

LANs, MANs, and WANs

- LAN (local area network)
 - Network confined to a relatively small space
 - 1980s
 - LANs became popular as peer-to-peer based
 - Today
 - Larger and more complex client/server network
- MAN (metropolitan area network)
 - Network extends beyond building boundaries
 - Larger than LAN
 - Connects clients and servers from multiple buildings

LANs, MANs, and WANs (cont'd.)

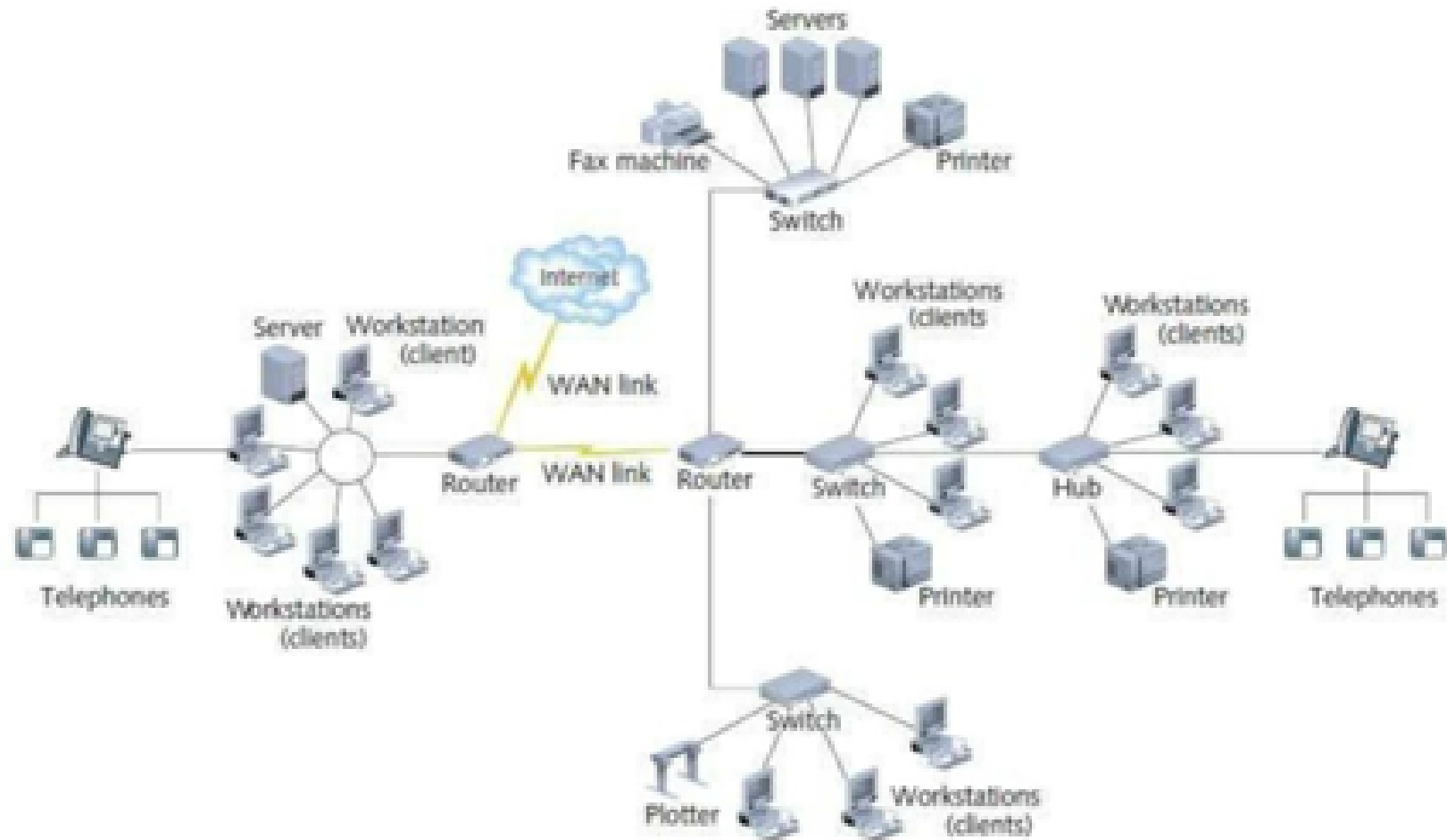


Figure 1-3 A more complex client/server network

LANs, MANs, and WANs (cont'd.)

- WAN (wide area network)
 - Connects two or more geographically distinct LANs or MANs
 - Comparison to LANs
 - Use slightly different transmission methods and media
 - Use greater variety of technologies
 - Network connection
 - Separate offices in same organization
 - Separate offices in different organizations

LANs, MANs, and WANs (cont'd.)

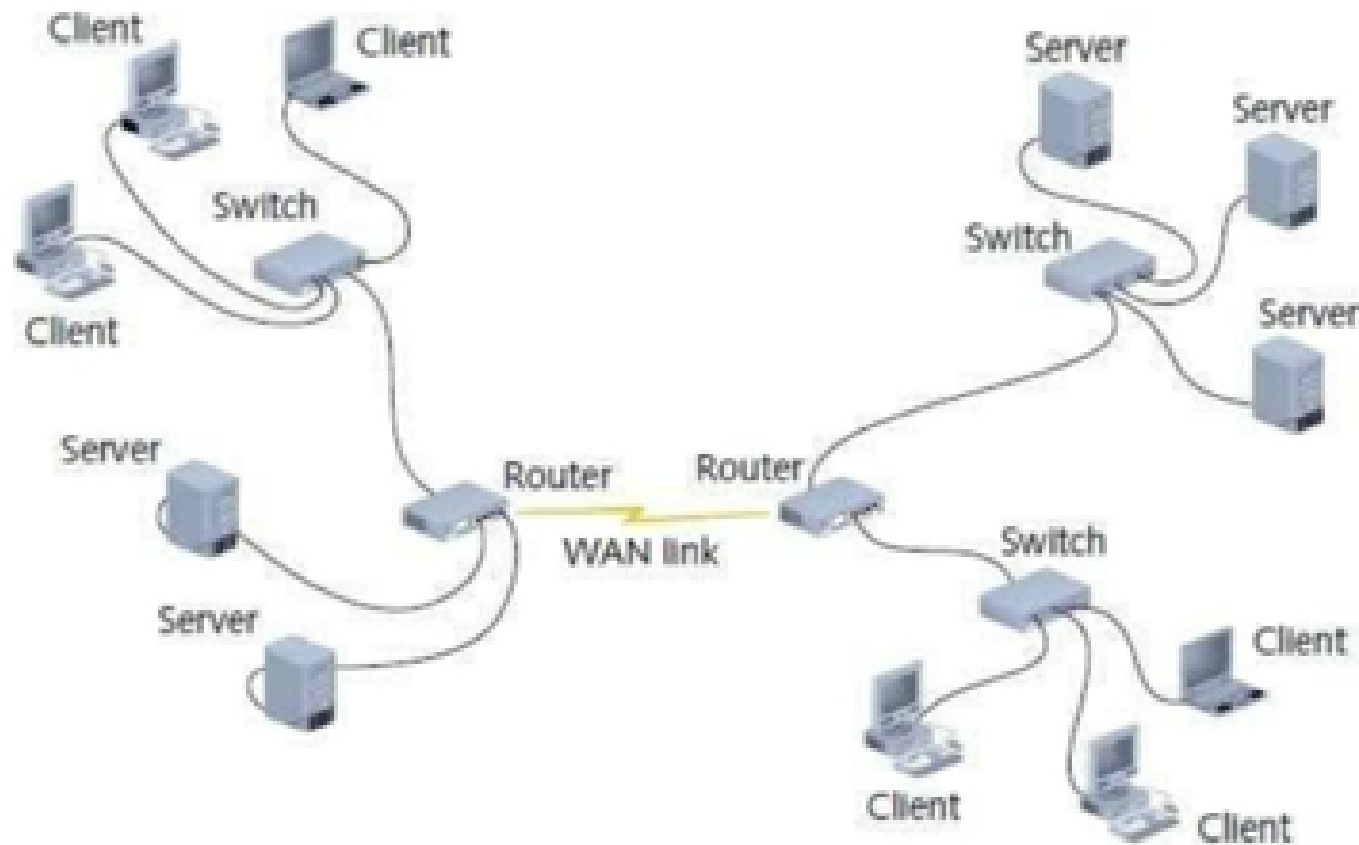


Figure 1-4 A simple WAN

Elements Common to Client/Server Networks

- Client
 - Network computer requesting resources or services from another network computer
 - Client workstation human user
 - Client software installed on workstation
- Server
 - Network computer managing shared resources
 - Runs network operating system
- Workstation
 - Personal computer
 - May or may not be connected to network

Elements Common to Client/Server Networks (cont'd.)

- NIC (network interface card)
 - Device inside computer
 - Connects computer to network media
 - Allows communication with other computers
- NOS (network operating system)
 - Server software
 - Enables server to manage data, users, groups, security, applications, and other networking functions

Elements Common to Client/Server Networks (cont'd.)



Figure 1-5 A NIC (network interface card)

Elements Common to Client/Server Networks (cont'd.)

- Host
 - Computer
 - Enables network resource sharing by other computers
- Node
 - Client, server, or other device
 - Communicates over a network
 - Identified by unique number (network address)
- Connectivity device
 - Allows multiple networks or multiple parts of one network to connect and exchange data

Elements Common to Client/Server Networks (cont'd.)

- Segment
 - Group of nodes
 - Use same communications channel for traffic
- Backbone
 - Connects segments and significant shared devices
 - “A network of networks”
- Topology
 - Computer network physical layout
 - Ring, bus, star or hybrid formation

Elements Common to Client/Server Networks (cont'd.)

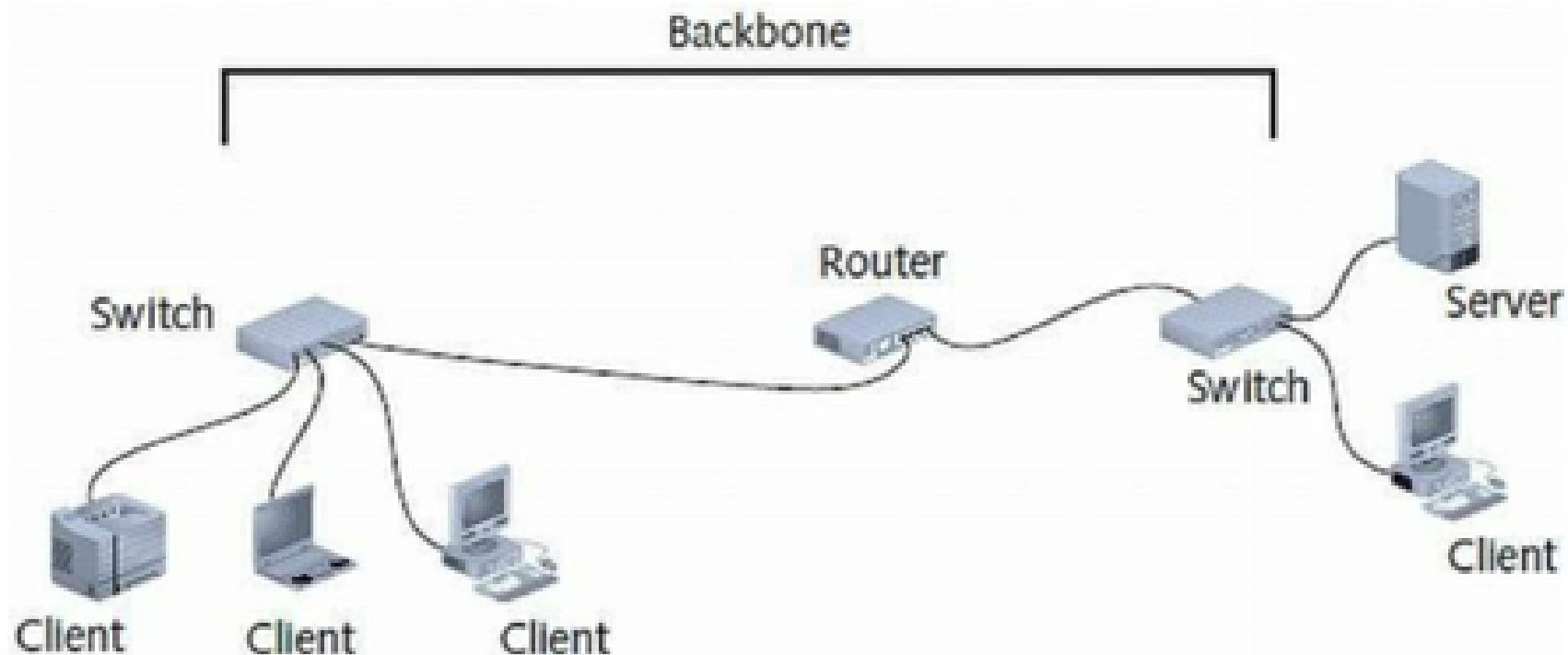


Figure 1-6 A LAN backbone

Elements Common to Client/Server Networks (cont'd.)

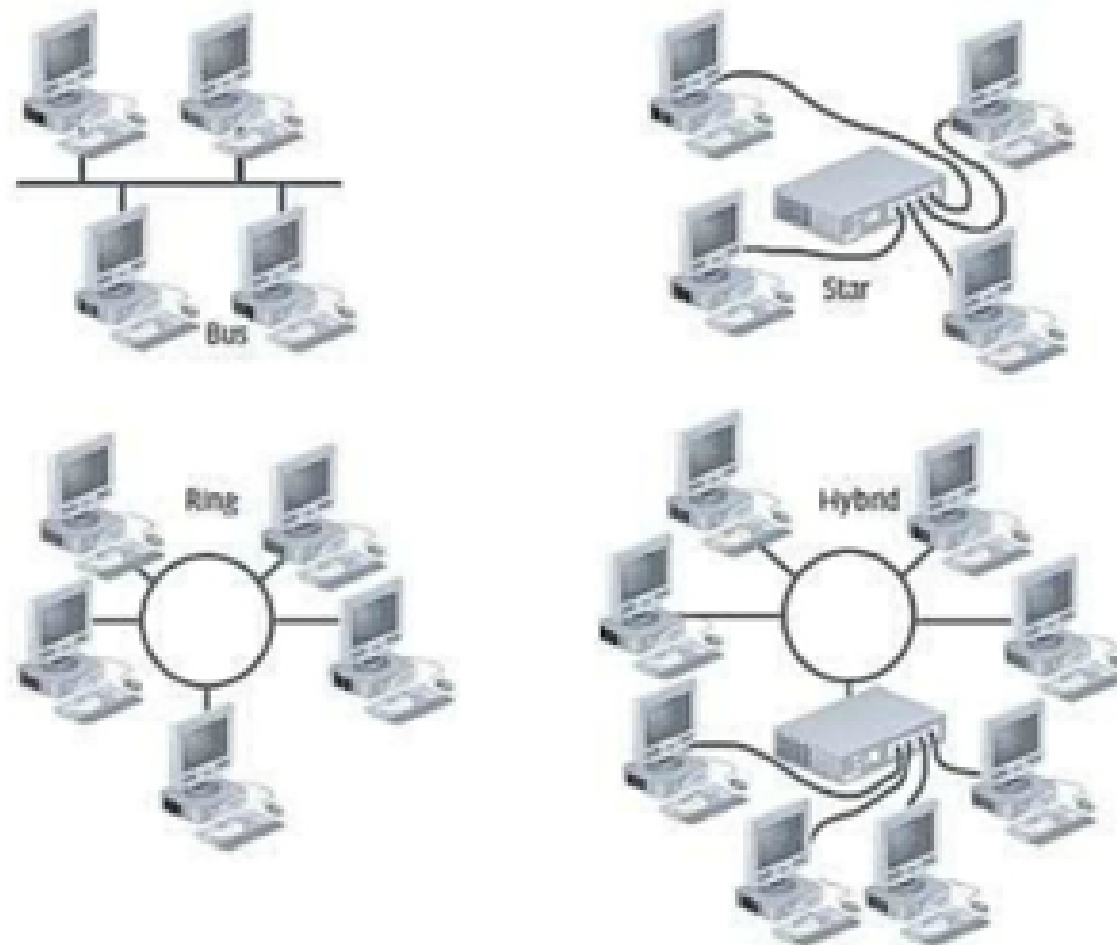


Figure 1-7 Common network topologies

Elements Common to Client/Server Networks (cont'd.)

- Protocol
 - Standard method or format for communication between networked devices
- Data packets
 - Distinct data units exchanged between nodes
- Addressing
 - Scheme for assigning unique identifying number to every node
- Transmission media
 - Means through which data is transmitted and received

Elements Common to Client/Server Networks (cont'd.)

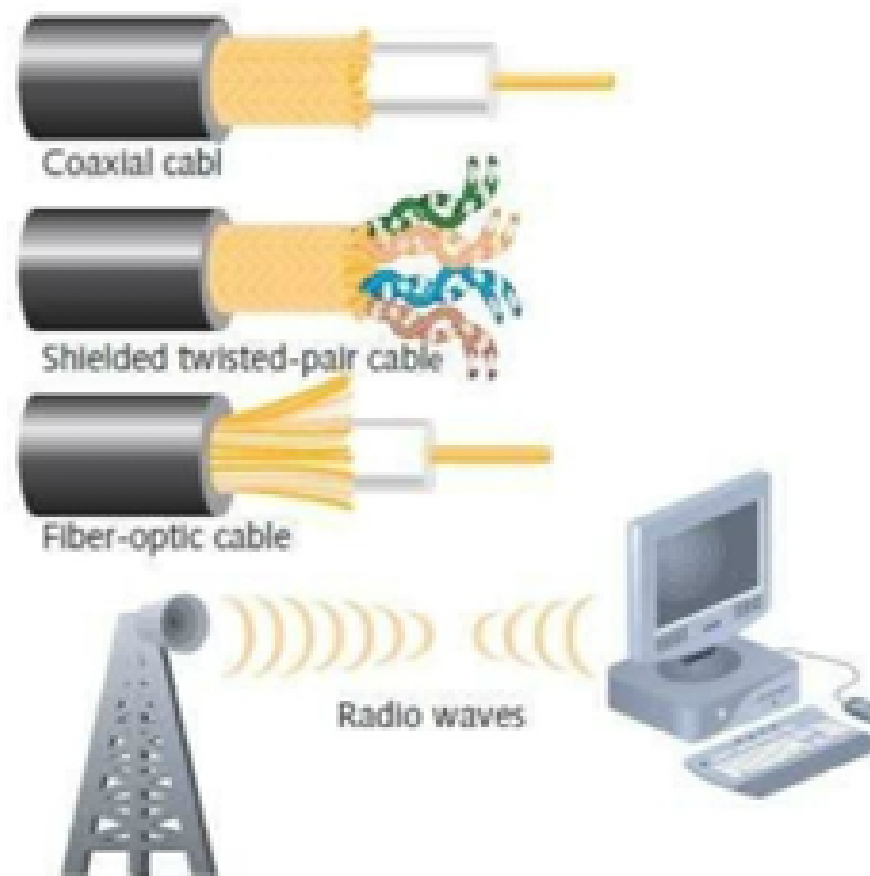


Figure 1-8 Examples of network transmission media

How Networks Are Used

- Network services
 - Functions provided by a network
 - Most visible
 - E-mail
 - Other vital services
 - Printer sharing, file sharing, Internet access and Web site delivery, remote access capabilities, the provision of voice (telephone) and video services, network management

File and Print Services

- File services
 - Capability of server to share data files, applications and disk storage space
- File server
 - Provides file services
- File services provide foundation of networking
- Print services
 - Share printers across network
 - Saves time and money

Access Services

- Allow remote user network connection
- Allow network users to connect to machines outside the network
- Remote user
 - Computer user on different network or in different geographical location from LAN's server
- Network operating systems include built-in access services

Access Services (cont'd.)

- Provide LAN connectivity when WAN connection is not cost-effective
 - External staff used to diagnose problems
- Allow external users to use network resources and devices
 - Same as if logged on to office workstation

Communications Services

- Convergence
 - Phenomenon of offering multiple types of communications services on the same network
- Unified communications
 - Multiple network-based communications centralized management
- E-mail
 - Oldest and most frequently used
- Mail server
 - Computer responsible for mail services
 - Coordinates storage and transfer of e-mail

Communications Services (cont'd.)

- Additional tasks of mail servers
 - Intercept spam
 - Handle objectionable content
 - Route messages according to rules
 - Provide Web-based client
 - Notify administrators or users if certain events occur
 - Schedule e-mail transmission, retrieval, storage, maintenance functions
 - Communicate with mail servers on other networks
- Mail server runs specialized mail server software

Internet Services

- Supplying Web pages
 - Servers work together to bring Web pages to user's desktop
 - Web server
 - Computer installed with appropriate software to supply Web pages to many different clients upon demand
- Other Internet services
 - File transfer capabilities, Internet addressing schemes, security filters, means for directly logging on to other Internet computers

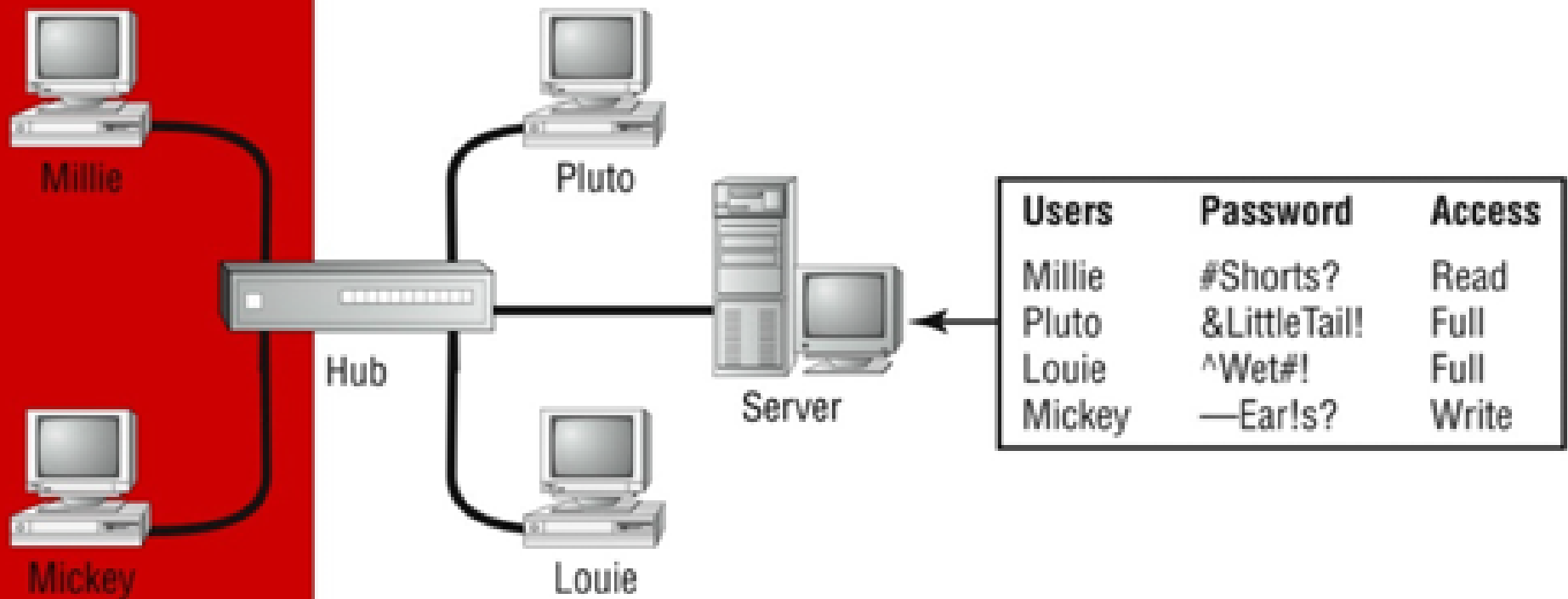
Management Services

- Small network management
 - Single network administrator
 - Network operating system's internal functions
- Today's larger network management
 - Centrally administered network management tasks

Management Services (cont'd.)

- Other important services
 - Traffic monitoring and control
 - Load balancing
 - Hardware diagnosis and failure alert
 - Asset management
 - License tracking
 - Security auditing
 - Address management
 - Backup and restoration of data

Client Server Networks

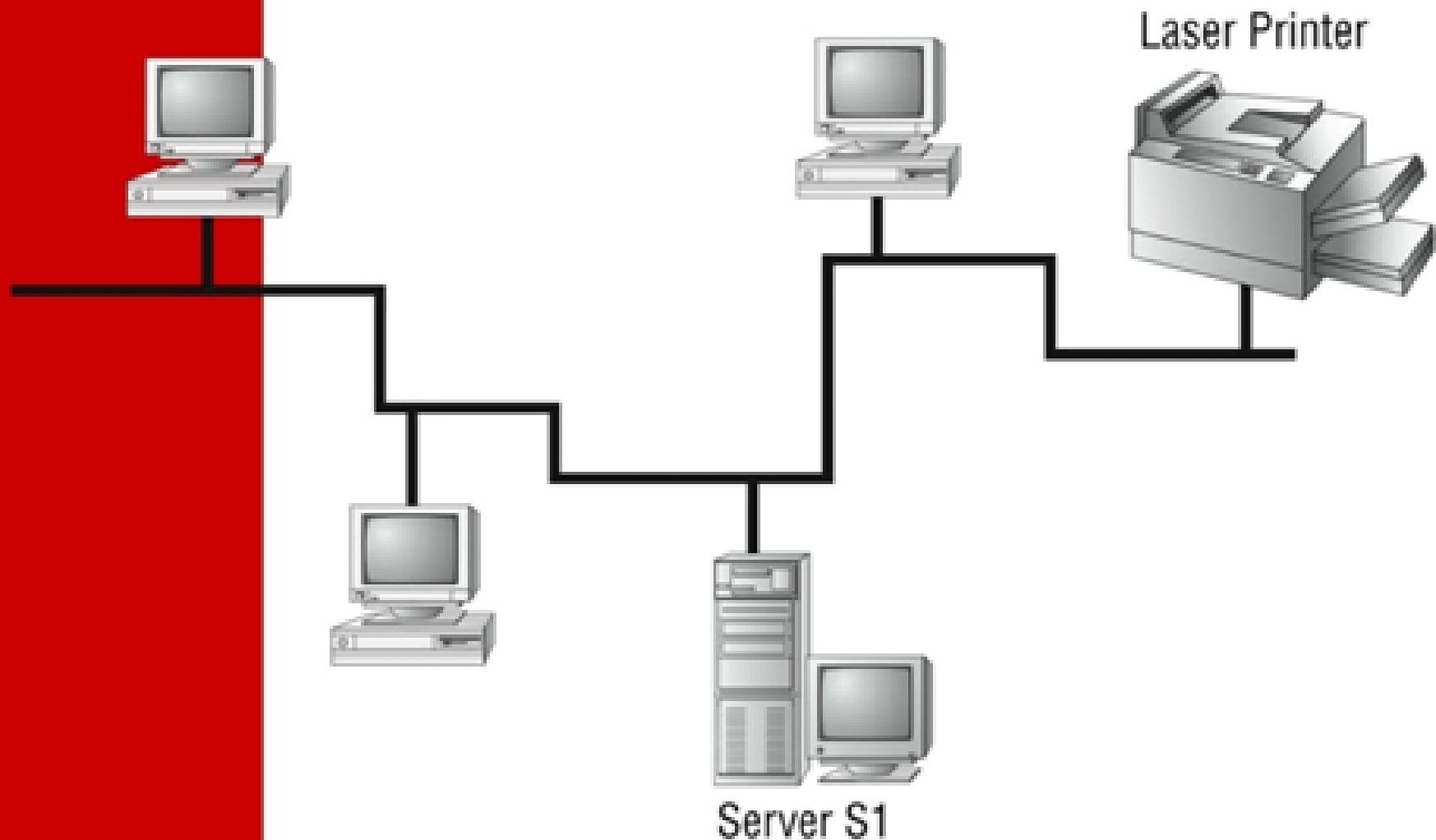


Physical Topologies

Here is a list of the various topologies you're most likely to run in to these days:

- Bus
- Star
- Ring
- Mesh
- Point-to-point
- Point-to-multipoint
- Hybrid

A Physical Bus Topology



Simple Physical Topologies

- Physical topology
 - Physical network nodes layout
 - Depicts broad scope
 - Does not specify:
 - Device types
 - Connectivity methods
 - Addressing schemes
 - Fundamental shapes
 - Bus, ring, star
 - Hybrid

Bus

- Bus topology
 - Bus
 - Single cable
 - Connecting all network nodes
 - No intervening connectivity devices
 - One shared communication channel
 - Physical medium
 - Coaxial cable
 - Passive topology
 - Node listens for, accepts data
 - Use broadcast to send

Bus (cont'd.)

- Bus topology (cont'd.)
 - Broadcast domain
 - Node communicates using broadcast transmission
 - Terminators
 - 50-ohm resistors
 - Stops signal at end of wire
 - Signal bounce
 - Signal travel endlessly between two network ends
 - One end grounded
 - Removes static electricity

Bus (cont'd.)

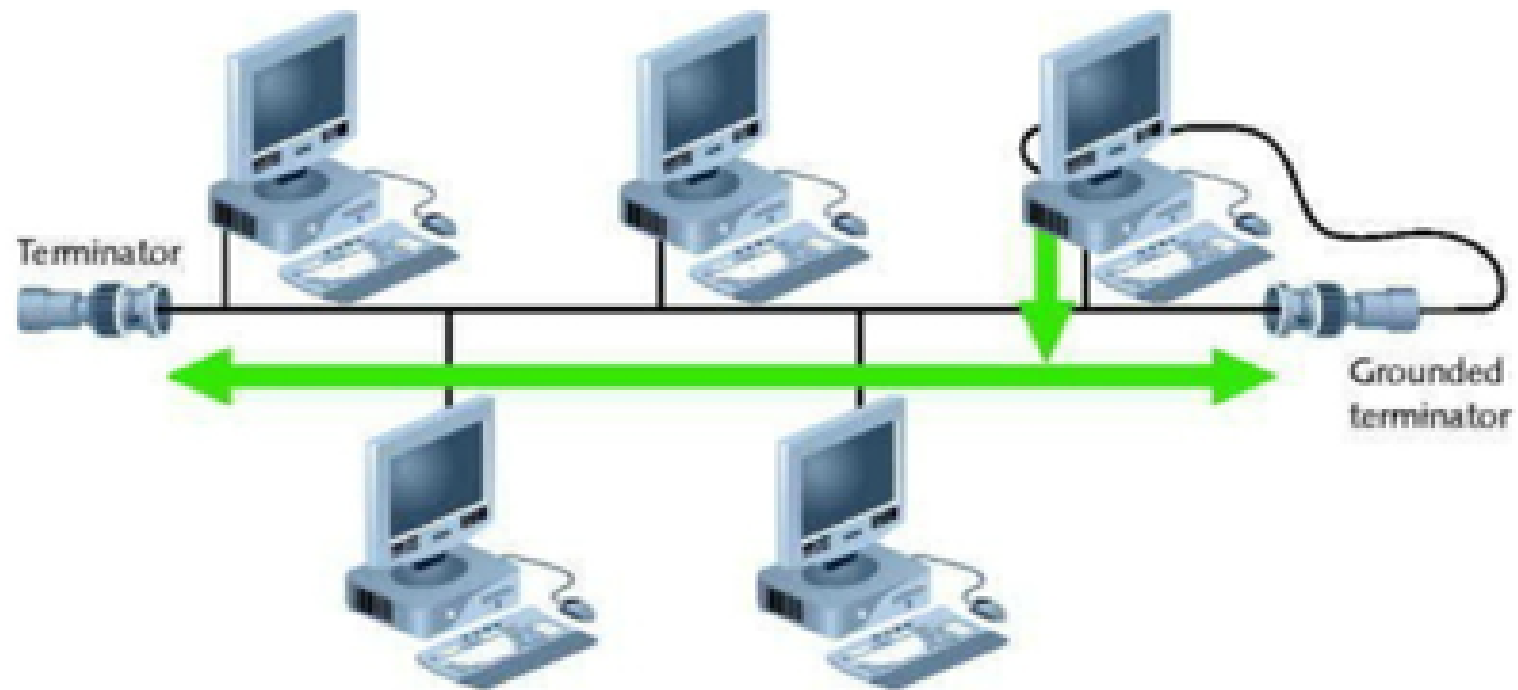
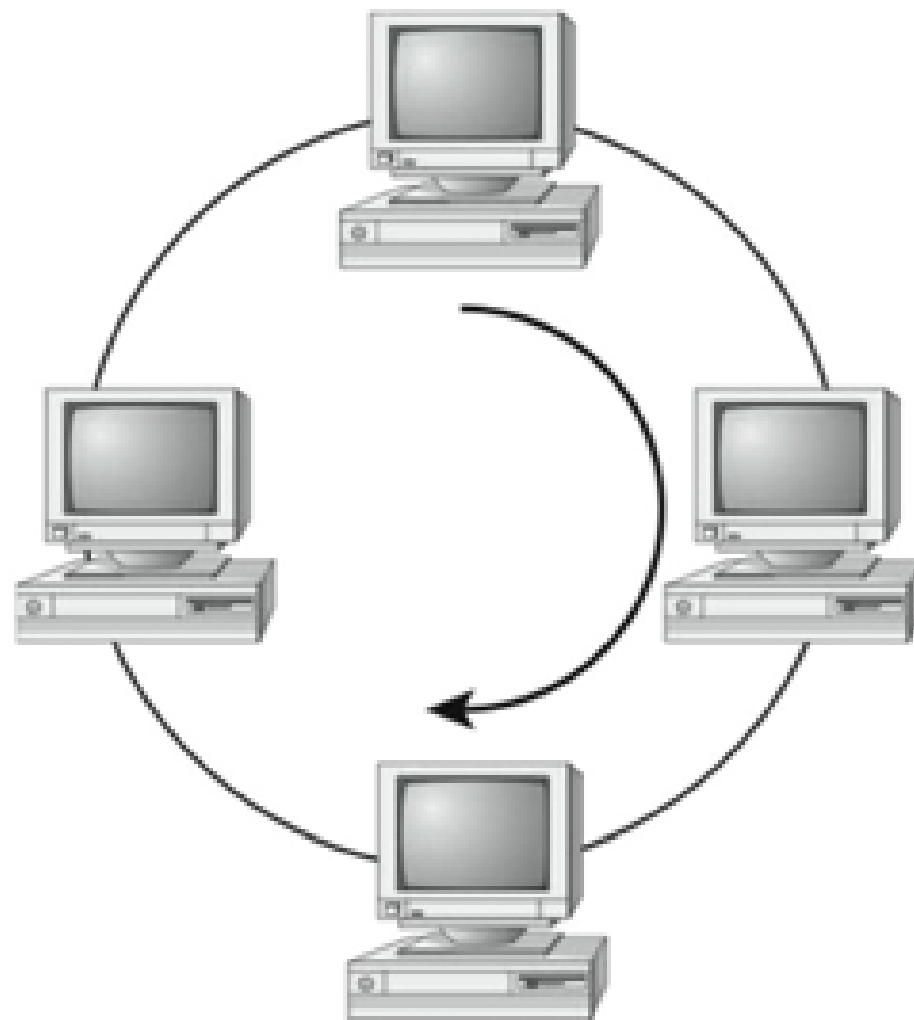


Figure 5-1 A terminated bus topology network

Bus (cont'd.)

- Advantages
 - Relatively inexpensive
- Disadvantage
 - Does not scale well
 - Difficult to troubleshoot
 - Not very fault tolerant

A Physical Ring Topology



Ring

- Ring topology
 - Node connects to nearest two nodes
 - Circular network
 - Clockwise data transmission
 - One direction (unidirectional) around ring
 - Active topology
 - Workstation participates in data delivery
 - Data stops at destination
 - Physical medium
 - Twisted pair or fiber-optic cabling

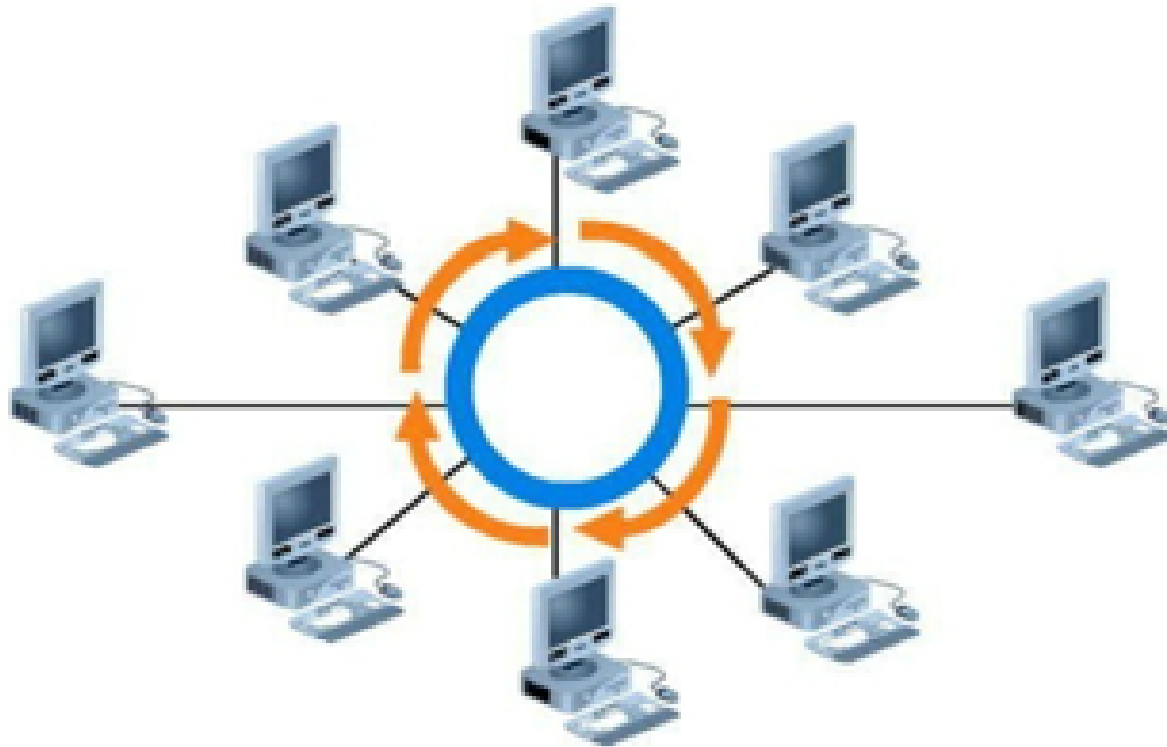
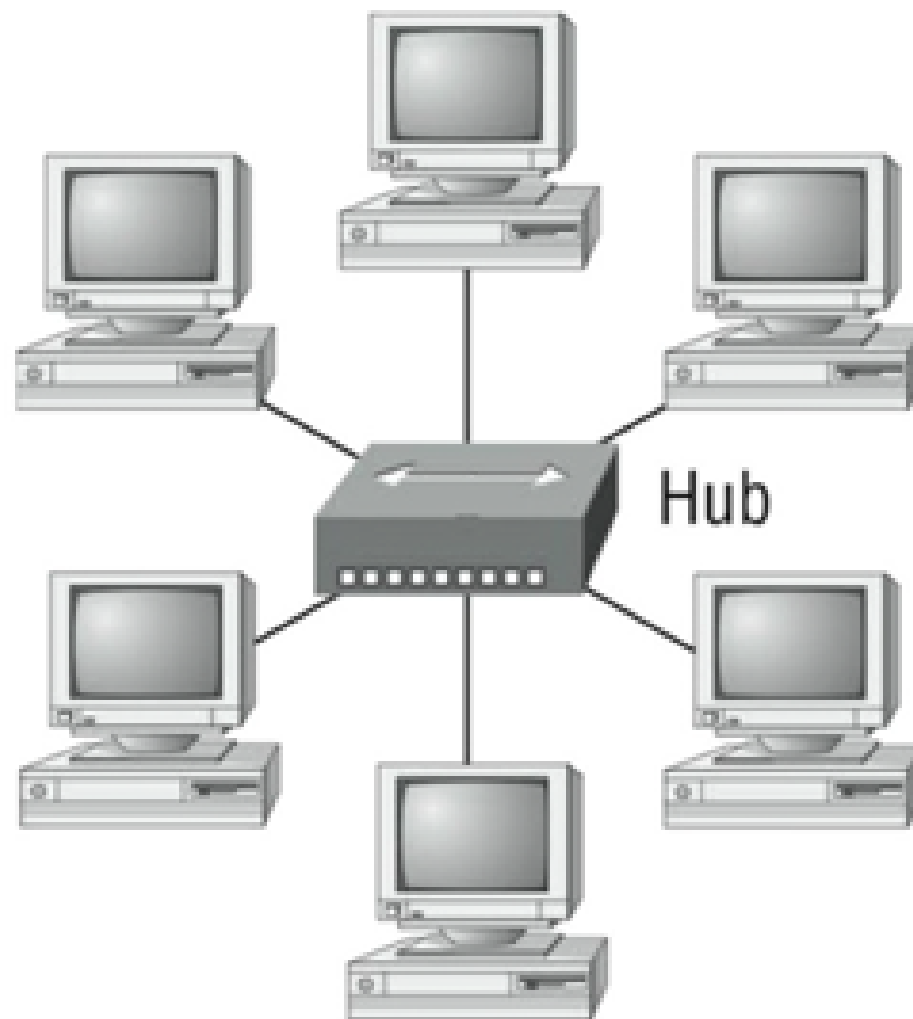


Figure 5-2 A typical ring topology network

- Drawback
 - Malfunctioning workstation can disable network
 - Not flexible or scalable

Physical Star Topology



Star

- Star topology
 - Node connects through central device
 - Physical medium
 - Twisted pair or fiber-optic cabling
 - Single cable connects two devices
 - Require more cabling, configuration
- Advantage
 - Fault tolerance
 - Centralized connection point affects LAN segment
 - Scalable

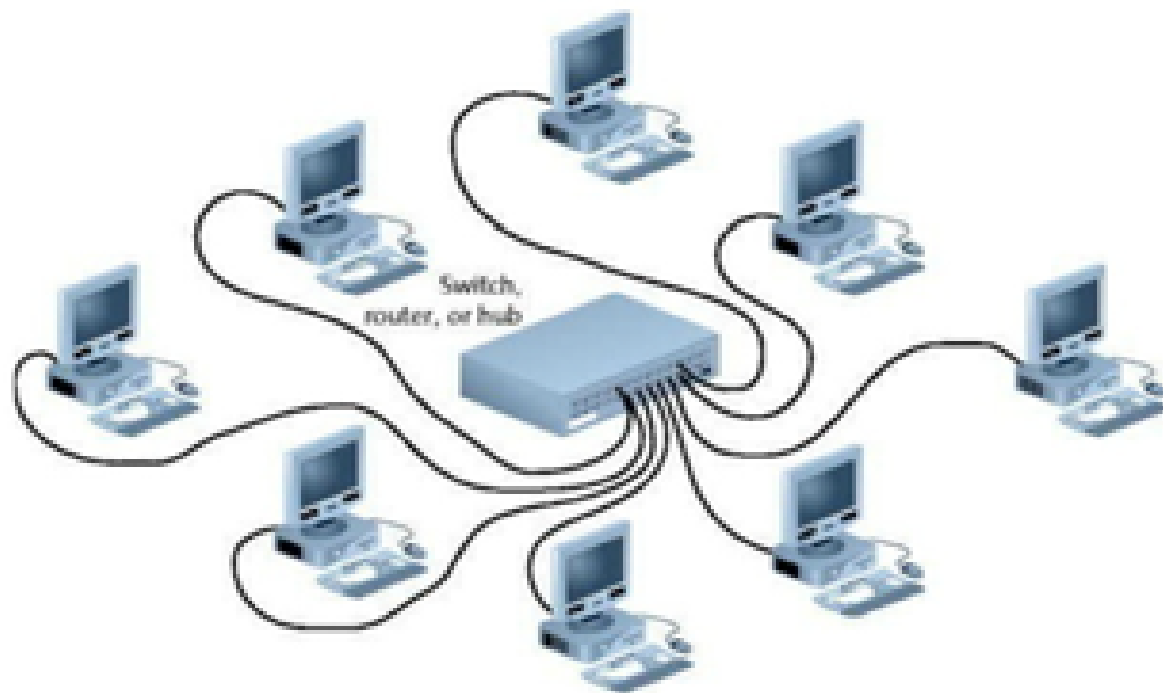


Figure 5-3 A typical star topology network

- Most popular fundamental layout
 - Ethernet networks based on star topology
- 1024 addressable logical network nodes maximum

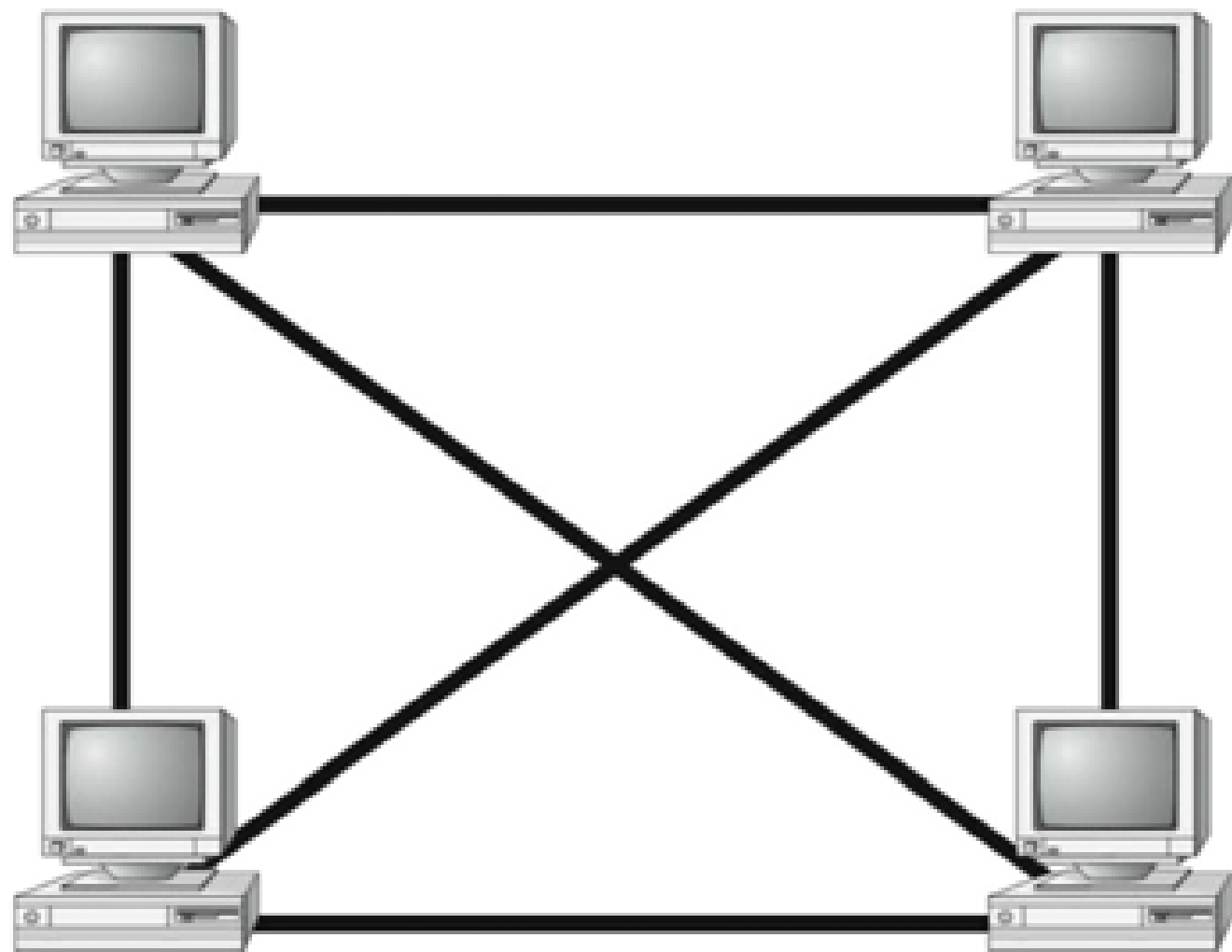
Logical Topologies

- Describes data transmission between nodes
- Most common: bus, ring
- Bus logical topology
 - Signals travel from one device to all other devices
 - May or may not travel through intervening connectivity device
 - Bus logical topology used by networks with:
 - Physical bus topology
 - Star, star-wired bus topology
 - Ethernet

Logical Topologies (cont'd.)

- Ring logical topology
 - Signals follow circular path
 - Ring logical topology used by networks with:
 - Pure ring topology
 - Star-wired ring hybrid physical topology
 - Token ring

A Physical MESH Topology



Point-to-point Topologies

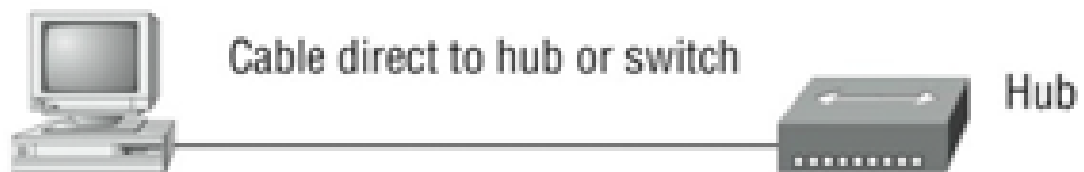
Serial connection, like a T1 between routers



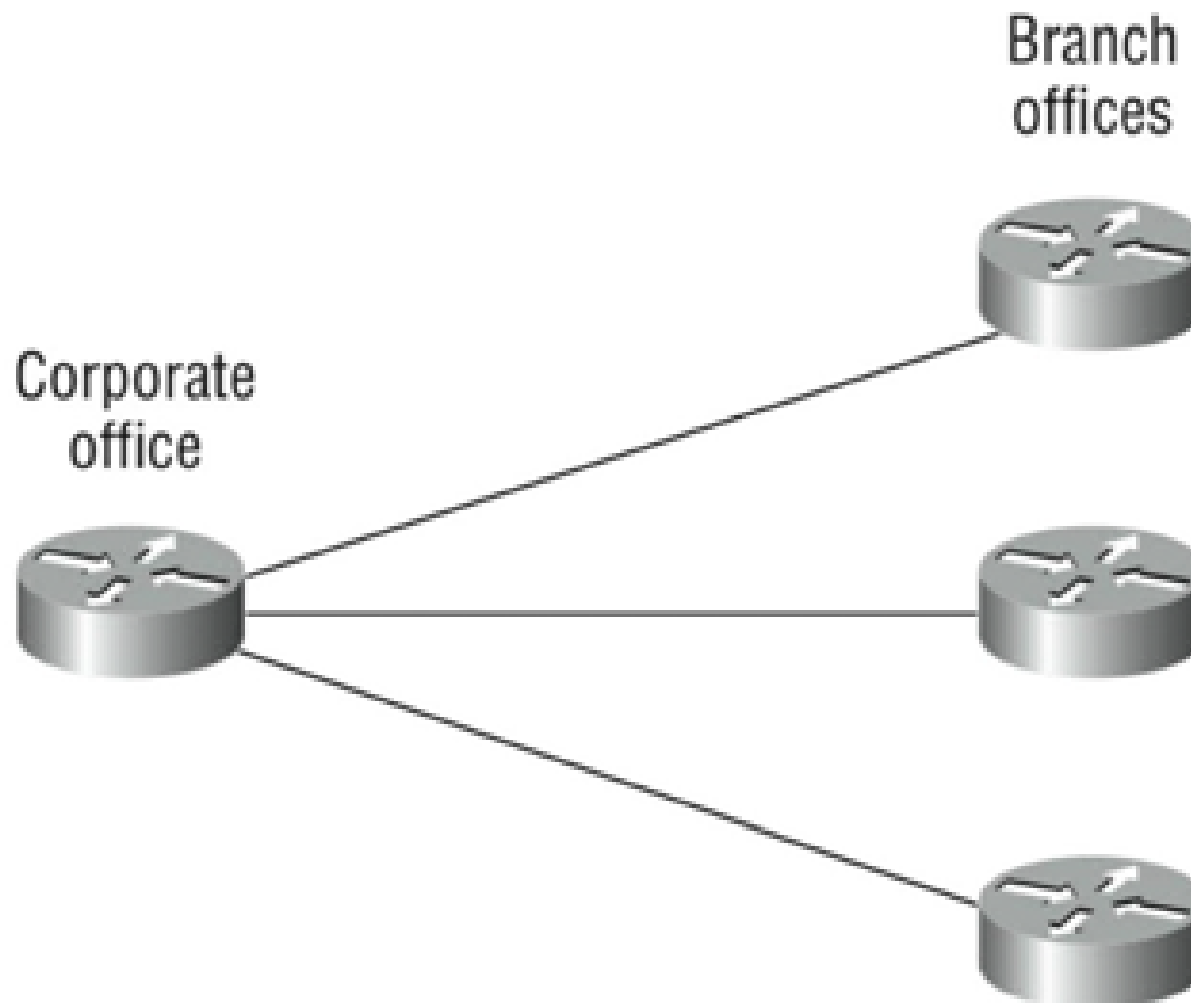
Direct Ethernet or wireless



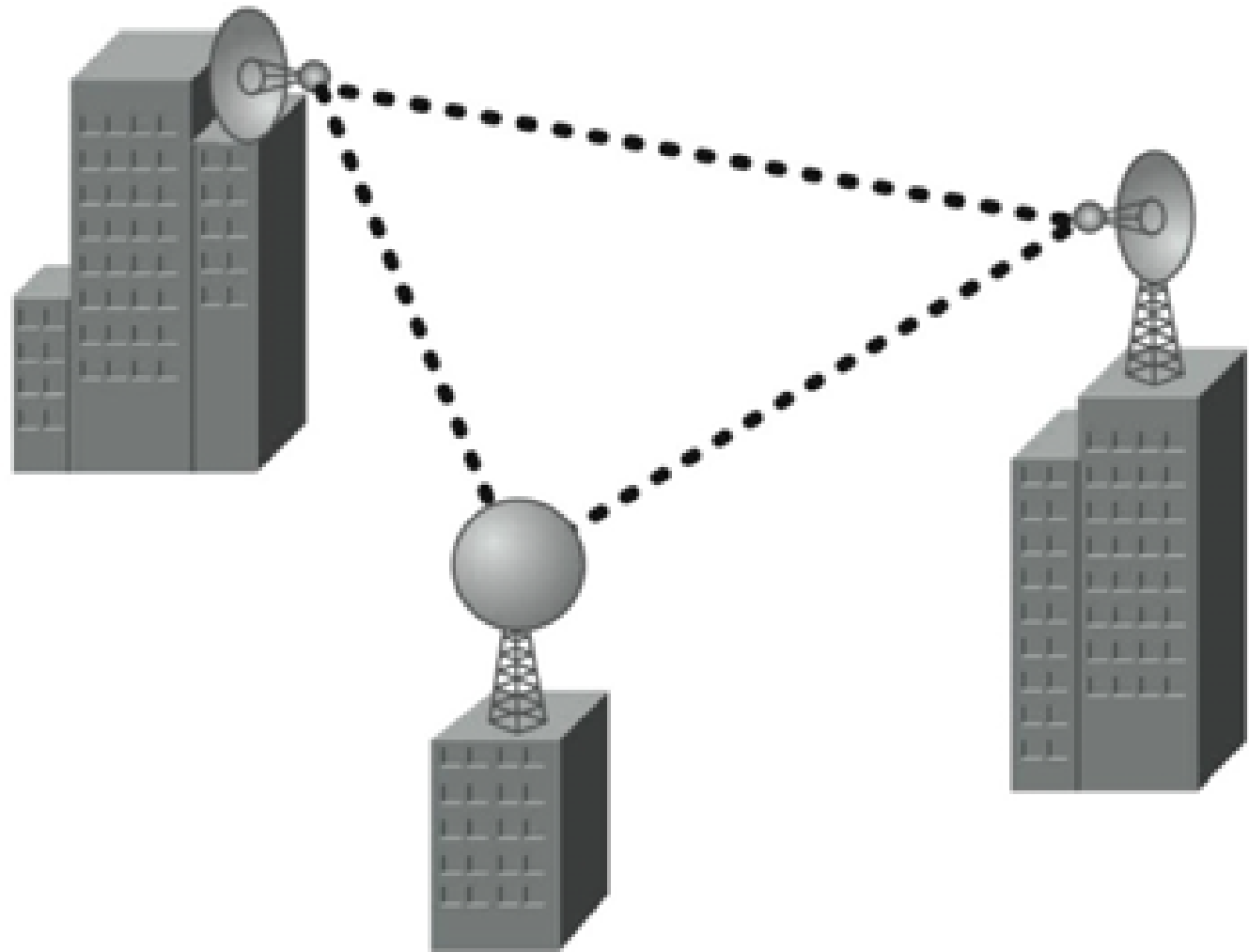
Cable direct to hub or switch



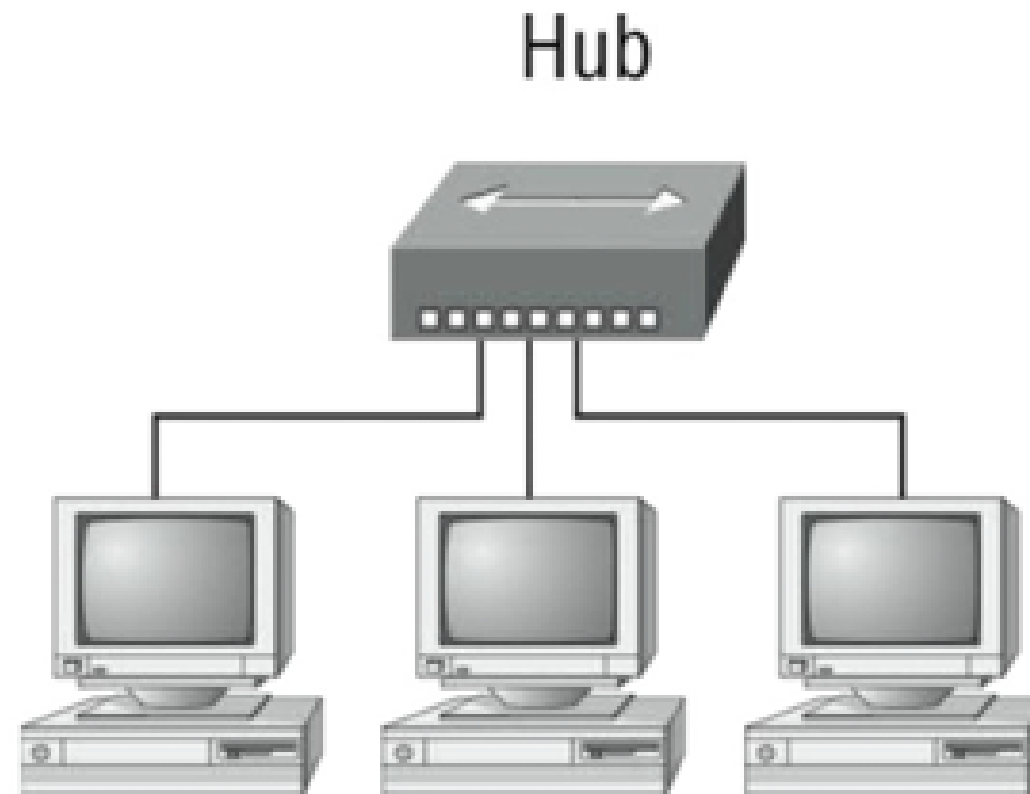
Point-to-Multipoint Topology



Point-to-Multipoint Example 2



Hybrid Topology



Physical Star, Logical Bus

Hybrid Physical Topologies

- Pure bus, ring, star topologies
 - Rarely exist
 - Too restrictive
- Hybrid topology
 - More likely
 - Complex combination of pure topologies
 - Several options

Star-Wired Ring

- Star-wired ring topology
 - Star physical topology
 - Ring logical topology
- Benefit
 - Star fault tolerance
- Network use
 - Token Ring networks
 - IEEE 802.5

Star-Wired Ring (cont'd.)

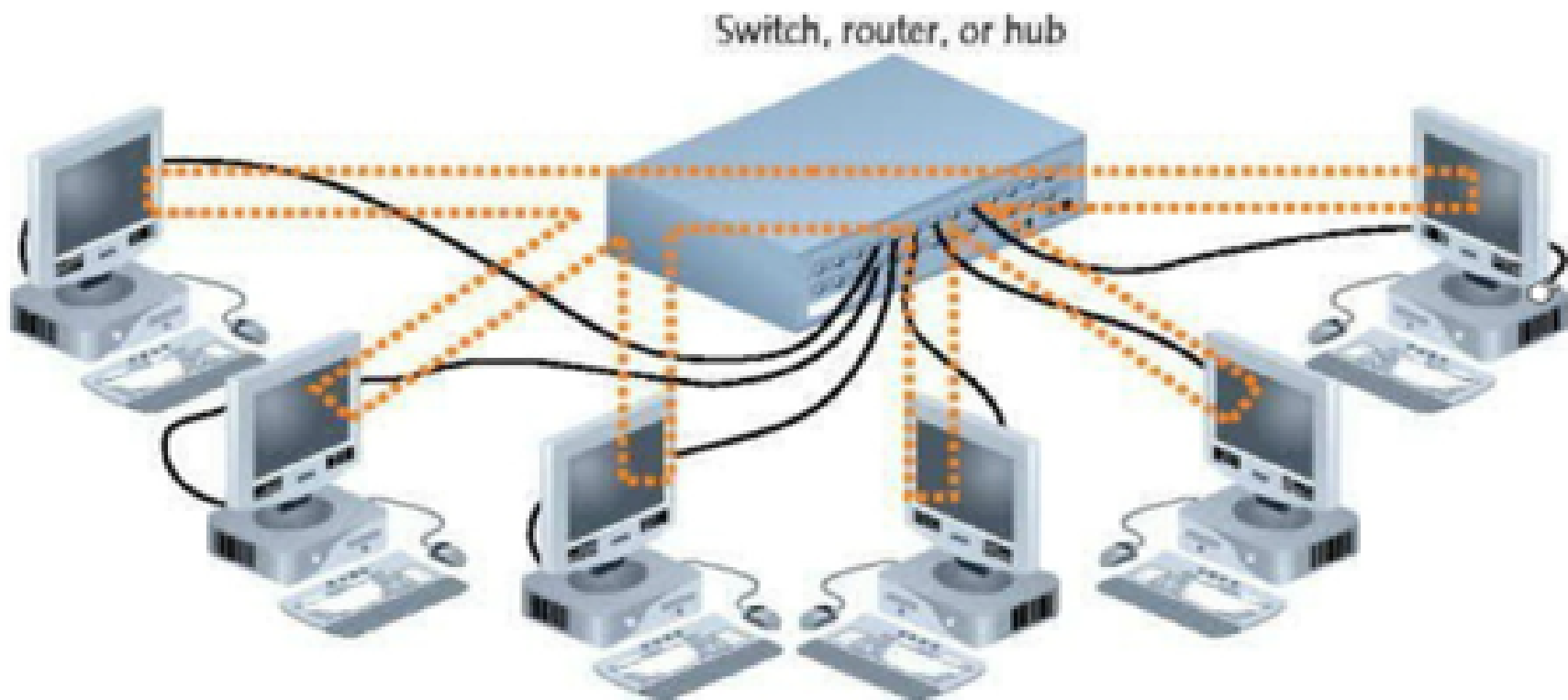


Figure 5-4 A star-wired ring topology network

Star-Wired Bus

- Star-wired bus topology
 - Workstation groups
 - Star-connected devices
 - Networked via single bus
- Advantage
 - Cover longer distances
 - Easily interconnect, isolate different segments
- Drawback
 - Cabling, connectivity device expense
- Basis for modern Ethernet networks

Star-Wired Bus (cont'd.)

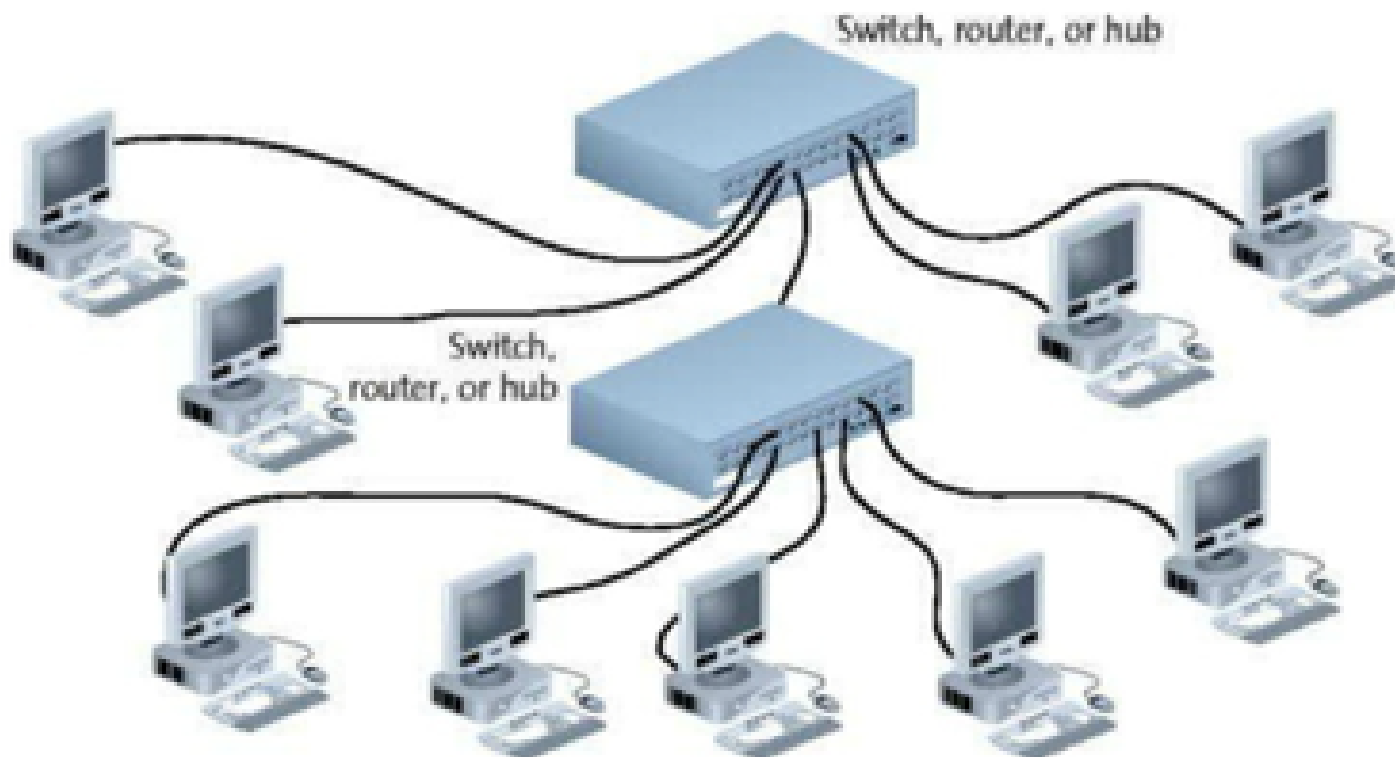


Figure 5-5 A star-wired bus topology network