LESSON 1.5

98-366 Networking Fundamentals

Understand Network Topologies and Access Methods
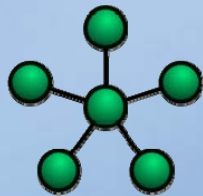
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Lesson Overview
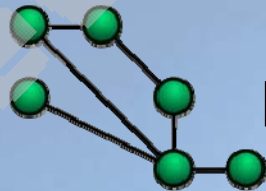
In this lesson, you will learn about:

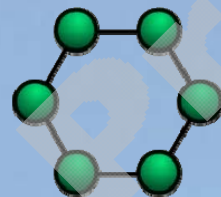▪Network topologies and access methods

Star

Mesh

Ring

Bus

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Anticipatory Set

We previously discussed networks such as local area networks and this leads to the topic of topology—how the network is structured.

1. Draw a network that includes: 3 computers , 2 desktops and a laptop, and a network printer.

2. Be prepared to show your drawing and tell what network topology is being used.

Class Activity

Use the mind map during the PowerPoint presentation to record information about the different types of network topologies. Be sure to include information about which topology types are appropriate for various situations.

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Network Topologies

- The interconnection of the various elements (links, nodes, etc.) of computer equipment

- Network Topologies can be physical or logical

- Topology is the virtual shape or structure of a network, which does not need to correspond to the actual physical design of the devices on the computer network.

- The physical design of a network including the devices, location, and cable installation is known as physical topology.

- How data actually transfer in a network, as opposed to its physical design, is the logical topology, also called signal topology.

- Distances between nodes, transmission rates, physical interconnections, and/or signal types may differ in two networks and yet their topologies may be identical.
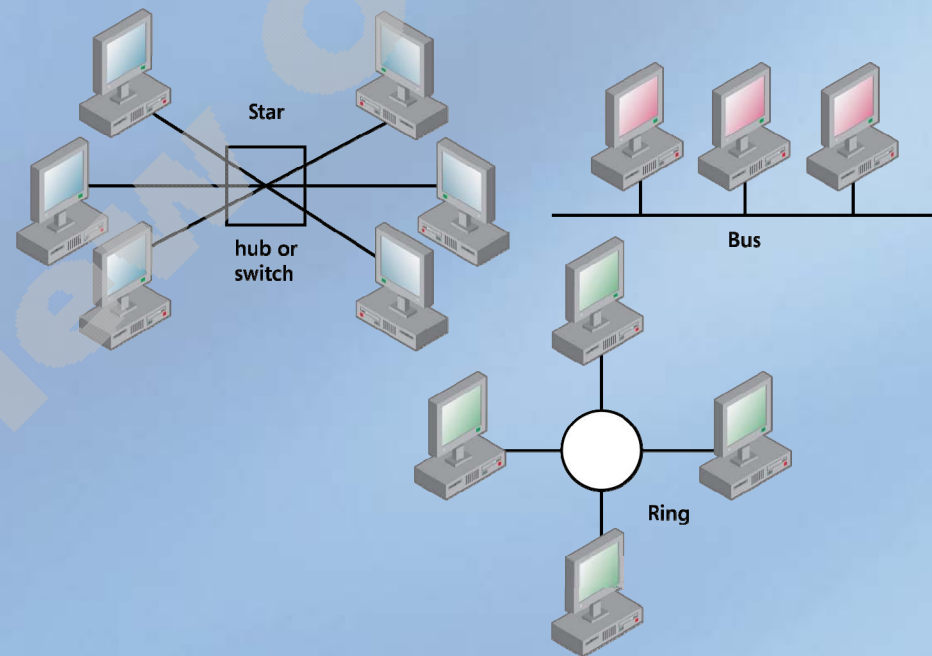
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Compare the
logical and physical
topology of the star

If a hub is used, then the
topology is a physical star
and a logical bus.

If switch is used, then the
topology is a physical star
and a logical star.

If IBM MAU is used, then
the topology is a physical
star and a logical ring.

Star

hub or
switch

Bus

Ring

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Star Network

- The topology structure of a star network consists of one central switch, hub or computer, which acts as a conduit to transmit messages.

- The hub and leaf nodes, and the transmission lines between them, form a graph with the topology of a star.

- An active **star network** has an active central node that usually has the means to prevent echo-related problems.
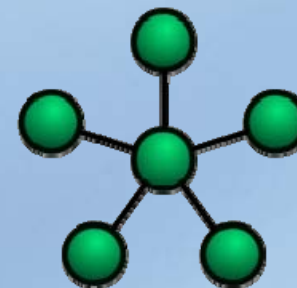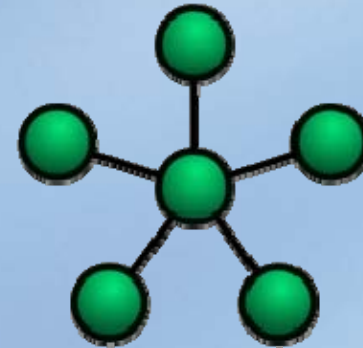
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- By connecting all of the systems to a central node, the star topology reduces the chance of network failure.

- The central hub rebroadcasts all transmissions received from any peripheral node to all peripheral nodes on the network when applied to a bus-based network.

- All peripheral nodes may thus communicate with all others by transmitting to, and receiving from, the central node only.

- Isolation of a peripheral node from all others occurs when there is a failure of a transmission, but the rest of the systems will be unaffected.

- Each node (file servers, workstations, and peripherals) is designed to be connected directly to a central network hub, switch, or concentrator.

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- Data on a star network passes through the hub, switch, or concentrator before continuing to its destination.

- The functions of the network are controlled and managed by the hub, switch, or concentrator, and it acts as a repeater.

- The twisted pair cable is the most often used although it can be used with coaxial cable or optical fiber cable.
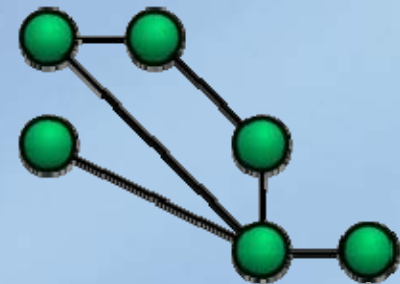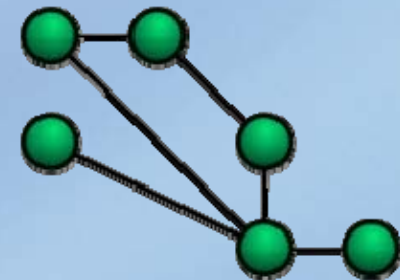
Mesh Networks

- Each node in the network acts as an independent router.

- A mesh network whose nodes are all connected to each other is a fully connected network.

- The component parts connect to each other via multiple hops.

- Is self-healing and can still operate when one node breaks down or a connection goes bad

- Considered more reliable than other networks

- Mobile ad hoc networks (MANET) must deal with the problems of the mobility of the nodes. Mesh networks do not have this problem but they are closely related with the MANET network.

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- Originally developed for military applications

- Wireless networks are typical of mesh architectures.

- The mesh network can support multiple functions such as client access, backhaul service, and scanning in mobile applications.

- Increased power has enabled the mesh nodes to become more modular.

- One node or device can contain multiple radio cards or modules, allowing the nodes to be customized to handle a unique set of functions and frequency bands.

- Game theory methods that analyze strategies for the allocation of resources and routing of packets have aided mesh networks.
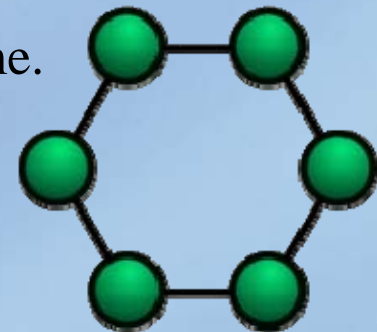
Ring Network

- Data travels from node to node, with each node along the way handling every packet.

- It forms a single continuous pathway for signals through each node.

- May be disrupted by the failure of a single link

- A node failure or cable break might isolate every node attached to the ring.

- Each machine or computer has a unique address that is used for identification purposes.

- Only one machine can transmit on the network at a time.

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- Even though computers on a home network can be arranged in a circle shape, it does not mean that it presents a ring topology.

- By sending data on a counter clockwise ring FDDI (fiber distributed data interface) networks circumvent a node failure or cable break.

- 802.5 networks, also known as Token Ring networks, avoid the weakness of a ring topology altogether.

  o They actually use a *star* topology at the *physical* layer and a multi-station access unit (MAU) to *imitate* a ring at the *data-link* layer.

- The signal can be boosted or repeated as the computers connected to the ring act to strengthen the signals that transverse the network.

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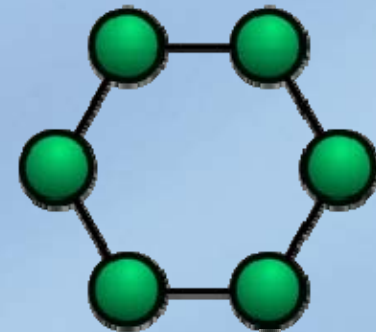
Bus Network

- A shared communications line

- A common backbone to connect all devices that operates and functions as a shared communication medium

- A single cable that devices attach or tap into with an interface connector

- Communicates by sending a broadcast message onto the wire for all other devices to see, but only the intended recipient actually accepts and processes the message.

- Devices on the bus must first determine that no other device is sending a packet on the cable before any device can send a packet.

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- Bus mastering is supported by many bus architectures that enable a device connected to the bus to initiate transactions.

- Devices with Ethernet communicate like they were in chat room, which is called carrier sense multiple access/ collision detection (**CSMA/CD**).

- Two packets are sometimes sent (two cards talk) at the same time.

- The cards arbitrate on their own to decide which one will resend its packet first when this collision occurs.

- All PCs share the data transfer capacity of that bandwidth (wire) if they are on a bus network.

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Advantages of a Bus Network

- Easy to implement and extend

- Well-suited for temporary or small networks not requiring high speeds (quick and easy setup)

- Cost effective; only a single cable is used

- Cheaper than other topologies

- Easy identification of cable faults

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Disadvantages of Bus Networks

- Limited cable length and number of stations

- Only one packet can remain on the bus during one clock pulse

- If there is a problem with the cable, the entire network breaks down.

- Performance degrades as additional computers are added or with heavy traffic

- Slower data transfer rate than other topologies

- It works best with limited number of nodes
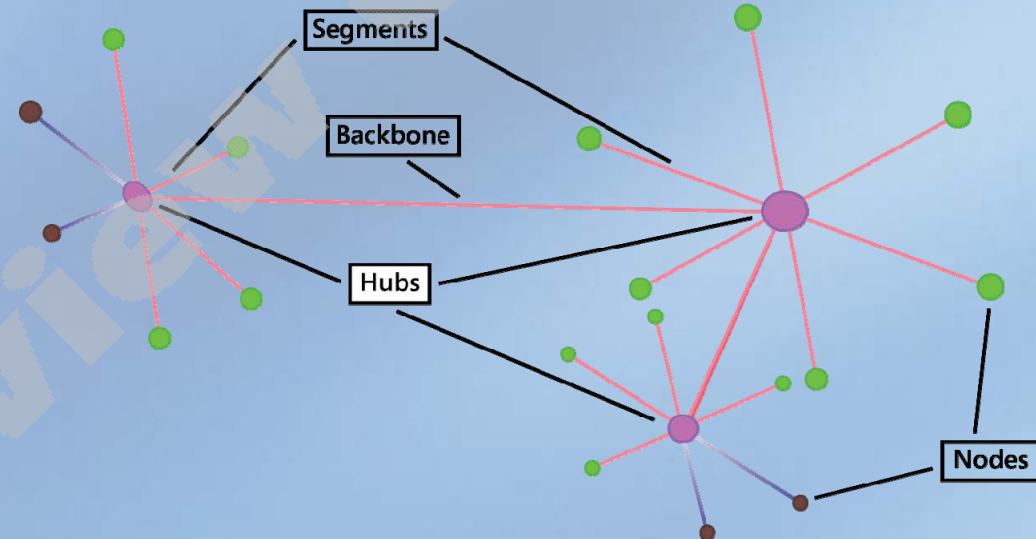
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Hybrid Network

- When a combination of two or more topologies are connected

- If two star networks were connected together, they would exhibit a hybrid network topology.

  o A star ring network would be two or more star topologies linked together using a multistation access unit (MAU) as a centralized hub.

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- Two or more star topologies connected using a bus trunk would be a star-bus network.

- A multi-station access unit (MSAU) connects a group of computers to a token ring local area network.

Segments

Backbone

Hubs

Nodes

Lesson Review

- Use the Student Activity brain map document

- Work in small groups (3–4 students) to discuss the completed brain map

- Select a presenter to tell about the network topology applications which your group decided was appropriate for various scenarios

- Share one scenario and describe how the topology your group selected is ideal for this scenario