Chapter 1

What Is a LAN?

Not long ago, home local area networks were proof of their owner's geekhood. They were very expensive, cantankerous, difficult to set up, and useful for only a very few advanced home users (mostly for programmers and writers). Thanks to falling prices and vastly improved software, home LANs aren't just for geeks anymore. In this chapter, you'll find the following:

- A typical home LAN
- Basic LAN building blocks
- The difference between LANs and WANs

As you'll see, building a home LAN isn't rocket science. Thanks in large part to the explosive growth of broadband Internet connections and the proliferation of multi-PC homes, there are hundreds of networking products made specifically for home and small-business users. These products are simple to install and operate, so you don't need a computer science degree to set them up. In fact, many home networking devices simply "plug and play" right out of the box, with little or no setup or configuration required.

It's Simpler Than You Might Think

What is a network? It's simply two or more devices that communicate with one another over some type of electronic connection. The connection itself can be copper wire, fiber optic cable, or radio waves. There are all sorts of networks in use today, including the broadcast and cable television networks, the public telephone network, several cellular telephone networks, and the Internet. A ***local area network*** (LAN) is a network of computers, located physically close to one another. (The Internet, by the way, is a WAN, or ***wide area network***, that connects millions of LANs.)

A LAN consists of two or more computers, each equipped with a communications device called a ***network interface*** or ***network adapter***. The network interfaces are connected to one another by some type of communications medium, which provides a pathway for electrical signals that connect all of the computers on a LAN. The most widely used, cost-effective, and highest-performance network medium in use today is twisted-pair Ethernet cable, often called CAT5 or CAT6 cable. (CAT is short for category — there are several grades of cable that can be used for Ethernet LANs.)

A relatively new technology called ***wireless Ethernet*** uses radio signals instead of copper cable as the communications medium. Early wireless devices were slow, expensive, and unreliable. Worse

still, there were no industry standards, so products from one manufacturer didn't always work with products from another. In the late 1990s, most of the wireless equipment manufacturers formed a trade association called the WiFi Alliance to set technical standards and to certify interoperability. The current generation of WiFi devices offers excellent speed and reliability at very low prices, so your LAN no longer requires hardwiring between components. As you'll see in Chapter 6, you can use a mix of wired and wireless Ethernet connections on the same LAN.

Wired Ethernet interfaces are standard equipment on most modern desktops and laptops, and some high-end laptops include wired and wireless Ethernet interfaces as standard equipment. If your computer didn't come with a network adapter, there are several inexpensive ways to add one to your existing computer. There are different types of network adapters for different types of communications media; I cover them in detail in Chapter 4. Figure 1-1 shows a simple two-computer Ethernet LAN.

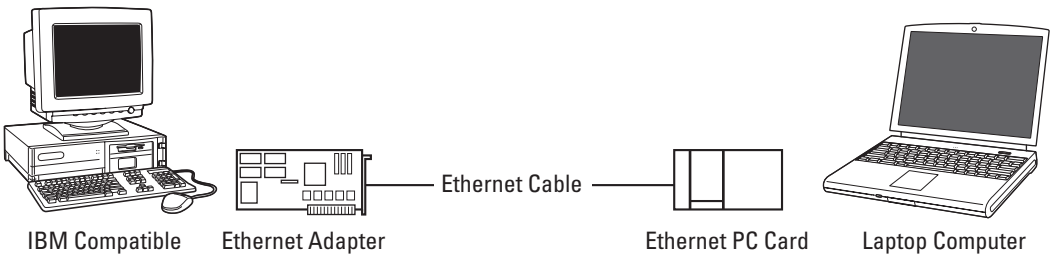

Figure 1-1: This simple LAN has two computers connected by an Ethernet cable.

The example in Figure 1-1 shows a desktop computer on the left and a laptop computer on the right. The desktop is equipped with an internal Ethernet adapter card, and the laptop with a PC Card Ethernet adapter. The two Ethernet adapters are connected by a single cable. In many cases, you can create such a network simply by connecting an Ethernet cable between the two computers (assuming that the computers came from the factory with Ethernet adapters already installed).

While the LAN in Figure 1-1 is perfectly functional, it is also very limited because it provides connections for only two computers. To add a third computer or other device to the LAN, you would need to add an Ethernet switch to the network. For now, you can think of a switch as a sort of signal splitter for Ethernet connections. I'll explain switches in detail in Chapter 4.

The diagram in Figure 1-1 is deceptively simple because it doesn't show the complex interaction between the PC computer's operating system and the network adapter. Early versions of Windows (before Windows 3.11) didn't include the software necessary for computers to communicate over a LAN. Fortunately, Windows 98, Me, 2000, and XP all include built-in networking features as a standard part of the operating system. These features allow Windows computers to share files, printers, and Internet connections over a LAN. I'll discuss these features in detail in Part IV.

Note

The step-by-step examples in this book assume that you are using Windows XP, but the basic networking concepts are universal and apply to all versions of Windows. Windows XP contains many features designed to make networking easier, including easier networking installation and setup, and built-in support for wireless networking.

So far, I've only discussed connecting computers to a LAN. If you have a broadband Internet connection, you'll almost certainly want to share that connection among all the computers on your home network. (You can connect a cable or DSL, for digital subscriber line, modem directly to a LAN, but I don't recommend it for security reasons.)

Home networks aren't just for computers anymore. If you have a TiVo, Xbox, or Sony PlayStation, you may want to connect those devices to your LAN too. As you'll see in Chapters 2 and 13, the worlds of computing and home entertainment are converging, with the Internet — and the home network — as their meeting point.

A Guided Tour of Les' LAN

As you might expect, my own home is pretty well wired, and I thought you might find it interesting to see what my home LAN looks like. Figure 1-2 shows what's on my network.

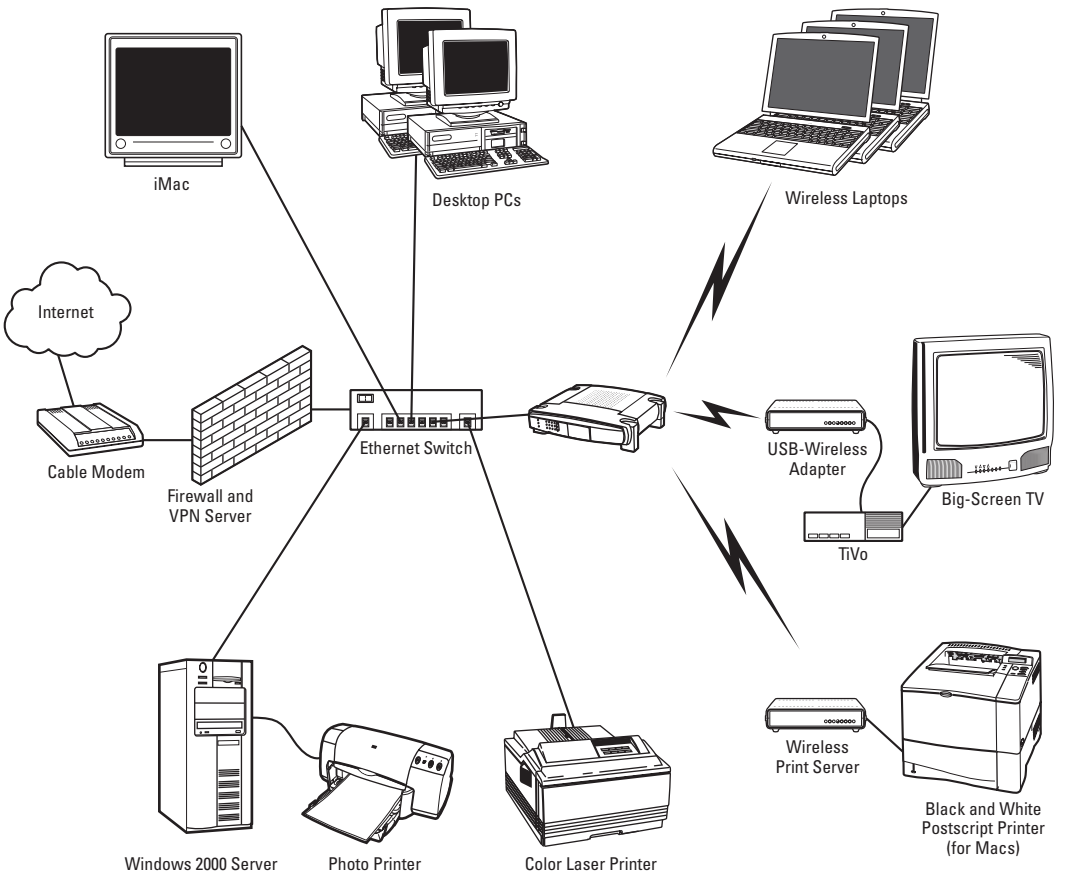

Figure 1-2: My home LAN has grown from a few desktop PCs to something a little more complex.

So what is all this stuff, and what does it do? The equipment at the center of the diagram (the cable modem, firewall, Ethernet switch, and wireless access point) makes up the core of the network. These four devices provide and manage the connection among the devices on the LAN, and between the LAN and the Internet. The devices at the edge of the network (the PCs, Macs, laptops, TiVo, Windows 2000 Server, and printers) fall into two further classes: They either provide services for other devices on the LAN, or they use services that are provided by those devices. As you probably know, devices that provide services are called ***servers***, and devices that use services are called ***clients***.

For example, the Windows 2000 server (with its attached printer) provides file sharing and printing services for the other computers on the LAN. If I am working on my desktop PC and need to print a photograph, I can send the print job to the photo printer attached to the server. In this example, the Windows 2000 system is a server, and my desktop PC is a client. (Some devices can be both a client and a server, as I'll explain in Chapter 3.)

JOURNEY TO THE CENTER OF THE LAN

The device in the center of the diagram is an ***Ethernet switch***, and it is the heart of the network. Ethernet switches have anywhere from a few to a few dozen connectors on them. All of the wired devices on the LAN connect to one of the sockets (called ***ports***) on the Ethernet switch. The switch analyzes the data coming in on each port and reroutes the data to the appropriate device connected to another port. This enables any two devices on the LAN to exchange data with each other. There are six devices connected to the switch in Figure 1-2.

The wireless access point, or AP, to the right of the Ethernet switch does for wireless devices what the Ethernet switch does for wired devices. The AP is connected to the Ethernet switch so wireless devices can communicate with any of the wired devices on the LAN, and vice versa.

The cable modem and firewall to the left of the Ethernet switch work together to provide secure Internet access for all of the devices on the LAN. The cable modem provides a fast, always-on connection to the Internet. As you've probably heard, high-speed connections like cable and DSL modems tend to attract hackers and snoopers, so a firewall is an essential item on any Internet-connected LAN.

The firewall acts as an electronic gatekeeper between the LAN and the Internet. Outgoing connections (like Web browser and e-mail client connections) going from the LAN to the Internet pass directly through the firewall unimpeded, just as if the firewall wasn't even there. Incoming connections are blocked to keep intruders out of your home network, with a very few exceptions.

The firewall also serves another important role: As you'll see in Chapter 3, every device connected to the Internet must have a unique IP address. My cable modem provider (like most broadband providers) only assigns a single IP address to my cable modem, but I have over a dozen devices connected to the LAN. Using a technique called Network Address Translation (NAT), the firewall leverages that single IP address into any number of private IP addresses. The firewall keeps track of all traffic coming and going to and from the Internet and routes the traffic to the appropriate device on the LAN.

Note

If this seems like a lot of equipment, relax. My network uses a separate Ethernet switch, wireless AP, and firewall, but you don't have to. Most network equipment manufacturers offer products that combine these three functions into a single unit costing less than $200. Figure 1-3 shows a typical product from D-Link. I prefer the separate units for my own home LAN because I do a lot of product testing and I need to be able to test out a new firewall or Ethernet switch without reconfiguring the entire LAN.

Figure 1-3: D-Link calls its model DI-624 a Wireless Broadband Router. It combines a four-port Ethernet switch, a wireless access point, and a firewall into one compact, inexpensive unit.

OUT ON THE EDGE

The devices on the outside edges of the LAN diagram (the PCs, Macs, laptops, TiVo, and other devices) are either clients or servers. Most of these devices can communicate with one another, but some can't. Even though two devices may be connected to the same LAN, there's no guarantee that they'll have much to say to one another. What would a big-screen TV and a printer have to discuss?

Different types of devices communicate using different communications protocols. A *protocol* is essentially a digital language that defines the way that devices communicate over a network. There are hundreds of communications protocols in use today, including TCP/IP, NetBIOS, NetWare, and AppleTalk. It is possible — and actually quite common — for a single LAN to use several communications protocols at once.

For example, Windows PCs share files and printers using the NetBIOS protocol. Macs use AppleTalk for file sharing. The Internet (and everything connected to the Internet) uses the IP protocol.

On my home LAN, the Macs can "see" one another using AppleTalk, but they can't see files or printers that are shared by the Windows PCs, and vice versa (with one exception, which I'll explain later). The Macs and PCs can all print to the PostScript printer because the print server (the device that connects the printer to the LAN) can communicate using AppleTalk as well as NetBIOS. The color printer, on the other hand, is a Windows-only device that communicates using NetBIOS.

The Macs can see files shared on the Windows 2000 file server (this is the exception I mentioned earlier). Windows 2000 Server supports AppleTalk and Macintosh client PCs in addition to Windows PCs, so I can store Mac files on the Windows 2000 Server's hard drive. This makes it possible to work on the same file (a Microsoft Word document, for example) from either a Mac or a PC. It also provides an easy way to move files between the Macs and the PCs on my LAN, using the Windows 2000 Server as an intermediary between the Mac and PC universes.

Summary

I hope this first chapter has shown you that you don't need a computer science degree to set up a home network. I'll admit that you'll have to learn some new acronyms, but the most important thing to take away from this chapter is a broad idea of what a home LAN does and what kinds of components it links together.

The key points in this chapter are as follows:

- A network is any combination of computers and other devices that are connected by an electronic communications medium.
- There are two main types of home networks: wired and wireless.
- You can mix and match wired and wireless components as your needs dictate.
- Equipment manufacturers have a broad array of products to help get your home networked with a minimum of effort, and at a very low cost.
- A firewall is essential for sharing Internet access on any LAN.