Lesson Plan

Course Title: Telecommunications and Networking
Session Title: Topologies and Access Methods

Lesson Duration:
This lesson will take approximately 150 minutes (2.5 hours)
[Lesson length is subjective and will vary from instructor to instructor]

Performance Objective:
Upon completion of this assignment, the student will be able to describe and design the major topologies used in computer networking.

Specific Objectives:
• Differentiate between a logical topology and a physical topology
• Describe and design a bus network
• Describe and design a ring network
• Describe and design a star network
• Describe and design a mesh network

Preparation

TEKS Correlations: 130.274

(4) The student acquires an understanding of telecommunication and data network services
(K) differentiate between local area networks and wide area networks
(5) The student analyzes various types of configurations and upgrading
(E) recognize the differences among computer network topologies
(6) The student recognizes and recommends the various types of network components to address industry needs
(A) analyze various types and components of networks
(B) analyze the characteristics of networks used to select the optimum configuration for an industry solution

Instructor/Trainer
The instructor must have a strong knowledge of network topologies and terminology including the type of cabling, connectors, and scenarios for the following network types:
• Bus
• Ring
• Star
• Mesh

References:
Conduct an online search for information on network topologies
Conduct an online search for network tutorials

Instructional Aids:
- Topologies Presentation
- Topologies Handout 1
- Topologies Handout 2
- Topologies Quiz

**Materials Needed:**
Paper (for printed assignments)

**Equipment Needed:**
- Computer that can be used by instructor to demonstrate how to use the application for creating interactive network diagrams (Handout 1)
- Computers with an application for creating interactive network diagrams installed for students to use

**Learner**
Students must understand these basic networking terms and concepts:
1. Network
   a. LAN
   b. MAN
   c. WAN
2. Networking Media (Twisted pair [TP], Untwisted Pair [UTP], Fiber Optics)
3. Traffic
4. Fault-tolerance
5. Workstation/Node
6. Hub
7. Switch
8. Central Device

**Introduction**

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<tr>
<th>MI</th>
<th>Introduction (LSI Quadrant I):</th>
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<td>📖</td>
<td>Greet students as per your routine. Lead into the discussion by asking students how they hear about breaking news, whether it is world news or what is going on in the lives of their friends. Ask them to think about how information travels around the school/their group of friends: is it organized like a straight line (first person tells the second, second person tells third etc.)? A circle (first person is retold by last person)? Is it random and moves around like how the strings in a fishing net are connected?</td>
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<td>Ask someone in the class to draw on the board a diagram of how (s)he thinks information travels through his/her group of friends (or school). Based on the drawing, explain how this would be a ‘logical’ or theoretical map of how information travels.</td>
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<td>Now, arrange several students in a ring holding hands. Draw on the board a ‘map’ of how the students are arranged. Explain that the diagram you drew represents a true physical representation of how the students are arranged, much like a map of a state/city/etc.</td>
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Explain that just like the exercises you just demonstrated the same things are done in the world of networking. We call these layouts the ‘network topology’ and that there are logical topologies and physical topologies. Explain that the logical and physical topologies do not always look the same. Tell the students that they will be studying physical network topologies and learn under what circumstances each topology should be used.

### Outline

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<th>MI</th>
<th>Outline (LSI Quadrant II):</th>
<th>Instructor Notes:</th>
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<tr>
<td></td>
<td>Defining topology:</td>
<td>Define a node as any device attached to the network that is capable of processing and forwarding data.</td>
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<td>The physical arrangement of devices on a network is the ‘network topology’. It literally refers to how and where equipment is connected to the network.</td>
<td>Define a backbone as a cable that serves as a common path and often employs high-speed network cable such as fiber-optic.</td>
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<td>There are four major topologies:</td>
<td>Explain that sometimes the network topology is a hybrid (it is formed by combining one or more of the major network topologies).</td>
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<td>Bus</td>
<td>Uses a single cable to connect all the devices to each other and often serves as a backbone to link other topologies.</td>
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<td>Star</td>
<td>On slide 4: Regarding missing terminator: signal bounce occurs when the signal/packet simply travels endlessly between the two ends of the network. No new signals can get through.</td>
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<td>Ring</td>
<td>Slide 5: Under Cons, point this out: Not Scalable: When you add nodes, you decrease network performance because the nodes share bandwidth.</td>
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<td>Mesh</td>
<td>Difficult to troubleshoot: Single point of failure means if the cable is damaged or broken in one place, none of the network will function.</td>
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<td>The first network to be discussed is the simplest and most inexpensive to build but the easiest to break: Bus</td>
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<th>Second network to discuss is Ring: Ring is slightly more expensive than bus</th>
<th>Repeater is a device that regenerates a signal</th>
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<td>Active topology: all workstations participate in delivery of data</td>
<td>TP: Twisted pair</td>
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<td><strong>Token passing:</strong> Ring networks function through token passing. Tokens are 3-byte packets or ‘control frames’. Think of a clock face. If the 12 o’clock computer wants to send a message to the 11 o’clock computer, it must send the data all the way around with each ‘hour’ checking to see if the message is intended for them. When each ‘hour’ determines that the data is not for it, it forwards the signal to the next computer in line. In token passing, the token travels the ring until it gets a signal from a computer stating, “I need to send data”. When the token passes that computer again, the data is attached to the end of the ‘empty’ token and sent to the next computer in line and so on until the correct node receives the data. The receiving computer attaches an acknowledgement or ACK, which is a verification of receipt to the token, and puts it back on the network. The token returns (still traveling clockwise) to the sending computer. The</td>
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The third topology is the Star. Star provides for centralized management of the network with a centralized device in the form of a hub or switch.

Tell students that in order to keep networks manageable, they need to divide them into sub-nets (sub-networks) that are connected to each other by switches/bridges/routers.

Last topology is the Mesh

The Mesh requires an extensive amount of cabling and usually no centralized management.

High fault tolerance is due to the fact that if one cable breaks between nodes, there is another route for the data to take to get to the node.

Adding a device requires connecting the device to every other device on the network, which is why scalability is more difficult than with star network.

### Application

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<th>MI</th>
<th>Guided Practice (LSI Quadrant III):</th>
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<td>Give students Interactive Network Diagrams Handout 1: The instructor will demonstrate how to use the application for the class. Connect a computer with the application installed to an overhead projector. Students should have access to a computer on which they can work along with the instructor and create a map of a small bus network (four computers) with each computer labeled as Node 1, Node 2, etc...</td>
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<td>Give students Interactive Network Diagrams Assignment (Handout 2). They should complete this portion of the assignment individually. Students should print the topologies they design and submit for review to the instructor. There should be some</td>
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leeway given for the design process; however, they must include all components required.

### Summary

**MI**  
**Review (LSI Quadrants I and IV):**

Have students develop a list of questions based on the presentation. Collect the questions and review them for appropriateness. Divide the students into pairs and redistribute the questions (making sure no student gets their questions to answer). Have the students answer the questions and then review them as a class.

### Evaluation

**MI**  
**Informal Assessment (LSI Quadrant III):**

The instructor will monitor student progress during the independent practice portion of the lesson and ensure that the students understand how to use the application and the concepts of the different topologies. The teacher will use this time to reteach/redirect as needed.

**MI**  
**Formal Assessment (LSI Quadrant III, IV):**

Students will take a quiz to ensure mastery of the material.