

Cisco Systems



CCNA

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Data Networks

Sharing data through the use of floppy disks is not an efficient or cost-effective manner in which to operate businesses.

Businesses needed a solution that would successfully address the following three problems:

- How to avoid duplication of equipment and resources
- How to communicate efficiently
- How to set up and manage a network

Businesses realized that networking technology could increase productivity while saving money.

Networking Devices

Equipment that connects directly to a network segment is referred to as a device.

These devices are broken up into two classifications.

- end-user devices
- network devices

End-user devices include computers, printers, scanners, and other devices that provide services directly to the user.

Network devices include all the devices that connect the end-user devices together to allow them to communicate.

Network Interface Card

A network interface card (NIC) is a printed circuit board that provides network communication capabilities to and from a personal computer. Also called a LAN adapter.

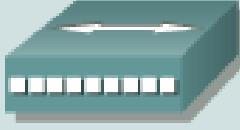
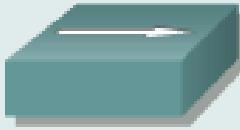
PCMCIA Network interface card



Internal network interface card



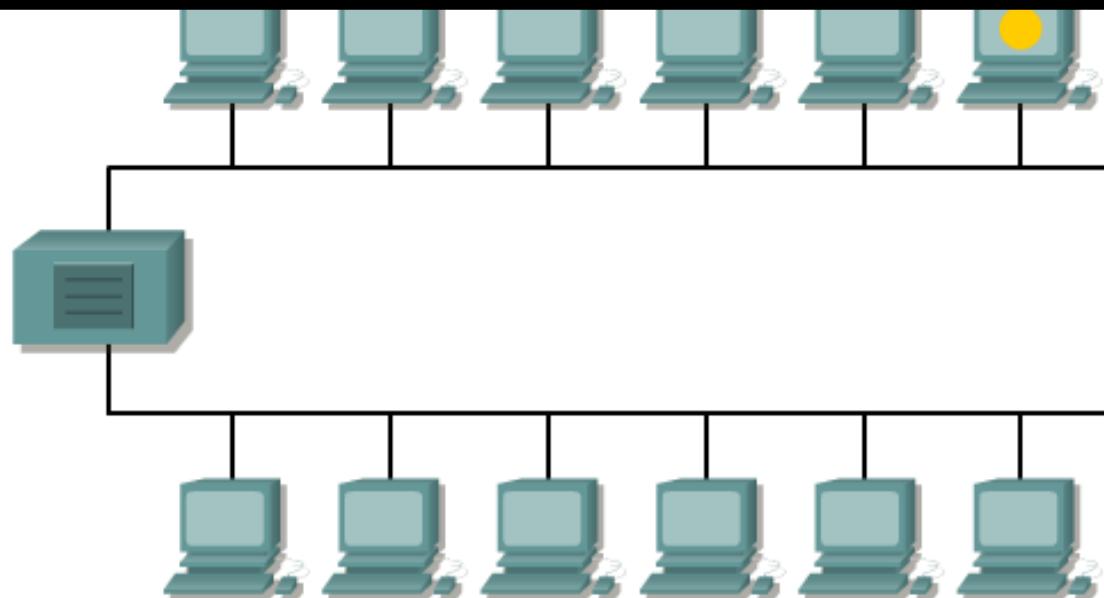
Networking Device Icons

Network Devices	
Repeater	
Bridge	
10BASE-T Hub	
Workgroup Switch	
100BASE-T Hub	
Router	
Hub	
Network Cloud	

Repeater

A repeater is a network device used to regenerate a signal.

Repeaters regenerate analog or digital signals distorted by transmission loss due to attenuation. A repeater does not perform intelligent routing.

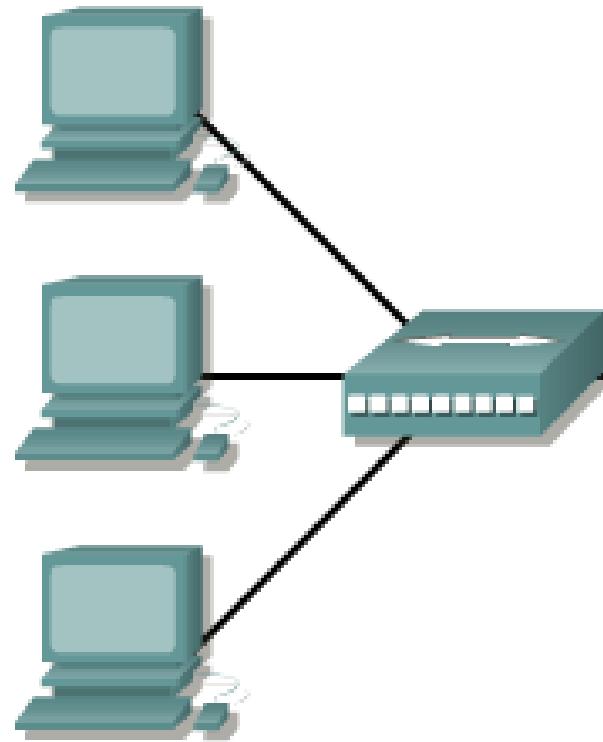


Hub

Hubs concentrate connections. In other words, they take a group of hosts and allow the network to see them as a single unit.

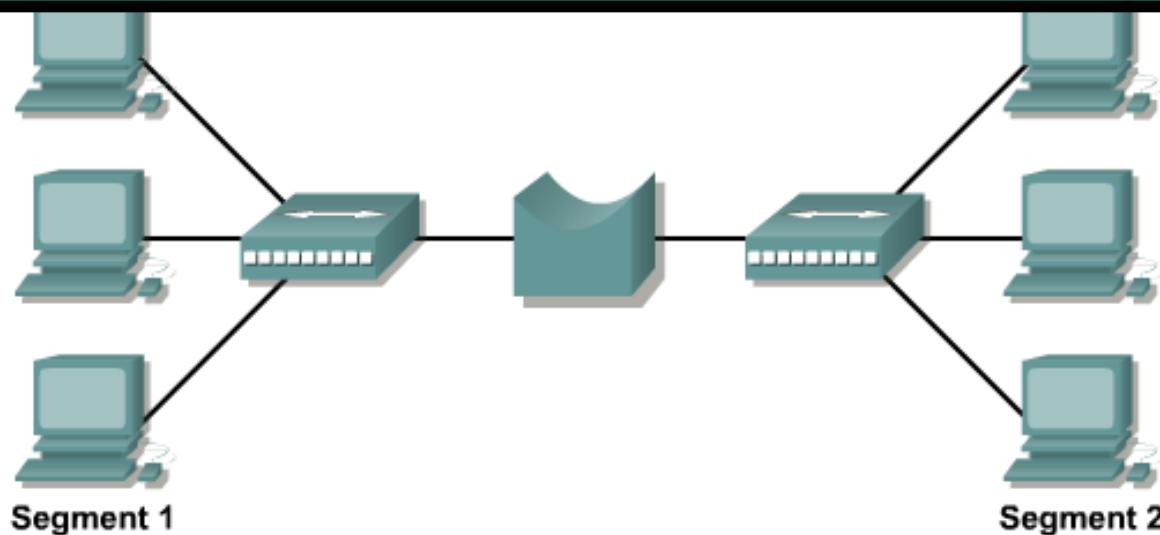
This is done passively, without any other effect on the data transmission.

Active hubs not only concentrate hosts, but they also regenerate signals.



Bridge

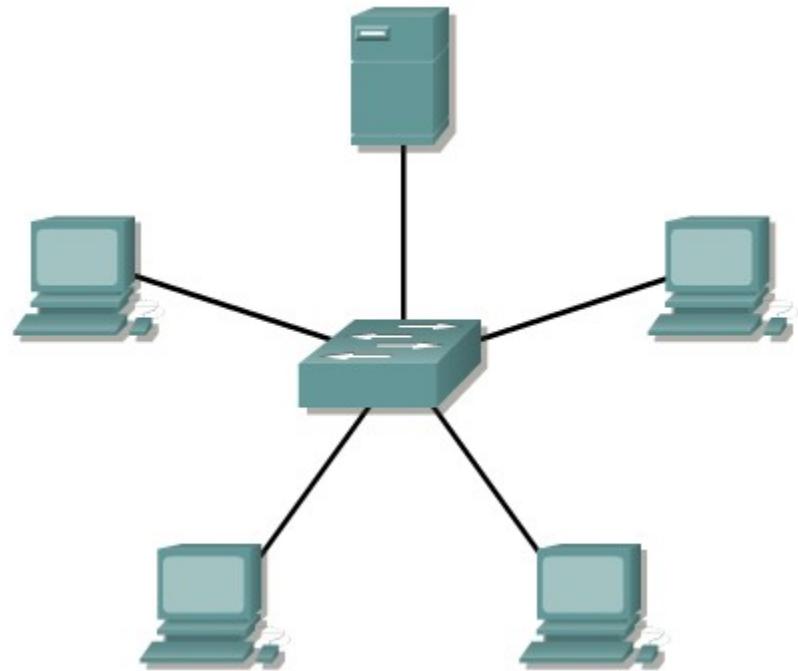
Bridges convert network transmission data formats as well as perform basic data transmission management. Bridges, as the name implies, provide connections between LANs. Not only do bridges connect LANs, but they also perform a check on the data to determine whether it should cross the bridge or not. This makes each part of the network more efficient.



Workgroup Switch

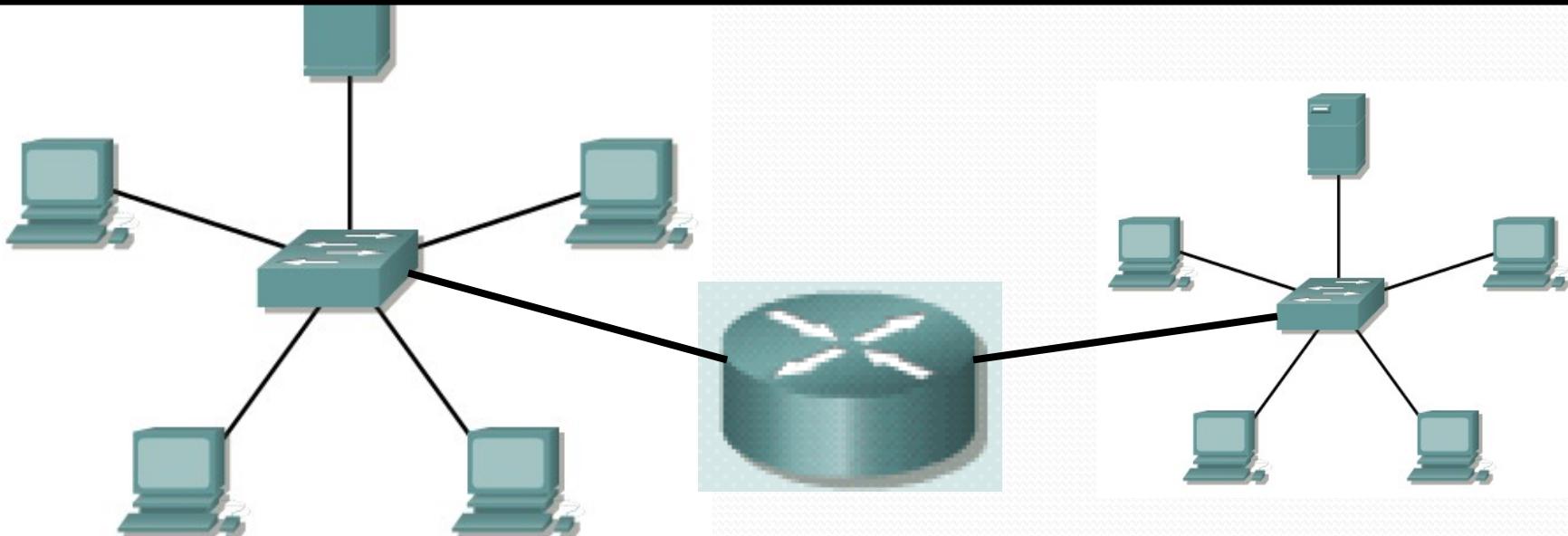
Workgroup switches add more intelligence to data transfer management.

Switches can determine whether data should remain on a LAN or not, and they can transfer the data to the connection that needs that data.



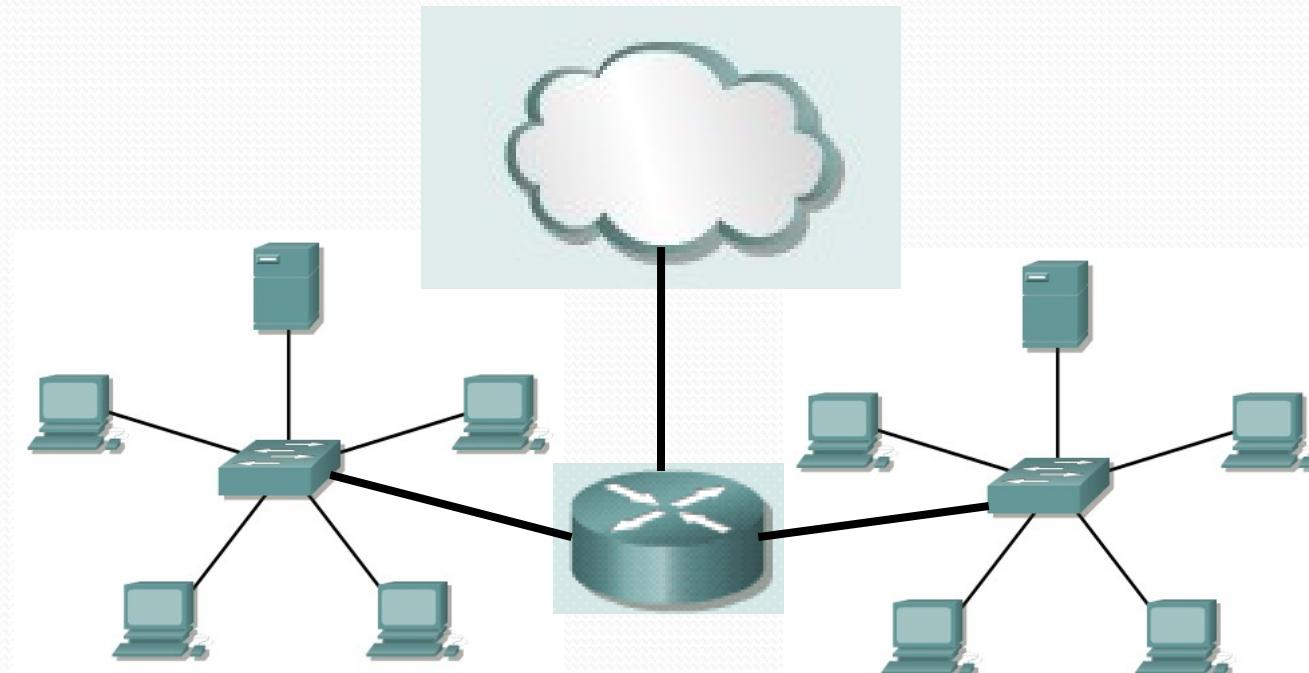
Router

Routers have all capabilities of the previous devices. Routers can regenerate signals, concentrate multiple connections, convert data transmission formats, and manage data transfers. They can also connect to a WAN, which allows them to connect LANs that are separated by great distances.



“The Cloud”

The cloud is used in diagrams to represent where the connection to the internet is. It also represents all of the devices on the internet.



Network Topologies

Network topology defines the structure of the network.

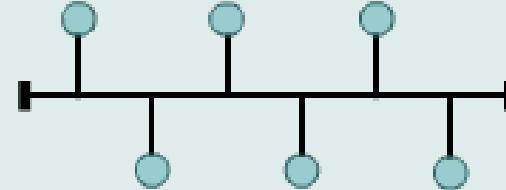
One part of the topology definition is the physical topology, which is the actual layout of the wire or media.

The other part is the logical topology, which defines how the media is accessed by the hosts for sending data.

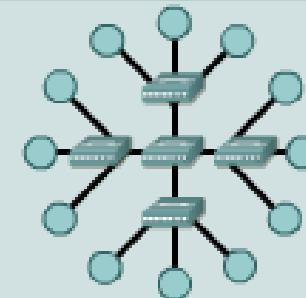
Physical Topologies

Physical Topologies

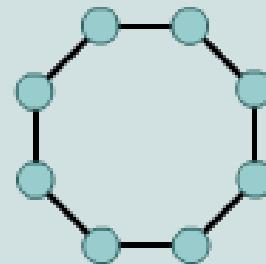
Bus
Topology



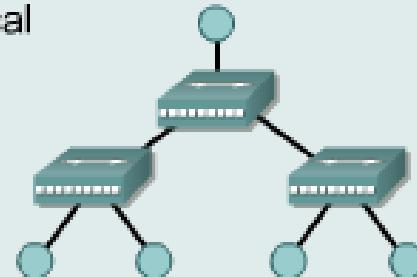
Extended Star
Topology



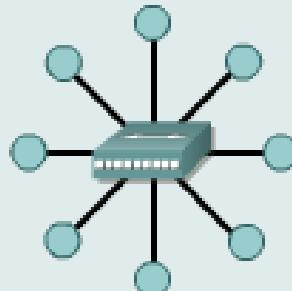
Ring Topology



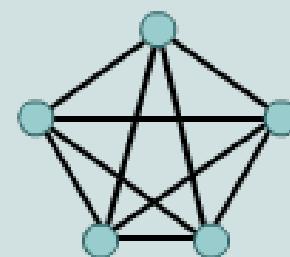
Hierarchical
Topology



Star Topology



Mesh Topology

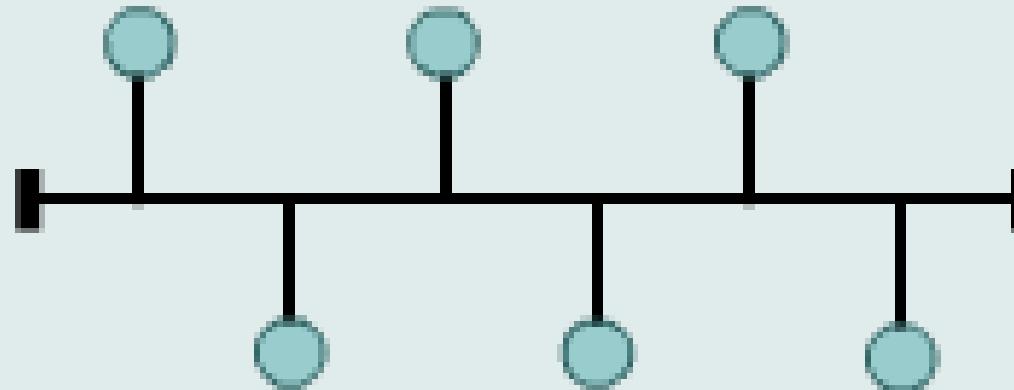


Bus Topology

A bus topology uses a single backbone cable that is terminated at both ends.

All the hosts connect directly to this backbone.

Bus
Topology

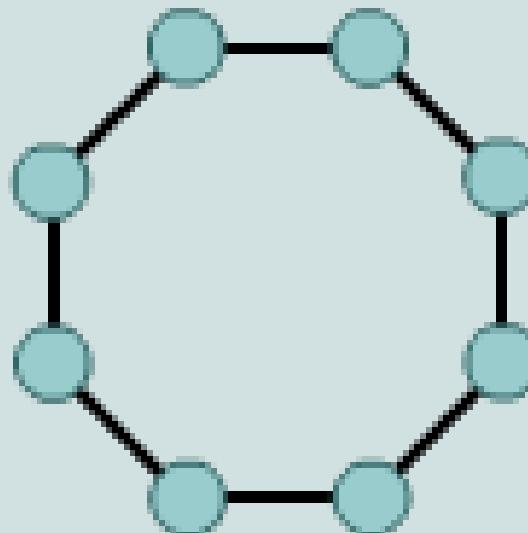


Ring Topology

A ring topology connects one host to the next and the last host to the first.

This creates a physical ring of cable.

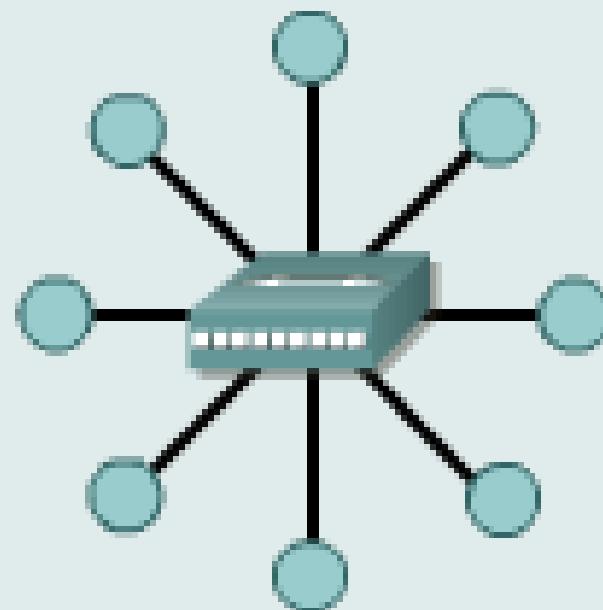
Ring Topology



Star Topology

A star topology connects all cables to a central point of concentration.

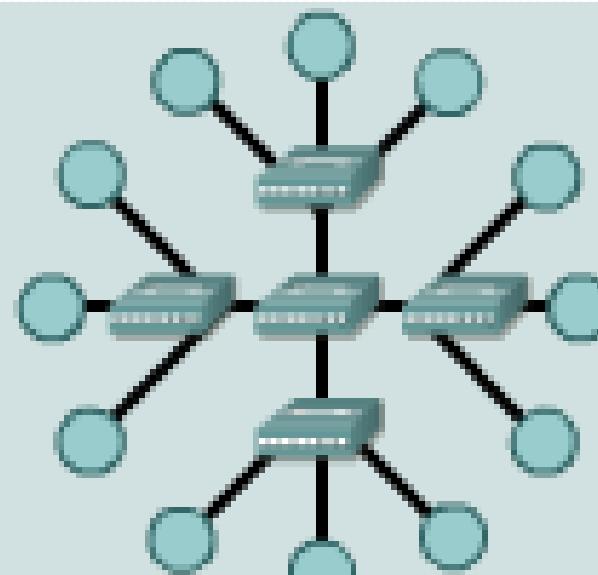
Star Topology



Extended Star Topology

An extended star topology links individual stars together by connecting the hubs and/or switches. This topology can extend the scope and coverage of the network.

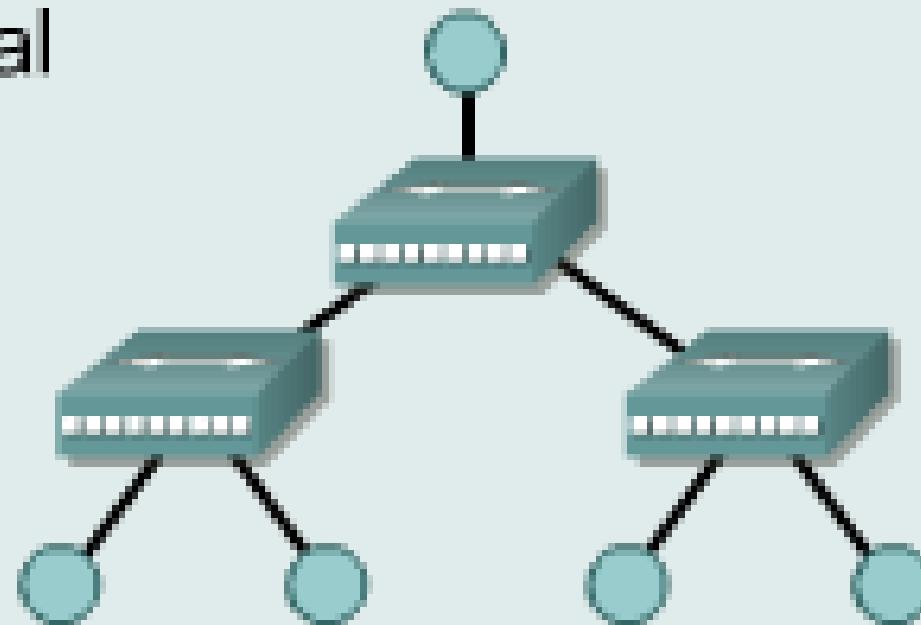
Extended Star
Topology



Hierarchical Topology

A hierarchical topology is similar to an extended star.

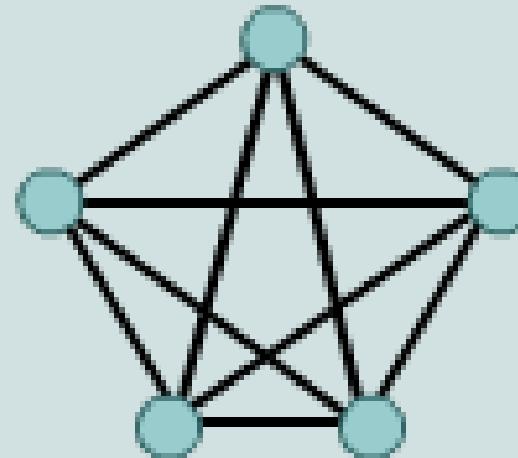
Hierarchical
Topology



Mesh Topology

A mesh topology is implemented to provide as much protection as possible from interruption of service. Each host has its own connections to all other hosts. Although the Internet has multiple paths to any one location, it does not adopt the full mesh topology.

Mesh Topology



LANs, MANs, & WANs

One early solution was the creation of local-area network (LAN) standards which provided an open set of guidelines for creating network hardware and software, making equipment from different companies compatible.

What was needed was a way for information to move efficiently and quickly, not only within a company, but also from one business to another.

The solution was the creation of metropolitan-area networks (MANs) and wide-area networks (WANs).

Examples of Data Networks

Distance Between CPUs	Location of CPUs	Name
0.1 m	Printed circuit board Personal data asst.	Motherboard Personal Area Network (PAN)
1.0 m	Millimeter Mainframe	Computer Systems Network
10 m	Room	Local Area Network (LAN) Your classroom
100 m	Building	Local Area Network (LAN) Your school
1000 m = 1 km	Campus	Local Area Network (LAN) Stanford University
100,000 m = 100 km	Country	Wide Area Network (WAN) Cisco Systems, Inc.
1,000,000 m = 1,000 km	Continent	Wide Area Network (WAN) Africa
10,000,000 m = 10,000 km	Planet	Wide Area Network (WAN) The Internet
100,000,000 m = 100,000 km	Earth-moon system	Wide Area Network (WAN) Earth and artificial satellites

LANs

LANs are designed to:

- Operate within a limited geographic area
- Allow multi-access to high-bandwidth media
- Control the network privately under local administration
- Provide full-time connectivity to local services
- Connect physically adjacent devices

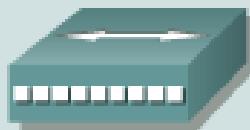
Using:



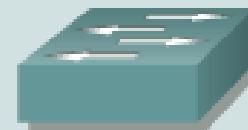
Router



Bridge



Hub



Ethernet Switch



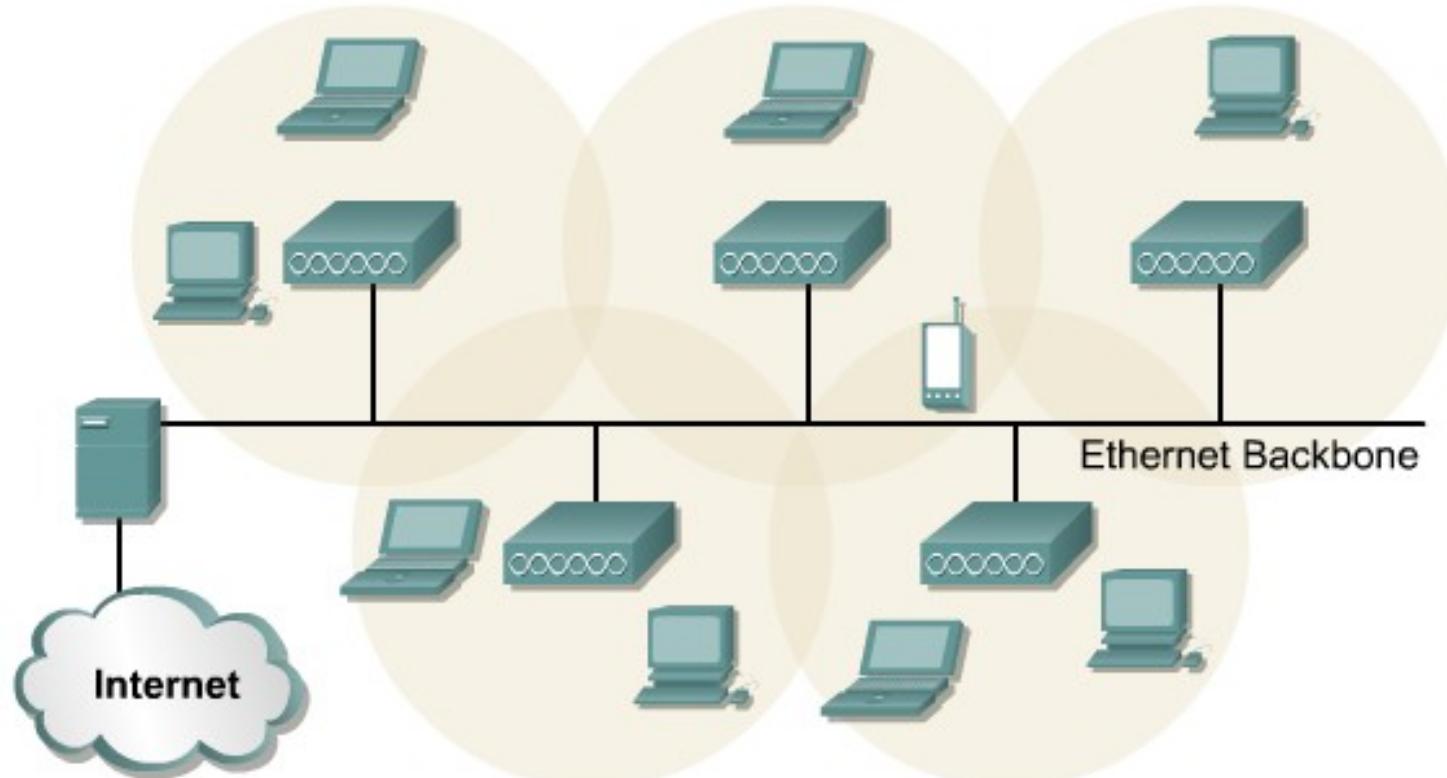
Repeater

Wireless LAN Organizations and Standards

In cabled networks, IEEE is the prime issuer of standards for wireless networks. The standards have been created within the framework of the regulations created by the Federal Communications Commission (FCC).

A key technology contained within the 802.11 standard is Direct Sequence Spread Spectrum (DSSS).

Cellular Topology for Wireless



WANs

WANS are designed to:

- Operate over a large geographical area
- Allow access over serial interfaces operating at lower speeds
- Provide full-time and part-time connectivity
- Connect devices separated over wide, even global areas

Using:



Router



Communication
Server

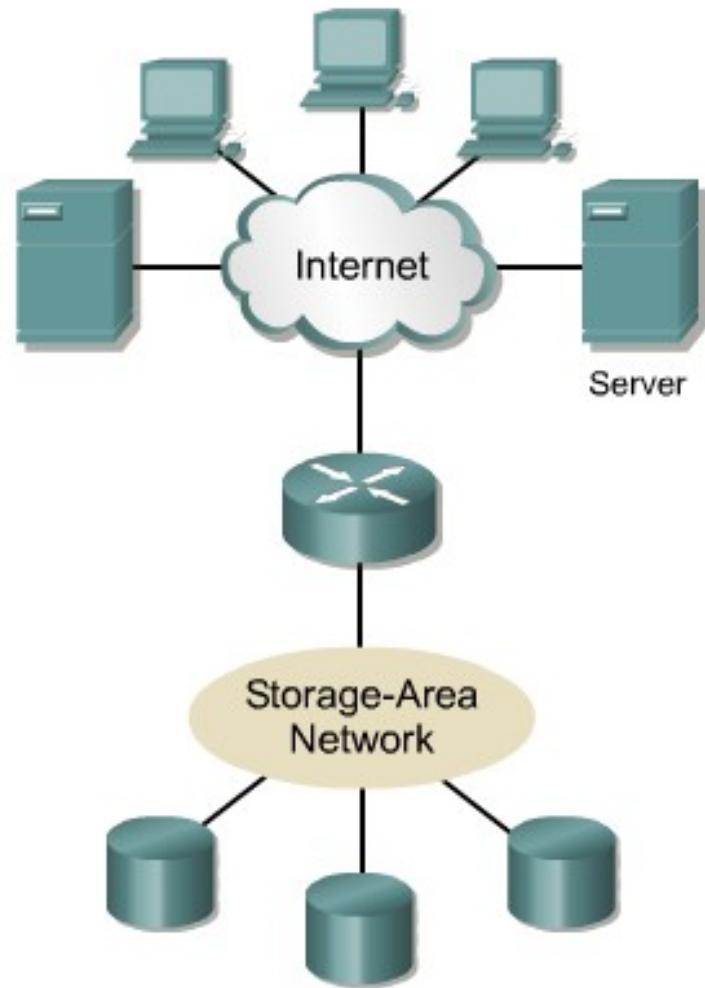


Modem CSU/DSU
TA/NT1

SANs

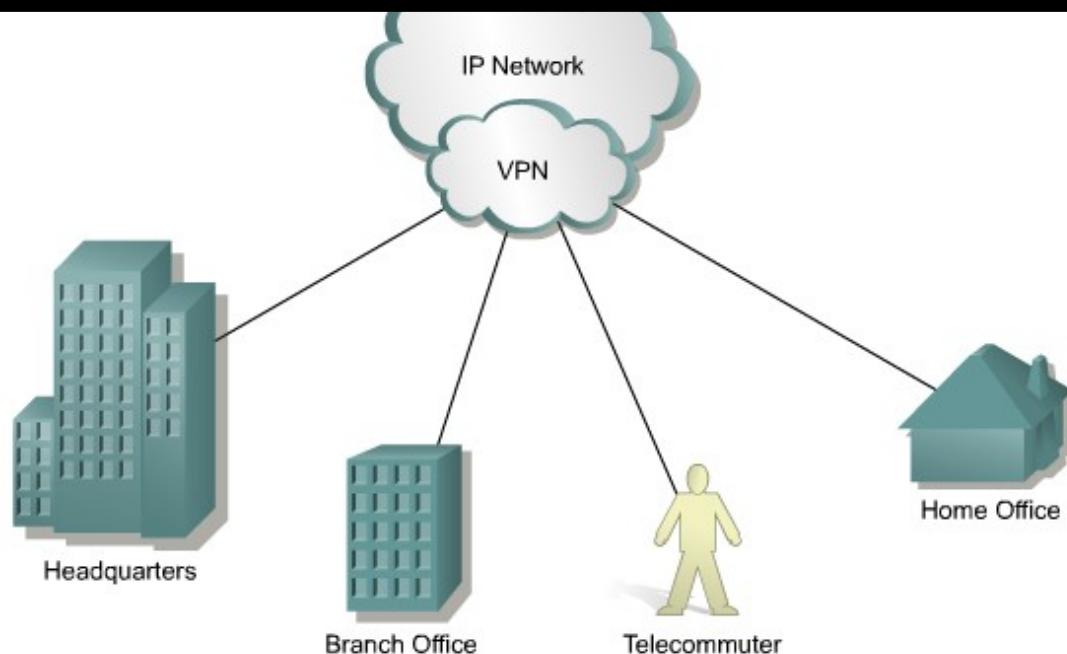
A SAN is a dedicated, high-performance network used to move data between servers and storage resources.

Because it is a separate, dedicated network, it avoids any traffic conflict between clients and servers.



Virtual Private Network

A VPN is a private network that is constructed within a public network infrastructure such as the global Internet. Using VPN, a telecommuter can access the network of the company headquarters through the Internet by building a secure tunnel between the telecommuter's PC and a VPN router in the headquarters.

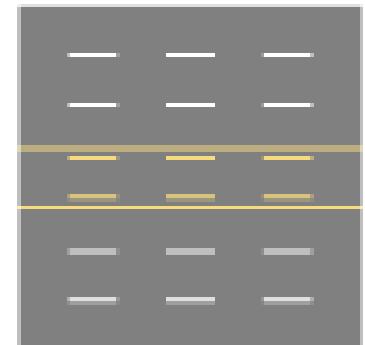
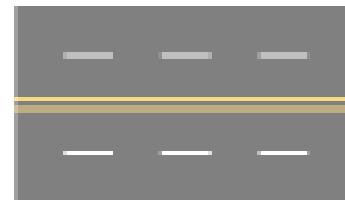


Bandwidth

Why bandwidth is important:

- Bandwidth is limited by physics and technology
- Bandwidth is not free
- Bandwidth requirements are growing at a rapid rate
- Bandwidth is critical to network performance

Bandwidth is like the number of lanes on a highway.



Measuring Bandwidth

Unit of Bandwidth	Abbreviation	Equivalence
Bits per second	bps	1 bps = fundamental unit of bandwidth
Kilobits per second	kbps	1 kbps = ~1,000 bps = 10^3 bps
Megabits per second	Mbps	1 Mbps = ~1,000,000 bps = 10^6 bps
Gigabits per second	Gbps	1 Gbps = ~1,000,000,000 bps = 10^9 bps
Terabits per second	Tbps	1 Tbps = ~1,000,000,000,000 bps = 10^{12} bps