Network Basics

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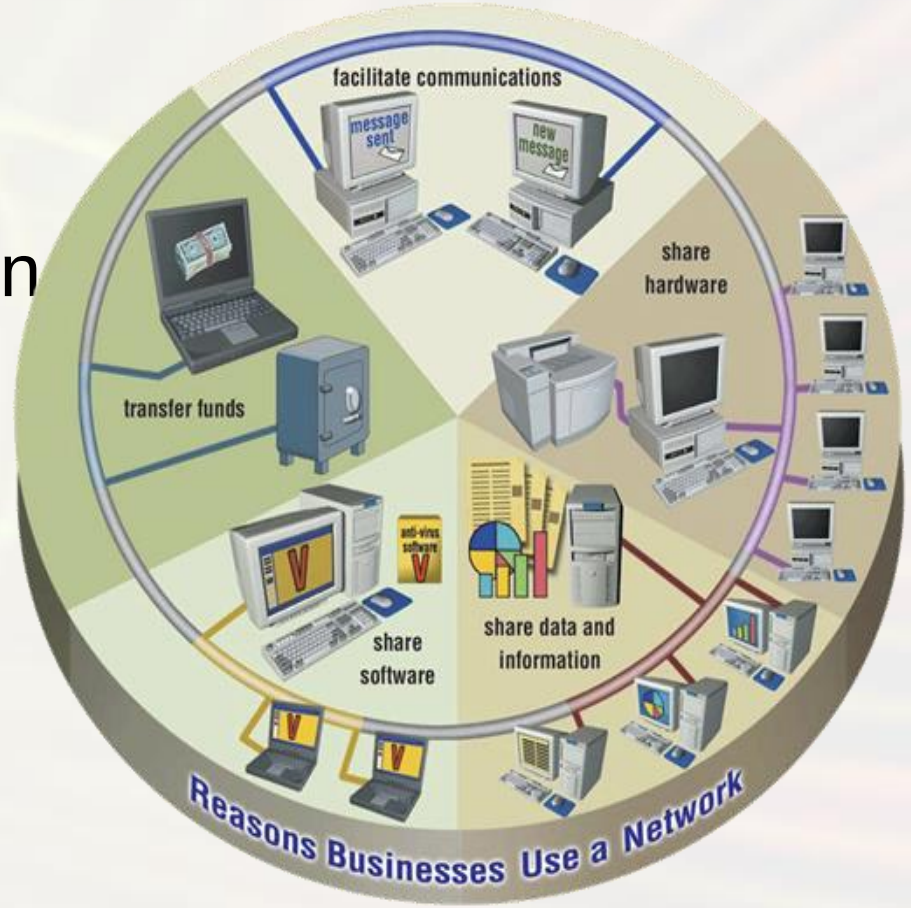
Network Definition

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



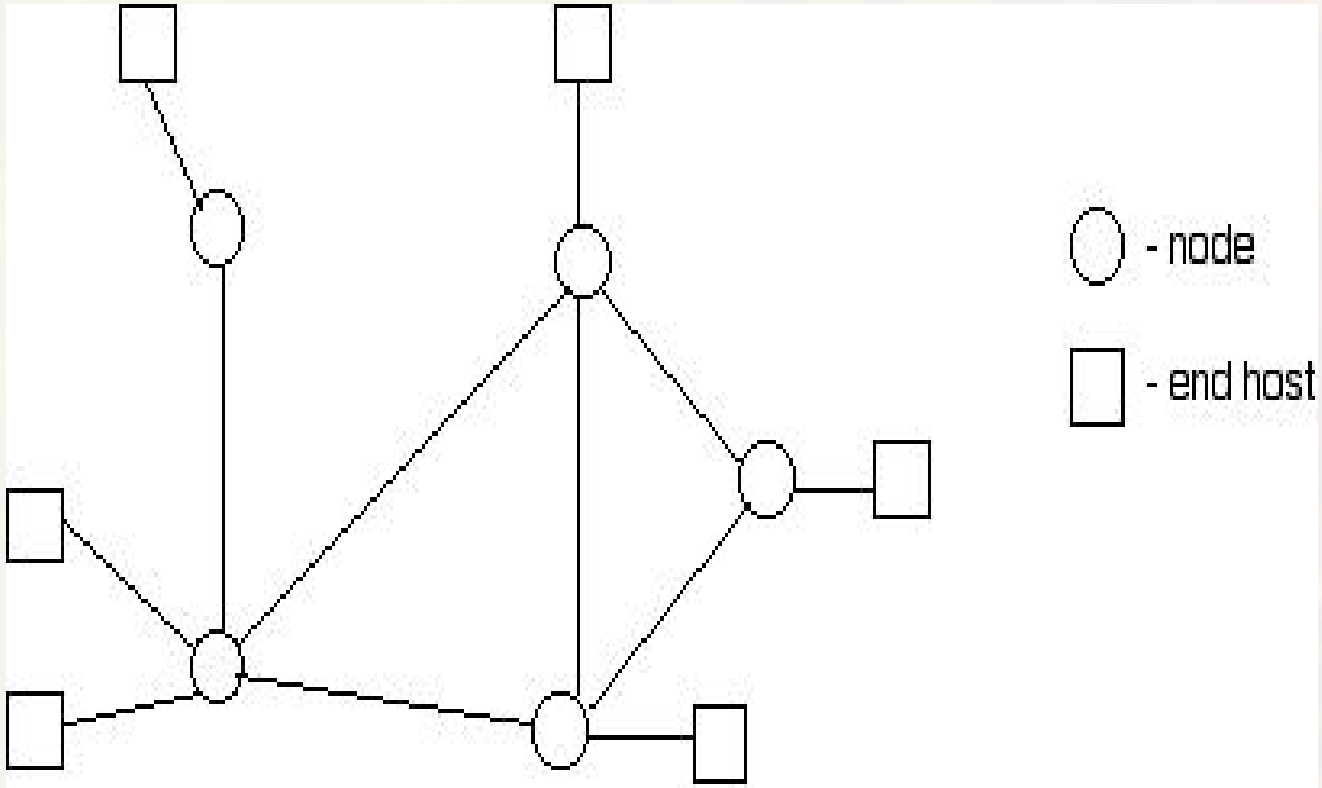


Figure : The definition of a computer network: a set of transmission paths, interconnected at nodes

Components of a computer network

A computer network is composed of:

- Hosts (PCs, laptops, handhelds)
- Routers & switches (IP router, Ethernet switch)
- Links (wired, wireless)
- Protocols (IP, TCP, CSMA/CD, CSMA/CA)
- Applications (network services)
- Humans and service agents

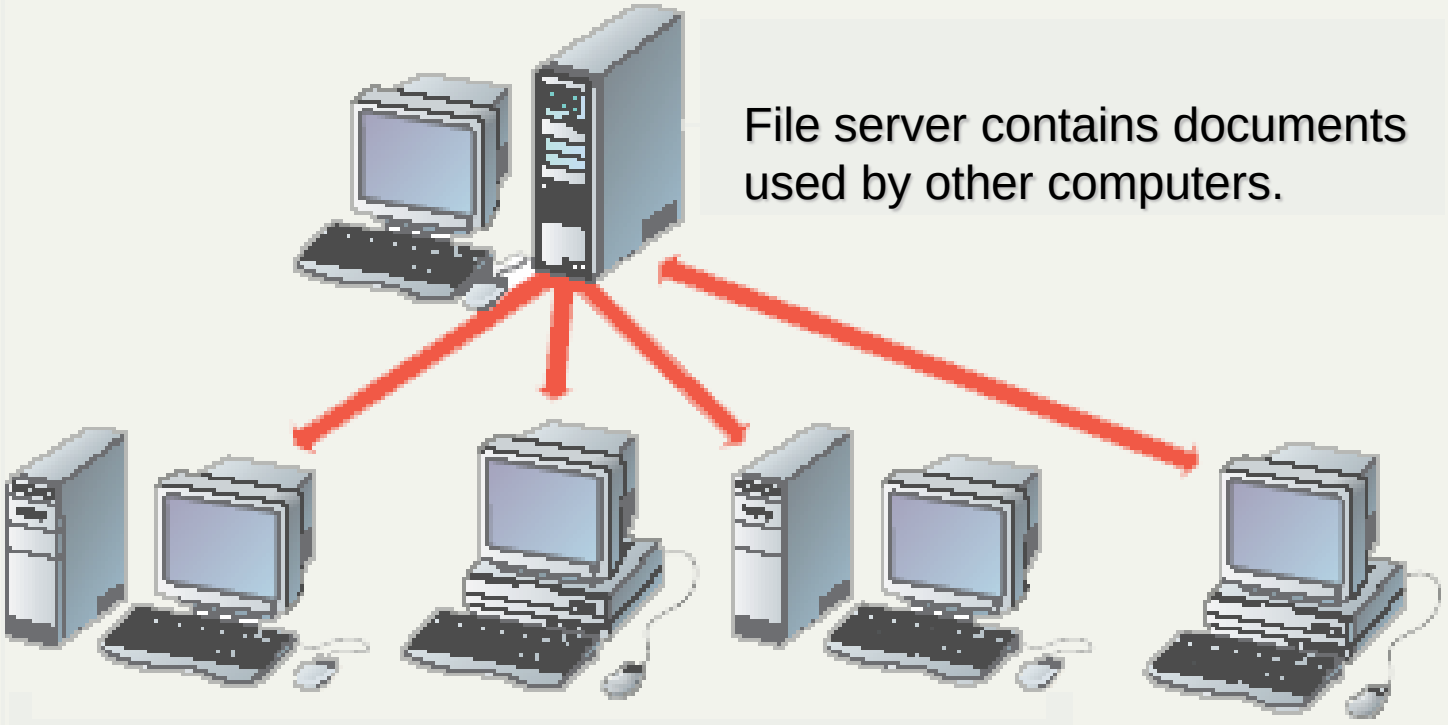
The Uses of a Network

- 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

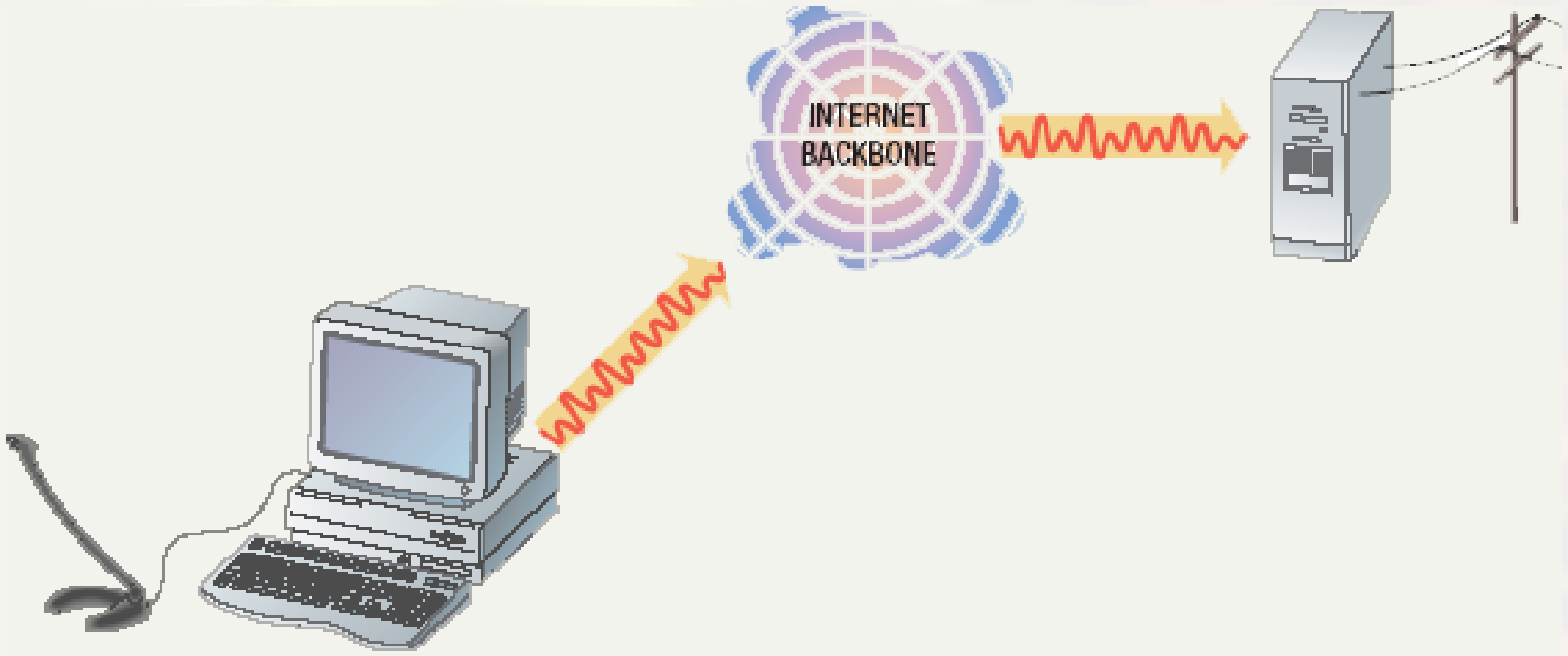


File server contains documents used by other computers.

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



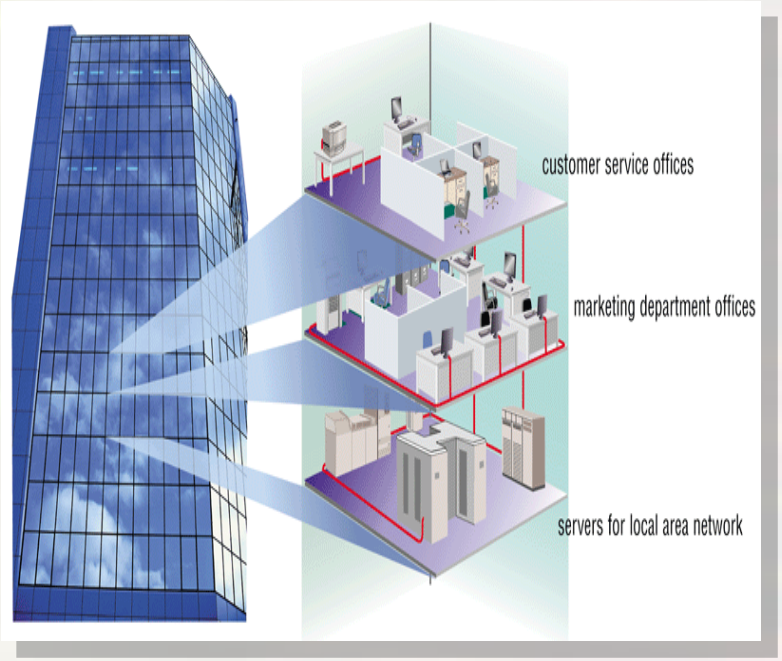
The Uses of a Network

- Easier data backup
  - Backup copies data to removable media
  - Server data backed up in one step

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

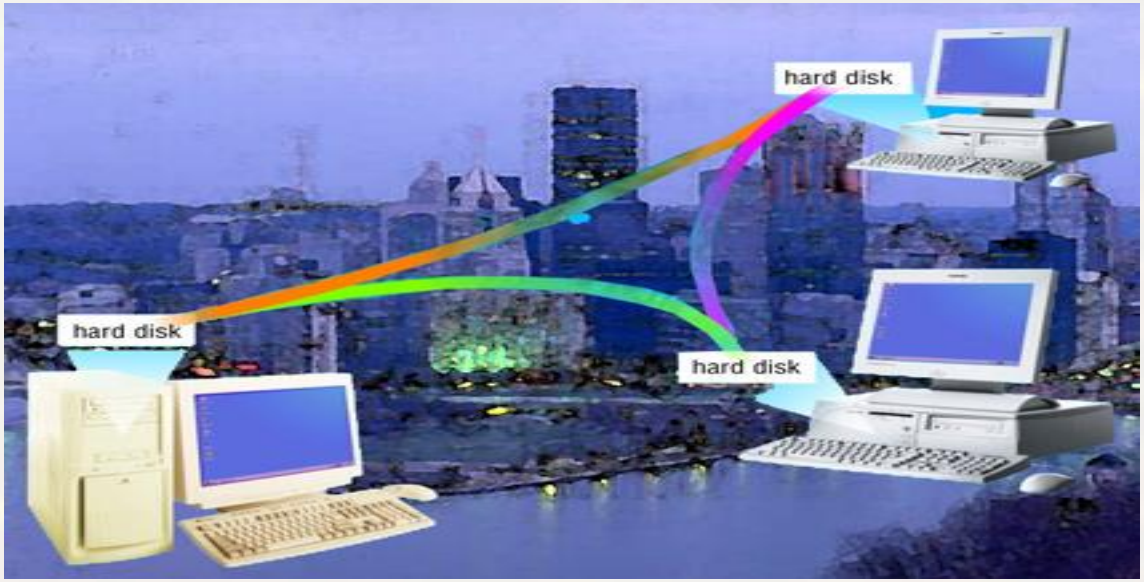
Campus Area Networks (CAN)

- 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

Network Architecture

- The design of computers, devices, and media on a network is sometimes called the **network architecture**.

Can be categorized as:

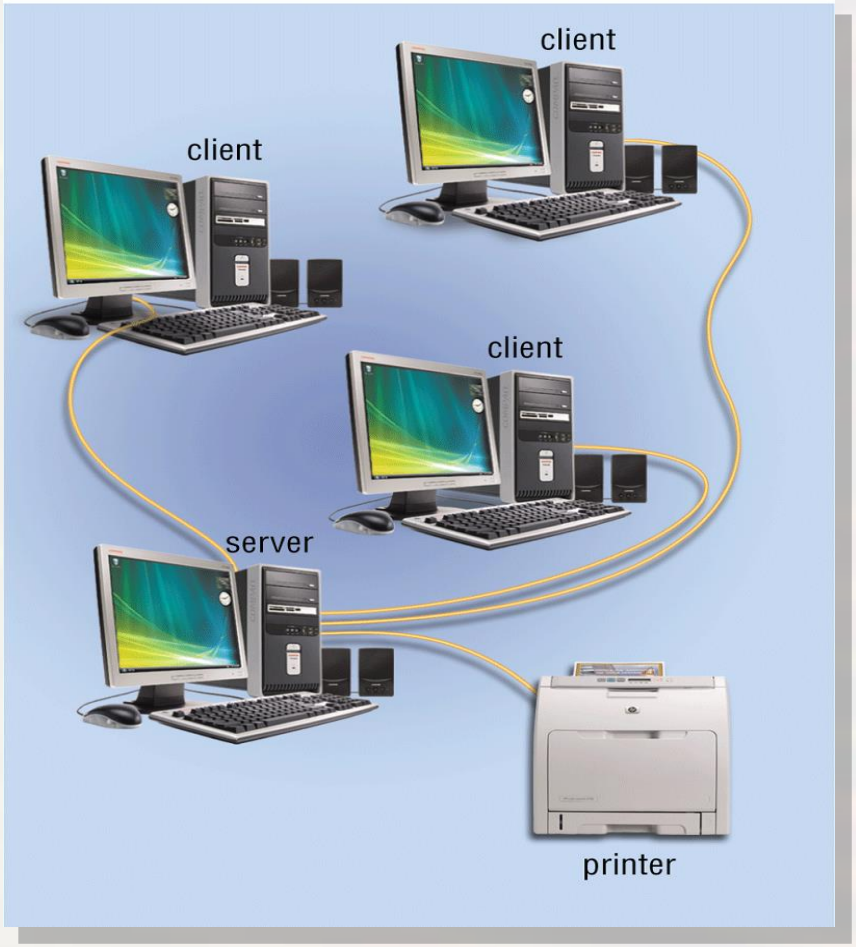
- **Client/server network**
- **Peer-to-peer network**
- **Internet Peer-to-peer network**

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

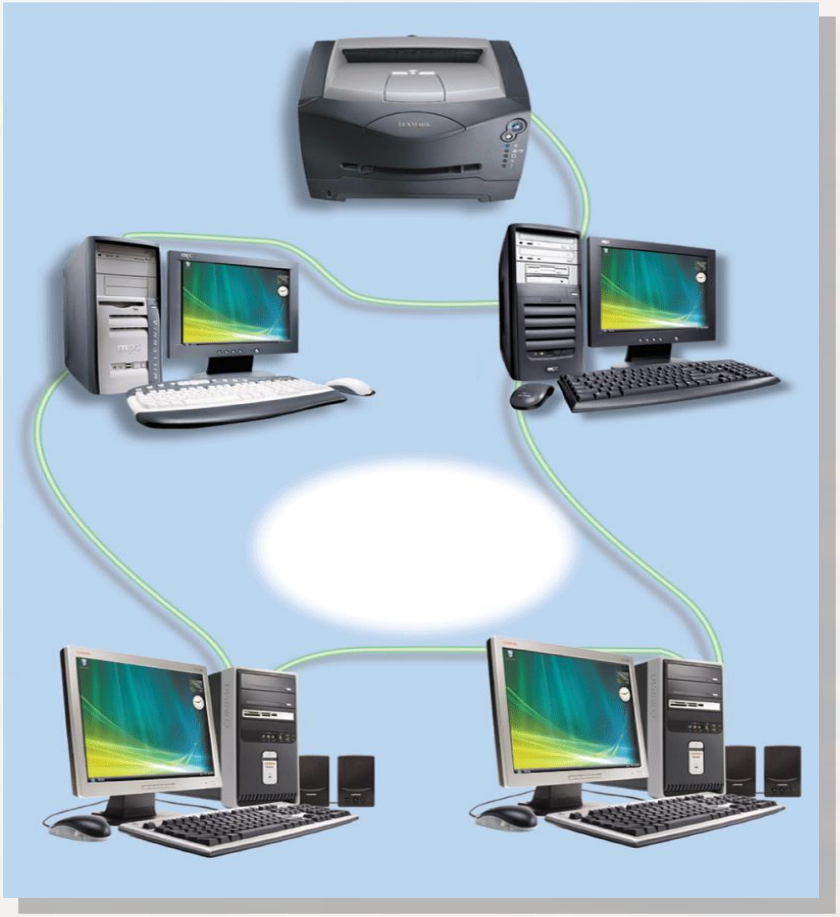
How Networks Are Structured

- **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
  - Server is the most important computer



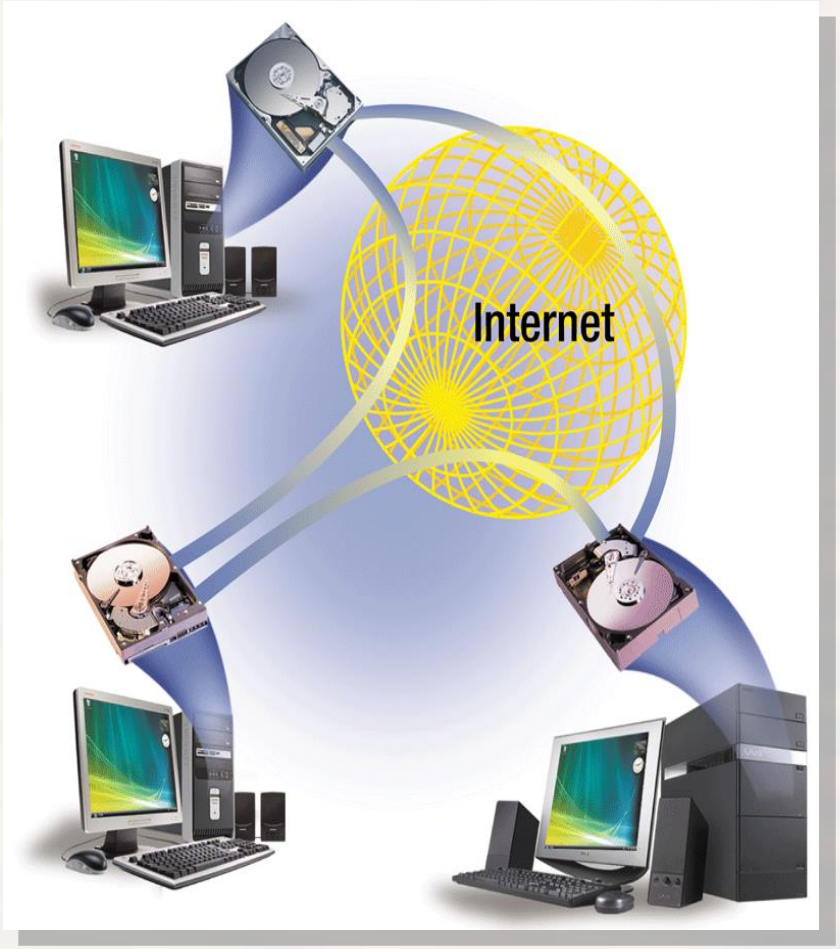
How Networks Are Structured

- **Peer –to- peer network**
  - **Simple network that connects fewer than 10 computers**
  - **Each computer, or peer, has equal capabilities**



How Networks Are Structured

- **Internet 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
  - Distributing computing is a form



Network Topologies

- A **Network topology** refers to the layout of the computers and devices in a communication network.
  - Star Network
  - Bus Network
  - Ring Network
  - Mesh Network
  - Tree Network

Network Topologies

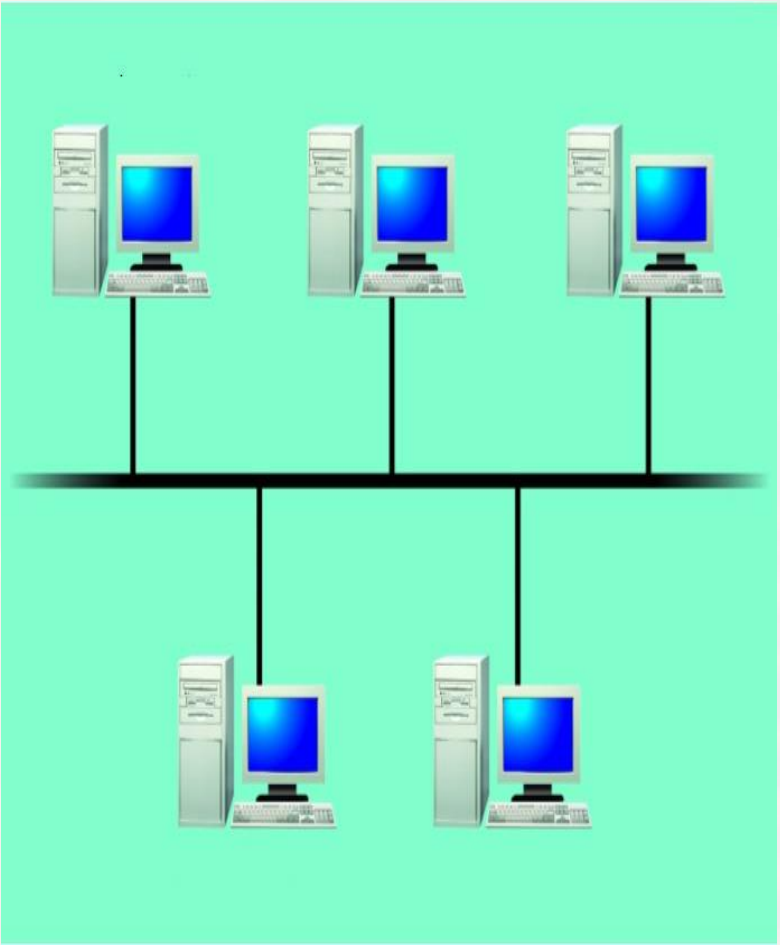
- Topology
  - Choice affects
    - Network performance
    - Network size
    - Network collision detection
  - Several different types

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

Network Topologies

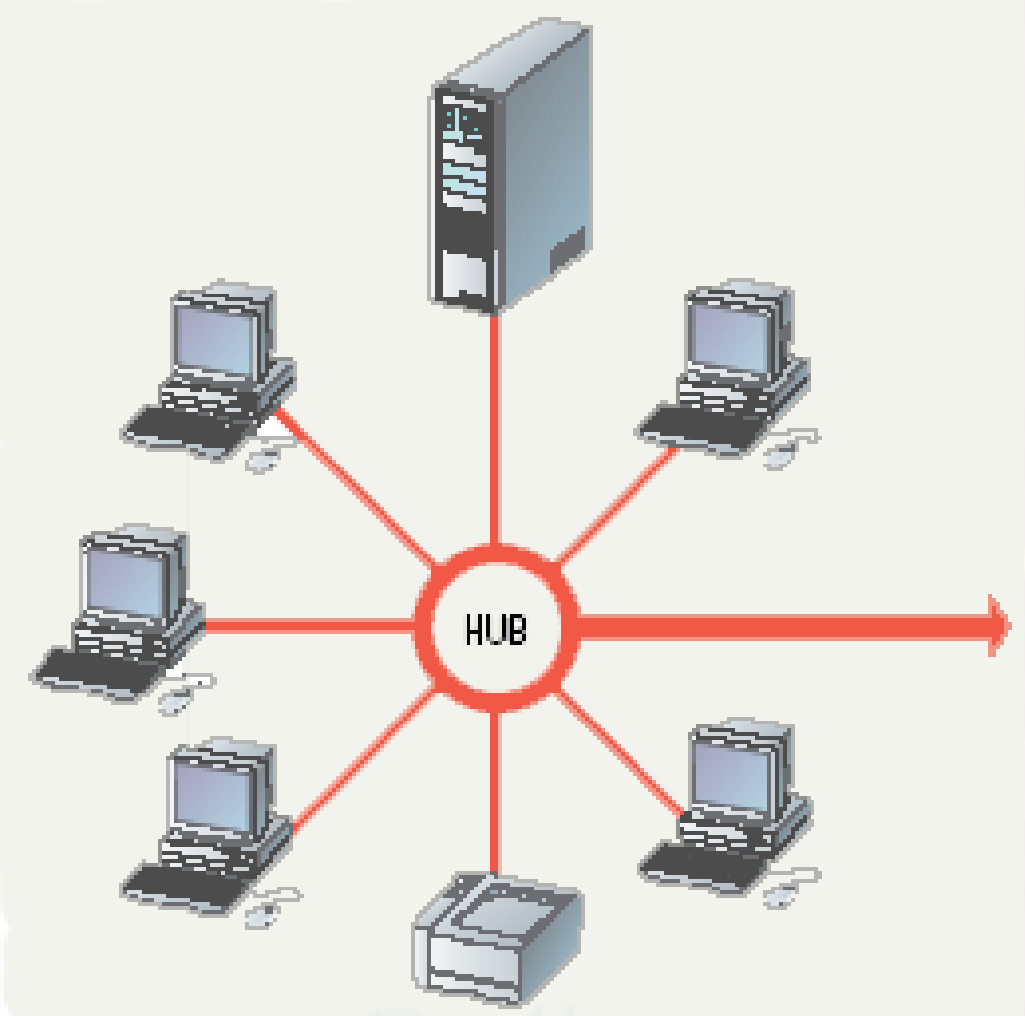
- Bus topology
  - Also called linear bus
  - One wire connects all nodes
  - Terminator ends the wires
  - Advantages
    - Easy to setup
    - Small amount of wire
  - Disadvantages
    - Slow
    - Easy to crash



Network Topologies

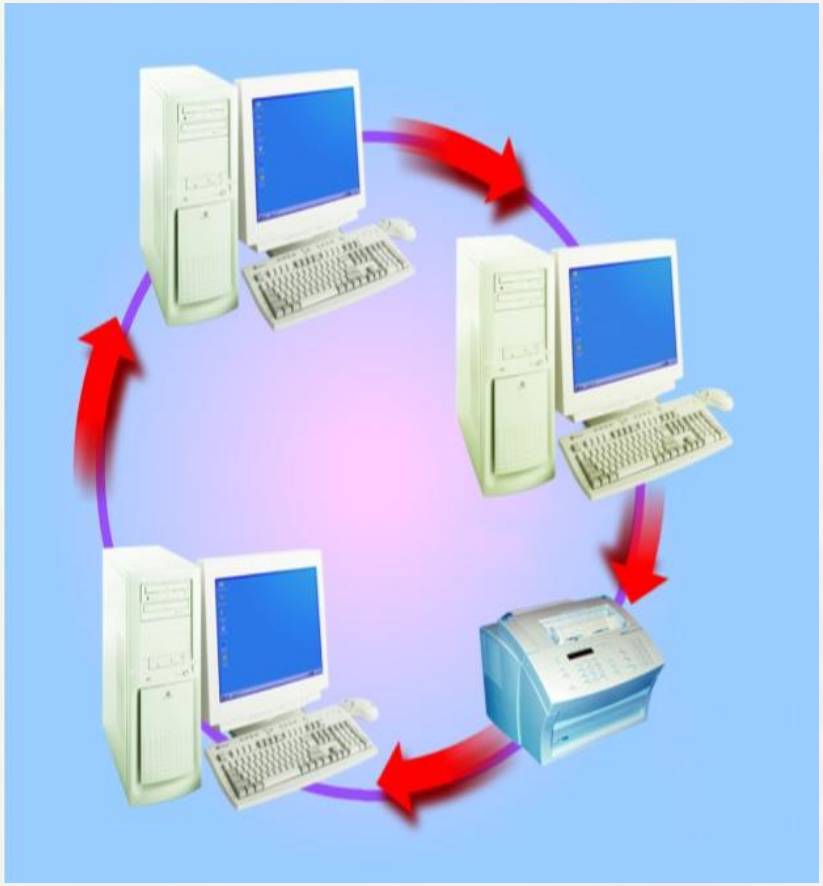
- Star topology
  - All nodes connect to a hub
    - Packets sent to hub
    - Hub sends packet to destination
  - Advantages
    - Easy to setup
    - One cable can not crash network
  - Disadvantages
    - One hub crashing downs entire network
    - Uses lots of cable
  - Most common topology

Star Topology



Network Topologies

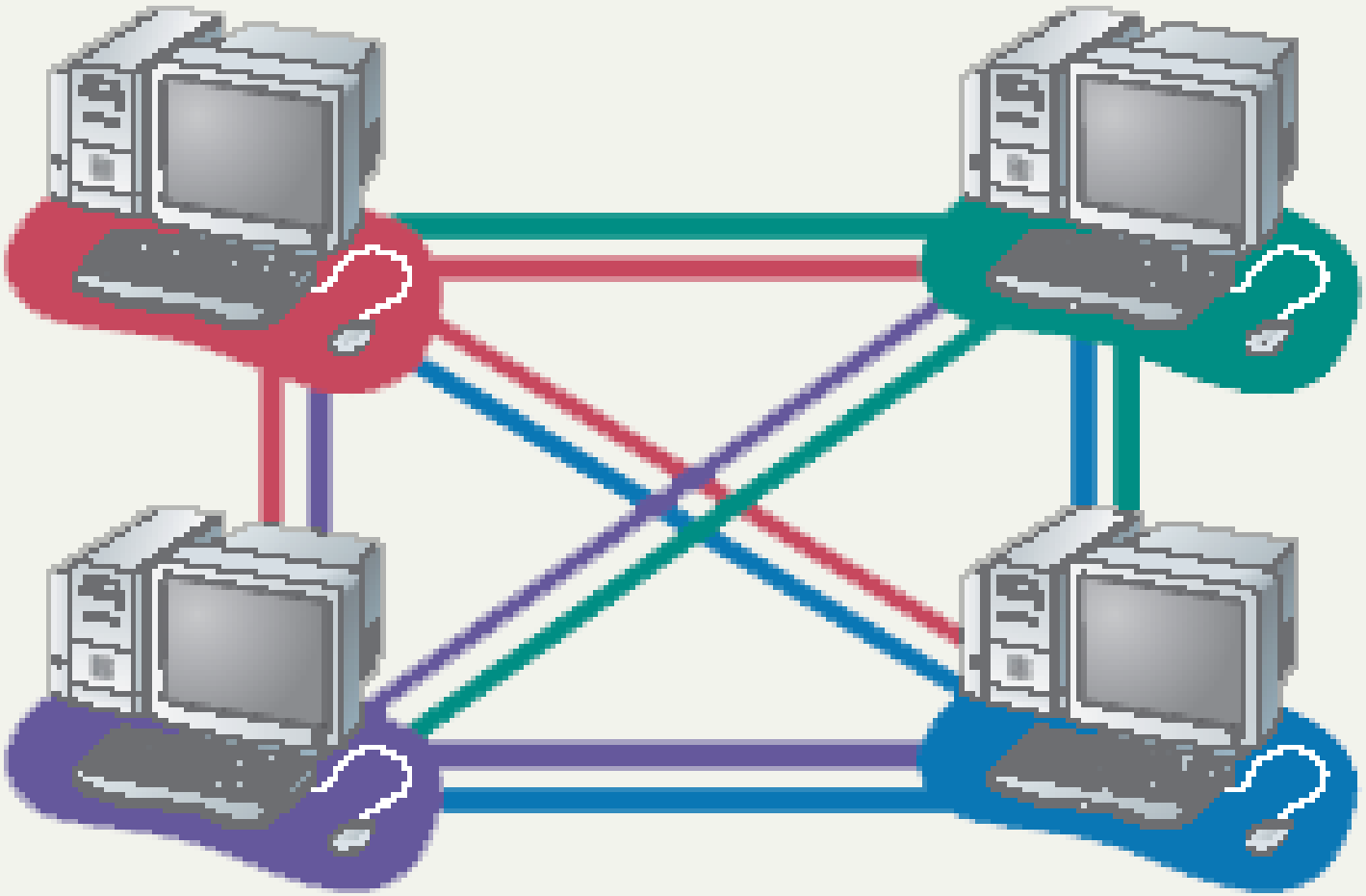
- Ring topology
  - Nodes connected in a circle
  - Tokens used to transmit data
    - Nodes must wait for token to send
  - Advantages
    - Time to send data is known
    - No data collisions
  - Disadvantages
    - Slow
    - Lots of cable



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

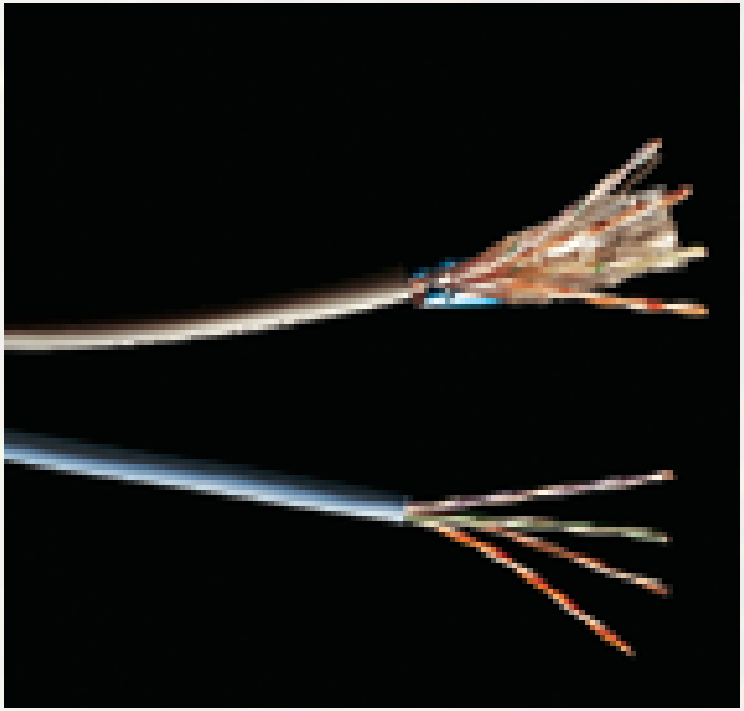


Network Media

- 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



Wire Based Media

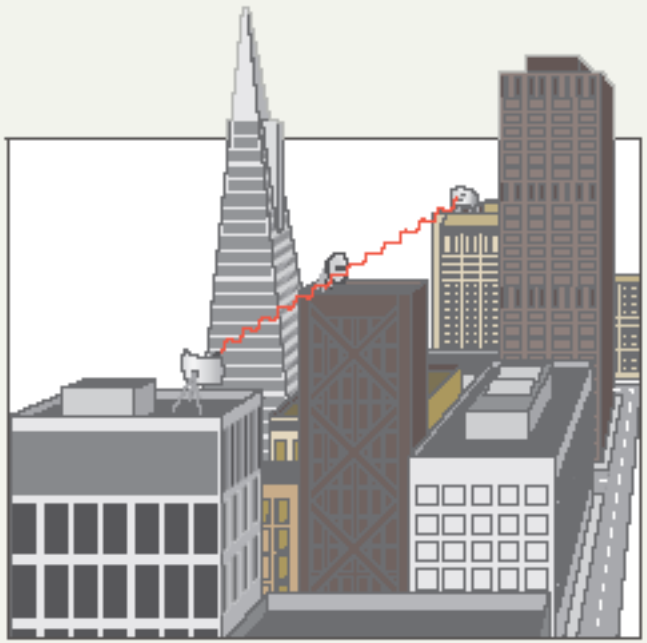
- Coaxial cable
  - Similar to cable TV wire
  - One wire runs through cable
  - Shielded from interference
  - Speeds up to 10 Mbps
  - Nearly obsolete

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

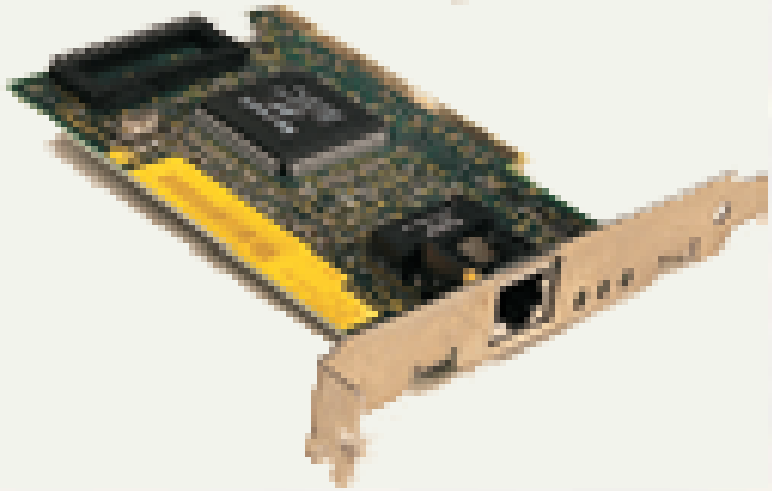
Wireless Media

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



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 distances100 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
  - Uses shielded twisted pair cabling
  - Bandwidth between 10 and 25 Mbps
  - Uses a multiple access unit (MAU)
  - Popular in manufacturing and finance

Network Protocols

- Language of the network
  - Rules of communication
  - Error resolution
  - Defines collision and collision recovery
  - Size of packet
  - Naming rules for computers

Network Protocols

- TCP/IP
  - Transmission Control Protocol/Internet Protocol
  - Most popular protocol
  - Machines assigned a name of 4 numbers
    - IP address
    - 209.8.166.179 is the White House's web site
  - Dynamic Host Configuration Protocol
    - Simplifies assignment of IP addresses
  - Required for Internet access

Network Protocols

- IPX/SPX
  - Internet Packet Exchange/Sequenced Packet Exchange
  - Older protocol
  - Associated with Novell Netware
  - Replaced by TCP/IP

Network Protocols

- NetBEUI
  - Network BIOS Extended User Interface
  - Used by Windows to name computers
  - Transmission details handled by TCP/IP

Network Protocols

- Token ring
  - Popular in manufacturing and finance
  - Nodes communicate when they have the token

End of Presentation

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