Chapter 1

Networks Will Not Take Over the World, and Other Network Basics

In This Chapter

- Getting a handle on networks
- Considering why networking is useful (and is everywhere)
- Telling the difference between servers and clients
- Looking under the hood at the network operating system
- Asking "How does it work when a network works if a network works for me?" (Say what?)
- Assessing how networks change computing life
- Identifying (and offering sympathy to) the network administrator
- Comparing servers to clients: What have they got that you don't got?

Computer networks get a bad rap in the movies. In the *Terminator* movies, Skynet (a computer network of the future) takes over the planet, builds deadly terminator robots, and sends them back through time to kill everyone unfortunate enough to have the name Sarah Connor. In *The Matrix* movies, a vast and powerful computer network enslaves humans and keeps them trapped in a simulation of the real world. And in one of Matthew Broderick's first movies, *War Games,* a computer whiz kid nearly starts World War III by connecting to a Defense Department network and playing the game Global Thermonuclear War.

Fear not. These bad networks exist only in the dreams of science fiction writers. Real-world networks are much more calm and predictable. They don't think for themselves, they can't evolve into something you don't want them to be, and they won't hurt you — even if your name is Sarah Connor.

Now that you're over your fear of networks, you're ready to breeze through this chapter. It's a gentle, even superficial, introduction to computer networks, with a slant toward the concepts that can help you use a computer that's attached to a network. This chapter goes easy on the details; the detailed and boring stuff comes later.

What Is a Network?

A *network* is nothing more than two or more computers connected by a cable (or in some cases by radio connection) so that they can exchange information.

Of course, computers can exchange information in ways other than networks. Most of us have used what computer nerds call the *sneakernet.* That's where you copy a file to a diskette, a CD-RW disc, or a removable flash drive, and then walk the data over to someone else's computer. (The term *sneakernet* is typical of computer nerds' feeble attempts at humor, and why not? As a way to transfer information, sneakernet *is* feeble.)

The whole problem with the sneakernet is that it's slow — plus, it wears a trail in your carpet. One day, some penny-pinching computer geeks discovered that connecting computers with cables was cheaper than replacing the carpet every six months. Thus, the modern computer network was born.

You can create a computer network by hooking together all the computers in your office with cables and using the computer's *network interface* (an electronic circuit that resides inside your computer and has a special jack on the computer's backside). Then you set up your computer's operating system software to make the network *work,* and — *voilà* — you have a working network. That's all there is to it.

If you don't want to mess with cables, you can create a *wireless network* instead. In a wireless network, each computer is equipped with a special wireless network adapter that has little rabbit-ear antennas. Thus, the computers can communicate with each other without the need for cables.

Figure 1-1 shows a typical network with four computers. You can see that all four computers are connected by a network cable to a central network device: the *hub.* You can also see that Ward's computer has a fancy laser printer attached to it. Because of the network, June, Wally, and the Beaver can also use this laser printer. (Also, you can see that the Beaver stuck yesterday's bubble gum to the back of his computer. Although the bubble gum isn't recommended, it shouldn't adversely affect the network.)

Computer networking has its own, strange vocabulary. Fortunately, you don't have to know every esoteric networking term. Here are a few basic buzzwords to get you by:

- **LAN:** Networks are often called LANs. The acronym *LAN* stands for *local-area network.* It's the first *TLA,* or *three-letter acronym,* that you see in this book. You don't really need to remember it, or any of the many TLAs that follow. In fact, the only three-letter acronym you need to remember is TLA.
- **FLA:** You may guess that a four-letter acronym is an *FLA.* Wrong! A four-letter acronym is an *ETLA,* which stands for *extended three-letter*

acronym. (After all, it just wouldn't be right if the acronym for *four-letter acronym* had only three letters.)

- **On the network:** Every computer connected to the network is said to be *on the network.* The technical term (which you can forget) for a computer that's on the network is a *node.*
- **Online:** When a computer is turned on and can access the network, the computer is said to be *online.* When a computer can't access the network, it's *offline.* A computer can be offline for several reasons. The computer can be turned off, the user may have disabled the network connection, the computer may be broken, the cable that connects it to the network can be unplugged, or a wad of gum can be jammed into the disk drive.
- **Up:** When a computer is turned on and working properly, it's said to be *up.* When a computer is turned off, broken, or being serviced, it's said to be *down.* Turning off a computer is sometimes called *taking it down.* Turning it back on is sometimes called *bringing it up.*

Don't confuse local-area networks with the Internet. The *Internet* is a huge amalgamation of computer networks strewn about the entire planet. Networking the computers in your home or office so that they can share information with one another and connecting your computer to the worldwide Internet are two separate, but related, tasks. If you want to use your local-area network to connect your computers to the Internet, you can consult Chapter 10 for instructions.

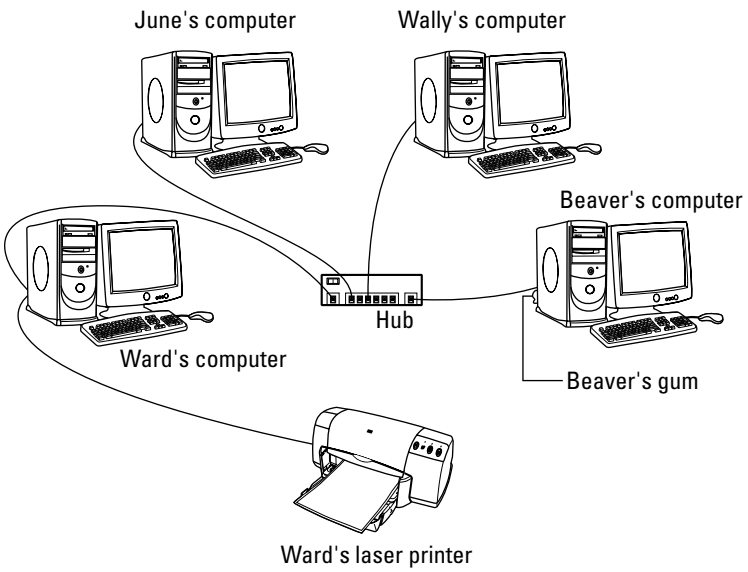

Figure 1-1: A typical network.

Why Bother with a Network?

Frankly, computer networks are a bit of a pain to set up. So, why bother? Because the benefits of having a network make the pain of setting up one bearable. You don't have to be a PhD to understand the benefits of networking. In fact, you learned everything you need to know in kindergarten: Networks are all about sharing. Specifically, networks are about sharing three things: files, resources, and programs.

Sharing files

Networks enable you to share information with other computers on the network. Depending on how you set up your network, you can share files with your network friends in several different ways. You can send a file from your computer directly to a friend's computer by attaching the file to an e-mail message and then mailing it. Or, you can let your friend access your computer over the network so that your friend can retrieve the file directly from your hard drive. Yet another method is to copy the file to a disk on another computer and then tell your friend where you put the file so that he can retrieve it later. One way or the other, the data travels to your friend's computer over the network cable, and not on a floppy disk, CD-RW, or flash drive, as it would in a sneakernet.

Sharing resources

You can set up certain computer resources — such as hard drives or printers — so that all computers on the network can access them. For example, the laser printer attached to Ward's computer in Figure 1-1 is a *shared resource,* which means that anyone on the network can use it. Without the network, June, Wally, and the Beaver would have to buy their own laser printers.

Hard drives can be shared resources, too. In fact, you must set up a hard drive as a shared resource to share files with other users. Suppose that Wally wants to share a file with the Beaver, and a shared hard drive has been set up on June's computer. All Wally has to do is copy his file to the shared hard drive in June's computer and tell the Beaver where he put it. Then when the Beaver gets around to it, he can copy the file from June's computer to his own (unless, of course, Eddie Haskell deletes the file first).

You can share other resources, too, such as an Internet connection. In fact, sharing an Internet connection is one of the main reasons many networks are set up.

Sharing programs

Rather than keep separate copies of programs on each person's computer, putting programs on a drive that everyone shares is sometimes best. For example, if ten computer users all use a particular program, you can purchase and install ten copies of the program — one for each computer. Or, you can purchase a ten-user license for the program and then install just one copy of the program on a shared drive. Each of the ten users can then access the program from the shared hard drive.

In most cases, however, running a shared copy of a program over the network is unacceptably slow. A more common way of using a network to share programs is to copy the program's installation disks or CDs to a shared network drive. Then you can use that copy to install a separate copy of the program on each user's local hard drive. For example, Microsoft Office enables you to do this if you purchase a license from Microsoft for each computer on which you install Office.

The advantage of installing Office from a shared network drive is that you don't have to lug around the installation disks or CDs to each user's computer. And, the system administrator can customize the network installation so that the software is installed the same way on each user's computer. (However, these benefits are significant only for larger networks. If your network has fewer than about ten computers, you're probably better off installing the program separately on each computer directly from the installation disks or CDs.)

Remember that purchasing a single-user copy of a program and then putting it on a shared network drive — so that everyone on the network can access it — is illegal. If five people use the program, you need to either purchase five copies of the program or purchase a *network license* that specifically allows five or more users.

Another benefit of networking is that networks enable computer users to communicate with one another over the network. The most obvious way networks allow computer users to communicate is by passing messages back and forth, using e-mail or instant-messaging programs. Networks also offer other ways to communicate: For example, you can hold online meetings over the network. Network users who have inexpensive video cameras *(Webcams)* attached to their computers can have videoconferences. You can even play a friendly game of Hearts over a network — during your lunch break, of course.

Servers and Clients

The network computer that contains the hard drives, printers, and other resources that are shared with other network computers is a *server.* This

term comes up repeatedly, so you have to remember it. Write it on the back of your left hand.

Any computer that's not a server is a *client.* You have to remember this term, too. Write it on the back of your right hand.

Only two kinds of computers are on a network: servers and clients. Look at your left hand and then look at your right hand. Don't wash your hands until you memorize these terms.

The distinction between servers and clients in a network has parallels in sociology — in effect, a sort of class distinction between the "haves" and "have-nots" of computer resources:

- Usually, the most powerful and expensive computers in a network are the servers. There's a good technical reason: Every user on the network shares the server's resources.
- The cheaper and less powerful computers in a network are the clients. *Clients* are the computers used by individual users for everyday work. Because clients' resources don't have to be shared, they don't have to be as fancy.
- Most networks have more clients than servers. For example, a network with ten clients can probably get by with one server.
- In many networks, a clean line of demarcation exists between servers and clients. In other words, a computer functions as either a server or a client, and not both. For the sake of an efficient network, a server can't become a client, nor can a client become a server.
- Other (usually smaller) networks can be more evenhanded by allowing any computer in the network to be a server and allowing any computer to be both server and client at the same time.

Dedicated Servers and Peers

In some networks, a server computer is a server computer and nothing else. It's dedicated to the sole task of providing shared resources, such as hard drives and printers, to be accessed by the network client computers. This type of server is a *dedicated server* because it can perform no other task than network services.

Some smaller networks take an alternative approach by enabling any computer on the network to function as both a client and a server. Thus, any

computer can share its printers and hard drives with other computers on the network. And, while a computer is working as a server, you can still use that same computer for other functions, such as word processing. This type of network is a *peer-to-peer network* because all the computers are thought of as *peers,* or equals.

Here are some points to ponder concerning the differences between dedicated server networks and peer-to-peer networks while you're walking the dog tomorrow morning:

- Peer-to-peer networking features are built into Windows. Thus, if your computer runs Windows, you don't have to buy any additional software to turn your computer into a server. All you have to do is enable the Windows server features.
- The network server features that are built into desktop versions of Windows (such as Windows XP and Vista) aren't efficient because these versions of Windows weren't designed primarily to be network servers.

  If you dedicate a computer to the task of being a full-time server, use a special network operating system rather than the standard Windows operating system. A *network operating system,* also known as a *NOS,* is specially designed to handle networking functions efficiently.

  - The most commonly used network operating systems are the server versions of Windows.

    At the time of publication, the current server version of Windows was *Windows Server 2003,* and a newer version, probably to be called *Windows Server 2007,* was on the way.
  - Other network operating systems include *Linux* and *Novell NetWare.*
- Many networks are both peer-to-peer *and* dedicated-server networks at the same time. These networks have
  - At least one *server* computer that runs a NOS, such as Windows Server 2003.
  - *Client* computers that use the server features of Windows to share their resources with the network.
- Besides being dedicated, your servers should also be sincere.

What Makes a Network Tick?

To use a network, you don't really have to know much about how it works. Still, you may feel a little bit better about using the network if you realize that

it doesn't work by voodoo. A network may seem like magic, but it isn't. The following list describes the inner workings of a typical network:

- **Network interface card:** Inside any computer attached to a network is a special electronic circuit card: the *network interface card.* The TLA for network interface card is *NIC.*

  

  Using your network late into the evening isn't the same as watching NIC at night. If the network is set up to use that time to update software and back up data, the NIC has to be robust enough to handle all-day-all-night use.

  

  Although you can also use an external network interface that connects to the computer by using the computer's USB (universal serial bus) port, most networked computers use a built-in network interface card.

  Nearly all computers built these days have a network interface built into the computer's motherboard. This network interface is still commonly called the NIC, even though it isn't technically a separate card.

- **Network cable:** The network cable physically connects the computers. It plugs into the network interface card on the back of your computer.

  Nearly all networks now use a type of cable that looks something like telephone cable. However, appearances can be deceiving. Most phone systems are wired using a lower grade of cable that doesn't work for networks. For a computer network, each pair of wires in the cable must be twisted in a certain way. That's why this type of cable is called *twisted-pair cable.* (Standard phone cable doesn't do the twist.)

  For the complete lowdown on networking cables, refer to Chapter 5.

  

  You can do away with network cable by creating a wireless network, although that option has some challenges of its own. For more information about wireless networking, see Chapter 9.

- **Network switch:** Networks built with twisted-pair cabling require one or more switches. A *switch* is a box with a bunch of cable connectors. Each computer on the network is connected by cable to the switch. The switch, in turn, connects all the computers to each other.

  

  In the early days of twisted-pair networking, devices known as *hubs* were used rather than switches. The term *hub* is sometimes used to refer to switches, but true hubs went out of style sometime around the turn of the century.

- **Network software:** Of course, the software makes the network work. To make any network work, a whole bunch of software has to be set up just right. For peer-to-peer networking with Windows, you have to play with the Control Panel to get networking to work. And, a network operating

system (such as Windows Server 2003) requires a substantial amount of tweaking to get it to work just right.

For more information about choosing which network software to use for your network, refer to Chapter 7.

It's Not a Personal Computer Anymore!

If I had to choose one point that I want you to remember from this chapter more than anything else, it's this: After you hook up your personal computer (PC) to a network, it's not a "personal" computer anymore. You are now part of a network of computers, and in a way, you've given up one of the key concepts that made PCs so successful in the first place: independence.

I got my start in computers back in the days when mainframe computers ruled the roost. *Mainframe computers* are big, complex machines that used to fill entire rooms and had to be cooled with chilled water. My first computer was a water-cooled Binford Power-Proc Model 2000. Argh, argh, argh. (I'm not making up the part about the water. A plumber was often required to install a mainframe computer. In fact, the really big ones were cooled by liquid nitrogen. I *am* making up the part about the Binford 2000.)

Mainframe computers required staffs of programmers and operators in white lab coats just to keep them going. The mainframes had to be carefully managed. A whole bureaucracy grew up around managing them.

Mainframe computers used to be the dominant computers in the workplace. Personal computers changed all that: They took the computing power out of the big computer room and put it on the user's desktop, where it belongs. PCs severed the tie to the centralized control of the mainframe computer. With a PC, a user could look at the computer and say, "This is mine — all mine!" Mainframes still exist, but they're not nearly as popular as they once were.

Networks are changing everything all over again. In a way, it's a change back to the mainframe-computer way of thinking: central location, distributed resources. True, the network isn't housed in the basement and doesn't have to be installed by a plumber. But you can no longer think of "your" PC as your own. You're part of a network — and, like the mainframe, the network has to be carefully managed.

Here are several ways in which a network robs you of your independence:

- **You can't just indiscriminately delete files from the network.** They may not be yours.

- **You're forced to be concerned about network security.** For example, a server computer has to know who you are before it lets you access its files. So, you have to know your user ID and password to access the network. This precaution prevents some 15-year-old kid from hacking his way into your office network by using its Internet connection and stealing all your computer games.
- **You may have to wait for shared resources.** Just because Wally sends something to Ward's printer doesn't mean that it immediately starts to print. The Beav may have sent a two-hour print job before that. Wally just has to wait.
- **You may have to wait for access to documents.** You may try to retrieve an Excel spreadsheet file from a network drive, only to discover that someone else is using it. Like Wally, you just have to wait.
- **You don't have unlimited storage space.** If you copy a 600MB database file to a server's drive, you may get calls later from angry co-workers complaining that no room is left on the server's drive for their important files.
- **Your files can become infected from viruses given to you by someone over the network.** You may then accidentally infect other network users.
- **You have to be careful about saving sensitive files on the server.** If you write an angry note about your boss and save it on the server's hard drive, your boss may find the memo and read it.
- **The server computer must be up and running at all times.** For example, if you turn Ward's computer into a server computer, Ward can't turn his computer off when he's out of the office. If he does, you can't access the files stored on his computer.
- **If your computer is a server, you can't just turn it off when you're finished using it.** Someone else may be accessing a file on your hard drive or printing on your printer.

Why does Ward always get the best printer? If *Leave It to Beaver* were made today, I would bet that the good printer would be on June's computer.

The Network Administrator

Because so much can go wrong — even with a simple network — designating one person as the *network administrator* is important. This way, someone is responsible for making sure that the network doesn't fall apart or get out of control.

The network administrator doesn't have to be a technical genius. In fact, some of the best network administrators are complete idiots when it comes

to technical stuff. What's important is that the administrator is organized. That person's job is to make sure that plenty of space is available on the file server, that the file server is backed up regularly, that new employees can access the network, and other tasks.

The network administrator's job also includes solving basic problems that the users themselves can't solve — and knowing when to call in an expert when something really bad happens. It's a tough job, but somebody's got to do it. Here are a few tips that might help:

- Part IV of this book is devoted entirely to the hapless network administrator. So, if you're nominated, read the chapters in that part. If you're lucky enough that someone *else* is nominated, celebrate by buying her a copy of this book.
- In small companies, picking the network administrator by drawing straws is common. The person who draws the shortest straw loses and becomes administrator.
- Of course, the network administrator can't be a *complete* technical idiot. I was lying about that. (For those of you in Congress, the word is *testifying.*) I exaggerated to make the point that organizational skills are more important than technical skills. The network administrator needs to know how to do various maintenance tasks. Although this knowledge requires at least a little technical know-how, the organizational skills are more important.

What Have They Got That You Don't Got?

With all this technical stuff to worry about, you may begin to wonder whether you're smart enough to use your computer after it's attached to the network. Let me assure you that you are. If you're smart enough to buy this book because you know that you need a network, you're more than smart enough to use the network after it's put in. You're also smart enough to install and manage a network yourself. It isn't rocket science.

I know people who use networks all the time. They're no smarter than you are, but they do have one thing that you don't have: a certificate. And so, by the powers vested in me by the International Society for the Computer Impaired, I present you with the certificate in Figure 1-2, confirming that you've earned the coveted title Certified Network Dummy, better known as CND. This title is considered much more prestigious in certain circles than the more stodgy CNE or MCSE badges worn by real network experts.

Congratulations, and go in peace.

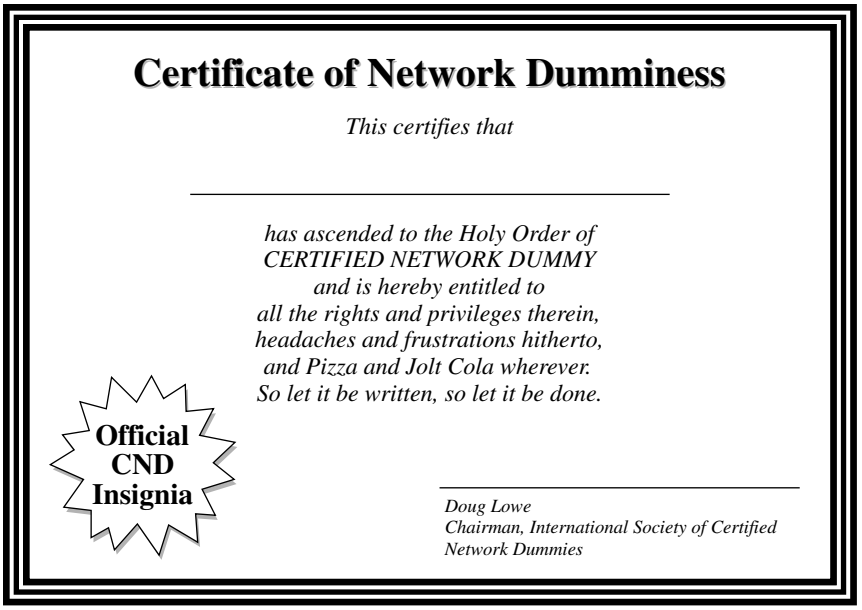

Figure 1-2: Your official CND certificate.