

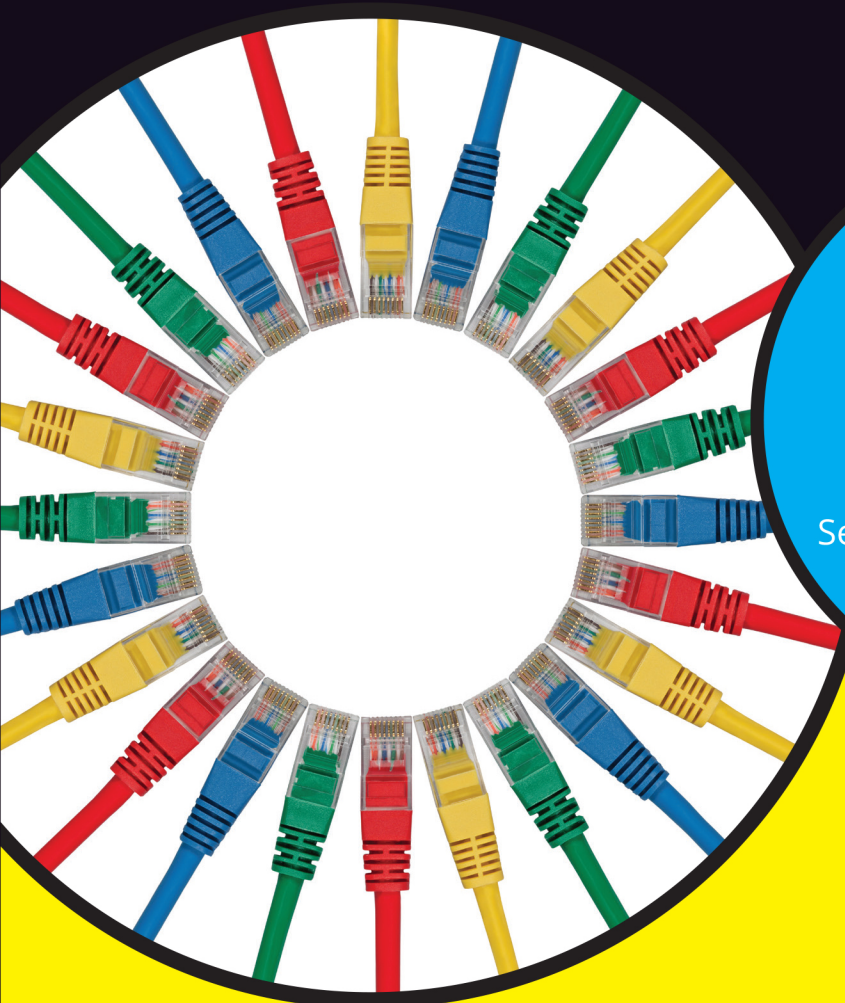
LEARNING MADE EASY



11th Edition

# Networking

for  
**dummies**<sup>®</sup>  
A Wiley Brand



Build a wired or  
wireless network

Secure and optimize  
your network

Set up a server and manage  
Windows® User Accounts

**Doug Lowe**

*Bestselling author of Java All-in-One  
For Dummies*





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for  
**dummies**<sup>®</sup>  
A Wiley Brand

11th Edition

by **Doug Lowe**

for  
**dummies**<sup>®</sup>  
A Wiley Brand

## Networking For Dummies® , 11th Edition

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# Introduction

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**W**elcome to the eleventh edition of *Networking For Dummies*, the book that's written especially for people who have this nagging feeling in the back of their minds that they should network their computers but haven't a clue about how to start or where to begin.

Do you often copy a spreadsheet to a flash drive just so you can give it to someone else in your office? Are you frustrated because you can't use the fancy color laser printer that's on the financial secretary's computer? Do you wait in line to use the computer that has the customer database? You need a network!

Or maybe you already have a network, but you have just one problem: Someone promised that a network would make your life easier, but it's instead turned your computing life upside down. Just when you had this computer thing figured out, someone popped into your office, hooked up a cable, and said, "Happy networking!" Makes you want to scream.

Regardless, you've found the right book. Help is here, within these humble pages.

This book talks about networks in everyday (and often irreverent) terms. The language is friendly; you don't need a graduate education to get through it. And the occasional potshot helps unseat the hallowed and sacred traditions of networking, bringing just a bit of fun to an otherwise dry subject. The goal is to bring the lofty precepts of networking down to earth, where you can touch them and squeeze them and say, "What's the big deal? I can do this!"

## About This Book

---

This isn't the kind of book you pick up and read from start to finish, as if it were a cheap novel. If I ever see you reading it at the beach, I'll kick sand in your face. This book is more like a reference, the kind of book you can pick up, turn to just about any page, and start reading. Each chapter covers a specific aspect of networking, such as printing from the network, hooking up network cables, or setting up security so that bad guys can't break in. Just turn to the chapter you're interested in and start reading.

Each chapter is divided into self-contained chunks, all related to the major theme of the chapter. For example, the chapter on hooking up the network cable contains nuggets like these:

- »» What is Ethernet?
- »» All about cable
- »» To shield or not to shield
- »» Wall jacks and patch panels
- »» Switches

You don't have to memorize anything in this book. It's a need-to-know book: You pick it up when you need to know something. Need to know what 100BaseT is? Pick up the book. Need to know how to create good passwords? Pick up the book. Otherwise, put it down and get on with your life.

Feel free to skip the sidebars that appear throughout the book; these shaded gray boxes contain interesting info that isn't essential to your understanding of the subject at hand. The same goes for any text I mark with the Technical Stuff icon.

If you need to type something, you see the text you need to type like this: **Type this stuff**. In this example, you type **Type this stuff** at the keyboard and then press Enter. An explanation usually follows, just in case you're scratching your head and grunting, "Huh?"

Within this book, you may note that some web addresses break across two lines of text. If you're reading this book in print and want to visit one of these web pages, simply key in the web address exactly as it's noted in the text, pretending as though the line break doesn't exist. If you're reading this as an e-book, you've got it easy — just click the web address to be taken directly to the web page.

## Foolish Assumptions

I'm making only two assumptions about who you are: You're someone who works with a PC, and you either have a network or you're thinking about getting one. I hope that you know (and are on speaking terms with) someone who knows more about computers than you do. My goal is to decrease your reliance on that person, but don't throw away his phone number yet.

Is this book useful for Macintosh users? Absolutely. Although the bulk of this book is devoted to showing you how to link Windows-based computers to form a network, you can find information about how to network Macintosh computers as well.

Windows 10? Gotcha covered. You'll find plenty of information about how to network with the latest and greatest Microsoft desktop operating system.

Windows Server 2016? No worries. You'll find plenty of information about the newest version of Microsoft's server operating system.

## Icons Used in This Book

Those nifty little pictures in the margin aren't there just to pretty up the place. They also have practical functions.



TECHNICAL  
STUFF

Hold it — technical details lurk just around the corner. Read on only if you have a pocket protector.



TIP

Pay special attention to this icon; it lets you know that some particularly useful tidbit is at hand — perhaps a shortcut or a little-used command that pays off big.



REMEMBER

Did I tell you about the memory course I took?



WARNING

Danger, Will Robinson! This icon highlights information that may help you avoid disaster.

## Beyond the Book

In addition to the material in the print or e-book you're reading right now, this product also comes with some access-anywhere goodies on the web. Check out the free Cheat Sheet for links to useful websites for networking information, private

IP address ranges for networks, and more. To get this Cheat Sheet, simply go to [www.dummies.com](http://www.dummies.com) and type **Networking For Dummies Cheat Sheet** in the Search box.

## Where to Go from Here

---

Yes, you can get there from here. With this book in hand, you're ready to plow right through the rugged networking terrain. Browse through the Table of Contents and decide where you want to start. Be bold! Be courageous! Be adventurous! Above all, have fun!

# 1

## **Getting Started with Networking**

**IN THIS PART . . .**

Find out what a network is and what you can do with one.

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Compare server and client computers.

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Access network resources such as shared storage and network printers.

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Use Microsoft Office and other software on a network.

## 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?

# Chapter 1

# Let's Network!

Computer networks get a bad rap in the movies. In the 1980s, the *Terminator* movies featured Skynet, a computer network that becomes self-aware (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 the 2015 blockbuster *Spectre*, James Bond goes rogue (again) to prevent the Evil Genius Ernst Blofeld from taking over the world (again) by linking the computer systems of all the world's intelligence agencies together to form a single all-powerful evil network that spies on everybody.

Fear not. These bad networks exist only in the dreams of science fiction writers. Real-world networks are much more calm and predictable. Although sophisticated networks do seem to know a lot about you, they don't think for themselves and they don't evolve into self-awareness. And although they can gather a sometimes disturbing amount of information about you, they aren't trying to kill 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.

## Defining a Network

A *network* is nothing more than two or more computers connected by a cable or by a wireless 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 flash drive or other portable storage device and then walk the data over to someone else's computer. (The term *sneakernet* is typical of computer nerds' feeble attempts at humor.)

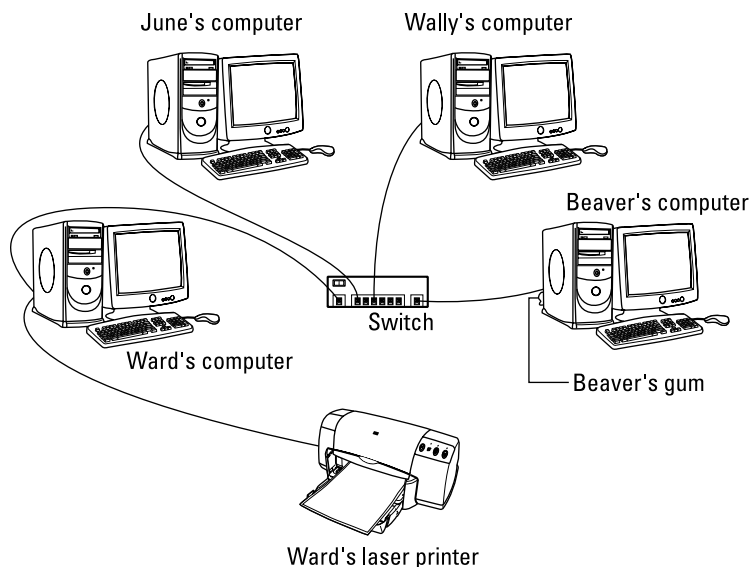
The whole problem with the sneakernet is that it's slow, and it wears a trail in your carpet. One day, some penny-pinching computer geeks discovered that connecting computers with cables was cheaper than replacing the carpet every six months. Thus, the modern computer network was born.

You can create a simple 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 tweak a few simple settings in the computer's operating system (OS) software, 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, the computers use wireless network adapters that communicate via radio signals. All modern laptop computers have built-in wireless network adapters, as do most desktop computers. (If yours doesn't, you can purchase a separate wireless network adapter that plugs into one of the computer's USB ports.)



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 *switch*. 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.)



**FIGURE 1-1:**  
A typical network.

Computer networking has its own strange vocabulary. Although you don't have to know every esoteric networking term, it helps to be acquainted with a few of the basic buzzwords:

» **LAN:** Networks are often called LANs, short for *local area network*.

LAN is the first *TLA* — or *three-letter acronym* — of 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. You might guess that the acronym for *four-letter acronym* is *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, offline:** When a computer is turned on and can access the network, the computer is *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, down:** When a computer is turned on and working properly, it's *up*. When a computer is turned off, broken, or being serviced, it's *down*. Turning off a computer is sometimes called *taking it down*. Turning it back on is sometimes called *bringing it up*.
- » **Local, remote:** A resource such as a disk drive is *local* if it resides in your computer. It's *remote* if it resides in another computer somewhere else on your network.
- » **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.

## 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 outweigh the difficulties of setting up one.

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 email 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 your friend 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 CD or DVD 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, that hooligan Eddie Haskell deletes the file first).



TIP

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

## 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.)



WARNING

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.



TIP

That being said, many software manufacturers sell their software with a concurrent usage license, which means that you can install the software on as many computers as you want, but only a certain number of people can use the software at any given time. Usually, special licensing software that runs on one of the network's server computers keeps track of how many people are currently using the software. This type of license is frequently used with more specialized (and expensive) software, such as accounting systems or computer drafting systems.

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 email 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: All users on the network share 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, 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 7 and 8) aren't particularly efficient because these versions of Windows weren't designed primarily to be network servers.



REMEMBER

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

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

As of this writing, the current server version of Windows is Windows Server 2016. However, many companies still use the previous version (Windows Server 2012), and a few even use its predecessor, Windows Server 2008.

- Another popular server operating system is *Linux*. Linux is popular because it is free. However, it requires a more expertise to set up than Windows Server.
- » 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 server operating system such as Windows Server 2016
  - *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.



TIP

## 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:** Inside any computer attached to a network is a special electronic circuit called the *network interface*. The network interface has either an external jack into which you can plug a network cable — or, in the case of a wireless network interface, an antenna.
- » **Network cable:** The network cable physically connects the computers. It plugs into the network interface card (NIC) on the back of your computer.

The type of network cable most commonly used is twisted-pair cable, so named because it consists of several pairs of wires twisted together in a certain way. Twisted-pair cable superficially resembles telephone cable. However,