Chapter 1
Networks Will Not Take Over the World, and Other Network Basics

In This Chapter

- What is a network?
- Why is networking a great idea?
- What's the difference between servers and clients?
- What is the network operating system?
- How does a network work?
- How can the network change your computing life?
- Who or what is the network manager?
- What have they got that you don't got?

Computer networks get a bad rap in the movies. In **War Games,** Matthew Broderick plays a nerdy computer-whiz kid who nearly starts World War III by playing a game called "Global Thermonuclear War" on a Defense Department computer. In the **Terminator** movies, a computer network of the future called "Skynet" 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. And in **The Matrix,** a vast and powerful computer network enslaves humans and keeps them trapped in a simulation of the real world.

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 isn't very detailed; the really detailed and boring stuff comes later.

What Is a Network?

A **network** is nothing more than two or more computers

connected by a cable so that they can exchange information.

Of course, computers can exchange information in other ways besides networks. Most of us have used what computer nerds call the **sneakernet.** That's where you copy a file to a floppy disk and then walk the disk over to someone else's computer. (The term **sneakernet** is typical of computer nerds' feeble attempts at humor.)

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 together with cables was actually cheaper than replacing the carpet every six months. Thus, the modern computer network was born.

You can create a computer network by hooking all the computers in your office together with cables and installing a special **network interface card** (an electronic circuit card that goes inside your computer -- ouch!) in each computer so that you have a place to plug in the cable. 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.

Figure 1-1 shows a typical network with four computers. You can see that all four computers are connected with a network cable to a central network device called a **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 has stuck yesterday's bubble gum to the back of his computer. Although not recommended, the bubble gum shouldn't adversely affect the network.)

Figure 1-1: A typical network.
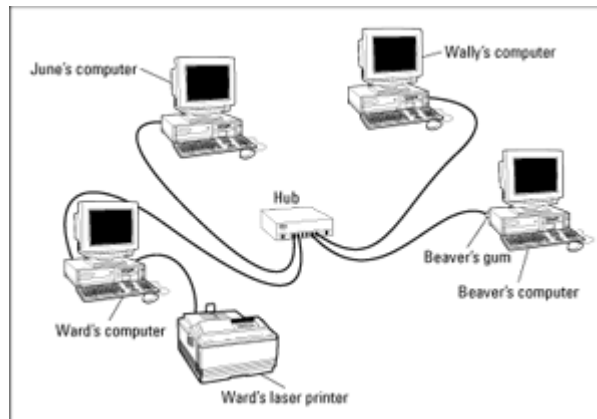
Computer networking has its own strange vocabulary. Fortunately, you don't have to know every esoteric networking term. Here are a few basic buzzwords to get you by:

- Networks are often called LANs. **LAN** is an acronym that stands for **local area network.** It's the first **TLA,** or **three-letter acronym,** that you see in this book. You don't 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.

- You may guess that a four-letter acronym is called an **FLA.** Wrong! A four-letter acronym is called an **ETLA,** which stands for **extended three-letter acronym.**

- 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.**

- 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.

- When a computer is turned on and working properly, it's said to be **up.** When a computer is turned off or broken, 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 entirely separate things. If you want to use your local area network to connect your computers to the Internet, you can consult Chapter 18 for instructions.

Why Bother?

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 one up bearable. You don't have to be a Ph.D. 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 or she 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 as it does in a sneakernet.

- **Sharing resources:** You can set up certain computer resources -- such as a hard drive or a printer -- so that all the 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 in order to share files with other users. Suppose 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 modems (which enable you to access the Internet) and CD-ROM or DVD drives (devices that store vast quantities of data and are most useful for large clip-art libraries and encyclopedias and for playing tunes or watching movies while you're supposed to be working).

- **Sharing programs:** Rather than keeping separate copies of programs on each person's computer, sometimes putting programs on a drive that everyone shares is best. For example, if you have ten computer users who 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 onto 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 you have five people who 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 programs or instant messaging programs. But networks also offer other ways to communicate: For example, you can hold online meetings over the network. Network users who have inexpensive video cameras attached to their computers can have video conferences. 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 called 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 called 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 have these terms memorized.

The distinction between servers and clients in a network would be somewhat fun to study in a sociology class, because it's similar to the distinction between the haves and the have-nots in society.

- Usually, the most powerful and expensive computers in a network are the servers. This fact makes sense because 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 segregation exists between servers and clients. In other words, a computer is either a server or a client, and not both. A server can't become a client, nor can a client become a server.

- Other networks are more progressive, allowing any computer in the network to be a server and allowing any computer to be both server and client at the same time. The network illustrated in Figure 1-1 is this type of network.

Dedicated Servers and Peers

In some networks, a server computer is a server computer and

nothing else. This server computer is dedicated solely to the task of providing shared resources, such as hard drives and printers, to be accessed by the network client computers. Such a server is referred to as a **dedicated server** because it can perform no other task besides network services.

Other networks take an alternative approach, 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 called a **peer-to-peer network,** because all the computers are thought of as peers, or equals.

Here are some points to ponder concerning the difference 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 Microsoft Windows 95, 98, and Millennium Edition (Windows Me). 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 Windows 9**x**/Me aren't very efficient because these versions of Windows were not designed primarily to be network servers. If you're going to dedicate a computer to the task of being a full-time server, you should use a special network operating system instead of the standard Windows operating system. A network operating system, also known as a **NOS,** is specially designed to handle networking functions efficiently. The two most commonly used network operating systems are Microsoft's Windows 2000 Server (which used to be known as Windows NT Server) and Novell's NetWare. I describe them both in the next section, "The NOS Choice."

- Many networks are both peer-to-peer and dedicated server networks at the same time. These networks have one or more server computers that run Windows 2000 Server or some other NOS, as well as client computers that use the server features of Windows to share their resources with the network.

- Besides being dedicated, it's helpful if your servers are also sincere.

The NOS Choice

Most dedicated network servers do not run a desktop version of

Windows such as Windows Me or Windows 98. Instead, dedicated network servers usually run a network operating system or NOS**.** A network operating system is specially designed to efficiently carry out the tasks of coordinating the access to shared network resources among the network client computers.

Although you have several network operating systems to choose from, the two most popular are NetWare and Windows 2000 Server.

- One of the most popular network operating systems is NetWare, from a company called Novell. NetWare is very advanced but also very complicated. So complicated, in fact, that it has an intensive certification program that rivals the bar exam. The lucky ones that pass the test are awarded the coveted title **Certified Novell Engineer,** or **CNE,** and a lifetime supply of pocket protectors. Fortunately, a CNE is really required only for large networks with dozens or even hundreds of computers attached. Building a NetWare network with just a few computers isn't too difficult.

- Windows 2000 Server is a special network server version of Windows 2000, which is itself a more advanced version of the popular Windows operating system from Microsoft. Windows 2000 used to be known as Windows NT. Thanks to the familiar Windows interface, Windows 2000 Server is a bit easier to set up and use than NetWare.

Not wanting to be left out, Microsoft has its own certification program for Windows 2000 specialists. If you pass the full battery of certification tests, you get to wear an MCSE badge, which lets the whole world know that you are a **Microsoft Certified Systems Engineer.**

- Other network operating system choices include UNIX, Linux, and IBM's OS/2 Warp Server. Apple also makes its own network server operating system called Mac OS X Server, designed specially for Macintosh computers.

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 is a list of the inner workings of a typical network:

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

Using your network late into the evening is not the same as watching NIC at night.

On newer computers, you can use an external network interface

that connects to the computer via the computer's USB port.

- **Network cable:** The network cable is what physically connects the computers together. It plugs into the network interface card at the back of your computer. Two types of cables are commonly used for networks. The first type of cable, called **coaxial** (sometimes called just **coax**), is similar to the cable used to bring Nick at Nite to your TV. The cable used for cable TV is not the same as the cable used for computer networks, though. So, don't try to replace a length of broken network cable with TV cable. It won't work. Networks require a higher grade of cable than is used for cable TV.

The other common type of network cable looks like a telephone cable. However, appearances can be deceiving. Many phone systems are wired using a lower grade of cable that won'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 a **twisted-pair cable.** Standard phone cable doesn't have the right twists.

Of the two cable types, twisted-pair cable is the best kind to use for new networks. Coax cable is found in plenty of older networks, but if you are building a new network, you want to use twisted-pair cable. For the complete lowdown on networking cables, refer to Chapter 10.

- **Network hub:** If your network is set up using twisted-pair cable, your network also needs a network hub. A **hub** is a small box with a bunch of cable connectors. Each computer on the network is connected by cable to the hub. The hub, in turn, connects all the computers to each other. If your network uses coax cable, the cable goes directly from computer to computer, so a network hub isn't used.

Instead of hubs, some networks use a faster device known as a **switch.** The term **hub** is often used to refer to both true hubs and switches.

- **Network software:** Of course, the software really 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 network operating systems such as Windows 2000 Server or Novell's NetWare require a substantial amount of tweaking to get them to work just right. For more information about choosing which network software to use for your network, refer to Chapter 8. To find out what you need to know to configure the software so that your network runs smoothly, refer to Chapters 12 through 16.

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: Once 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 things 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 frequently 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 just to keep them going. They had to be carefully managed. A whole bureaucracy grew up around managing mainframes.

Mainframe computers used to be the dominant computer in the workplace. Personal computers changed all that. Personal computers 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. 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 a few 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.

- Just because Wally sends something to Ward's printer doesn't mean it immediately starts to print. The Beave may have sent a two-hour print job before that. Wally just has to wait.

- 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.

- If you copy that 600MB database file to a server's drive, you may get calls later from angry coworkers complaining that no room is left on the server's drive for their important files.

- Someone may pass a virus to you over the network. You may then accidentally infect other network users.

- If you want to access a file on Ward's computer but Ward

hasn't come in and turned his computer on yet, you have to go into his office and turn it on yourself. To add insult to injury, you have to know Ward's password if Ward decided to password-protect his computer. (Of course, if you're the Beave, you probably already know Ward's password and everyone else's too, for that matter. If you don't, you can always ask Eddie Haskell.)

- 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 bet the good printer would be on June's computer.

The Network Manager

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

The network manager doesn't have to be a technical genius. In fact, some of the best network managers are complete idiots when it comes to technical stuff. What's important is that the manager be organized. The manager's job is to make sure that plenty of space is available on the file server, the file server is backed up regularly, new employees can access the network, and so on.

The network manager'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.

- Part III of this book is devoted entirely to the hapless network manager. So if you're nominated, read that section. If you're lucky enough that someone else is nominated, celebrate by buying him or her a copy of this book.

- In small companies, picking the network manager by drawing straws is common. The person who draws the shortest straw loses and becomes manager.

- Of course, the network manager can't really be a complete technical idiot. I was lying. (For those of you in Congress, that means I was "testifying.") I exaggerated to make the point that organizational skills are more important than technical skills. The network manager needs to know how to do various maintenance tasks. This knowledge requires at least a little technical know-how, but the organizational skills are more important.

What Have They Got That You Don't Got?

With all this stuff to worry about, you may begin to wonder if

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. This isn't rocket science.

I know people who use networks all the time. And 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 MSCE badges worn by real network experts.

Congratulations, and go in peace.

Figure 1-2: Your official CND certificate.

Certificate of Network Dumminess

This certifies that

_____

has ascended to the Holy Order of
CERTIFIED NETWORK DUMMY
and is hereby entitled to
all the rights and privileges therein,
headaches and frustrations hitherto,
and Pizza and Jolt Cola wherever.
So let it be written, so let it be done.

Official
CND
Insignia

John Kilcullen
CEO, IDG Books Worldwide

Doug Lowe
Chairman, International Society of Certified Network Dummies