CHAPTER 3

Network Relationships: Network Types and Topologies

IN THIS CHAPTER

- Network Basics: How the Building Blocks Come Together 40
- Network Control: Peer-to-Peer Networks Versus Client/Server 40
- Network Topologies: How Your Home Network Comes Together 47
- Wrap It Up 51
After reading Chapter 2, “Home Network Building Blocks: What Makes Your Network Tick,” you should understand the building blocks that you need in order to put together a simple but highly functional home network. These building blocks are used by nearly every type of local area network, both in the office environment and within the home.

Although we have explored the basic network building blocks, there are still a few network basics that would be helpful before we dive into talking about the different network technologies and choosing which will be best for you. Discussing these different basics will help you to better understand how networks are set up and then help you decide, based on your needs, which is best for you.

**Network Basics: How the Building Blocks Come Together**

In addition to the basic building blocks used in a typical home network, there are certain things you must consider when planning to put together a home network. “Oh great,” you’re thinking, “I knew there had to be a catch.” The building blocks were just too easy. Well, if you’re thinking this you’re right in one sense: understanding the network building blocks is easy. And the other concepts described in this chapter about network basics are just as easy, and will help you decide how you want your network set up.

The discussion in this chapter centers around relationships between the PCs on your network. These relationships can be broken down into two categories: the control relationship and the physical relationship. If you think this is starting to sound like marital counseling, don’t worry, I won’t go into how to “reignite your hard drive.”

The control relationship in your network is based on whether you want a peer-to-peer or client/server network. The physical relationship of your network is described as network topology. Both of these topics sound complicated, but they are not, as you’ll see next.

**Network Control: Peer-to-Peer Networks Versus Client/Server**

In the world of local area networks, there are basically two choices of network control, or network types: peer-to-peer and client/server. The choice of these two networks basically determines the relationship each PC or device on the network has with the other in terms of control.

A peer-to-peer network is a true democracy. Each PC on the network is equal to the other in that the PCs can communicate with each other directly, and do not have a centralized PC monitoring and controlling the communication on the network.
A client/server network, on the other hand, has a central authority figure that controls the communication and access to resources on the network. This centralized controlling PC is called a server.

**NOTE**

*Servers* are PCs that control access to different resources on the network. In a home network, this can be such things as printers, a central storage drive, MP3 files, and anything you can think of that can take advantage of the server's capabilities. The server generally has a bigger processor and more storage than other PCs, or the clients, on the network.

A network *client* is a PC on a client/server network that communicates to other PCs on the network community through the server. It takes advantage of the server's resources and is very similar to other "clients" on the network.

If the peer-to-peer network is like a democracy, the server in a client/server network is more a network "dictator." Don't worry; in reality, the server is not a bad guy, and there are actually sound reasons that many networks today are set up as client/server networks, which we will explore later.

But first, let's look at the relative characteristics of each type of network to help you better understand the differences. Table 3.1 outlines these differences.

**Table 3.1** Peer-to-Peer Networks Versus Client/Server Networks

<table>
<thead>
<tr>
<th>Peer-to-Peer Networks</th>
<th>Client/Server Networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Each PC is an equal participant on the network</td>
<td>One PC acts as the network controller</td>
</tr>
<tr>
<td>PCs are not reliant on one PC for resources such as the printer</td>
<td>One PC controls access to network resources</td>
</tr>
<tr>
<td>Access to the network is not centrally controlled</td>
<td>Network access and security are centrally controlled</td>
</tr>
<tr>
<td>Can operate on a basic PC operating system</td>
<td>Need a special operating system</td>
</tr>
<tr>
<td>Are generally simpler and lower cost</td>
<td>Are generally more complex but give the user more control</td>
</tr>
</tbody>
</table>
As shown in Table 3.1, there are definite differences between networks set up as peer-to-peer and those set up as client/server. It should be stated that most home networks today are set up as peer-to-peer, because this network type is simpler and works great for the needs of the home user. Because most home networks today are set up to perform basic but important tasks such as sharing an Internet connection or multiplayer gaming, there is no reason for a user to consider a client/server network. However, we will discuss each type more in-depth, and this information will help you decide how you want to set up your network.

**Understanding Peer-to-Peer Networks**

When all PCs on the network are set up to act as equals, this is called a peer-to-peer network. Every PC shares its files and resources with the other PCs on the network. Communication among PCs is a direct link with no central network controller, such as a server.

As shown in Figure 3.1, the two PCs on this simplified network engage in direct communication, or peer-to-peer. In reality, the network can look as simple as this figure, with the PCs talking directly to each other through one cable. We will look more at the actual physical configuration of the PCs and cables later in this chapter.

**FIGURE 3.1**

A basic peer-to-peer network.

A basic peer-to-peer network can also be set up in which a piece of network equipment can facilitate this direct relationship. Remember the discussion in Chapter 2, “Home Network Building Blocks: What Makes Your Network Tick,” about the network hub? The hub can, as described before, act as the central station for the direct, peer-to-peer communication between the different PCs on the network, as shown in Figure 3.2.

**FIGURE 3.2**

A basic peer-to-peer network using a hub.
At first it might not be apparent why you would want to use a hub in your network if you can connect them directly, NIC to NIC, with one piece of network cabling. We will discuss the benefits of each type of configuration in the second half of this chapter (in “Network Topologies”). For now you should know that it is easier to grow your network when you are using a hub, because you simply add a new connection from the PC to the hub.

**Pluses of a Peer-to-Peer Network**

The peer-to-peer network is the easiest type of network to set up. It does not require any software other than the operating system already on your PC, and it does not require the more complex configuration of a client/server network.

The following subsections cover all the advantages of a peer-to-peer network.

**Simplicity**
A peer-to-peer network is so basic that you don’t need anything more than your PC’s existing software, a couple of NICs, and some cable. In a wireless network, all the hardware you will need is two wireless NICs.

**Peer-to-Peer Is Supported in Windows**
Because most personal computers in homes today have some form of Windows, it is very easy to set up a home network. Of course, you need to have Windows 95 or a newer edition of Windows, but chances are that you do.

**Low Cost**
The cost to build a home network using peer-to-peer technology is lower than that for a client/server network because you do not need any special software or computer.

**New Technologies for Home Networking Favor Peer-to-Peer**
Technologies we will talk about in Part II, “Digital Plumbing: Network Wiring and Hardware Options,” such as phoneline, powerline, and wireless networking, are built with the understanding that you will likely build a peer-to-peer network. This isn’t to say that you can’t build a client/server network with these technologies, but with these “no-new-wires” solutions, a peer-to-peer network is extremely simple.

**What’s Mine Is Yours**
A peer-to-peer network allows each PC on the network to access resources on all the other PCs on the network. That Zip drive on Dad’s PC, the laser printer downstairs on Mom’s, the PC camera on Billy’s PC—they’re all part of the network community after you create a peer-to-peer network.
Potential Minuses of a Peer-to-Peer Network

Now that you have seen some of the advantages a peer-to-peer network can offer, you will explore some possible drawbacks peer-to-peer networks can hold. The following are the potential minuses of a peer-to-peer network.

**Security**

If a PC is on a peer-to-peer network, there is the chance that another PC on the home network will access files that the owner of the PC might not want accessed. Not that this will necessarily happen or that you have something to hide from other users (or do you?), but this is something to think about. However, Windows provides the capability to block access to certain drives, so this shouldn’t be a worry for anyone who properly configures her network software.

**PCs Down on the Network Can Cause the Network to Go Down**

In some instances, a PC might not be working, either because of problems or because it has simply been shut off. In a basic peer-to-peer network that uses direct connections from PC to PC without a hub, this might cause a problem.

**Network Speed**

In a peer-to-peer network situation in which a hub or switch is not used (such as a phoneline network), it becomes a real possibility that the network can get bogged down when more than one user is using it at the same time.

**Scalability**

A peer-to-peer network is great for a home network with a handful of users such as three to five PCs. However, if one day you decide to go into business with Brad, your neighbor, and set up a network in your home, when you start to increase the number of users to 10 or beyond, you might want to consider moving to a client/server network.

**Understanding Client/Server Networks**

The other network type is a client/server network. As described earlier, client/server networks have more centralized control of the network through the network server.

As shown in Figure 3.3, the communication and services on the network are controlled through the server. The resources, such as Internet service and printer sharing, are controlled through the network server. If you were to set up passwords to get on the network, this would also be controlled through the server.
FIGURE 3.3
Central control through a client/server network.

Considering that a client/server network is generally more complicated and expensive than a peer-to-peer network, you’re probably asking yourself why you would ever need one. Here are the circumstances in which you might want to consider using a client/server network:

- You expect that your network will grow over time and might exceed 10 users.
- You have a PC that has a noticeable advantage in processor speed and disk drive (storage) space.
• You need to control access to your network.
• You want to be able to have greater management and monitoring control over your network.
• You want to set up a Web server (a special server that creates Web pages on the Internet).

These are all reasons you should consider using a client/server network over a peer-to-peer network. A client/server network, because of a more robust operating system such as Windows NT or NetWare, allows the network administrator to have better control over who accesses what and allows monitoring of network traffic and usage patterns.

Choosing Between Peer-to-Peer and Client/Server: A Suggestion for Your Sanity

As you can see, you must weigh a few basic considerations when deciding between the two options. But to give you even more value from your investment in this book, I will make a suggestion that should ease your pain considerably:

Unless you feel very strongly that you should have a client/server network based on the answers you had to the previous questions, by all means go with the much easier solution of a peer-to-peer network.

So you might be shocked that I go so far as to suggest what you should use, but don’t be. That’s my job (and I’m an extremely nice person).

Not convinced? Let me go over a few reasons I believe you should consider a peer-to-peer network unless you are absolutely convinced a client/server is for you:

• As I’ve mentioned repeatedly, peer-to-peer networks are much simpler. They use your basic PC operating system and the newer operating systems, such as Windows ME and XP, have built-in wizards to help you create your home network.
• Network operating systems are more complex, and you will have to learn a whole new set of commands to get your client/server network operating to your liking.
• Client/server networks are more expensive.
• Most home networks have only five or fewer PCs, which is well within the capabilities of a peer-to-peer network.
• Most important, in a peer-to-peer network you can share files, share printers, create passwords, and do most of the things you do with a client/server network.

Don’t be surprised by that last statement. A peer-to-peer network can take advantage of the resources of different PCs within the network. If one has a larger hard drive, make that one the PC where you store all your large music and video files. If you want to use dad’s laser printer
in the den, make sure you ask him nicely to allow sharing. For a home network, in almost all instances, you can do all the things you want to do with a peer-to-peer network.

Here’s one more reason to consider a peer-to-peer network. As I’ve mentioned before, new products aimed specifically for home networks are coming to market, and many of these are beginning to fulfill functions that a server might have done in the past.

For example, home routers or residential gateways are available today to provide basic security against hackers and allow for Internet sharing, two functions that could have been administered by a server in the past. Media servers and network storage drives are available that allow you to store large multimedia files such as movies and music in a “media tank.” Some of these products are even designed to plug right into your stereo system or TV so that they won’t look like a PC sitting awkwardly in your living room.

Because I feel so strongly that a peer-to-peer network is a great fit for a home network, the rest of this book focuses mainly on explaining how to set up and use a peer-to-peer home network.

**Network Topologies: How Your Home Network Comes Together**

As you’re learning, new home network technologies are making lives easier for people like you, me, and even dear old Grandma. Grandma, you ask? Certainly that nice little lady who knits me overly large sweaters and bakes the world’s best apple pie (although her meatloaf might leave something to be desired) wouldn’t want to set up a home network. Or would she?

Actually, don’t be surprised if someday everyone has a home network. And chances are that when this happens, most people still won’t know what the term network topology, or neuro-photonic asynchronous reassemblerator, for that matter, means. This is because as home networking advances and becomes easier for everyone, traditional networking terms that were born out of the business-networking world will take on less meaning to the home user. The user won’t have to put thought into such things as network topologies and other traditional networking considerations. Someday (within the next 10 years, but not quite yet), we’ll just plug things in and they’ll be networked. But because you are a curious sort, I’ll briefly discuss network topologies with you, Mr. Pocket-Protector.

So, what is a network topology? In the simplest description in history of network topology descriptions (will someone alert the Guinness Book for me?), a network topology describes how network communication links or “roads” run from one PC to the other. In other words, it’s the way the cables and networking equipment are arranged.

Why do we need to even think about this? Well, even in the case of a home network, it is important to think about how things are arranged or risk running into confusion and clutter
down the “road.” Network topology is important to consider when you look at how your network will evolve. To understand this, let’s look at the different types of network topologies.

**The Three Network Topologies**

The three basic network topologies you need to consider for a home network are bus, ring, and star. Each of these looks and operates differently from the others.

**Bus**

Like its name, a bus topology is like a basic bus route going from point A to point B and point C. Our bus is very simple in that it is straight and simple as a direct connection between the PCs on the network. Of course, in real life, your bus network might not be as simple as shown in Figure 3.4. Not all PCs on a bus network sit next to each other in a straight line, but still the bus network has connections that are “direct and straight” from one PC to the next.

![Figure 3.4](image)

*Figure 3.4*

A “bus” topology.

The appeal of a bus connection is that it is simple to create. No network equipment other than a single cable and couple of NICs are needed. Some phoneline or powerline networks are not really called “bus” networks, but some can in essence be basic “bus” networks using the phone or power wiring in your home. The difference here is that you do not lay the cabling, but instead use your existing phone or powerline wiring.

The disadvantage of the bus network is that it relies on one cable, and if this cable were to become disconnected from one of the PCs or to break, the entire network would stop working. This would not be the case with a phoneline or powerline network.

**Ring**

A ring topology is much like it sounds: The different nodes or PCs on the network form a ring like that shown in Figure 3.5.

Ring topologies are probably the least likely to be used in a home environment. The type of technology used to make ring networks is called Token Ring, which is more expensive than other types of network technologies we will discuss in Part II.
Token Ring is a technology for networking in which PCs communicate by sending an information "packet" around a ring until the packet finds the PC it was intended for. This technology is very polite in that a packet will not be sent by another PC until the packet circulating at a given time finds its destination. Token Ring, while being a very stable technology, is not as popular for new network installments and is not a good choice for a home network.

**Note**

*Token Ring* is a technology for networking in which PCs communicate by sending an information "packet" around a ring until the packet finds the PC it was intended for. This technology is very polite in that a packet will not be sent by another PC until the packet circulating at a given time finds its destination. Token Ring, while being a very stable technology, is not as popular for new network installments and is not a good choice for a home network.

**Star**

The star topology, also called spanning tree, is the most common topology used in business networks, and is also very popular with home networks. This is because the star topology is used with the networking technology called Ethernet, which is also very popular.

**Note**

*What is Ethernet?* Ethernet, like Token Ring, is a kind of communication protocol, except that Ethernet operates over cable networks using a star topology as opposed to the ring topology explained previously. We’ll go more in depth into Ethernet in Part II, but it’s important to remember that Ethernet is an extremely popular and reliable way to network.
Star networks using Ethernet look like—what else—a star, with a center and several “spokes” reaching out from the center to the different PCs on the network. As shown in Figure 3.6, the network hub is the center of the star, with the different PCs connected through the hub.

![Network Diagram](image)

**FIGURE 3.6**

*A star topology.*

As to be expected, a network might in reality look a little different from the simplified picture in Figure 3.6, with the network hub sitting in one of the rooms of your house, and the cabling running throughout your walls to reach it.

**Network Topologies with Wireless Home Networks**

If you are one of those who are set on using a wireless network in your home (if you haven’t decided, don’t worry; we’ll go over each way to network your home in Part II and help you reach a decision), you might be asking whether this discussion about how to set up the network cabling is even necessary.

Well, even if you are going to use a wireless network, this discussion about network topology is still useful in helping you to understand how a network communicates. With wireless LAN technology, there is usually a type of device that acts as a wireless “hub,” taking and receiving the wireless signals from the different PCs equipped with wireless NICs and directing them to the other PC that the communication is directed to. This “wireless hub” is called an access point.
You can think of a wireless LAN that uses an access point to communicate with the different end points on the network as acting like a star network. In fact, one of the wireless LAN technologies, called 802.11b, or Wi-Fi, refers to itself as “Wireless Ethernet.” Remember, Ethernet is the most popular kind of star network.

But to make things more interesting (a polite word for confusing), not all wireless LANs use access points. Some are built to allow for the wireless NICs in each PC to communicate directly without going through a central access point or hub. These wireless LAN configurations are called “peer-to-peer.” This term is familiar to you from our discussion at the beginning of this chapter regarding the different network types (peer-to-peer versus client/server). Although the term peer-to-peer is helpful in describing the direct nature of the communication within these types of wireless LANs, it should not be confused with the network type discussed earlier in the chapter.

You can learn all about wireless home networking in Chapter 7, “The Wonderful World of Wireless Networking.”

Wrap It Up

You learned in this chapter about the types of relationships that can be used in networks. These relationships can be broken down into two categories, control and physical relationships.

The control relationship can be described in terms of peer-to-peer or client/server. Peer-to-peer networks describe network types in which every PC or device on the network is an equal. They share their resources and are not controlled centrally. Client/server networks are different in that control of the different clients’ access to resources is administered by the server.

Network topology is a term used to described the physical relationship of your network connections. Home network topologies can be broken down into bus, ring, or star networks.