# Overview

## Networking:

The history of networking is almost as old as the history of communication. It would be easy to define "networking" as just another word for "communication." A better definition for networking is, "sharing information and resources." For example, if you go to a work event to "network," you're not just going to talk to the people. You're hoping to share information and resources to build a relationship. The best definition of a computer network is, "two or more computers that connected to communicate and share information and resources."

Computer networking doesn't just transmit information across distances. It also has two other main advantages.

First, it allows computer operators to reduce the need for redundancy. Redundancy means having more than one of something. Suppose everyone in your home has a computer, and everyone needs to print. You could buy each person a printer. The problem is that this is inefficient. Plus, it can cost a lot! Before computer networking, people with this problem used the first form of networking, "Sneakernet." Sneakernet means copying the file to a disk and putting on your sneakers. You jog over to the one computer that has a printer, then print the file. Computer networking allows everyone to share one printer, reducing the cost of supplying printing and supporting the printer.

Second, computer networking also allows operators to achieve results that would be beyond the ability of a single machine. For example, major e-commerce sites like Amazon deliver more web pages in seconds than one web server can manage. Having many web servers working together like one big computer allows them to deliver services to more customers than any computer could ever do.

If you like history, check out the history of Networking & The Web. You may find this interesting, but you must not read it.

# Node Functions

There are distinct roles that nodes can serve in a network.

## Servers

Any node that shares resources and responds to requests can be called a server. All computers generally function as servers in some way. However, when we use the word "server," we're typically talking about a computer that has been designed to provide services to other devices. They're usually kept in locked rooms away from the users.

Servers supply central resources. These resources can include applications, files or printers and other hardware. A server can be dedicated to one specific function, or it can serve general needs. And multiple servers of more than one type can exist on the same network.

Because other devices depend on the services of the server, servers usually have redundant (duplicate) hardware components. That way, even if something breaks, the server can continue to run. They also usually have special operating systems. The most common server operating systems in use today are Microsoft Windows Server ® and Linux.

## Clients

A client is a network computer that uses the resources of servers. The client computer can also perform its own tasks and processing. All computers generally function as clients at some point. However, when we use the word "client," we're typically talking about a computer that has been designed to be used by end users. Clients are often called desktops or workstations. They usually run operating systems that are more responsive to users. Client also implies the computer is used in a business. The most popular client operating systems are Microsoft Windows ® and certain distributions of Linux.

Suppose you have a printer attached by a cable to your computer. If you allow someone else in your home to print to that printer, technically you're the server. The other computer is the client. But usually, these words describe business environments where the two devices are specially configured for what they do most of the time.

## Peer Computers

A peer is a computer that acts as both a server and a client to other computers on a network. Peer computing is most often used in smaller networks that don't have a dedicated server. Although, peers can belong to networks with servers.

Peer computers run client operating systems. The key difference between clients and peers is whether they have a security relationship with the server. If users that have an account on the server can log in on the workstation, it's a client. If the user needs to have an account on the workstation, then it's a peer.

In the above scenario, where you shared your printer with a family member, your computer is functioning as a peer.

## Host Computers

A host computer is a central computer system that performs storage and processing for other devices. On a host-based network, the host computer does all computing. It then returns the data to the end user's terminal. Host computers are often referred to as mainframes.

In the early days of networking, all computers were hosts. The hosts were then joined together in the early research networks that became the Internet. As the TCP/IP protocol became popular, and personal computers joined the networks, the term host became generalized. Now "host" is used to describe to any node on a TCP/IP network.

## Terminals

A terminal is a specialized device on a host-based network. Users enter data into the terminal. The terminal sends the data to a host for processing. The host sends the results back to the terminal. Terminals are often called "dumb terminals." Unlike clients, they have no processor or memory of their own. They're usually just a keyboard and a monitor. Standard client computers that need to interact with host computers can run software called a terminal emulator so that they appear as terminals to the host.

# Local Area Networks (LANs)

When it comes to types of networks, the terms can be confusing. The nature of networking has changed quite a bit since these terms were invented.

A Local Area Network (LAN) implies a self-contained network. LANs exist in small areas, such as a single building, floor, or room. In a LAN, all nodes are directly connected with cables or short-range wireless. LANs do not need any outside technology, like an Internet Service Provider (ISP), to function. Due to their smaller size, LANs have faster speeds than other network types. Most modern LANs use a technology called Ethernet. You will learn more about Ethernet later in the course.

Instead of "LAN," professionals might refer to a LAN as the "local network."

If you're talking about a computer, "local" means "contained in the computer itself." If you're talking about a network, "local" means "connected to the same network." This might refer to the whole LAN. Or it could mean "all the nodes that can talk to each other without needing a router." Routers are devices that connect two or more different networks and can pass information between them.

Typically, LANs are supported by LAN Administrators. They manage and update the local network. The administrator's job includes servicing hardware, cabling and software. They may perform installations and deployments, upgrades, and troubleshooting. To be a LAN administrator, you need a broad range of skills and knowledge about networking, software and hardware.

# Wide Area Networks (WANs)

A Wide Area Network (WAN) is a network that spans a large area. WANs often cross countries or continents. Typically, WANs connect multiple LANs and other networks. They use long-range transmission media provided by telecommunications companies. WANs can be private, which means that they belong to one company. Or they can be public, meaning they can be used by anyone. The Internet is a public WAN.

When multiple networks form a larger network, we often call them subnetworks, subnets or segments. In that case, the "local network" is the one you're using. The other networks are called "remote." When messages travel through multiple networks, the connections are usually made by routers. That's why we say that messages (traffic) are "routed" through a network.

Typically, WANs are maintained by WAN Administrators. They usually address more complex technical issues than LAN administrators. They tend to focus on resolving network issues rather than user issues. A WAN administrator typically performs the following duties:

- Designs and maintains the connections between remote segments.
- Develops and troubleshoots routing structures.
- Works with both voice and data systems.
- Develops scripts to automate administrative tasks.
- Works on security issues and helps implement recovery schemes.
- Plans, tests, and implements hardware and software upgrades.

# More Network Terminology

**Intranets:**

An intranet is a private network that uses Internet protocols and services to share a company's information with its employees. As with the Internet, the employees can access an intranet via a web browser and navigate a company's web pages. An intranet contains information that is segregated from the Internet for confidentiality and security reasons.

**Extranets:**

An extranet is a private network that grants controlled access to users outside of the network. It is an extension of an organization's intranet. With the help of an extranet, organizations can grant access to users such as vendors, suppliers, and clients to connect to resources on the network.

For example, suppose Akamai contracted with Acme Computer Corp (a fictitious company) to provide all their desktop machines. Acme has a private network with a web server that hosts a web application that can be used to make and track orders and open service tickets. After the contract is signed, Acme makes this network available to employees of Akamai. This network would be most properly called an extranet.

Source: COURSERA (online learning platform)

**Enterprise Networks:**

An enterprise network is a network that includes elements of both local and wide area networks. Owned and operated by a single organization to interlink its computers and resources, it employs technologies and software designed for fast data access, email exchange, and collaboration. Enterprise networks are scalable and include high-end equipment, strong security systems, and mission-critical applications.

In practice, the term "enterprise network" is sometimes used to mean all the networking technologies that belong to one company, or all the networking technologies that belong to one large company. The term "enterprise" generally means either "the whole company" or "a large company."

**Small Office Home Office (SOHO) Networks:**

A Small Office/Home Office (SOHO) network is a small network that can comprise up to 10 nodes. SOHO networks can either be wired or wireless. It is necessary that all the computers in a SOHO network be present at the same physical location. A SOHO can include devices such as switches or routers, but typically they are connected using multifunction devices that most people just call "home routers." Routers technically connect two or more networks and can pass information between them. SOHO routers usually do a lot more. They often incorporate switches, devices that can connect multiple devices on the same network to each other using a common media. They also usually provide services to give out IP addresses and secure the SOHO network. Most SOHO routers have a web-based interface that allows the owner to configure and monitor the network.

# Overview of Network Models

A network model describes how the nodes on a network are interact. Network models vary based on how communications and processing are centralized or distributed.

The three network models we will be discussing are:

- Centralized
- Client/Server
- Peer-to-peer

These network models focus on the way the different nodes accomplish the primary objectives of the network. But they're not the only way we describe a network.

Networks have a physical topology. This describes how the nodes are physically connected. They also have a logical topology. This describes how the data flows through the network. For example, Ethernet (the most common technology used for LANs) is usually wired together in a star topology. Each device has a wire connection to a central point, usually a switch. The data in a wired Ethernet network uses a bus topology. In a bus network, all the nodes see all the traffic. Thus, we can describe Ethernet as a "physical star, logical bus."

But many professionals work their whole careers and don't have to worry about either the physical or logical topology of their networks. The roles of the nodes on the network are always important. When you enter a new network, you will almost always want to know how processing is being handled. If there's a problem, knowing the network model helps identify where to look for the solution.

# Client/Server

A client/server network is a network in which servers provide resources to clients. Both the clients and servers have their own local processors and storage. Using servers allows centralized management and security. Clients perform basic end-user tasks on their own. Because some of the processing happens on the client, the servers don't need to be as expensive as hosts. It also allows administrators to place the processing power closer to where it's needed. Tasks that don't need a lot of processing power can be done on the clients. Tasks that require more resources can be done on the servers.

In a client/server network there's usually at least one server in charge of central authentication. That server hosts a database of usernames and passwords. The users can log in to any client in the network. The client transmits the information to the server. Authentication happens when the server verifies the identity of the user. The user proves their identity by sending a valid combination of a username and password or some other information to prove their identity.

Typically, servers aren't as powerful or expensive as host computers. That means companies can buy multiple servers for the same amount of money (or less) than needed to buy one host. Having multiple servers allows the company to achieve fault tolerance. Fault tolerance literally means a system that can tolerate a "fault" (failure). For practical purposes, fault tolerance means there is a backup that can takeover when something fails with little to no interruption.

# Peer-to-Peer

A peer-to-peer network does not have centralized control. Resource sharing, processing, and communications happen at all computers. All clients on the network are equal in terms of supplying and using resources. Each workstation authenticates its users.

Peer-to-peer networks are easy and inexpensive. However, they are only practical in small companies. A peer-to-peer network is more commonly referred to as a workgroup. More recently, the industry uses the term SOHO (Small Office Home Office).

In peer-to-peer networks, users need a username and password on each computer. Suppose you created a peer-to-peer network in your home. You're logged in on your laptop. You would like to print to a printer connected to a desktop in a study. If the study computer has a user with the same username and password as the laptop, you will be able to print with no issues. If the username or password is different, you would need to login to the study computer to print.

Effectively, each user needs the same username and password at each machine. This makes running a peer-to-peer network difficult. As the network grows, it gets more difficult.