

Introduction to Computing (SE-101)

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Questions from previous lecture?

Networking Basics

Lecture # 8

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Network Definition

- Set of technologies that connects computers
- Allows communication and collaboration between users

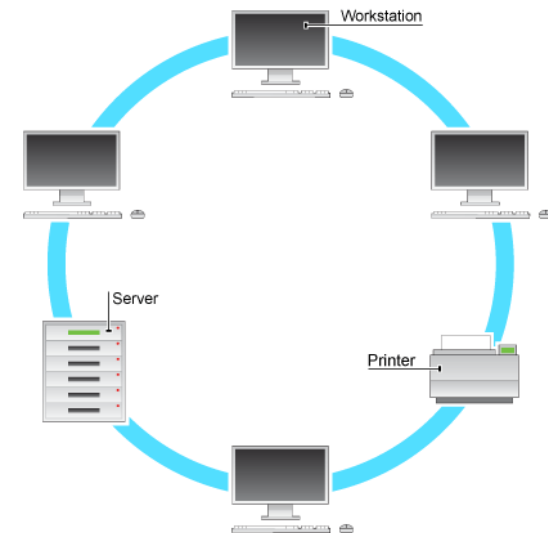
The Uses of a Network

- Simultaneous access to data
 - Data files are shared
 - Access can be limited
 - Shared files stored on a server
 - Software can be shared
 - Site licenses
 - Network versions
 - Application servers

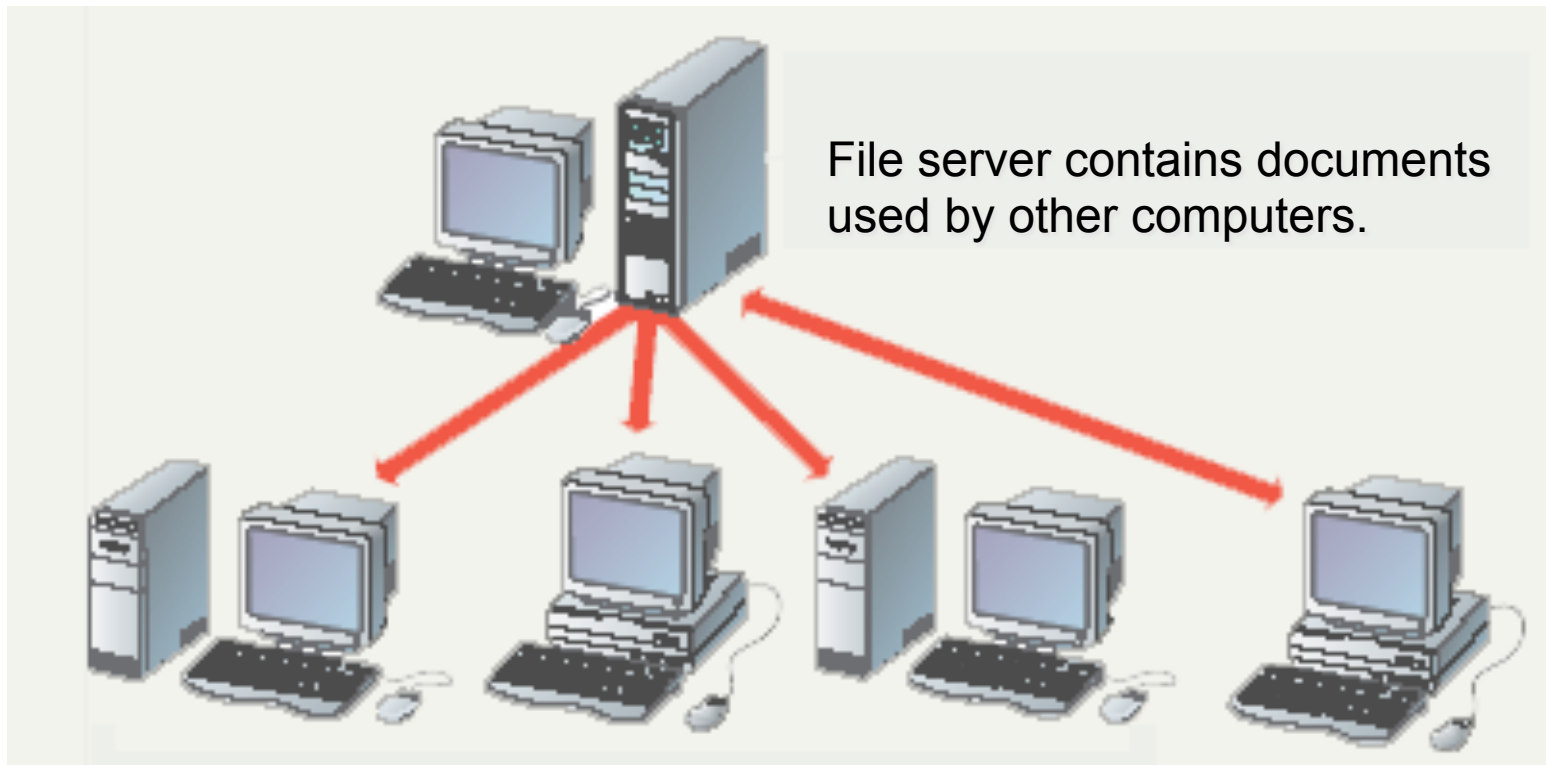


The Uses of a Network

- Shared peripheral device
 - Printers and faxes are common shares
 - Reduces the cost per user
 - Devices can be connected to the network
 - Print servers control network printing
 - Manage the print queue



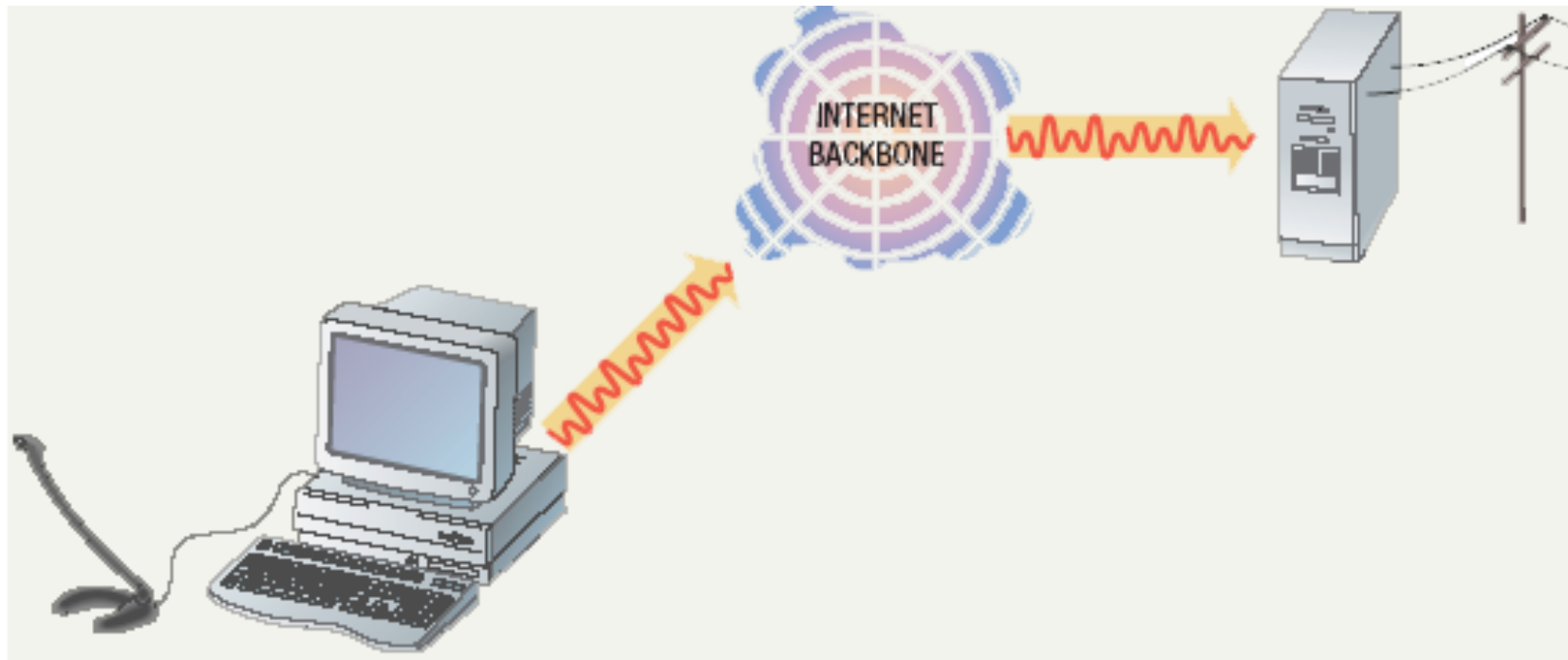
Sharing Data



The Uses of a Network

- Personal communication
 - Email
 - Instantaneous communication
 - Conferencing
 - Tele conferencing
 - Videoconferencing
 - Audio-conferencing
 - Data-conferencing
 - Voice over IP
 - Phone communication over network wires

Voice Over IP



Voice Over IP



VoIP



Common Network Types

- Local Area Network (LAN)
 - Contains printers, servers and computers
 - Systems are close to each other
 - Contained in one office or building
 - Organizations often have several LANS

Common Network Types

- Wide Area Networks (WAN)
 - Two or more LANs connected
 - Over a large geographic area
 - Typically use public or leased lines
 - Phone lines
 - Satellite
 - The Internet is a WAN

Hybrid Network Types

- Campus Area Networks (CAN)
 - A LAN in one large geographic area
 - Resources related to the same organization
 - Each department shares the LAN

Hybrid Network Types

- Metropolitan Area Network (MAN)
 - Large network that connects different organizations
 - Shares regional resources
 - A network provider sells time

Hybrid Network Types

- Home Area Network (HAN)
 - Small scale network
 - Connects computers and entertainment appliances
 - Found mainly in the home



Hybrid Network Types

- Personal Area Network (PAN)
 - Very small scale network
 - Range is less than 2 meters
 - Cell phones, PDAs, MP3 players

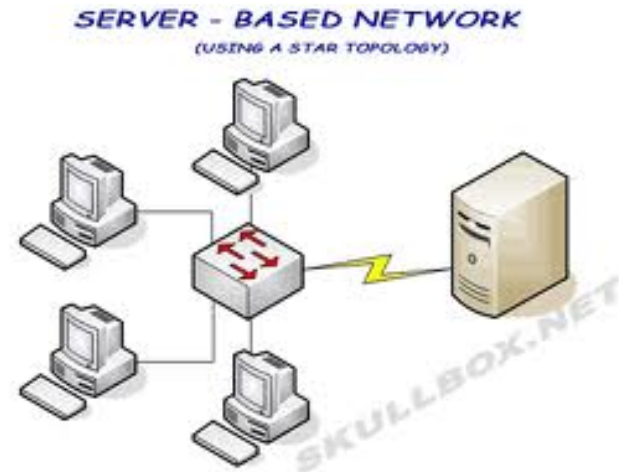


How Networks Are Structured

- Server based network
 - Node is any network device
 - Servers control what the node accesses
 - Users gain access by logging in
 - Server is the most important computer

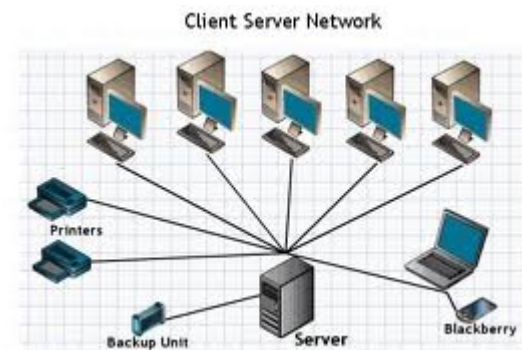
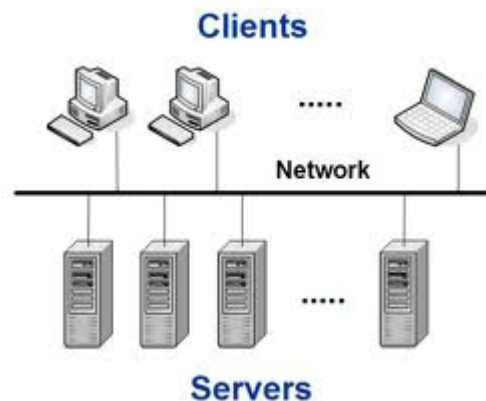


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How Networks Are Structured

- Client/Server network
 - Nodes and servers share data roles
 - Nodes are called clients
 - Servers are used to control access
 - Database software
 - Access to data controlled by server



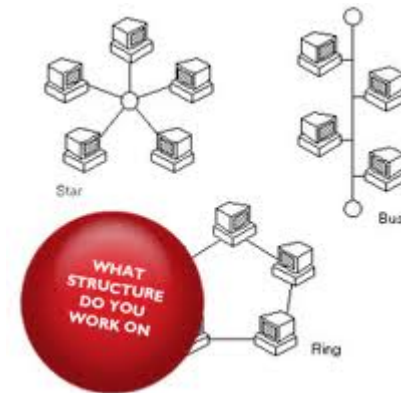
How Networks Are Structured

- Peer to peer networks (P2PN)
 - All nodes are equal
 - Nodes access resources on other nodes
 - Each node controls its own resources
 - Most modern OS allow P2PN
 - Kazaa, Napster, BitTorrent



Network Topologies

- Topology
 - Logical layout of wires and equipment
 - Choice affects
 - Network performance
 - Network size
 - Network collision detection
 - Several different types



Network Topologies

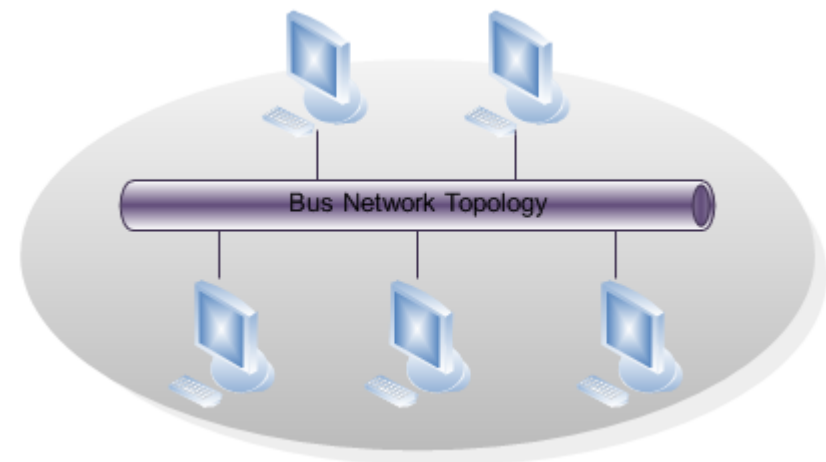
- Packets
 - Pieces of data transmitted over a network
 - Packets are created by sending node
 - Data is reassembled by receiving node
 - Packet header
 - Sending and receiving address
 - Packet payload
 - Number and size of data
 - Actual data
 - Packet error control

Packet - E-mail Example

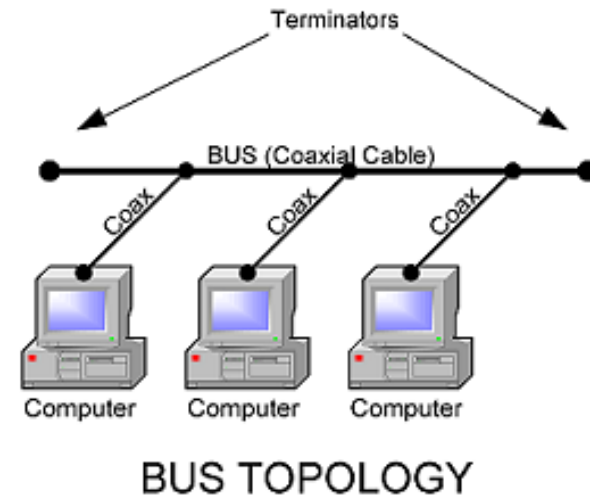
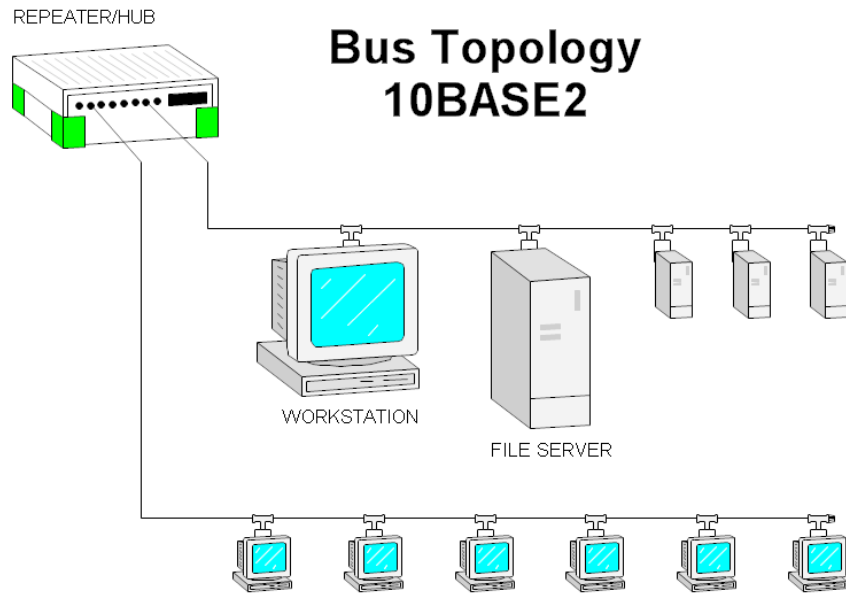
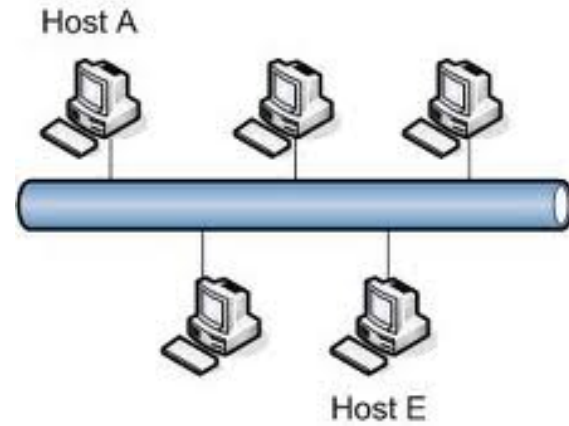
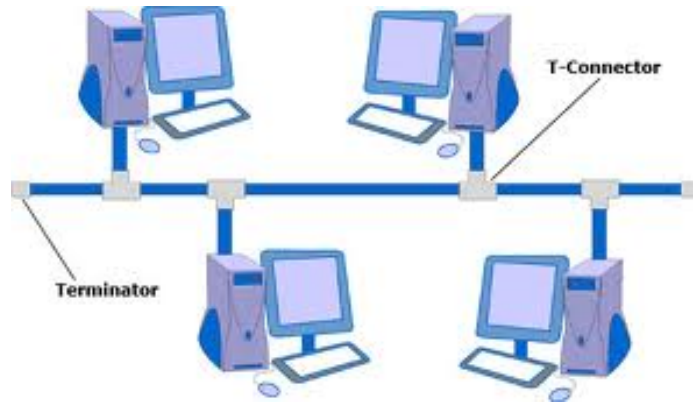
Header	Sender's IP address Receiver's IP address Protocol Packet number	96 bits
Payload	Data	896 bits
Trailer	Data to show end of packet Error correction	32 bits

Network Topologies

- Bus topology
 - Also called linear bus
 - One wire connects all nodes
 - Terminator ends the wires
 - Advantages
 - Easy to setup
 - Small amount of wire
 - Disadvantages
 - Slow
 - Easy to crash



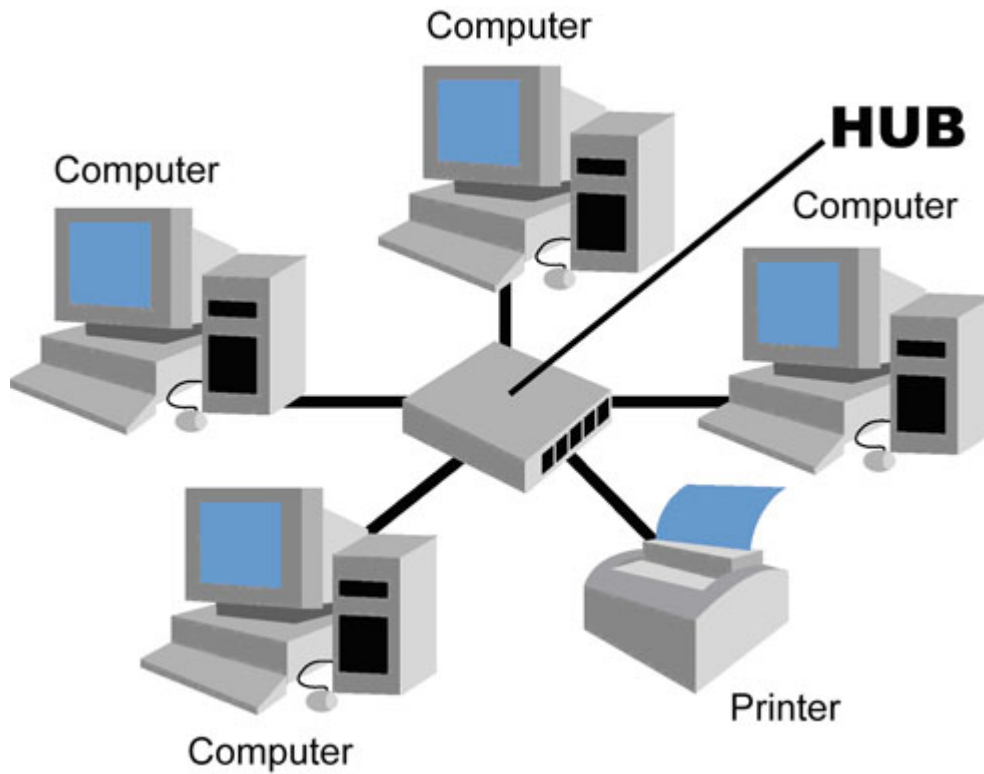
Bus topology



Network Topologies

- Star topology
 - All nodes connect to a hub
 - Packets sent to hub
 - Hub sends packet to destination
 - Advantages
 - Easy to setup
 - One cable can not crash network
 - Disadvantages
 - Hub can crash down entire network
 - Uses lots of cables
 - Most common topology

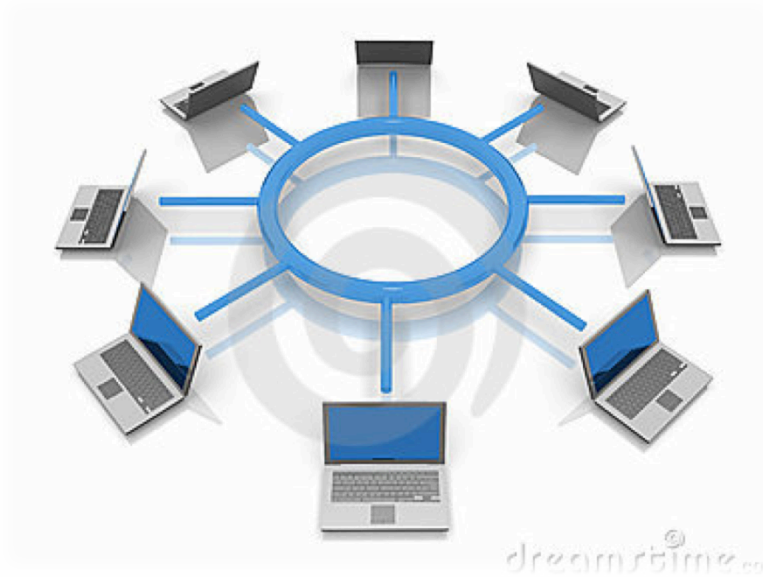
Star Topology



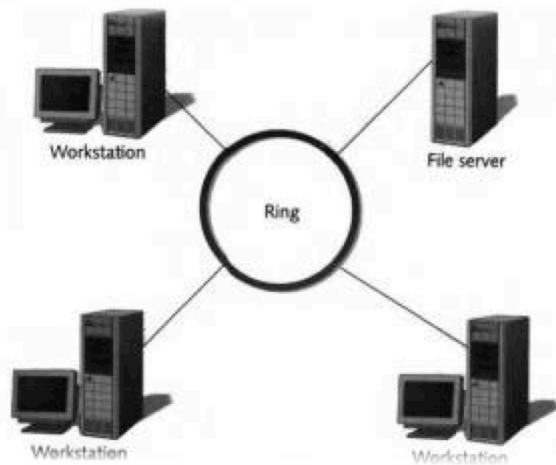
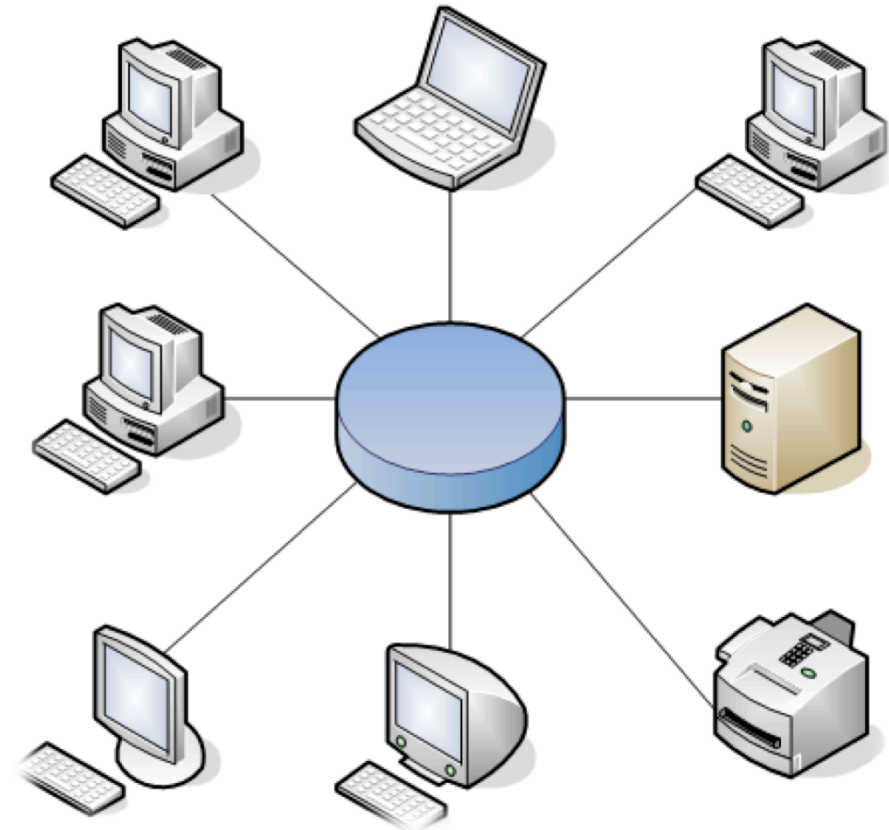
Network Topologies

- Ring topology
 - Nodes connected in a circle
 - Tokens used to transmit data
 - Nodes must wait for token to send
 - Advantages
 - Time to send data is known
 - No data collisions
 - Disadvantages
 - Slow
 - Lots of cable

Ring topology



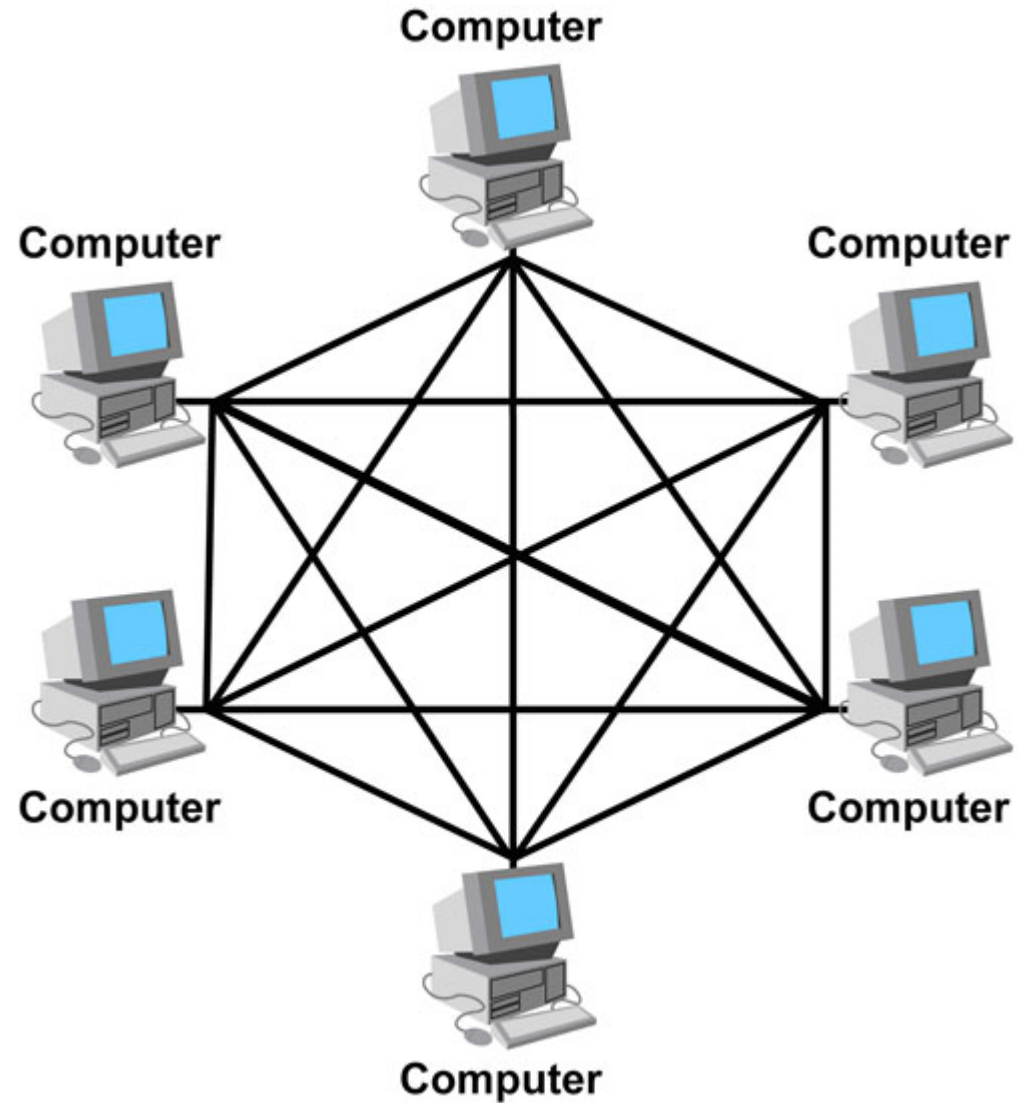
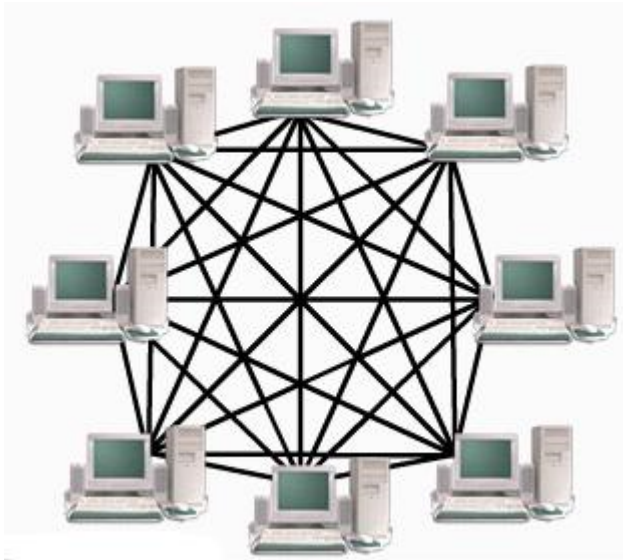
RING Topology



Network Topologies

- Mesh topology
 - All computers connected together
 - Internet is a mesh network
 - Advantage
 - Data will always be delivered
 - Disadvantages
 - Lots of cable
 - Hard to setup

Mesh Topology



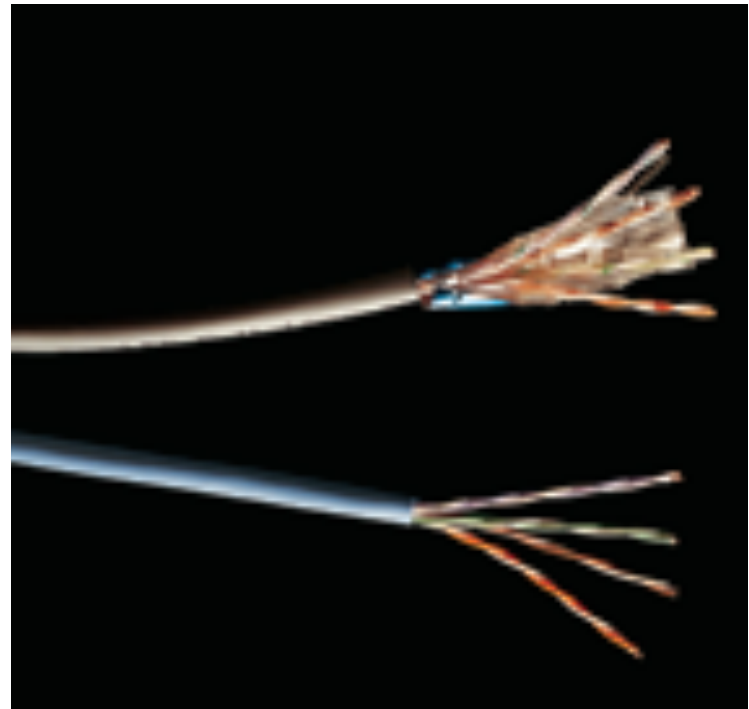
Network Media

- Links that connect nodes
- Choice impacts
 - Speed
 - Security
 - Size

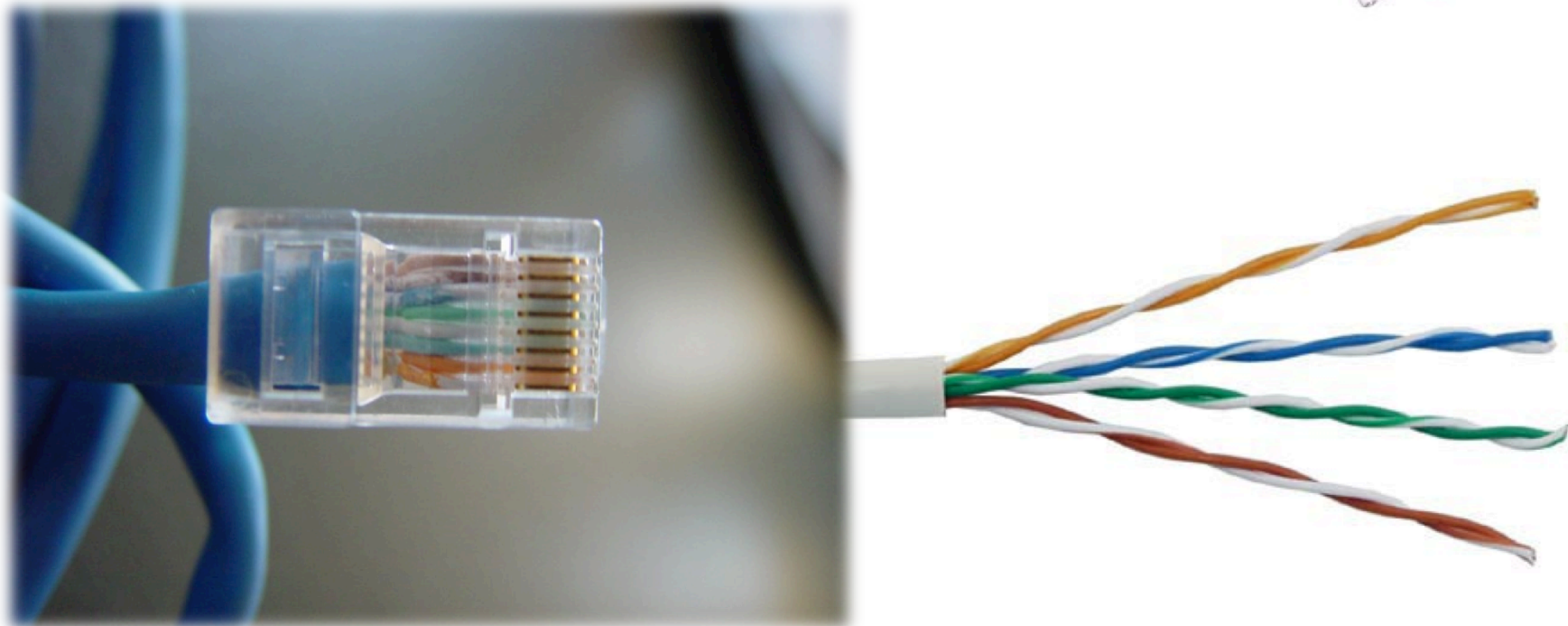
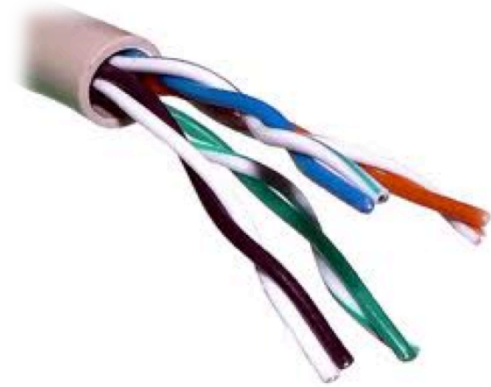


Wire Based Media

- Twisted-pair cabling
 - Most common LAN cable
 - Called Cat5 or 100BaseT
 - Four pairs of copper cable twisted
 - May be shielded from interference
 - Speeds range from 1 Mbps to 1,000 Mbps

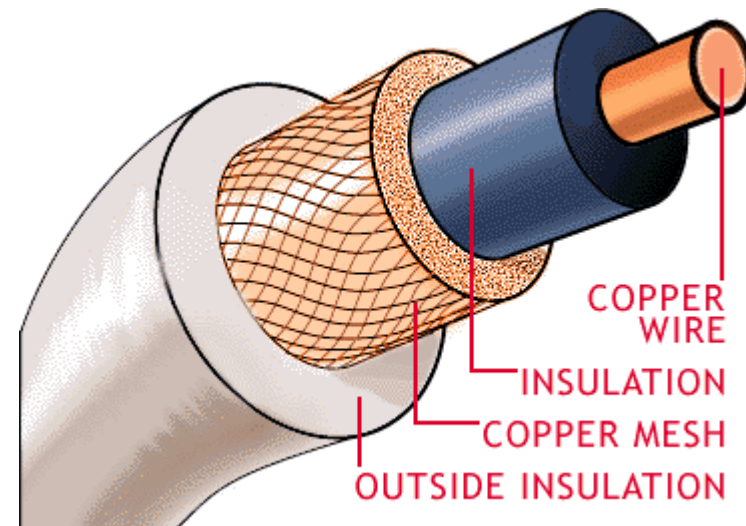


Twisted-pair cabling

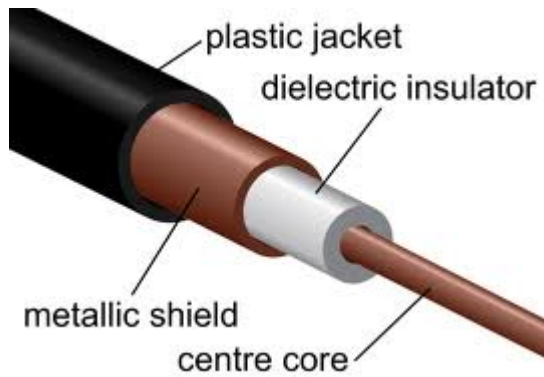


Wire Based Media

- Coaxial cable
 - Similar to cable TV wire
 - One wire runs through cable
 - Shielded from interference
 - Speeds up to 10 Mbps
 - Nearly obsolete



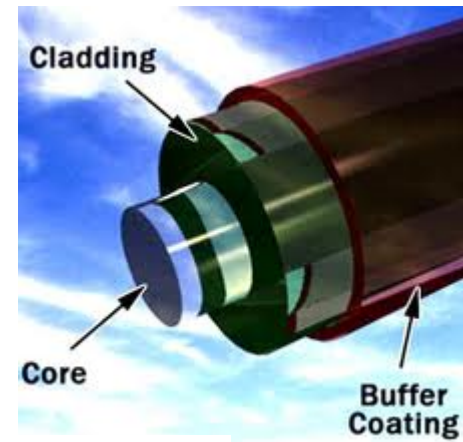
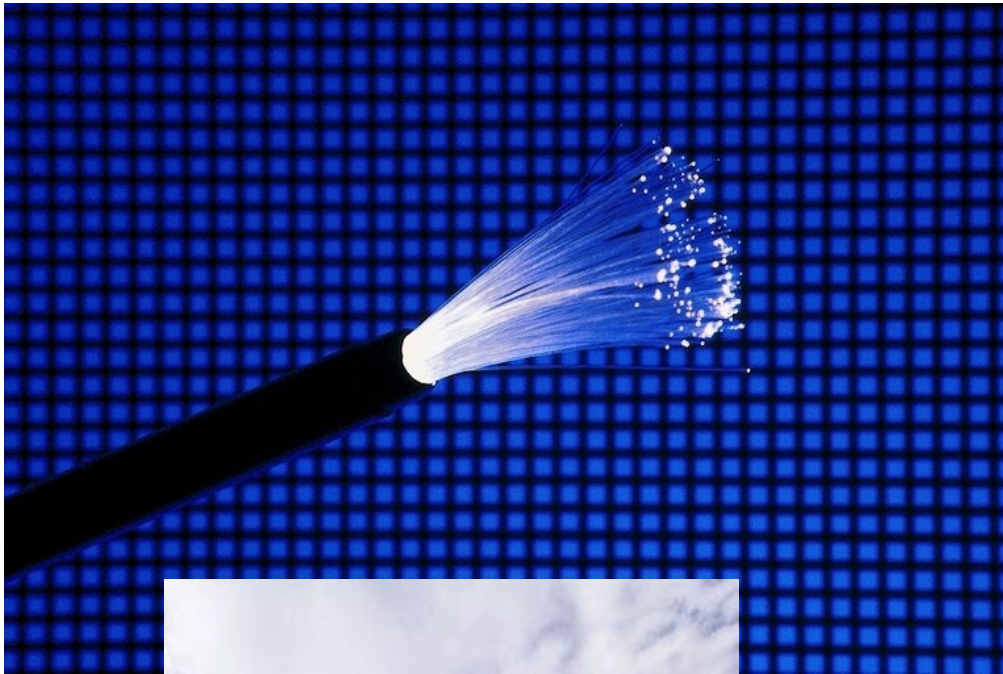
Coaxial cable



Wire Based Media

- Fiber-optic cable
 - Data is transmitted with light pulses
 - Glass strand instead of cable
 - Immune to interference
 - Very secure
 - Hard to work with
 - Speeds up to 100 Gbps



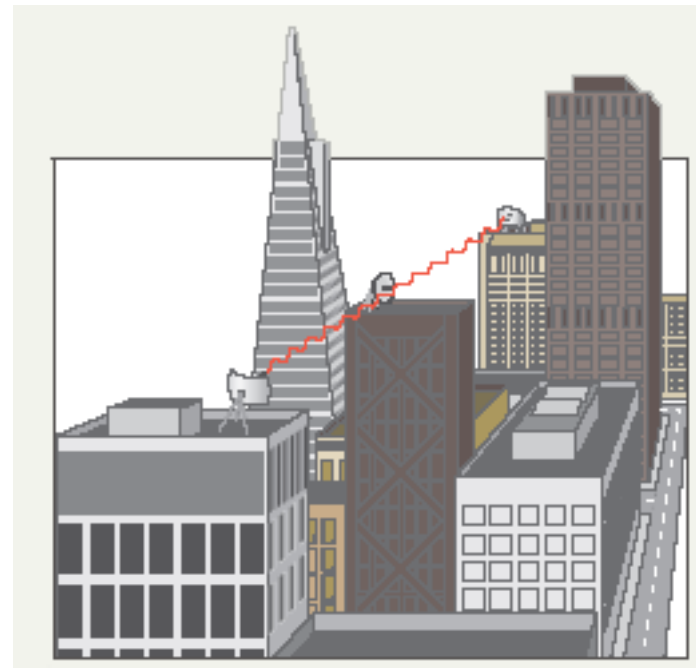


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Wireless Media

- Data transmitted through the air
- LANs use radio waves
- WANs use microwave signals
- Easy to setup
- Difficult to secure

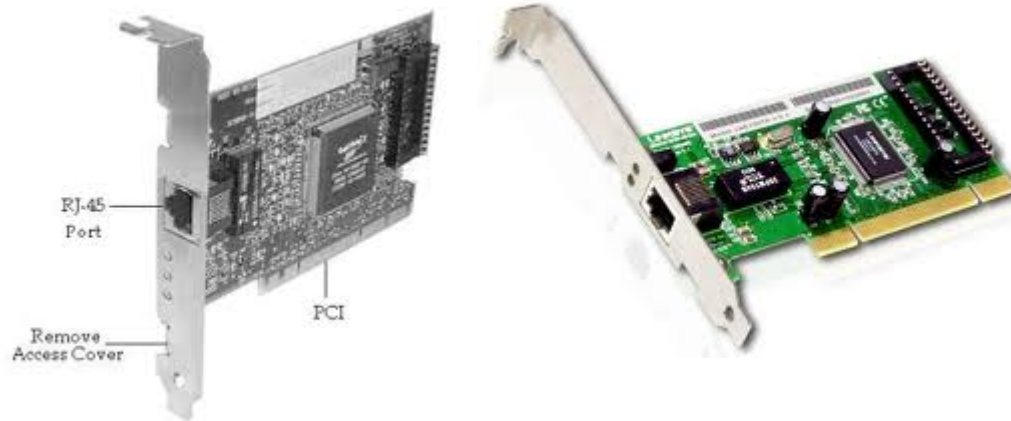


Wireless Media



Network Hardware

- Network interface cards
 - Network adapter
 - Connects node to the media
 - Unique Machine Access Code (MAC)



Network Hardware

- Network linking devices
 - Connect nodes in the network
 - Cable runs from node to device
 - Crossover cable connects two computers

Network Hardware

- Hubs
 - Center of a star network
 - All nodes receive transmitted packets
 - Slow and insecure



Network Hardware

- Switches
 - Replacement for hubs
 - Only intended node receives transmission
 - Fast and secure



Network Hardware

- Bridge
 - Connects two or more LANs together
 - Packets sent to remote LAN cross
 - Other packets do not cross
 - Segments the network on MAC addresses

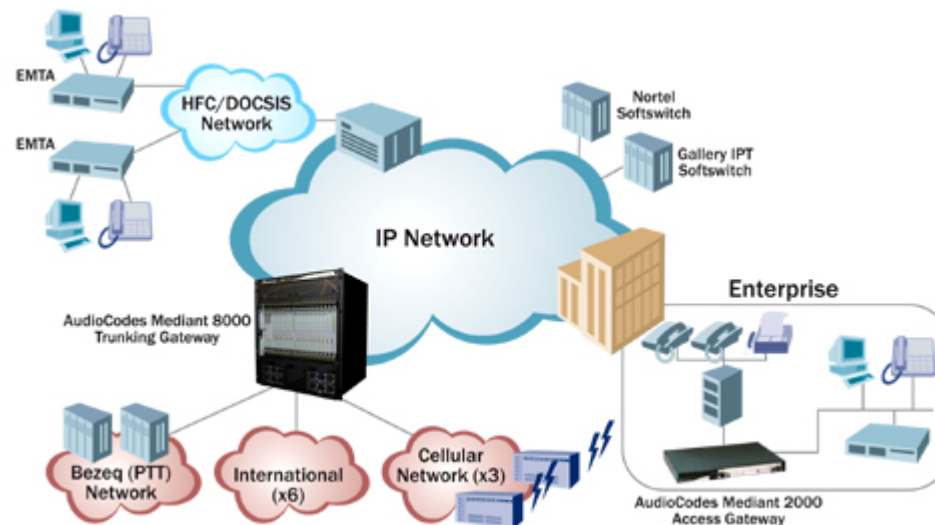
Network Hardware

- Router
 - Connects two or more LANs together
 - Packets sent to remote LAN cross
 - Network is segmented by IP address
 - Connect internal networks to the Internet
 - Need configured before installation



Network Hardware

- Gateway
 - Connects two dissimilar networks
 - Connects coax to twisted pair
 - Most gateways contained in other devices



Network Cabling

- Cabling specifications
 - Bandwidth measures cable speed
 - Typically measured in Mbps
 - Maximum cable length
 - Connector describes the type of plug

Network Cabling

- Ethernet
 - Very popular cabling technology
 - 10 Base T, 10Base2, 10Base5
 - Maximum bandwidth 10 Mbps
 - Maximum distances 100 to 500 meters



Network Cabling

- Fast Ethernet
 - Newer version of Ethernet
 - Bandwidth is 100 Mbps
 - Uses Cat5 or greater cable
 - Sometimes called 100Base T
 - Requires a switch

Network Cabling

- Gigabit Ethernet
 - High bandwidth version of Ethernet
 - 1 to 10 Gbps
 - Cat 5 or fiber optic cable
 - Video applications

Network Cabling

- Token ring
 - Transmits Token around the ring
 - Uses shielded twisted pair cabling
 - Earlier bandwidth between 4 & 16 Mbps
 - Token ring hardware is expensive

Network Protocols

- Language of the network
 - Rules of communication between devices
 - Agreed upon format for data transmission
 - Breaking up data into packets, sending, receiving, reassembling using standard protocol
 - TCP/IP, IPX/SPX, NetBIOS/NetBEUI

TCP/IP

- The **Internet Protocol Suite** is the set of communications protocols used for the Internet and other similar networks.
- It is commonly also known as **TCP/IP**, named from two of the most important protocols.
- Transmission Control Protocol (TCP) and the Internet Protocol (IP), were the first two networking protocols defined in this standard.

Questions?

If you have any query please feel free to ask

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Reference

- The slides were taken from the book:
 - “Introduction to computing” by Peter Norton