File folder	12/8/2011 8:21:00 PM	drwxrws---	536 536
scm		File folder	2/3/2012 3:39:00 AM	drwxrwsr-x	536 536
site		File folder	12/1/2011 7:56:00 PM	drwxrwsr-x	536 536
software		File folder	11/27/2011 5:31:00 PM	drwxr-sr-x	536 536
tools		File folder	4/30/2008	drwxrwsr-x	536 536
README_ABOUT_BZ2_FILES	578 B	File	3/18/2003	-r--r--r--	536 536

1 file and 9 directories. Total size: 578 B

Server/Local file	Direction	Remote file	Size	Priority	Status

• **Figure 24.45** The FileZilla FTP program

Telnet and SSH

Telnet is a terminal emulation program for TCP/IP networks that uses port 23 and enables you to connect to a server or fancy router and run commands on that machine as if you were sitting in front of it. This way, you can remotely administer a server and communicate with other servers on your network. As you can imagine, this is rather risky. If *you* can remotely control a computer, what's to stop others from doing the same? Of course, Telnet does not allow just *anyone* to log on and wreak havoc with your network. You must enter a special user name and password to run Telnet. Unfortunately, Telnet shares FTP's bad habit of sending passwords and user names as clear text, so you should generally use it only within your own LAN.

If you need a remote terminal that works securely across the Internet, you need **Secure Shell (SSH)**. In fact, today SSH has replaced Telnet in almost all places Telnet used to be popular. To the user, SSH works just like Telnet. Behind the scenes, SSH uses port 22, and the entire connection is encrypted, preventing any eavesdroppers from reading your data. SSH has one other trick up its sleeve: it can move files or any type of TCP/IP network traffic through its secure connection. In networking parlance, this is called **tunneling**, and it is the core of most secure versions of Internet technologies such as SFTP (discussed next) and VPN, which I will discuss in more depth later in the chapter.

All terminal emulation programs require separate server and client programs.

The CompTIA A+ certification exams test your knowledge of a few networking tools, such as Telnet, but only enough to let you support a CompTIA Network+ tech or network administrator. If you need to run Telnet (or its more secure cousin, SSH), you will get the details from a network administrator. Implementation of Telnet falls well beyond CompTIA A+.

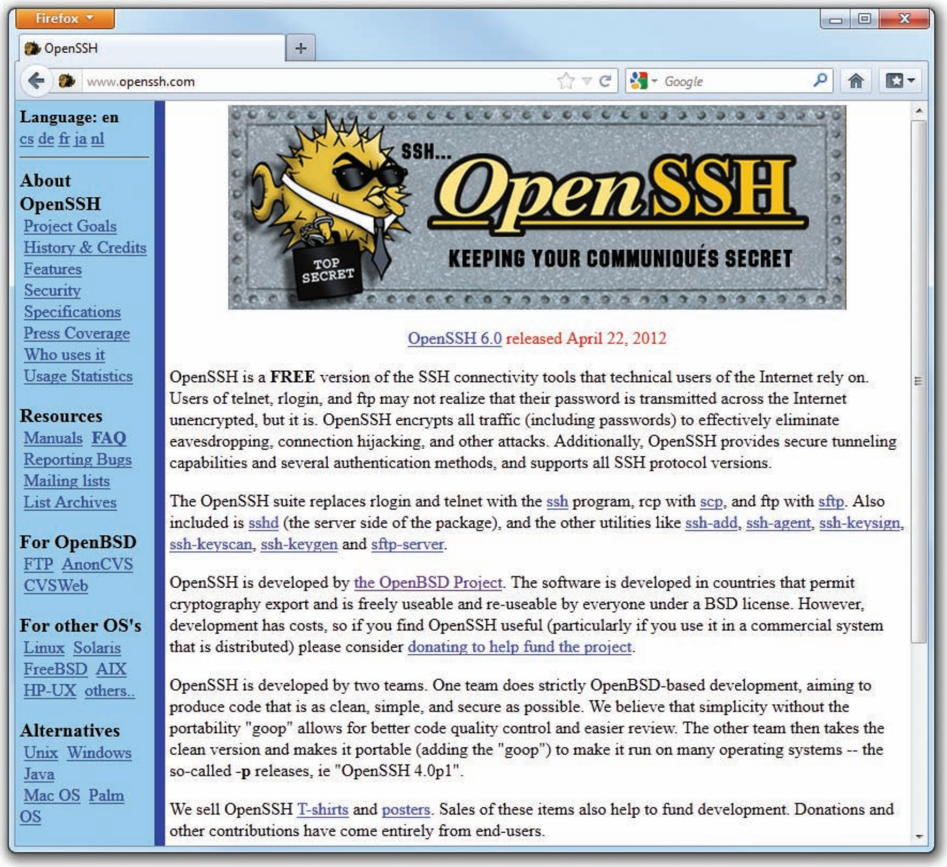
SFTP

Secure FTP is nothing more than FTP running through an SSH tunnel. This can be done in a number of ways. You can, for example, start an SSH session between two computers. Then, through a moderately painful process, start an FTP server on one machine and an FTP client on the other and redirect the input and output of the FTP data to go through the tunnel. You can also get a dedicated SFTP server and client. Figure 24.46 shows OpenSSH, a popular SSH server with a built-in SFTP feature as well.

Voice over IP

You can use **Voice over IP (VoIP)** to make voice calls over your computer network. Why have two sets of wires, one for voice and one for data, going to every desk? Why not just use the extra capacity on the data network for your phone calls? That's exactly what VoIP does for you. VoIP works with every type of high-speed Internet connection, from DSL to cable to satellite.

VoIP doesn't refer to a single protocol but rather to a collection of protocols that make phone calls over the data network possible. The most common VoIP application protocol is Session Initiation Protocol (SIP), but some popular VoIP applications like Skype are completely proprietary.



Language: en
cs de fr ja nl

About OpenSSH
Project Goals
History & Credits
Features
Security
Specifications
Press Coverage
Who uses it
Usage Statistics

Resources
Manuals FAQ
Reporting Bugs
Mailing lists
List Archives

For OpenBSD
FTP AnonCVS
CVSWeb

For other OS's
Linux Solaris
FreeBSD AIX
HP-UX others..

Alternatives
Unix Windows
Java
Mac OS Palm
OS

OpenSSH 6.0 released April 22, 2012

OpenSSH is a **FREE** version of the SSH connectivity tools that technical users of the Internet rely on. Users of telnet, rlogin, and ftp may not realize that their password is transmitted across the Internet unencrypted, but it is. OpenSSH encrypts all traffic (including passwords) to effectively eliminate eavesdropping, connection hijacking, and other attacks. Additionally, OpenSSH provides secure tunneling capabilities and several authentication methods, and supports all SSH protocol versions.

The OpenSSH suite replaces rlogin and telnet with the ssh program, rcp with scp, and ftp with sftp. Also included is sshd (the server side of the package), and the other utilities like ssh-add, ssh-agent, ssh-keysign, ssh-keyscan, ssh-keygen and sftp-server.

OpenSSH is developed by the OpenBSD Project. The software is developed in countries that permit cryptography export and is freely useable and re-useable by everyone under a BSD license. However, development has costs, so if you find OpenSSH useful (particularly if you use it in a commercial system that is distributed) please consider donating to help fund the project.

OpenSSH is developed by two teams. One team does strictly OpenBSD-based development, aiming to produce code that is as clean, simple, and secure as possible. We believe that simplicity without the portability "goop" allows for better code quality control and easier review. The other team then takes the clean version and makes it portable (adding the "goop") to make it run on many operating systems -- the so-called **-p** releases, ie "OpenSSH 4.0p1".

We sell OpenSSH T-shirts and posters. Sales of these items also help to fund development. Donations and other contributions have come entirely from end-users.

• **Figure 24.46** OpenSSH

Try This!

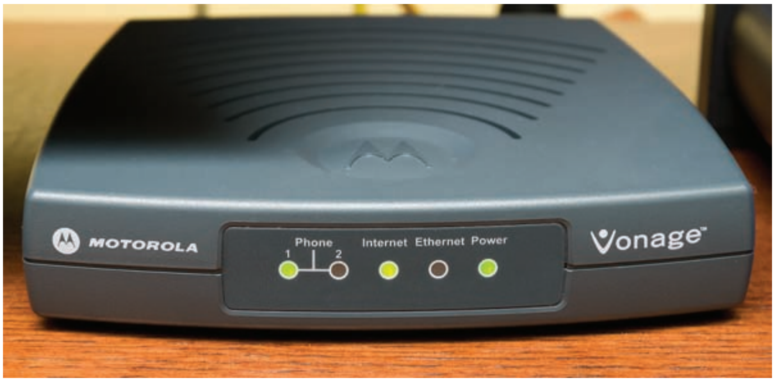
Checking Latency with ping

Latency is the bane of any VoIP call because of all the problems it causes if it is too high. A quick way to check your current latency is to use the ever-handy ping, so Try This!

1. Run ping on some known source, such as www.microsoft.com or www.totalsem.com.
2. When the ping finishes, take note of the average round-trip time at the bottom of the screen. This is your current latency to that site.

Venders such as Skype, Cisco, Vonage, and Comcast offer popular VoIP solutions, and many corporations use VoIP for their internal phone networks. A key to remember when installing and troubleshooting VoIP is that low network latency is more important than high network speed. **Latency** is the amount of time a packet takes to get to its destination and is measured in milliseconds. The higher the latency, the more problems, such as noticeable delays during a VoIP call.

VoIP isn't confined to your computer, either. It can completely replace your old copper phone line. Two popular ways to set up a VoIP system are to either use dedicated **VoIP phones**, like the ones that Cisco makes, or use a small VoIP phone adapter (see Figure 24.47) that can interface with your existing analog phones.



• Figure 24.47 Vonage Box VoIP phone adapter

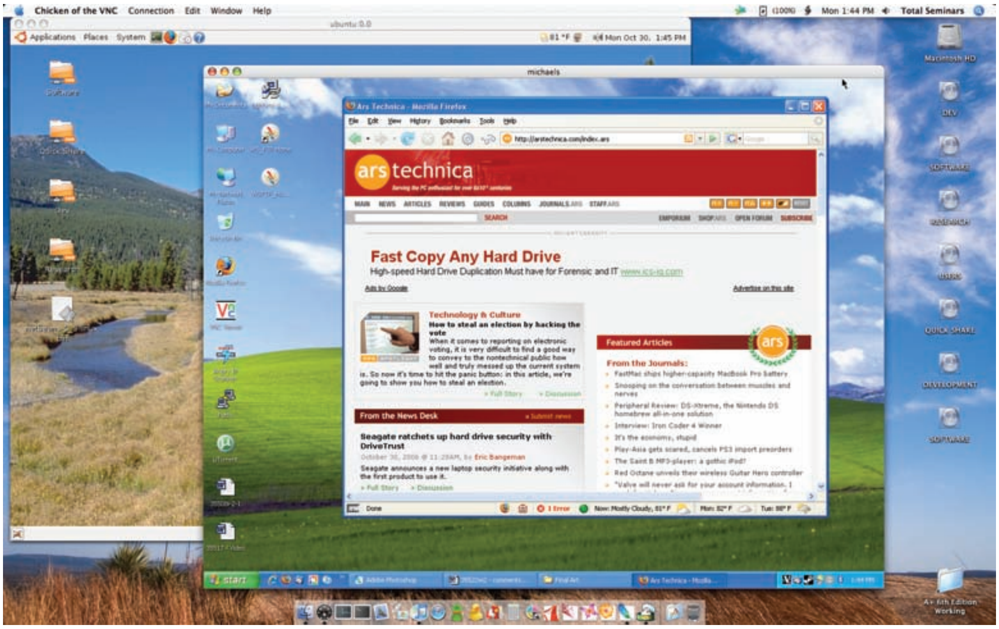
True VoIP phones have RJ-45 connections that plug directly into the network and offer advanced features such as HD-quality audio and video calling. Unfortunately, these phones require a complex and expensive network to function, which puts them out of reach of most home users.

For home users, it's much more common to use a VoIP phone adapter to connect your old-school analog phones. These little boxes are very simple to set up: just connect it to your network, plug in a phone, and then check for a dial tone. With the VoIP service provided by cable companies, the adapter is often built right into the cable modem itself, making setup a breeze.

Remote Desktop

In Microsoft networking, we primarily share folders and printers. At times, it would be convenient to be "transported" to another computer—to feel as if your hands were actually on its keyboard. There are plenty of programs that do exactly this, generically called remote desktops.

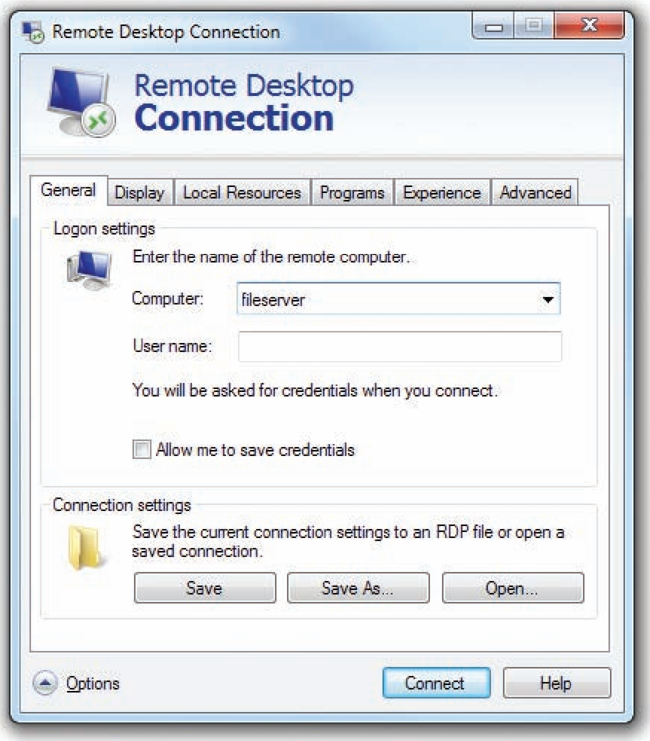
Like so many other Windows applications, remote desktops originally came from third-party companies. Microsoft bought the companies and



• **Figure 24.48** TightVNC in action

absorbed their code into the Windows operating system. Many third-party remote desktop applications are available. One of the most popular is TightVNC. TightVNC is totally cross-platform, enabling you to run and control a Windows system remotely from your Mac or vice versa, for example. Figure 24.48 shows TightVNC in action.

Windows offers an alternative to VNC: Remote Desktop. **Remote Desktop** provides control over a remote server with a fully graphical interface. Your desktop *becomes* the server desktop (see Figure 24.49).


Remote Desktop Connection

Remote Desktop
Connection

General | Display | Local Resources | Programs | Experience | Advanced

Logon settings

Enter the name of the remote computer.

Computer: fileserver

User name:

You will be asked for credentials when you connect.

□ Allow me to save credentials

Connection settings

Save the current connection settings to an RDP file or open a saved connection.

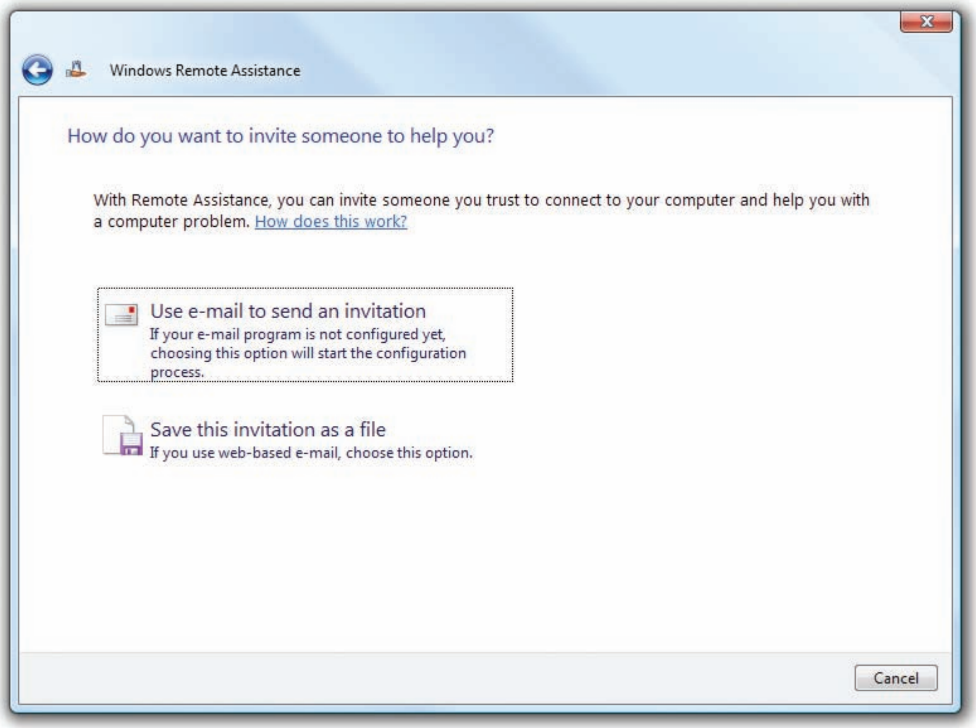
Save | Save As... | Open...

Options | Connect | Help

• **Figure 24.49** Windows Remote Desktop Connection dialog box

Wouldn't it be cool if, when called about a technical support issue, you could simply see what the client sees? (I'm not talking voyeur cam, here.) When the client says that something doesn't work, it would be great if you could transfer yourself from your desk to your client's desk to see precisely what the client sees. This would dramatically cut down on the miscommunication that can make a tech's life so tedious. Windows Remote Assistance does just that. **Remote Assistance** enables you to give anyone control of your desktop. If a user has a problem, that user can request support directly from you. Upon receiving the support-request e-mail, you can then log on to the user's system and, with permission, take the driver's seat. Figure 24.50 shows Remote Assistance in action.

With Remote Assistance, you can do anything you would do from the actual computer. You can troubleshoot some hardware configuration or driver


Windows Remote Assistance

How do you want to invite someone to help you?

With Remote Assistance, you can invite someone you trust to connect to your computer and help you with a computer problem. How does this work?

Use e-mail to send an invitation
If your e-mail program is not configured yet, choosing this option will start the configuration process.

Save this invitation as a file
If you use web-based e-mail, choose this option.

• **Figure 24.50** Remote Assistance in action

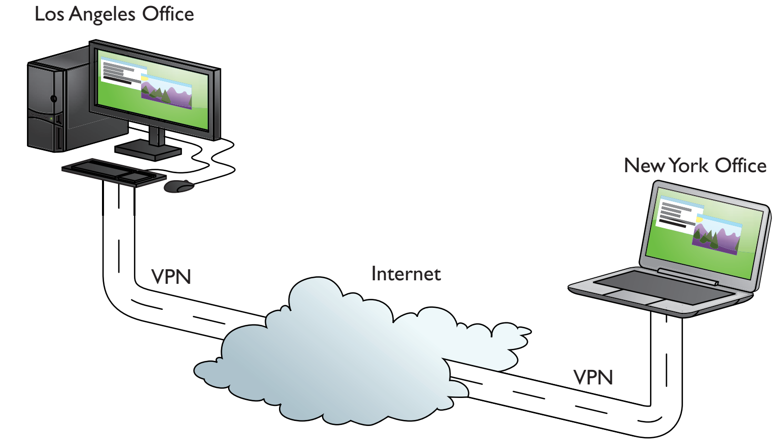
problem. You can install drivers, roll back drivers, download new ones, and so forth. You're in command of the remote machine as long as the client allows you to be. The client sees everything you do, by the way, and can stop you cold if you get out of line or do something that makes the client nervous! Remote Assistance can help you teach someone how to use a particular application. You can log on to a user's PC and fire up Outlook, for example, and then walk through the steps to configure it while the user watches. The user can then take over the machine and walk through the steps while you watch, chatting with one another the whole time. Sweet!

Remote desktop applications provide everything you need to access one system from another. They are common, especially now that Microsoft provides Remote Desktop for free. Whichever application you use, remember that you will always need both a server and a client program. The server goes on the system you want to access and the client goes on the system you use to access the server. On many solutions, the server and client software are integrated into a single product.

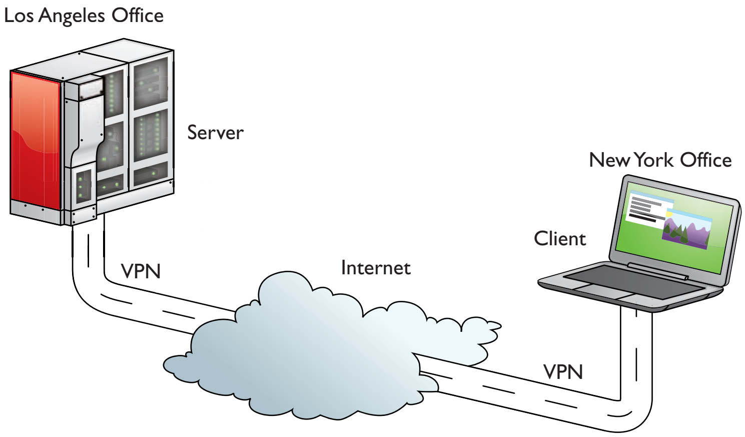
In Windows, you can turn Remote Assistance and Remote Desktop on and off and configure other settings. Go to the System Control Panel applet. In Windows XP, click on the Remote tab. In Windows Vista and Windows 7, click *Remote settings*. You will see checkboxes for both Remote Assistance and Remote Desktop, along with buttons to configure more detailed settings. (In Windows XP, you'll only see Remote Desktop controls if you installed the Remote Desktop client, which is not installed by default.)

The Remote Desktop executable file is mstsc.exe. You can also open Remote Desktop from a command-line interface by typing **mstsc** and pressing ENTER.

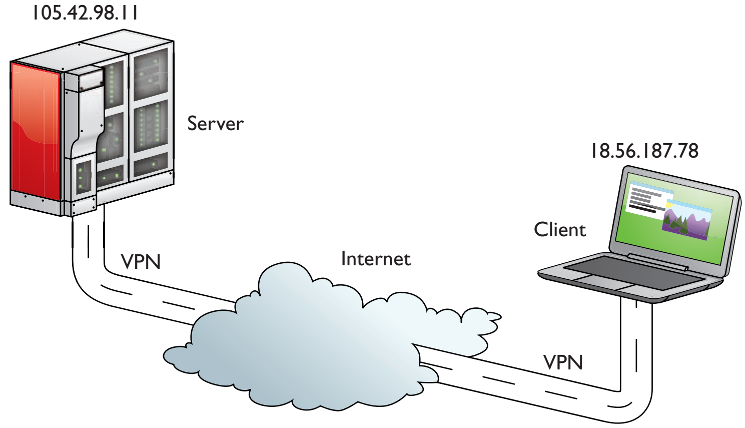
Windows 7 (and Windows Vista with the appropriate update) is capable of running specific applications hosted on a Windows Server 2008/2008 R2 machine. Think of it as Remote Desktop without the desktop—a single application run on one machine (a server) and appearing on another desktop (a client). You can set up your connection to the Windows Server machine using the RemoteApp and Desktop Connections applet in Control Panel.



• **Figure 24.51** VPN connecting computers across the United States



• **Figure 24.52** Typical tunnel



• **Figure 24.53** Endpoints must have their own IP addresses.

Virtual Private Networks

Remote connections have been around for a long time, long before the Internet existed. The biggest drawback about remote connections was the cost to connect. If you were on one side of the continent and had to connect to your LAN on the other side of the continent, the only connection option was a telephone. Or, if you needed to connect two LANs across the continent, you ended up paying outrageous monthly charges for a private connection. The introduction of the Internet gave people wishing to connect to their home networks a very cheap connection option, but with one problem: the whole Internet is open to the public. People wanted to stop using dial-up and expensive private connections and use the Internet instead, but they wanted to do it securely.

Those clever network engineers worked long and hard and came up with several solutions to this problem. Standards have been created that use encrypted tunnels between a computer (or a remote network) to create a private network through the Internet (see Figure 24.51), resulting in what is called a **Virtual Private Network (VPN)**.

An encrypted tunnel requires endpoints—the ends of the tunnel where the data is encrypted and decrypted. In the SSH tunnel you've seen thus far, the client for the application sits on one end and the server sits on the other. VPNs do the same thing. Either some software running on a computer or, in some cases, a dedicated box must act as an endpoint for a VPN (see Figure 24.52).

To make VPNs work requires a protocol that uses one of the many tunneling protocols available and adds the capability to ask for an IP address from a local DHCP server to give the tunnel an IP address that matches the subnet of the local LAN. The connection keeps the IP address to connect to the Internet, but the tunnel endpoints must act like NICs (see Figure 24.53). Let's look at one of the protocols, PPTP.

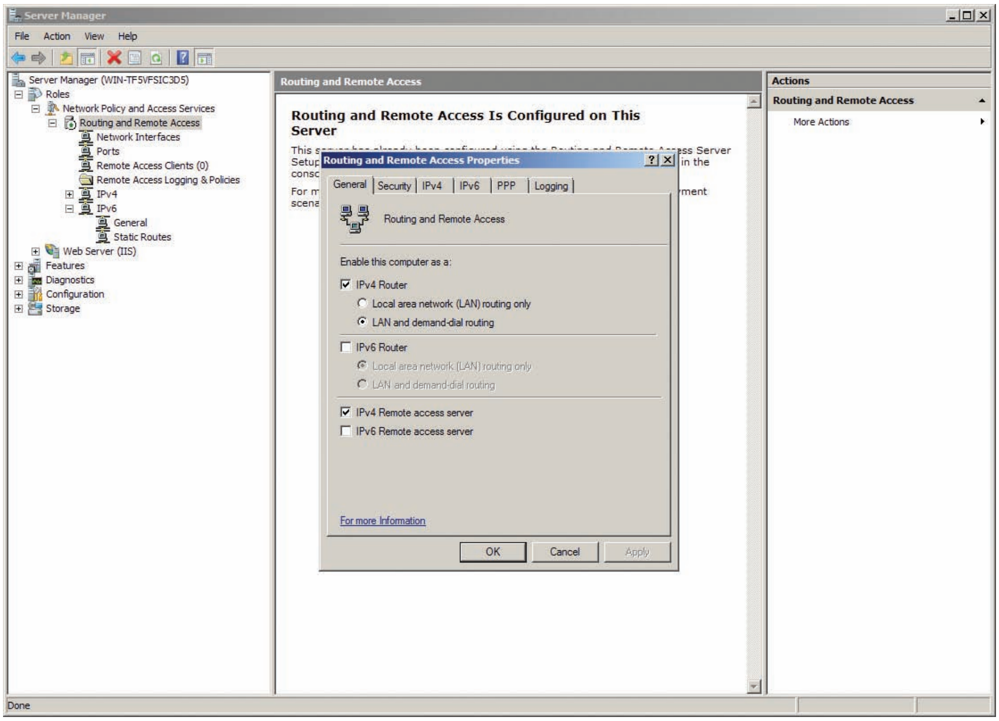
PPTP VPNs

So how do we make IP addresses appear out of thin air? Microsoft got the ball rolling with the **Point-to-Point Tunneling Protocol (PPTP)**, an advanced version of a protocol used for dial-up Internet called PPP that handles all of this right out of the box. The only trick is the endpoints. In Microsoft's view, a VPN is intended for individual clients (think employees on the road) to connect back to the office network, so Microsoft places the PPTP endpoints on the client and a special remote access server program called Routing and Remote Access Service (RRAS), available on Server versions of Windows, on the server (see Figure 24.54).

On the Windows client side, you right-click on My Network Places and click on Create a New Connection (Windows XP) or type **VPN** into the Start Search bar (Windows Vista and 7) and press ENTER. This presents you with a dialog box where you can enter all your VPN server information. Your network administrator will most likely provide this to you. The result is a virtual network card that, like any other NIC, gets an IP address from the DHCP server back at the office (see Figure 24.55).

A system connected to a VPN looks as though it's on the local network but often performs much slower than if the system were connected directly back at the office.

When your computer connects to the RRAS server on the private network, PPTP creates a secure tunnel through the Internet back to the private LAN. Your client takes on an IP address of that network, as if your computer were plugged into the LAN back at the office. Even your Internet traffic will go through your office first. If you open your Web browser, your client will go across the Internet to the office LAN and then use the LAN's Internet connection! Because of this, Web browsing is very slow over a VPN.


Server Manager
File
Action
View
Help
Server Manager (WIN-TF5VFSIC3D5)
Roles
Network Policy and Access Services
Routing and Remote Access
Network Interfaces
Ports
Remote Access Clients (0)
Remote Access Logging & Policies
IPv4
IPv6
General
Static Routes
Web Server (IIS)
Features
Diagnostics
Configuration
Storage
Routing and Remote Access
Actions
Routing and Remote Access
More Actions
Done

Routing and Remote Access Is Configured on This Server

Routing and Remote Access Properties

General | Security | IPv4 | IPv6 | PPP | Logging

Routing and Remote Access

Enable this computer as a:

☑ IPv4 Router
○ Local area network (LAN) routing only
● LAN and demand-dial routing

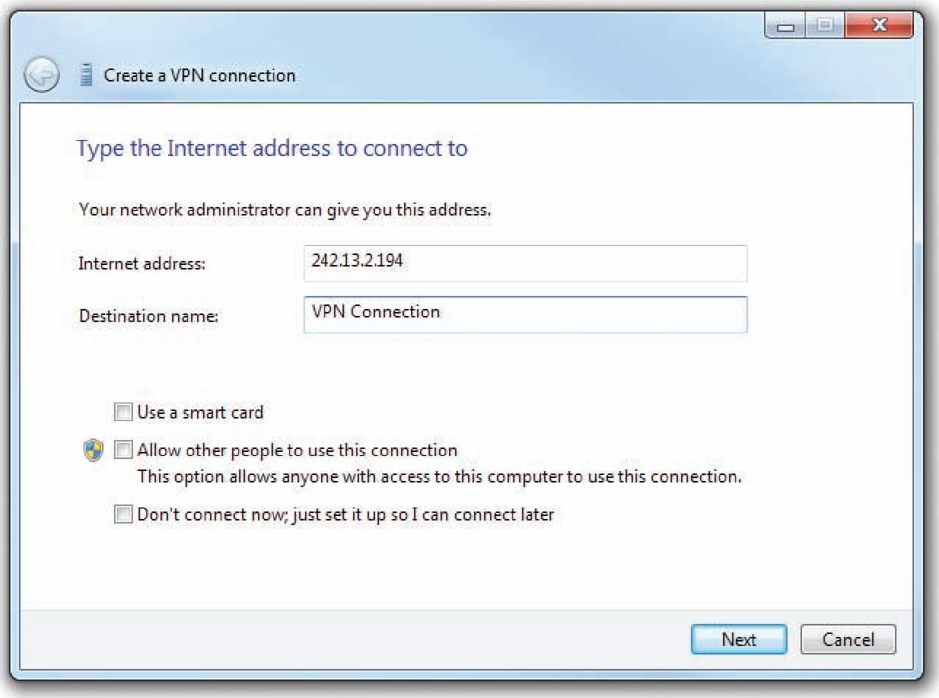
☐ IPv6 Router
● Local area network (LAN) routing only
○ LAN and demand-dial routing

☑ IPv4 Remote access server
☐ IPv6 Remote access server

For more Information

OK | Cancel | Apply

• **Figure 24.54** RRAS in action



Type the Internet address to connect to

Your network administrator can give you this address.

Internet address: 242.13.2.194

Destination name: VPN Connection

□ Use a smart card

□ Allow other people to use this connection
This option allows anyone with access to this computer to use this connection.

□ Don't connect now; just set it up so I can connect later

• Figure 24.55 VPN connection in Windows

Support Applications (Internet Utilities)

The CompTIA A+ 220-801 objectives list three rather unique protocols. Personally, I doubt you'll ever deal directly with two of them, and the other is more common to LANs, not the Internet, but you should know a little bit about all three anyway.

LDAP

The **Lightweight Directory Access Protocol (LDAP)** enables operating systems and applications to access directories. If you've got a Windows Server system running Active Directory, for example, Windows uses LDAP to do anything with Active Directory. If you're sitting at a computer and add it to an Active Directory domain, Windows uses LDAP commands to update the Active Directory with the computer's information. You don't see LDAP, but it works hard to keep networks running smoothly.

SNMP

The **Simple Network Management Protocol (SNMP)** enables remote query and remote configuration of just about anything on a network. Assuming all your computers, switches, routers, and so on are SNMP-capable, you can use programs to query the network for an unimaginable amount of data. SNMP is a popular tool to check on your network, but you'll need to take the CompTIA Network+ exam to see SNMP in action.

SMB

The **Server Message Block (SMB)** protocol isn't even an application but rather proof of the power of Microsoft. SMBs date back to the old NetBIOS naming service and were the tools that tossed a PC's name around a network. NetBIOS names are gone, but SMBs are the reason that tools like Network can show you all the computers on your network. SMB is so powerful that other operating systems copy SMB using a popular program called SAMBA. SAMBA emulates SMB—it makes non-SMB operating systems on a network look like Windows.

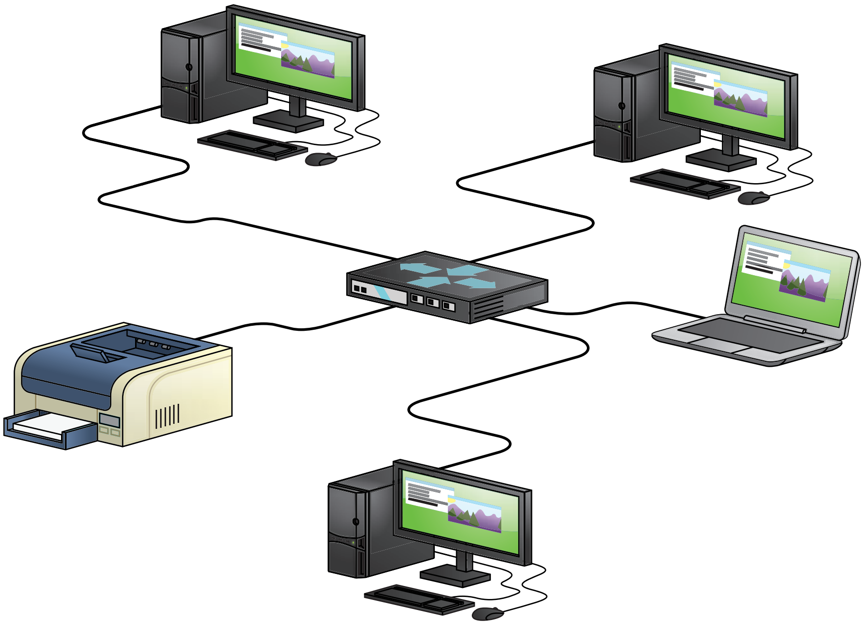
802

Internet Troubleshooting

There isn't a person who's spent more than a few hours on a computer connected to the Internet who hasn't run into some form of connectivity problem. I love it when I get a call from someone saying "The Internet is down!" as I always respond the same way: "No, the Internet is fine. It's the way you're trying to get to it that's down." Okay, so I don't make a lot of friends with that remark, but it's actually a really good reminder of why we run into problems on the Internet. Let's review the common symptoms CompTIA lists on their objectives for the CompTIA A+ 220-802 exam and see what we can do to fix these all-too-common problems.

The dominant Internet setup for a SOHO environment consists of some box from your ISP—a cable modem, a DSL modem, etc.—that connects via Ethernet cable to a home router. This router is usually 802.11 capable and includes four Ethernet ports. Some computers in the network connect through a wire and some connect wirelessly (see Figure 24.56). It's a pretty safe assumption that CompTIA has a setup like this in mind when talking about Internet troubleshooting, and we'll refer to this setup here as well.

One quick note before we dive in—most Internet connection problems are network connection problems. In other words, everything you learned in Chapter 22 still applies here. We're not going to rehash those repair problems in this chapter. The following issues are Internet-only problems, so don't let a bad cable fool you into thinking a bigger problem is taking place.



• Figure 24.56 Typical SOHO setup

No Connectivity

As you'll remember from Chapter 22, "no connectivity" has two meanings: a disconnected NIC or an inability to connect to a resource. Since Chapter 22 already covers wired connectivity issues and Chapter 23 covers wireless issues, let's look at lack of connectivity from a "you're on the Internet but you can't get to a Web site" point of view:

1. Can you get to other Web sites? If not, go back and triple-check your local connectivity.
2. Can you ping the site? Go to a command prompt and try pinging the URL as shown here:

   ```
   C:\>ping www.cheetos1.com
   Ping request could not find host www.cheetos1.com. Please check
   the name and try again.
   C:\>
   ```

   The ping is a failure, but we learn a lot from it. The ping shows that your computer can't get an IP address for that Web site. This points to a DNS failure, a very common problem. To fix a failing DNS:

1. Go to a command prompt and type **ipconfig /flushdns**:

   ```
   C:\>ipconfig /flushdns
   Windows IP Configuration
   Successfully flushed the DNS Resolver Cache.
   C:\>
   ```

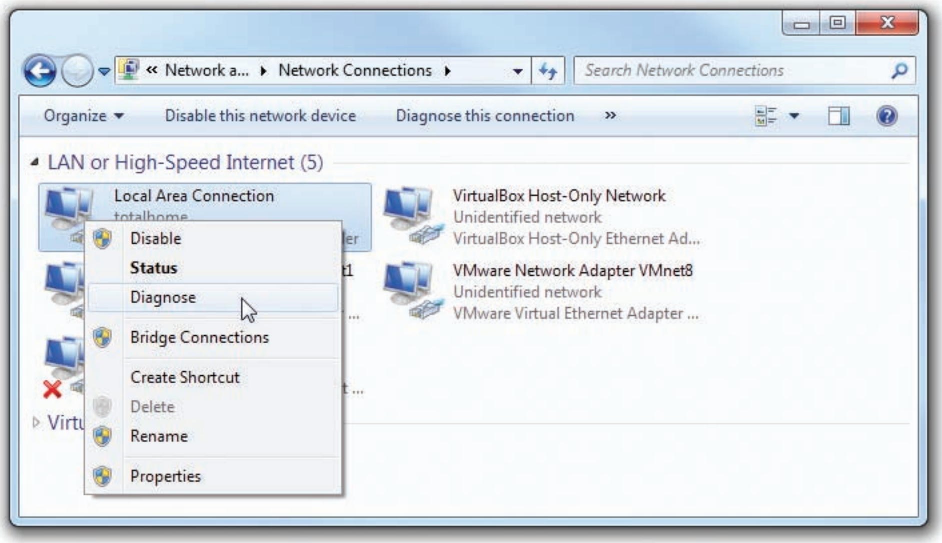
2. If you have Windows XP, go to the Network Connections applet in the Control Panel. Right-click on your network connection and select Repair. If you have Windows Vista/7, go to the Network and Sharing Center and click *Change adapter settings*. Right-click on your network connection and select Diagnose to run the troubleshooter (see Figure 24-57).
3. Try using another DNS server. There are lots of DNS servers out there that are open to the public. Try Google's famous 8.8.8.8 and 8.8.4.4.

If DNS is OK, make sure you're using the right URL. This is especially true when you're entering DNS names into applications like e-mail clients.

Limited Connectivity

Limited connectivity points to a DHCP problem, assuming you're connected to a DHCP server. Run **ipconfig** and see if you have an APIPA address:

```
C:\>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:
        Connection-specific DNS Suffix  . :
        IP Address. . . . . . . . . . . . : 169.254.0.16
        Subnet Mask . . . . . . . . . . . : 255.255.0.0
        Default Gateway . . . . . . . . . :
C:\>
```

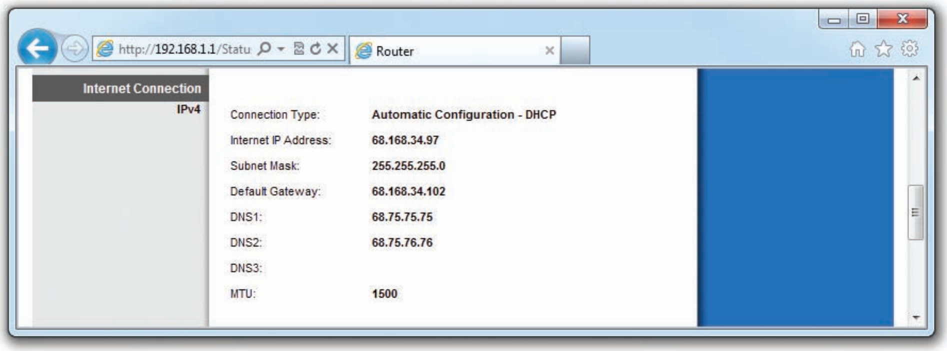

« Network a... ▸ Network Connections ▸
Search Network Connections
Organize ▾
Disable this network device
Diagnose this connection
»
LAN or High-Speed Internet (5)
Local Area Connection
totalhome
Disable
Status
Diagnose
Bridge Connections
Create Shortcut
Delete
Rename
Properties
Virtu
VirtualBox Host-Only Network
Unidentified network
VirtualBox Host-Only Ethernet Ad...
VMware Network Adapter VMnet8
Unidentified network
VMware Virtual Ethernet Adapter ...

• Figure 24.57 Diagnosing a network problem in Windows 7

Uh-oh! No DHCP server! If your router is your DHCP server, try restarting the router. If you know the Network ID for your network and the IP address for your default gateway (something you should know—it's your network!), try setting up your NIC statically.

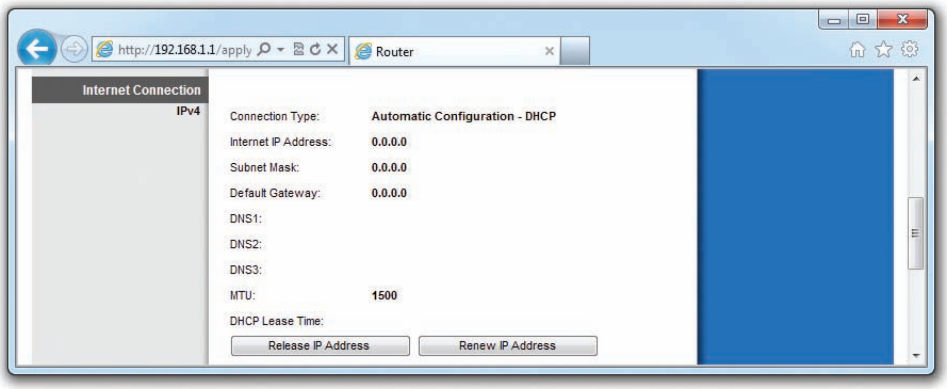
Local Connectivity

Local connectivity means you can access network resources but not the Internet. First, this is a classic symptom of a downed DHCP server since all the systems in the local network will have APIPA addresses. However, you might also have a problem with your router. In Windows XP, you need to ping the default gateway; if that's successful, ping the other port (the WAN port) on your router. The only way to determine the IP address of the other port on your router is to access the router's configuration Web page and find it (see Figure 24.58). Every router is different—good luck!



Connection Type: Automatic Configuration - DHCP
Internet IP Address: 68.168.34.97
Subnet Mask: 255.255.255.0
Default Gateway: 68.168.34.102
DNS1: 68.75.75.75
DNS2: 68.75.76.76
DNS3:
MTU: 1500

• Figure 24.58 Router's WAN IP address



Connection Type: Automatic Configuration - DHCP
Internet IP Address: 0.0.0.0
Subnet Mask: 0.0.0.0
Default Gateway: 0.0.0.0
DNS1:
DNS2:
DNS3:
MTU: 1500
DHCP Lease Time:

• Figure 24.59 No WAN connection

You can learn a lot by looking at your WAN IP address. Take a look at Figure 24.59. At first glance, it looks the same as Figure 24.58, but notice that there is no IP address. Most ISPs don't provide static IP addresses—they simply give you the physical connection, and your router's WAN network card uses DHCP, just like most internal networks. If you're lucky, you can renew your DHCP address using some button on the router's configuration. If not, try resetting the cable/DSL modem. If that doesn't work, it's time to call your ISP.

Slow Transfer Speeds

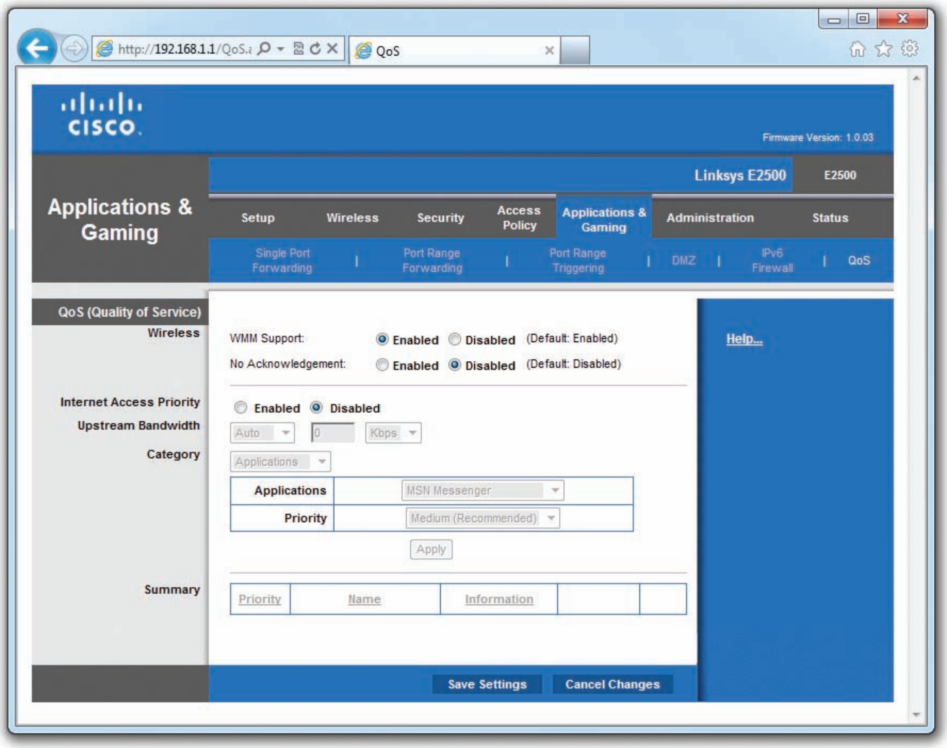
No matter how fast the connection is, we all want our Internet to go faster. People expect a certain amount of wait for a large program to download or an HD video to buffer, but your connection can sometimes slow down to unacceptable speeds.

Remember that your Internet connection has a maximum speed at which it can transfer. If you divide that connection between multiple programs trying to use the Internet, all of your programs will connect very slowly. To see what's happening on your network, open a command prompt and type **netstat**, which shows all the connections between your computer and any other computer. Here's a very simplified example of netstat output:

```
C:\>netstat
Active Connections
  Proto  Local Address          Foreign Address        State
  TCP    10.12.14.47:57788      totalfs3:microsoft-ds  ESTABLISHED
  TCP    192.168.15.102:139     Sabertooth:20508       ESTABLISHED
  TCP    192.168.15.102:50283   Theater:netbios-ssn    ESTABLISHED
  TCP    192.168.15.102:60222   dts1.google.com:https  ESTABLISHED
  TCP    192.168.15.102:60456   www.serve2.le.com:http   ESTABLISHED
  TCP    192.168.15.102:60482   64.145.92.65:http      ESTABLISHED
  TCP    192.168.15.102:60483   12.162.15.1:57080      TIME_WAIT
C:\>
```

If you look at the Foreign Address column, you'll see that most of the connections are Web pages (HTTP and HTTPS) or shared folders (microsoft-ds, netbios-ssn), but what is the connection to 12.162.15.1:57080? Not knowing every connection by heart, I looked it up on Google and found out that there was a background torrent program running on my machine. I found the program and shut it down.

When everyone on the network is getting slow Internet connectivity, it's time to check out the router. In all probability, you have too many people that need too much bandwidth—go buy more bandwidth!



QoS (Quality of Service)

Wireless

WMM Support: ● Enabled ○ Disabled (Default: Enabled)

No Acknowledgement: ○ Enabled ● Disabled (Default: Disabled)

Internet Access Priority: ○ Enabled ● Disabled

Upstream Bandwidth: Auto 0 Kbps

Category: Applications

Applications	MSN Messenger
Priority	Medium (Recommended)

Summary

Priority	Name	Information		

• Figure 24.60 QoS

You can control what's going through your router using *Quality of Service* (*QoS*). QoS is a feature that enables you to limit the bandwidth for certain types of data based on application protocol, the IP address of a computer, and all sorts of other features. Figure 24.60 is a typical router's QoS page.

Beyond A+

The areas covered by the CompTIA A+ certification exams do a great job on the more common issues of dealing with the Internet, but a few hot topics (although beyond the scope of the CompTIA A+ exams) are so common and important that you need to know them: online gaming, chatting, and file sharing.

Online Gaming

One of the more exciting and certainly more fun aspects of the Internet is online gaming. Competing online against a real person or people makes for some pleasant gaming. Enjoying classics such as Hearts and Backgammon with another human can be challenging and fun. Another popular genre of online gaming is the "first-person shooter." These games place you in a small world with up to 32 other players. A great example is Valve Software's *Counter-Strike: Source* (see Figure 24.61).

• Figure 24.61 *Counter-Strike: Source*

No discussion of online gaming is complete without talking about the most amazing game type of all: the massively multiplayer online role-playing game (MMORPG). Imagine being an elfin wizard, joined by a band of friends, all going on adventures together in a world so large that it would take a real 24-hour day to journey across it! Imagine that in this same world, 2000 to 3000 other players, as well as thousands of game-controlled characters, are participating! Plenty of MMORPGs are out there, but the most popular today is *World of Warcraft* (see Figure 24.62).

Each of these games employs good old TCP/IP to send information, using ports reserved by the game. For instance, the Quake series of games uses port 26000, while DirectX uses ports 47624 and 2300–2400.

Chat

If there's one thing we human beings love to do, it's chat. The Internet provides a multitude of ways to do so, whether by typing or actual talking. Keep in mind that chatting occurs in real time. As fast as you can type or talk, whoever is at the other end hears or sees what you have to say. To chat, however, you need some form of chat software. The oldest family of chat programs is based on the Internet Relay Chat (IRC) protocol; a very common IRC chat program is mIRC. IRC protocols allow for a number of other little extras as well, such as being able to share files.

Today, companies such as Google, AOL, Yahoo!, and Microsoft have made their own chat programs (otherwise known as instant messengers, or IMs) that not only provide text chat but also add features such as voice and

[Party] [Tsarion]: ooc: one of these screens will work beautifully. Thank you both. Trying to finish this chapter so I can enjoy Thanksgiving and not have to work all weekend.
You wave at Qps.
Qps receives loot: [Vicious Fang].
Qps receives loot: [Chilled Meat].
[Party] [Qps]: thats was my fishing rod e 2
Discovered Eastwind Shore: 2100 experience gained

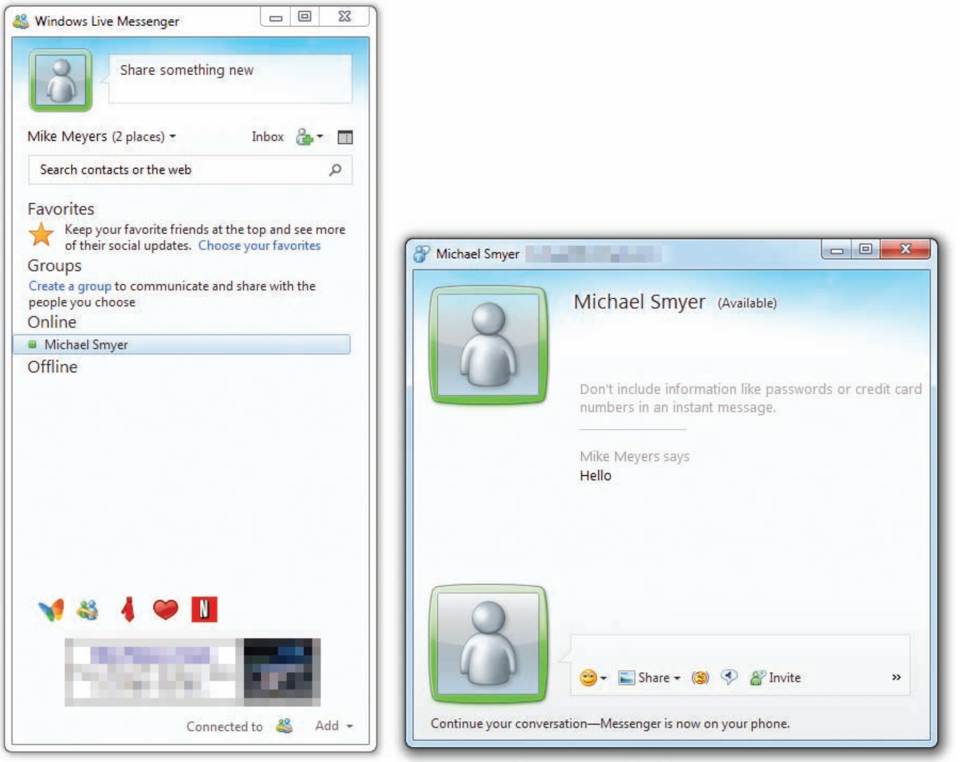
• **Figure 24.62** My editor playing *World of Warcraft*

video, turning your PC into a VoIP phone! Figure 24.63 shows the popular Microsoft Windows Live Messenger software.

File Sharing

The last extra Internet function to discuss is also probably the most controversial: file sharing. File sharing started over a decade ago and consisted of a whole bunch of computers with one program loaded, such as Napster or Kazaa. The file-sharing program enables each of the computers running that program to offer files to share, such as music and movies. Once all of the file-sharing programs connect to the Internet, any of them can download any file offered by any other in the group.

File sharing through such *distributed* sharing software becomes almost anonymous and free—and that's


Windows Live Messenger

Share something new

Mike Meyers (2 places) ▾ Inbox

Search contacts or the web

Favorites

Keep your favorite friends at the top and see more of their social updates. Choose your favorites

Groups

Create a group to communicate and share with the people you choose

Online

Michael Smyer

Offline

Connected to Add ▾

Michael Smyer

Michael Smyer (Available)

Don't include information like passwords or credit card numbers in an instant message.

Mike Meyers says

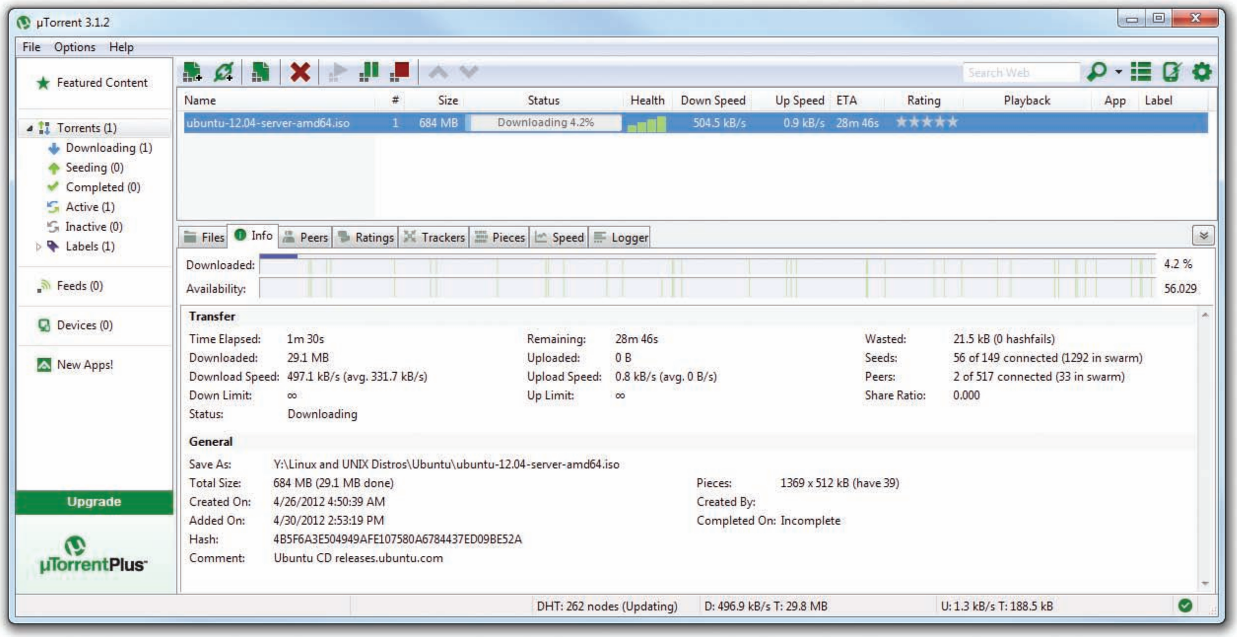
Hello

Share ▾ Invite

Continue your conversation—Messenger is now on your phone.

• **Figure 24.63** Windows Live Messenger in action the problem. You can share *anything*, even copyright-protected music, movies, and more. The music industry in particular has come out swinging to try to stop file-sharing practices. As a result, the music industry is working on a way to shut down those persons who share lots of files. Software developers and file sharers haven't backed down, creating Internet protocols such as BitTorrent that can share files faster and more efficiently. Figure 24.64 shows one of the more popular BitTorrent protocol programs called µTorrent (the µ is the symbol for "micro," so you pronounce it "micro torrent"). BitTorrent has many legitimate uses as well—its protocol is extremely efficient for the distribution of large files and has become the method of choice for distributing Linux distributions and is even used to distribute and patch *World of Warcraft* and *Starcraft II*!

These example programs just scratch the surface of the many applications that use the Internet. One of the more amazing aspects of TCP/IP is that its basic design is around 40 years old. We use TCP/IP in ways completely outside the original concept of its designers, yet TCP/IP continues to show its power and flexibility. Pretty amazing!



Name	#	Size	Status	Health	Down Speed	Up Speed	ETA	Rating	Playback	App	Label
ubuntu-12.04-server-amd64.iso	1	684 MB	Downloading 4.2%		504.5 kB/s	0.9 kB/s	28m 46s	★★★★★			

Downloaded: 4.2 %
Availability: 56.029

Transfer

Time Elapsed:	1m 30s	Remaining:	28m 46s	Wasted:	21.5 kB (0 hashfails)
Downloaded:	29.1 MB	Uploaded:	0 B	Seeds:	56 of 149 connected (1292 in swarm)
Download Speed:	497.1 kB/s (avg. 331.7 kB/s)	Upload Speed:	0.8 kB/s (avg. 0 B/s)	Peers:	2 of 517 connected (33 in swarm)
Down Limit:	∞	Up Limit:	∞	Share Ratio:	0.000
Status:	Downloading				

General

Save As:	Y:\Linux and UNIX Distros\Ubuntu\ubuntu-12.04-server-amd64.iso		
Total Size:	684 MB (29.1 MB done)	Pieces:	1369 x 512 kB (have 39)
Created On:	4/26/2012 4:50:39 AM	Created By:	
Added On:	4/30/2012 2:53:19 PM	Completed On:	Incomplete
Hash:	4B5F6A3E504949AFE107580A6784437ED09BE52A		
Comment:	Ubuntu CD releases.ubuntu.com		

DHT: 262 nodes (Updating)   D: 496.9 kB/s T: 29.8 MB   U: 1.3 kB/s T: 188.5 kB

• Figure 24.64 µTorrent

Chapter 24 Review

Chapter Summary

After reading this chapter and completing the exercises, you should understand the following about the Internet.

Explain how the Internet works

- A PC tech needs to know how PCs communicate with the world for two reasons: to troubleshoot when a process or piece stops working, and to communicate knowledgeably with a network technician who comes in to solve a more complex issue.
- The Internet is broken down into three tiers. Tier 1 providers own the fiber-optic backbones that interconnect at network access points. Backbone routers create an interwoven framework for redundant communications. Tier 2 providers own smaller, regional networks. Tier 3 providers are even more regional and connect to Tier 2 providers.
- Internet service providers (ISPs) lease connections to the Internet from Tier 1 and Tier 2 providers. In turn, ISPs lease connections to allow individuals and companies to access the Internet. ISPs may serve customers nationwide, such as Comcast, or they may be limited to a small community of users.
- Connecting to the Internet requires hardware for connectivity and software to govern the connection and data flow. The router that connects you to your ISP is your default gateway.

Connect to the Internet

- Nine technologies are commonly used to connect a PC to an ISP. These technologies fit into four categories: (1) dial-up (analog and ISDN), (2) dedicated (DSL, cable, fiber, and LAN), (3) wireless (cellular and WiMAX), and (4) satellite. Analog dial-up, the slowest connection, uses a telephone line and a modem. ISDN is a much faster, digital dial-up method. With the exception of satellite, which may use either a modem or a NIC, all the other technologies use an Ethernet NIC.
- A dial-up connection needs hardware, such as a modem or ISDN terminal adapter, and software, such as Microsoft's DUN.
- A modem converts digital signals from the PC into analog signals that travel on telephone lines, and vice versa. An example of serial communication, the modem transmits data as a series of ones and zeros. On the other hand, the computer processes data by using parallel communication of data in discrete 8-bit chunks. A UART chip converts serial to parallel and parallel to serial. An external modem uses the UART chip in the computer's serial port, while an internal modem has its own built-in UART.
- Modems may be internal or external. Many motherboards come with integrated modems. External modems attach to the PC's serial port or USB port.
- If you can't connect to the Internet, look at the modem's Properties dialog box to make sure the volume is turned up. Listen, too, for a befuddled voice on the other end that would indicate your modem is dialing the wrong number. Other things to check: Be sure the line is plugged into a good phone jack, and make sure the number and password are correct. If you still can't connect to the Internet, call the network technicians to check that the dial-up networking settings are correct.
- An ISDN consists of two types of channels: Bearer, or B, channels that carry data and voice at 64 Kbps, and Delta, or D, channels that transmit setup and configuration information at 16 Kbps. Users can use one or two B channels, but the most common setup is the BRI, consisting of two B channels and one D channel to provide a throughput total of 128 Kbps. Except for the steep cost of installation and equipment, ISDN lines are only slightly more expensive than regular phone lines, but this service is limited to an area within about 18,000 feet of a central office. ISDN uses a terminal adapter that looks like a regular modem and may be either external or internal.
- DSL modems connect to an ISP by using a standard telephone line and special connections on each end. Although service levels vary, typical upload speed is ~768 Kbps with a download speed of ~3+ Mbps. A tech usually comes to the house to install a DSL receiver (often called a DSL modem) as well

as a NIC in the PC. DSL is usually limited to about 18,000 feet from a main phone service switching center.

- Cable TV companies offer high-speed Internet access, with an upload speed of about 1–10 Mbps and download transmission rates of 6–100+ Mbps.
- Wireless Internet service requires connecting to a LAN that's wired to an ISP.
- Fiber-to-the-node (FTTN) and fiber-to-the-premises (FTTP) enable super-fast Internet speeds using fiber cabling for most of the connection between the ISP's central office and your home. Fiber connections can provide download speeds up to 150+ Mbps and often provide Internet and telephone services over the same connection.
- Cellular data services have evolved over the past two decades through four loosely defined generations. Current and future technologies like WiMAX and LTE are considered 4G. WiMAX offers wireless speeds up to 10+ Mbps.
- The other wireless option is a satellite connection. Although early satellite technology required uploads through a slow modem (26–48 Kbps) and fast downloads through the dish, newer technology uses the modem only for the initial setup, sending both downloads and uploads through the dish.
- SOHO routers allow multiple users to easily share a broadband connection without having to leave a Windows computer running all the time. They provide NAT that allows you to share a single IP address while acting as an effective firewall. Configuration of SOHO routers is done through special Web pages built into the routers.
- ICS enables multiple systems to use one Internet connection. Included in all current Windows versions, ICS uses an ICS host computer connected to the Internet that then shares the connection via a LAN with client computers. The ICS host computer must have a NIC or modem to connect to the Internet and a NIC that plugs into a switch. The other PCs then connect to the switch.

Use Internet application protocols

- Applications provide TCP/IP services, including Web, e-mail, FTP, Telnet, and VoIP. Using Web browser software such as Internet Explorer or Mozilla Firefox, you can access Web sites and pages from Web servers throughout the world. If you are unsuccessful in connecting to a site, use the command-line tool ping to determine whether the server is up. Simply type **ping** followed by either the DNS name or the IP address.
- A proxy server is software that enables multiple connections to the Internet to go through one protected PC. Configure proxy settings from within your browser of choice. When using Internet Explorer, for example, set proxy settings on the Connections tab of Internet Options.
- You should also know how to adjust security settings in your Web browser. In IE, choose Tools | Internet Options and open the Security tab. You can set different security levels or manually select the features you want to enable or disable.
- Security also includes encrypting information such as credit card numbers, home phone numbers, or other personal information. The most common method of encrypting this information is HTTPS. You identify Web sites using HTTPS by the https that appears at the beginning of the Web address.
- You need an e-mail program such as Microsoft Outlook to receive e-mail. To set up an e-mail client, provide your e-mail address and password. E-mail addresses use the *accountname@Internet domain* format. You must also add the names of the POP3 or IMAP4 server for incoming mail and the SMTP server for outgoing mail.
- FTP enables you to send and receive files. You may use an FTP client such as FileZilla, although later versions of IE and other Web browsers provide support for FTP. You'll have to log on to an FTP site, but most public FTP sites allow anonymous logon.
- Telnet is a terminal emulation program for TCP/IP networks. It lets you connect to a server and run commands as if you were sitting in front of the server. Telnet requires a special user name and password. The user name and password will be sent over the network in clear text.
- SSH is the secure replacement for Telnet. SSH uses port 22, and the entire connection is encrypted, preventing any eavesdroppers from reading your data.
- Secure FTP (SFTP) is nothing more than FTP running through an SSH tunnel. You can either start an SSH session between two computers and configure your FTP client and server to run through the SSH tunnel, or use dedicated SFTP servers and clients.

- Voice over IP (VoIP) enables you to make voice calls over your computer network and refers to a collection of protocols. Venders such as Skype and Vonage offer VoIP solutions.
- Today, terminal emulation usually means graphical terminal emulation programs from third-party companies or in the Windows operating system. Terminal emulation programs require separate server and client programs. The modern Windows client is called Remote Desktop and is built into every version of Windows since XP.
- Remote Assistance, available with Windows XP and later, enables you to give anyone control of your desktop. Useful for giving a tech control of a computer to troubleshoot a hardware configuration or driver problem, you can also use Remote Assistance to install drivers or teach someone how to use a particular application.
- VPNs, or Virtual Private Networks, enable you to connect over the public Internet and access a remote network as if you were physically plugged into it. PPTP is the protocol used by Microsoft to provide this service. It works by creating virtual network cards that have their own IP address that match what the LAN uses.
- Other protocols include LDAP, SNMP, and SMB. The Lightweight Directory Access Protocol (LDAP) is used by many operating systems and applications to access directories. The Simple Network Management Protocol (SNMP) enables more query and configuration of just about anything on a network. The Server Message Block (SMB) protocol enables your computer to see all the other computers on a network using tools like Network.

Troubleshoot an Internet connection

- If you can't connect to a specific Web site, check to make sure you can connect to other Web sites. Use the ping utility to check your connection. Try changing your DNS settings if ping is unable to find an IP address for a particular Web site.
- If you have limited connectivity, check your DHCP settings. If your PC has been assigned an APIPA address, try restarting your router to receive a new IP address from the DHCP server. Otherwise, you can try to set up a static IP address.
- If you can access your local network but not the Internet, you might have a DHCP server issue. You might also have a problem with your router. Try pinging your default gateway and the WAN port of your router.
- If your connection to the Internet feels slower than usual, use the netstat tool to see which programs use the most bandwidth. Also check the number of users connecting to the Internet through the same router. You may need to implement Quality of Service (QoS) to keep more of the bandwidth available.

Key Terms

baud *(906)*
bits per second (bps) *(906)*
default gateway *(904)*
Dial-up Networking (DUN) *(905)*
digital subscriber line (DSL) *(911)*
file transfer protocol (FTP) *(928)*
Hypertext Transfer Protocol (HTTP) *(919)*
Hypertext Transfer Protocol Secure (HTTPS) *(920)*
integrated services digital network (ISDN) *(910)*
Internet Connection Sharing (ICS) *(918)*
Internet Message Access Protocol version 4 (IMAP4) *(925)*
Internet service provider (ISP) *(903)*
latency *(931)*
Lightweight Directory Access Protocol (LDAP) *(936)*
Long Term Evolution (LTE) *(914)*
modem *(905)*
Network Address Translation (NAT) *(915)*
Point-to-Point Protocol (PPP) *(908)*
Point-to-Point Tunneling Protocol (PPTP) *(935)*
Post Office Protocol version 3 (POP3) *(925)*
proxy server *(924)*
Remote Assistance *(932)*
Remote Desktop *(932)*
Secure Shell (SSH) *(929)*
Server Message Block (SMB) *(937)*
Simple Mail Transfer Protocol (SMTP) *(925)*
Simple Network Management Protocol (SNMP) *(936)*

Telnet *(929)*
tier *(901)*
tunneling *(929)*
universal asynchronous receiver/transmitter (UART) *(905)*
Virtual Private Network (VPN) *(934)*
Voice over IP (VoIP) *(930)*
VoIP phone *(931)*
Web browser *(919)*
Worldwide Interoperability for Microwave Access (WiMAX) *(914)*

Key Term Quiz

Use the Key Terms list to complete the sentences that follow. Not all terms will be used.

1. The time it takes for a packet to travel to its destination and back is called _________________.
2. Internet Explorer is a(n) _________________.
3. The most common method used to encrypt information, such as credit card numbers, on the Internet is _________________.
4. A(n) _________________ is software that enables multiple connections to go to the Internet through one protected PC.
5. Although some people use the term to refer to modem speed, _________________ actually means the number of cycles per second, while _________________ is a more accurate measurement of actual data throughput.
6. By using an anonymous logon, _________________ allows you to send and receive files from a public site.
7. The service that provides the structure for the World Wide Web, allowing documents to be sent across the Web, is _________________.
8. Dial-up links to the Internet use a streaming hardware protocol called _________________.
9. A(n) _________________ enables you to access a remote network over the Internet securely.
10. While technically incorrect, most users refer to the box provided by their cable or DSL Internet providers as a(n) _________________.

Multiple-Choice Quiz

1. Which statements about integrated services digital network (ISDN) are true? (Select three.)
   - **A.** An ISDN connection uses either an internal or an external terminal adapter (TA).
   - **B.** BRI has two B channels and one D channel for a throughput total of 128 Kbps.
   - **C.** PRI has 23 B channels and 1 D channel for a total throughput of 1.544 Mbps.
   - **D.** ISDN consists of end-to-end high-speed analog lines.
2. What is the name for the router that your PC uses to connect to your Internet service provider?
   - **A.** Loopback address
   - **B.** Backbone
   - **C.** IP address
   - **D.** Default gateway
3. To configure dial-up networks with Windows XP, which applet should you use?
   - **A.** Network and Internet Connections
   - **B.** Network
   - **C.** Internet Connection Sharing
   - **D.** Remote Assistance
4. A Virtual Private Network creates a(n) _______________ through the Internet.
   - **A.** Tunnel
   - **B.** BRI
   - **C.** Connection
   - **D.** SSH session

5. To check to see if the Web server you are trying to reach is available or is down, which command-line utility should you use?

   A. ping

   B. ICS

   C. Telnet

   D. NAT

6. Which of the following Internet connection methods limit the distance you can be from a central office? (Select two.)

   A. DSL

   B. Satellite

   C. Cable

   D. ISDN

7. If your modem cannot connect to the Internet, which of the following can you eliminate as a cause of the problem?

   A. The phone line is dead.

   B. All lines on the Internet are busy.

   C. You dialed the wrong number.

   D. The modem is bad.

8. What port does POP3 use?

   A. 22

   B. 110

   C. 212

   D. 42

9. Liz can receive her e-mail, but she cannot send e-mail. Which of the following is most likely causing her problem?

   A. POP3

   B. SMTP

   C. IMAP4

   D. UART

10. What is the name for the extremely fast networking connections through which Internet transmissions take place?

    A. Gateways

    B. Tier 1 providers

    C. Backbones

    D. ISPs

11. Which technology enables you to make voice calls over your computer network?

    A. Internet Voice Protocol

    B. Voice over IP

    C. Digital Telephony Subscriber Service

    D. Universal Asynchronous Receiver Transmitter

12. A user on Windows 7 has asked you to teach her how to use a feature of Microsoft Word. What tool should you use?

    A. Remote Assistance

    B. Remote Desktop

    C. Telnet

    D. Secure Shell (SSH)

13. John tried going to www.totalsem.com with his Web browser, but the Web site wouldn't load. He opened a command-line window and typed **ping www.totalsem.com**. He received a message that the ping request couldn't find www.totalsem.com. What is the most likely reason John received this message?

    A. Bad default gateway

    B. DNS failure

    C. Corrupted NIC driver

    D. Too many applications using the Internet connection simultaneously

14. Where would you go first if you needed to configure a small Linksys router to use a static IP address?

    A. The Router Configuration applet in the Control Panel.

    B. The router's configuration Web page.

    C. Plug in a Yost cable and start PuTTY.

    D. There is no way to give the router a static IP.

15. A new client lives in a rural area, outside the connectivity radius of the local cable company and definitely more than 20,000 feet away from the nearest switching center for the phone company. Which Internet option offers the client the best performance?

    A. Cable

    B. Dial-up

    C. DSL

    D. Satellite

Essay Quiz

1. With the rash of worms and viruses that attack computers connected to the Internet, how can you protect your computer?
2. Andrew's wife, Talena, collects pottery. Andrew found a shop on the Internet that has a piece she's been wanting. He'd love to give it to her for her birthday next week, but the only way it can arrive by then is if he pays for it with his credit card. He's a bit apprehensive about giving his credit card number over the Internet. He wants you to tell him whether you think the site is safe or not. How can you evaluate the site to determine whether it uses encryption for credit card numbers?
3. Sean is planning to take some distance education courses next term. He currently uses a regular phone line and a modem to connect to the Internet. He's consulted you to figure out what his options are for a faster connection. Review his options, explaining the advantages and disadvantages, along with any restrictions that may prevent his receiving the service.
4. With a child in high school and another at a local college, it's always a struggle in Tom's house about who gets to use the computer to do Internet research. It's not feasible for Tom to have two DSL connections, but he does have a second computer. What solution can you offer to solve his problem?
5. You've become a regular columnist for your company's monthly newsletter. Everybody in the company uses e-mail and browses the Web, but you're convinced that the company would benefit if employees knew how to use some of the other Internet services. You've decided that this month's article will highlight three other Internet services. Which three will you discuss and what will you include about each?

Lab Projects

• Lab Project 24.1

Remote Desktop is a great feature of Windows. However, making it work when the computer you want to connect to is behind a router or firewall can be difficult. You need to consider and configure many things, such as the computer's public IP address and port forwarding or Network Address Translation on the router. Using the Internet, find a tutorial or a step-by-step "how-to" article that guides you through configuring a remote computer and router to make a Remote Desktop connection possible.

• Lab Project 24.2

Remote Desktop provides the same functionality as some third-party software and services, such as the open source VNC software, Symantec's commercial pcAnywhere software, and the online service GoToMyPC.com. Each has its own benefits, such as no cost, ease of configuration, or cross-platform use. Research two other solutions that offer remote control functionality similar to Remote Desktop and compare and contrast the three. What are the similarities? What are the unique benefits of each? Which one would you be more likely to use yourself? Why?

• Lab Project 24.3

Have you heard of WebDAV? Web Distributed Authoring and Versioning is a set of extensions added to the Hypertext Transfer Protocol to support collaborative authoring on the Web. While HTTP is a reading protocol, WebDAV is a writing protocol created by a working group of the Internet Engineering Task Force (IETF). WebDAV offers a faster, more secure method of file transfer than FTP, and some predict that it may make FTP obsolete. It's already incorporated into most current operating systems and applications. Some authors say that WebDAV will change the way we use the Web. Use the Internet to learn more about WebDAV and its features. Apple calls it "a whole new reason to love the Net." After learning about WebDAV, see if you agree.

• Lab Project 24.4

Are all high-speed Internet connections created equal? Test them to find out! Speakeasy.net hosts one of the best Internet sites for testing the speed of an Internet connection: www.speakeasy.net/speedtest/

Test three to five Internet connections that you can easily get to, such as your home, a friend's house, your school, a library, and an Internet café. How do the connections compare? If you can, find out which technology the connections use. Which one seems to offer the best connection in your area?