

Networking Concepts And Terms



Terms you'll need to understand:

- ✓ Local area network (LAN)
- ✓ Wide area network (WAN)
- ✓ Metropolitan area network (MAN)
- ✓ Peer-to-peer network
- ✓ Client/server network

Techniques you'll need to master:

- ✓ Understanding the features, advantages, and disadvantages of peer-to-peer and client/server networks
- ✓ Choosing a network technology that meets your needs
- ✓ Knowing when to implement what kind of network

To have a general understanding of networking, you must have a firm grasp of what a network is, as well as the terms used to describe it. In this chapter, we introduce you to some networking basics, including network components, network design, the types of networks, how communication takes place over a network, and how to set up network resources for users to share. Along the way, we point out some important items that you'll need to know. In addition, we provide additional resources for further study on the topics that we cover throughout this chapter.

Basic Terminology

Here are some basic networking terms and their definitions:

- **Account** Information about a user, which can include the user's account name, the user's password, and the access permissions assigned to the user for network resources.
- **Application server** A specialized server—located on the network—that provides access to client/server applications and to the data belonging to those applications.
- **Central processing unit (CPU)** The collection of circuitry—usually a single chip on most PCs—that supplies the “intelligence” for most computers.
- **Centralized administration** A method for controlling network resource access and managing network setup and configuration data from a single point of access.
- **Client** A networked computer that requests resources or services from another computer, usually a server of some kind.
- **Client/server** A computing model in which certain computers (clients) request services and other computers (called servers) respond to these client requests. Microsoft generally refers to this type of network as a server-based network.
- **Dedicated server** A network computer that acts only as a server and is not intended for regular use as a client machine.
- **Device sharing** The capability to permit users to share access to devices of all kinds, including servers and peripherals such as printers or plotters. This is the principal reason for having a network.

- **Directory server** A specialized server that responds to client requests for specific resources and services. In Windows NT parlance, this kind of server is commonly called a “domain controller.”
- **Disk space** The amount of space available on a disk drive, generally measured in megabytes (MB).
- **Domain controller** On a Windows NT Server-based network, a directory server that provides access controls over users, accounts, groups, computers, and other network resources.
- **Email** A networked application that permits users to send electronic messages to individual or multiple users, or to named groups of users.
- **Ethernet** A networking technology developed in the early 1970s that is governed by the IEEE 802.3 specifications. It is one of the most popular types of networking technology in use today.
- **File and print server** The most common type of network server. It provides networked file storage and retrieval services and handles print jobs for clients.
- **Group** A named collection of user accounts treated as a single entity, usually created for a specific purpose. (For example, the Production group might be the only named entity permitted to use a design application. By adding or removing users from the Production group, the network administrator controls who may access the application.)
- **Hybrid network** A network that combines the principles of client/server and peer-to-peer networking.
- **IEEE 802 specification** A series of standards created by the Institute of Electrical and Electronics Engineers that standardized network communications.
- **Industry Standard Architecture (ISA)** The bus architecture that supports the 16-bit PC adapter interface that is included in most PCs available on the market today.
- **Internetwork** Literally a network of networks. This term describes a logical network that consists of two or more physical networks. Unlike a WAN, an internetwork may reside in a single location, but because it includes too many computers or spans too much distance, it cannot fit within the scope of a single LAN.

- **Local area network (LAN)** A collection of computers and other connected devices that fits within the scope of a single physical network. LANs provide the building blocks for internetworks and WANs.
- **Locally attached device** A device that is attached directly to a single computer, rather than a device that's available only over the network (called network-attached or server-attached, depending on whether it has a built-in network interface or whether it must be attached directly to a server).
- **Metropolitan area network (MAN)** A network that makes use of WAN technologies to interconnect LANs within a specific geographical region, such as a city.
- **Network administrator** The person responsible for the installation, configuration, and maintenance of a network.
- **Network interface card (NIC)** A PC adapter board that permits a computer to be attached to some sort of network medium. It translates digital information into electrical signals for outgoing network communications and translates incoming signals into their digital equivalents for delivery to the machine.
- **Network medium** The cable, whether metallic or fiber optic, that links computers on a network. This term is also used to describe frequencies used in wireless network communications.
- **Network model/type** The type of networking capabilities available on a network, such as peer-to-peer, server-based, or a combination of the two.
- **Network operating system (NOS)** The specialized software that allows a computer to take part in networked communications and to employ a broad range of networking services. Windows NT is a network operating system available in Workstation and Server versions; Windows 95 and Windows For Workgroups also include built-in network client and peer-to-peer capabilities.
- **Network protocol** The set of rules used for communicating across a network. A common protocol is required for any two networked devices to be able to communicate successfully.
- **Network resources** Devices, information, and services that are available across a network.

- **Operating system (OS)** The basic program running on any computer that controls the underlying system and hardware. It is required for any computer to work.
- **Password** A privately selected string of letters, numbers, and other characters (which should be hard to guess) used to identify a particular user and to control access to protected resources.
- **Peer-to-peer network** A type of network in which all connected computers can be a client and/or a server to other computers on the network.
- **Peripheral device** In networking context, a device, such as a printer or a modem, that can be shared across a network.
- **Peripheral Component Interconnect (PCI)** A 32-bit PC bus that offers higher performance and more sophisticated capabilities than the 16-bit ISA bus.
- **Random access memory (RAM)** The memory cards or chips installed in a PC that provide working space for the CPU to use when running applications, providing network services, and so on. As far as network servers go, the more RAM you have, the better.
- **Request-response** How the client/server relationship works. A request from a client leads to some kind of response from a server (usually, the service or data requested, but sometimes an error message or a denial of service based on access permissions).
- **Security** The set of access controls and permissions that are used to determine if a server can grant a service or resource request from a client.
- **Server** The computer that responds to service or resource requests from network clients.
- **Server-based network** A type or model of network in which a networked server provides services and resources to client computers and manages and controls access to those services and resources.
- **Sharing** The way resources are made available to the network. The main reason for establishing a network is to share resources.
- **Specialized server** A type of special-function server. It can be an application server, a communications server, a directory server or domain controller, a fax server, a mail server, or a Web server, among other roles.

- **Standalone** Describes a computer, device, or application that's not attached to a network.
- **User** The person who uses a computer, whether standalone or networked.
- **Wide area network (WAN)** A collection of interconnected networks in which a third-party communications carrier is used to transmit communications between networks. WAN links can be expensive because they are charged on the basis of bandwidth, so few WAN links support the same bandwidth as that available on most LANs.
- **Workgroup model** How Microsoft refers to a peer-to-peer network that includes one or more Windows-based computers.

With these terms in mind, let's move on to discuss some networking fundamentals.

What Is A Network?

Put simply, a network is a connection between at least two computers so that they can share resources. Although most networks are more complex than this two-computer scenario, all networks are based on the concept of sharing. There's actually a great deal of technology involved when one computer connects to and communicates with another. In addition, there are many types of physical connections and related software to consider. In the following sections, we discuss some fundamental concepts behind all networks and explain what kinds of network models are appropriate for various business environments.

LAN, WAN, And MAN

There are three types of networks: local area networks (LANs), wide area networks (WANs), and metropolitan area networks (MANs). A LAN is a collection of networked computers that reside within a small physical region, such as an office building. A WAN can connect networks across the globe; a third-party communications carrier is generally used to transmit communications between networks. MANs use WAN technologies to interconnect LANs within a specific geographical region, such as a city.

In addition to these distinctions, a LAN, WAN, or MAN can be peer-to-peer networks, client/server networks, or hybrid networks (networks that

make use of both client/server and peer-to-peer technologies). The following sections discuss these topics in detail.

Peer-To-Peer Networks

Computers on a peer-to-peer network can act as both a client and a server. Because all computers on this type of network are peers, peer-to-peer networks have no centralized control over shared resources. Any individual machine can share its resources with any computer on the same network, however and whenever it chooses to do so. The peer relationship also means that no one computer has higher access priority, nor heightened responsibility to provide shared resources.

Every user on a peer-to-peer network is also a network administrator. That is, each user controls access to the resources that reside on his or her machine. It is possible to give all others unlimited access to local resources, or to grant only restricted (or no) access to others. Likewise, each user decides whether other users can access resources simply by requesting them, or whether the resources are password-protected.

Due to the flexibility and individual discretion regarding network resources on a peer-to-peer network, institutionalized chaos is the norm for peer-to-peer networks. For these reasons, security should be a major concern. You can set up a peer-to-peer network where resources are collected into workgroups, but without network-wide security. In a workgroup setting, users who know the right passwords can access resources; those who do not, can't.

This setup may be workable on small networks, but it might also require that users know—and remember—a different password for every shared resource on a network. In a peer-to-peer environment, as the number of users and resources grows, the network can become unworkable. This is not because the network can't function properly, but because users can't cope with the complexity involved.

In addition, most peer-to-peer networks consist of collections of typical end-user PCs that are linked by a common network medium. These types of machines are not designed to act as network servers; therefore, the network can easily bog down as more users try to access resources on any particular machine. Additionally, a user whose machine is being accessed across the network has to put up with reduced performance while that machine services network information requests. For example, if a user's machine has a network-accessible printer attached to it, that machine

will slow down every time other users send a job to that printer. Although this doesn't affect the other users, it may bother the user working at the slowed machine.

It is also difficult to organize data on a peer-to-peer network. When every network computer can be a server, it is difficult for users to keep track of what information is on which machine. If each of 10 users is responsible for a collection of documents, any user might have to search through files on all 10 machines to find a particular file. As networks grow, the decentralized nature of this type of network makes locating resources increasingly difficult, as the number of peers to be checked increases. Also, decentralization makes backing up data tricky, because instead of backing up a centralized data repository, you must back up each network computer to protect shared data.

At first glance, it may seem that all of these issues and added complexity make peer-to-peer networks unworthy of consideration. Keep in mind, however, that peer-to-peer networks offer some powerful inducements, particularly for smaller organizations and networks. Peer-to-peer networks are the easiest and cheapest kind of network to install. Most peer-to-peer networks require only an operating system, such as Windows 98 or Windows For Workgroups, on the machines, along with NICs and a common network medium. Once the computers are connected, users can immediately begin sharing information and resources.



Here are some benefits of peer-to-peer networks:

- They are easy to install and configure.
- Individual machines do not depend on a dedicated server.
- Users are able to control their own shared resources.
- This type of network is inexpensive to purchase and operate.
- You don't need any equipment or software other than an operating system, NICs, and cables.
- It is not necessary to have an employee act as a dedicated administrator to run the network.
- This type of network is well suited for networks with 10 or fewer users.

As with anything, peer-to-peer networks have their drawbacks as well:

- You can only apply network security to one resource at a time.

- Users might have to remember as many passwords as there are shared resources.
- You must perform individual backups on each machine to protect all shared data.
- When someone accesses shared resources, the machine where the resource resides suffers a performance hit.
- There is no centralized organizational scheme to locate or control access to data.

Client/Server Networks

Although the term “client/server” commonly describes network servers, Microsoft prefers the term “server-based” to describe them. In simple terms, a server is a machine whose only function is to respond to client requests. Servers are seldom operated directly by someone—and then usually only to install, configure, or manage its services. In general, a server is a combination of specialized software and hardware that provides services on a network to other computers (workstations) or to other processes.



Server-based networks rely on special-purpose computers called servers that provide centralized repositories for network resources and incorporate centralized security and access controls. In comparison, peer-to-peer networks have no centralized security or maintenance functions.

There are a number of reasons to implement a server-based network, including centralized control over network resources through the use of network security and control through the server’s configuration and setup. From a hardware standpoint, server computers typically have faster CPUs, more memory, larger disk drives, and extra peripherals—such as tape drives and CD-ROM jukeboxes—compared to client machines. Servers are also built to quickly and efficiently handle multiple requests for shared resources. Servers are usually dedicated to servicing network client requests. In addition, physical security—access to the machine itself—is a key component of network security. Therefore, it’s important for servers to be located in special, controlled-access rooms that are separate from general-access office areas.

Server-based networks also provide centralized verification of user accounts and passwords. Windows NT, for example, uses the domain model concept for management of users, groups, and machines, and for control of network

resource access. Before a user can access network resources, he must provide his name and password to a domain controller, a server that checks account names and passwords against a database of such information. The domain controller will only allow valid account and password combinations to access certain resources. Also, only network administrators can modify the security information in the domain controller's database. This approach provides centralized security, and it permits you to manage resources with varying degrees of control, depending on their importance, sensitivity, or location.

Unlike the peer-to-peer model, server-based networks typically require only a single login to the network itself, which reduces the number of passwords users must remember. In addition, network resources like files and printers are easier to find because they are generally located on specific servers, not on individual user machines across the network. The concentration of network resources on a smaller number of servers also makes data resources easier to back up and maintain.

Unlike peer-to-peer networks, server-based networks are much more scaleable. As the network population grows, peer-to-peer networks bog down seriously and can become sluggish and unmanageable. In comparison, server-based networks can handle anywhere from a handful of users and resources to tens of thousands of users and geographically dispersed resources. In other words, a server-based network can grow as a company grows, and not hold it back.

Like the peer-to-peer network model, server-based networks also have disadvantages. Foremost on the list are the additional costs involved in operating such a network. Server-based networks need one or more high-powered—and therefore more expensive—computers to run special-purpose (also expensive) server software. In addition, server-based networks require someone knowledgeable to run them. Training employees to acquire the necessary skills to manage a server-based network, or hiring an already-trained network administrator, also adds to the costs of operating such networks.

There are other negative aspects of server-based networks. Centralization of resources and control does simplify access, control, and aggregation of resources, but it also introduces a single point of failure on networks. If the server is not operational, a server-based network is not a network at all. On networks with more than one server, loss of any single server means loss of all resources associated with that server. Also, if the server that goes down is the only source of access control information for a certain set of users, those users can't access the network, either.



Here are some benefits of server-based networks:

- They provide centralized user accounts, security, and access controls, which simplifies network administration.
- More powerful equipment means more efficient access to network resources as well.
- Users only have to remember a single password for network login, which allows them to access all resources that they have permission to access.
- Server-based networks are scalable.

Now, let's take a look at some server-based networking cons:

- A server failure can render a network unusable; at best, it results in loss of network resources.
- Such networks require an expert staff to manage the complex, special-purpose server software, which adds to the overall cost.
- Costs also increase due to the requirements of dedicated hardware and specialized software.

Choosing A Network

Choosing a network depends on the circumstances. You should select a peer-to-peer network only when all of the following conditions apply:

- There are no more than 10 network users (preferably, no more than 5).
- All machines on the network are in close enough proximity to fit within a single LAN.
- Budget considerations require an inexpensive solution.
- You don't need any specialized servers (for example, fax servers, communication servers, or application servers).

On the other hand, a server-based network makes sense when one or more of the following conditions are true:

- More than 10 users must share network access.
- You require centralized control, security, resource management, or backup.

- You require access to specialized servers, or there is a heavy demand for network resources.
- You are using an internetwork or you require WAN access.

When a network has more than 5 but less than 10 users, budget limitations often incline organizations toward peer-to-peer. But if the organization is expecting to grow, or specialized network servers sound appealing, it's best to begin with a server-based network.

Practice Questions

Question 1

Which of the following are true about a server-based network?
[Check all correct answers]

- ☐ a. There is centralized control of network resources.
- ☐ b. All networked computers act as both clients and servers.
- ☐ c. You can implement centralized security to protect network resources.
- ☐ d. It can grow as an organization grows.

Answers a, c, and d are all correct. Server-based networks do provide centralized control and security for network resources; therefore, answers a and c are correct. Answer d is also correct; server-based networks are quite scalable. Answer b is incorrect because this describes behavior of a peer-to-peer network.

Question 2

Which of the following are advantages of a large-scale server-based network? [Check all correct answers]

- ☐ a. Ease of administration
- ☐ b. Centralized backups of network data
- ☐ c. Inexpensive to implement
- ☐ d. Increased performance

Answers a, b, and d are all correct. Server-based networks are easier to administer than peer-to-peer implementations, centralized backups are allowed, and there is increased network performance due to the power of the hardware involved. Answer c is incorrect; server-based networks can be very expensive, especially in a large-scale setting.

Question 3

Which of the following is a drawback of peer-to-peer networking?

- ☐ a. A server failure can render a network unusable; at best, it results in loss of network resources.
- ☐ b. Costs increase due to the requirements of dedicated hardware and specialized software.
- ☐ c. When you access shared resources, the machine where the resource resides suffers a performance hit.
- ☐ d. An expert staff is needed to manage the complex, special-purpose server software, which adds to the overall cost.

Answer c is the correct choice; machines that house network resources do take a performance hit when that resource is accessed. Answer a is incorrect; if a machine in a peer-to-peer environment goes down, only the resources on that particular machine are unavailable and the rest of the network continues to work. Answer b is incorrect; this is a drawback of a server-based network. Answer d is incorrect; peer-to-peer networks are easy to implement and no specialized staff is needed for full-time support.

Question 4

Which of the following describes a local area network?

- ☐ a. Connects networks across the globe
- ☐ b. A collection of networked computers that reside within a small physical region
- ☐ c. Requires the use of a third-party communications carrier to handle connections
- ☐ d. Uses WAN technologies to interconnect networks within a specific geographical region

Answer b is correct; LANs are limited to a small physical region. Answer a is incorrect; LANs are generally limited to a single building. Answers c and d are incorrect; they discuss requirements of WANs and MANs, respectively.

Question 5

Which of the following terms describes the specialized software that gives a computer the ability to take part in networked communications?

- ☐ a. Ethernet
- ☐ b. NOS
- ☐ c. CPU
- ☐ d. ISA

Answer b is correct; the NOS is what enables a computer to communicate across a network. Answer a is incorrect; Ethernet is a network architecture, not an application. Answer c is incorrect; the CPU is hardware, not software. Answer d is incorrect; ISA is a bus architecture that supports the 16-bit adapter interface cards in many PCs.

Need To Know More?



Chellis, James, Charles Perkins, and Matthew Strebe: *MCSE: Networking Essentials Study Guide, 2nd Edition*. Sybex Network Press, San Francisco, CA, 1998. ISBN 0-7821-2220-5. Chapter 1, “An Introduction to Networks,” discusses network types at length.



Microsoft Press: *Networking Essentials, 2nd Edition*. Redmond, WA, 1997. ISBN 1-57231-527-X. Unit 1, Lesson 2, “The Two Major Types of Networks,” discusses all of the topics in this chapter in great detail.



Search the TechNet CD-ROM (or its online version through www.microsoft.com) using the keywords “client/server,” “peer-to-peer,” and “network design.”