Unisys Corporation

Networking

Lesson 1
Introduction to Networking

Version 1.0

Student Guide

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Created for Unisys Corporation – www.unisys.com

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Notes:

Networking Module Map

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Lesson 2 – Cabling and Connectors

Lesson 3 – Networking Devices

Lesson 4 – OSI Reference Model and Networking Protocols

Lesson 5 – TCP/IP (Transmission Control Protocol/Internet Protocol)

Lesson 6 – Wan Technologies, Remote Access and VLANs

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Lesson 8 – Network Operating Systems and Clients

Lesson 9 – Fault Tolerance and Disaster Recovery

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Notes:

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Networking

Lesson 1 – Introduction to Networking

Introduction to basic networking; definitions of terms; introduction to networking concepts.

Time

15 Minutes

Description

This lesson introduces some of the basic networking concepts that will be covered in greater depth in later lessons. It includes comprehensive definitions and introduces new terms and concepts that you will need to become familiar with.

Notes:

Objectives

After completing this lesson, you will be able to:

- Define some common networking terms and acronyms.
- Identify typical network configurations and topologies.
- Identify some of the more common networking standards.

Prerequisites

In order to be properly prepared for this course, you should already be:

- Familiar with the use of a Personal Computer.
- Fluent in the English language.

Instructional Strategy

This course is conducted as instructor-led training with group discussion.

The following instructional strategies are used to teach this lesson:

- Introduction
- Presentation/Lecture
- Discussion
- Summary

Notes:

Materials Needed

The following materials are needed for this lesson:

Hardware

- None required.

Software

- None required.

Other Materials

- A pen or pencil.
- Writing Paper or notepad for taking notes. Notes may also be taken in the space provided in this workbook on each page.

Document Conventions

- All acronyms are defined the first time they are used in the text and the first time they are used in a procedure or exercise. There is also a glossary at the end of this training module that lists all acronyms and new terms that are used in this lesson, along with their definitions.
- In procedures or exercises, keywords, book titles, and filenames are formatted in **bold** text for quick recognition.

Notes:

Classroom and Campus Considerations

- Please turn off all cell phones and pagers, or set them to vibrate.
- Do not save questions for break times. Your question may be of interest to others in the class as well.
- Be polite to your fellow students and instructor.
- Smoking is permitted in designated areas only. Your instructor will direct you to the nearest smoking area.
- Your instructor will point out the locations of the nearest restroom facilities.

Classroom Procedures

- Class time is 15 minutes.
- Breaks will be provided after ~60 minutes of the class time and will be 10 minutes in duration. Please be prompt in returning from breaks so that the class can stay on schedule.

Safety Considerations

Students are **not** authorized to open any computers or perform any maintenance or troubleshooting of any lab computers or equipment. If your computer is malfunctioning, notify the instructor or a lab attendant immediately of the malfunction.

Any student input will be accomplished via the keyboard and mouse.

Notes:

Lesson 1 Contents

1. **Introduction to Networking**

   This presentation introduces some of the concepts and terms of networking and how networks are configured in a modern, corporate environment.

2. **Network Topologies**

   This presentation goes over what a network topology is, and some of the more common network topologies in use today.

3. **Networking Standards**

   This presentation defines some of the more common IEEE (Institute of Electrical and Electronic Engineers) networking standards.

4. **Lesson Review**

   This is a group discussion covering all of the presentations and lab exercises of this lesson.

Notes:

Introduction to Networking

Description

This lecture introduces some common networking terms and definitions, and answers some basic networking questions, such as:

- What is a Network?
- What is a LAN?
- What is a WAN?
- What is a Peer-to-Peer Network?
- What is a Client/Server Network?

What is a Network?

A network is a group of computers that are connected together either with a wire or wirelessly. By being connected together, they are able to share information such as files or applications, and they can communicate with each other using e-mail or other applications. They can also share devices and services, such as printing. You can have one printer attached to a computer or to the network itself and everyone on the network is able to print to the same printer.

Notes:

What is a LAN?

The term LAN stands for Local Area Network. A LAN is a network that is within a single geographical region. It could be as small as in one room, or as large as a building, or larger.

Two computers connected together on a network are all that's required to be considered a LAN, but a LAN could be large enough to accommodate all of the computers within a single building. When a network becomes larger than a single building, then multiple LANs would be connected together. It's also possible to have multiple LANs connected together within a single building, rather than one large LAN.

Within the computer and network administration industry, the terms *network* and *LAN* are commonly used interchangeably.

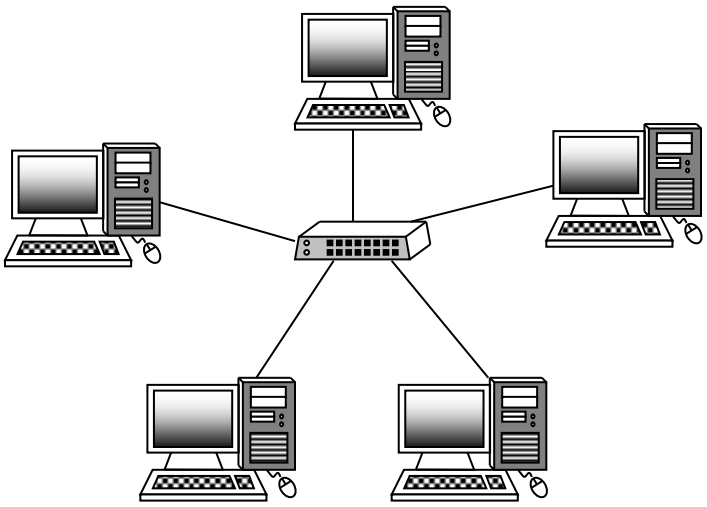

Figure 1.1 – Local Area Network

Notes:

What is a WAN?

A WAN is a Wide Area Network that goes beyond a single geographical region. A company that has offices in the United States and Canada might set up a WAN so that all of their employees could benefit from being on the same network. A WAN is when you connect two or more LANs together, regardless of where the two LANs are geographically located.

A WAN can span across cities, countries, or from one side of the globe to the other. There are a couple of terms you may hear from time to time. MAN stands for a Municipal Area Network, a network that is larger than a LAN, but smaller than a WAN, and is usually contained within a single city. A CAN is a Campus Area Network, and is generally a network that connects multiple buildings within the same general area, like a university campus.

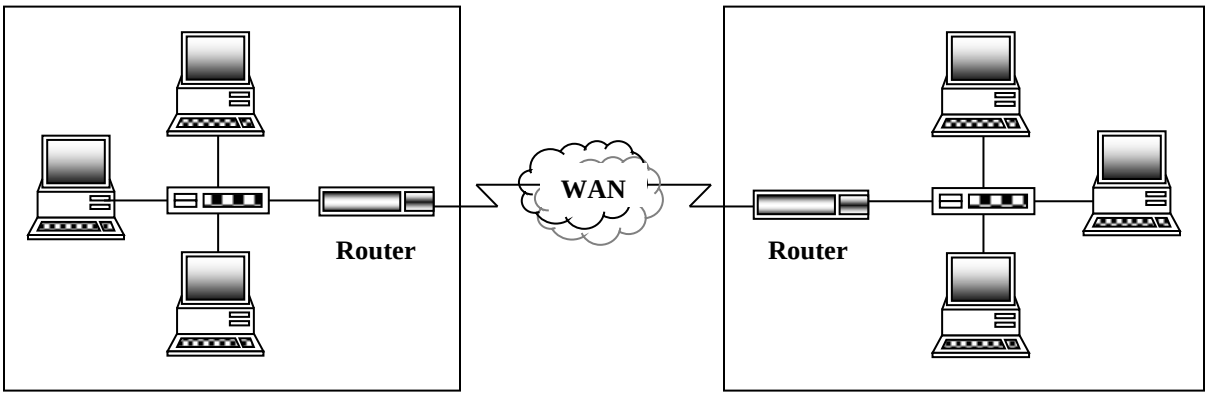

Figure 1.2 – Wide Area Network

Notes:

What is a Peer-to-Peer Network?

A peer-to-peer network is when computers are connected together, but without any single computer or user being in charge. Peer-to-peer networks are common in small offices where users need to be able to share files and information.

Peer-to-peer networking is accomplished through network operating systems such as Microsoft Windows 2000 Professional.

One advantage of peer-to-peer networks is that they are more economical for small offices, and allow multiple users to use a single device, such as a printer. This becomes cost-effective because the small business owner doesn't need to buy printers for each computer.

Although peer-to-peer networks are relatively easy to configure, one disadvantage is that the administration of the network is not centralized. Each system needs to be administered individually. This is called decentralized administration. Another consideration is that peer-to-peer networks shouldn't be used if there are more than 10 users on the network.

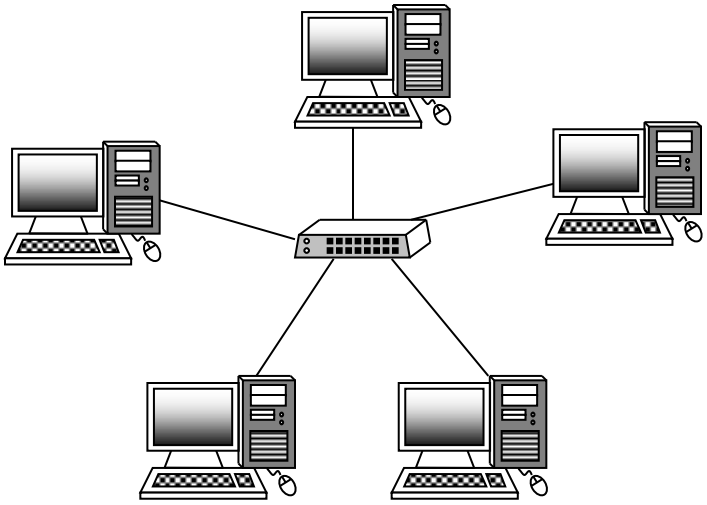

Figure 1.3 – Peer-to-Peer Network

Notes:

What is a Client/Server Network?

A client/server network is similar to a peer-to-peer network, except that one computer – the server – is in charge. All file and application sharing happens through the server.

Usually, one or more people, called system administrators, are in charge of the server and make sure that the network stays running, and they handle all of the administration from one central location. The system administrator is responsible for setting up new users, removing users who should no longer have access, maintaining current backups of the servers, providing maintenance, and generally ensuring that the network is continuously up and running efficiently.

Client/server networks are generally more costly but make up for that in speed and reliability. Administration of a client/server network is generally more complex than peer-to-peer network administration, but the administration is handled at a central location, rather than on each individual system. Client/server networks can be used for hundreds or thousands of users. Client/server networks usually run around the clock, 24 hours a day, 7 days a week.

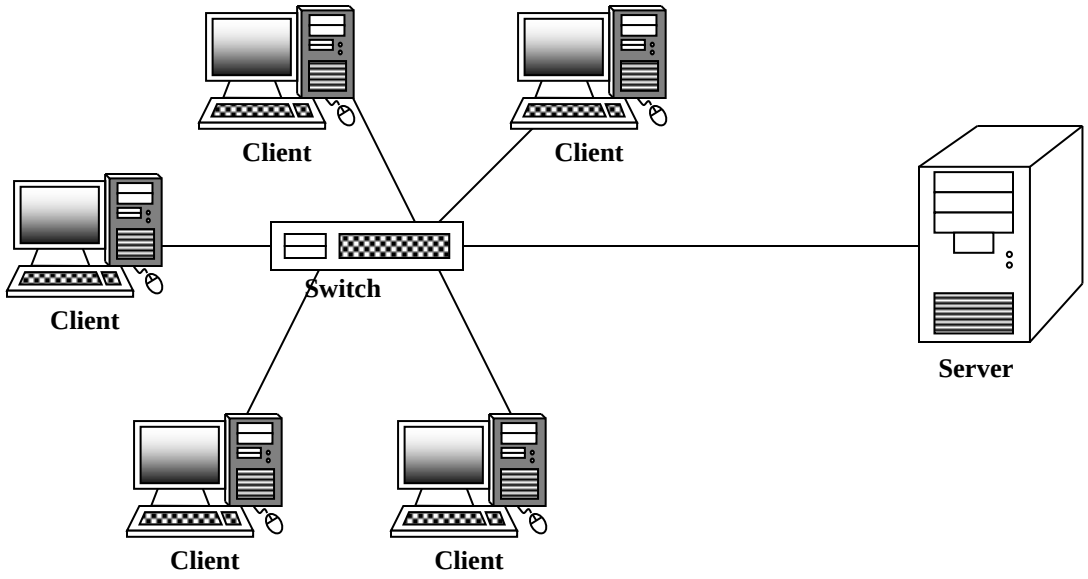

Figure 1.4 – Client/Server Network

Notes:

Network Topologies

Description

This presentation goes over some of the general rules for network topology, including the following topics:

- Introduction to Network Topology
- Physical Bus Topology
- Ring Topology
- Star Topology
- Mesh Topology
- Wireless Networking

Introduction to Network Topology

Network topology is a term used to describe the physical and logical layout of a network. The *physical* topology describes how a network is actually cabled together. The *logical* topology describes how a network *acts* rather than how it is physically configured. This will become clearer in just a moment.

Notes:

Physical Bus Topology

A bus topology is when the computers are wired together in a *line*. A physical bus topology will have two *ends*. Each end of a physical bus topology must be properly terminated to prevent signals on the cable from *reflecting* back onto the cable, causing interference, called attenuation.

A bus topology is a physical bus, meaning that the computers are physically configured connecting one to another in a line.

Typical networks that use a physical bus topology are 10Base2 and 10Base5 Ethernet networks.

Physical Bus Topology networks aren't as common as they once were. With the proliferation of Fast Ethernet (100BaseT) and Gigabit Ethernet (1000Base), networks that use this type of topology are becoming extinct.

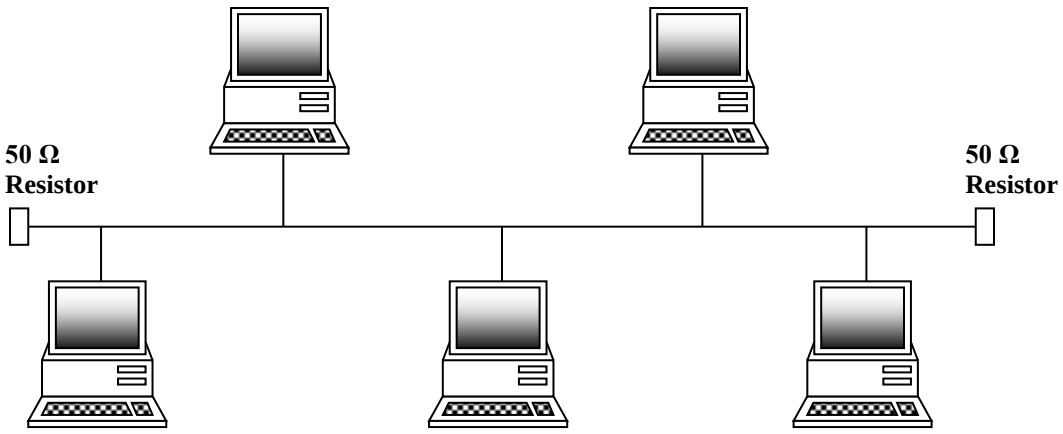

Figure 1.5 – Physical Bus Topology

Notes:

Ring Topology

A network that conforms to a ring topology means that a signal is passed from one computer to the next. The term *ring* usually refers to the *logical* topology of a network, rather than the *physical* topology.

An example of a ring network would be Token Ring or FDDI (Fiber Distributed Data Interface) network. Each of these network types will be covered in greater detail in the next section.

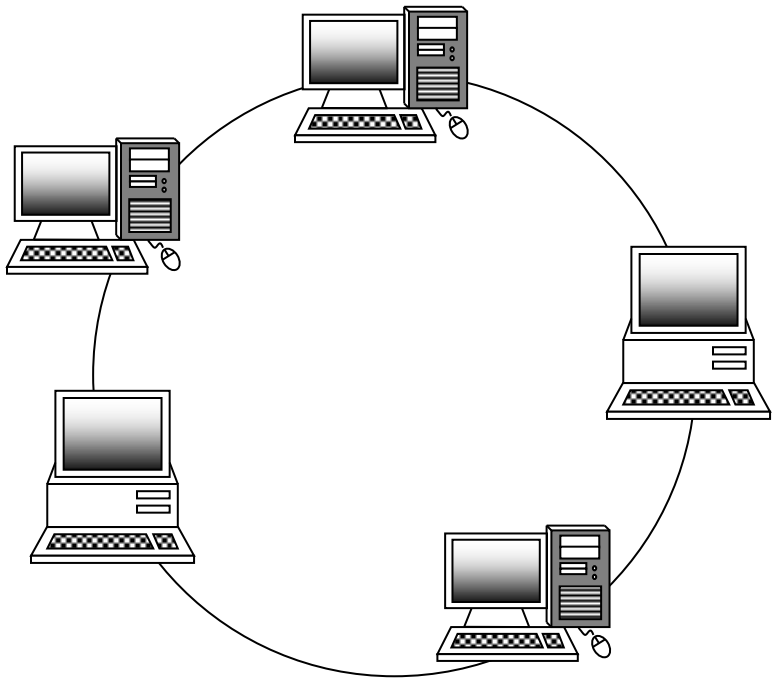

Figure 1.6 – Ring Topology

Notes:

Star Topology

A network in a star topology is probably the most common form you will see in modern networking. In a star topology, computers are connected to a central *hub* or *switch*. Most Ethernet networks are configured in a star topology, and operate as a *physical* and a *logical* star.

A token ring network is also *physically* configured in a star topology, although the *logical* topology is a ring. In a token ring *physical* ring topology, a group of computers are connected to a Multistation Access Unit, called a MAU or MSAU.

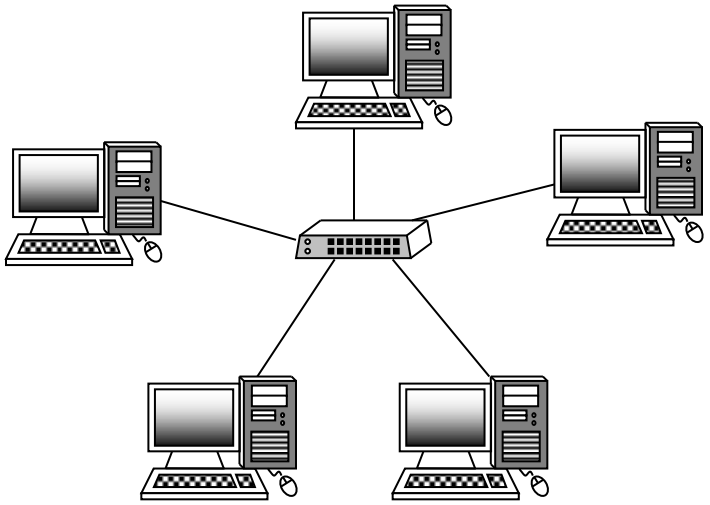

Figure 1.7 – Star Topology

Notes:

Mesh Topology

A mesh topology network is when every computer is connected to every other computer within the network. This configuration is extremely redundant. If there is a break in any part of the network, it doesn't halt the network from communicating. The mesh topology is a configuration that is extremely fault tolerant.

Mesh topology networks are also the most expensive to configure and maintain, because of the extra connections and wiring. Mesh topology networks are used when fault tolerance is more important than any monetary considerations.

You would typically only see a mesh topology network in a WAN, or possibly a CAN or MAN. A mesh topology is typically too expensive and too hard to configure to incorporate into a normal LAN.

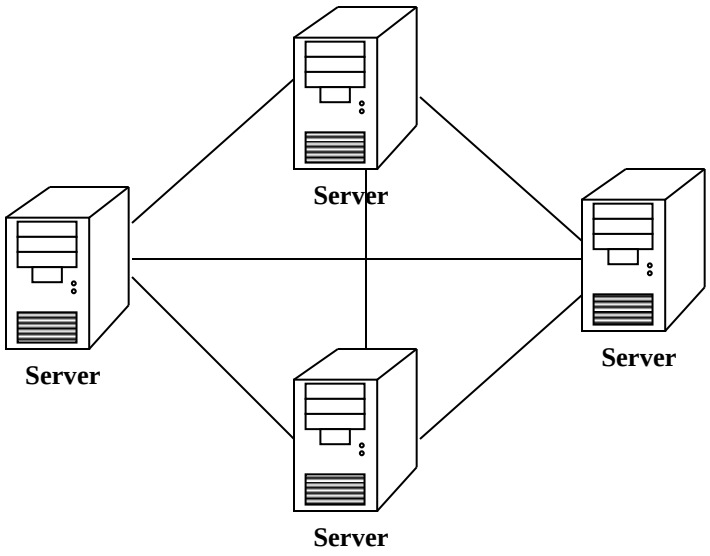

Figure 1.8 – Mesh Topology

Notes:

Wireless Networking

Wireless networking is an interesting topology in that the network isn't actually connected by cabling, but connects by radio signal. Rather than a *hub* or *switch*, a wireless network connects to a WAP, or Wireless Access Point.

Wireless networking is quickly becoming the most popular topology available. Restaurants and hotels have begun to incorporate Wireless Access Points into their business locations so customers can use their notebook computers to access the Internet or check their e-mail while eating or spending the night.

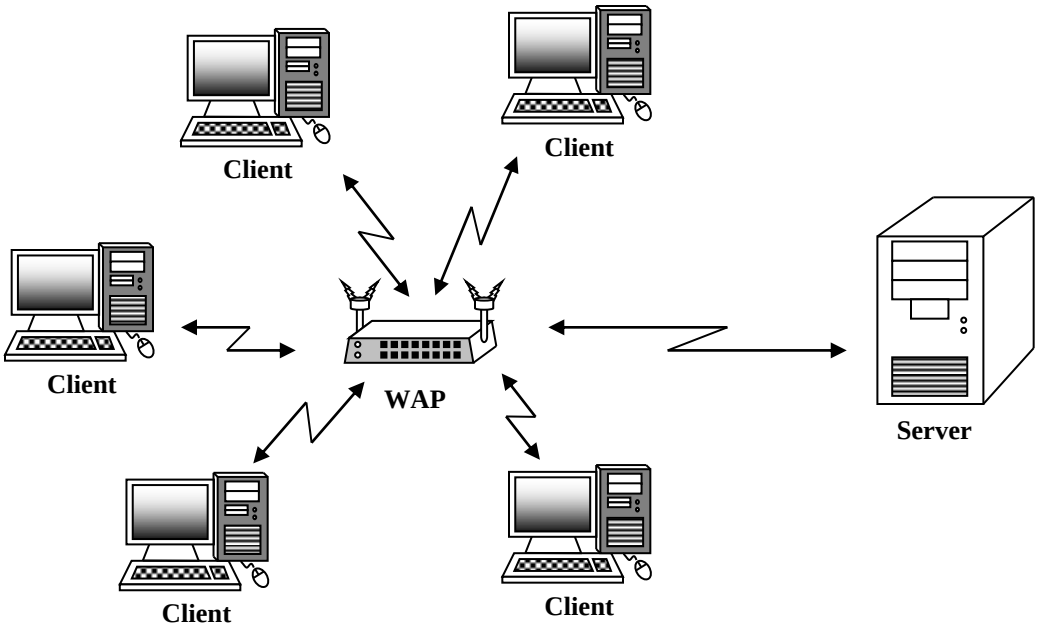

Figure 1.9 – Wireless Network

Notes:

Networking Standards

Description

This presentation identifies IEEE and defines some of the more common networking standards, such as:

- IEEE (Institute of Electrical and Electronic Engineers)
- 802.2 – The LLC (Logical Link Control) Sublayer
- 802.3 – CSMA/CD (Carrier Sense Multiple Access with Collision Detection)
- 802.5 – Token Ring Networks
- 802.11 – Wireless Networks
- FDDI (Fiber Distributed Data Interface)

IEEE

The Institute of Electrical and Electronic Engineers is the largest professional organization in the world. The 802 committee of the IEEE organization developed the standards for LANs and WANs.

802.2 – The LLC (Logical Link Control) Sublayer

The IEEE 802.2 standard defines an LLC (Logical Link Control) sublayer that is used by lower-level protocols. The LLC sublayer separates the Network Layer from the Physical layer.

The LLC sublayer is a part of the Data Link layer of the OSI (Open System Interconnect) Reference model, which will be covered in lesson 4. It's called a sublayer because there is also a MAC (Media Access Control) sublayer that, together with the LLC sublayer, make up the OSI Data Link layer.

The point to remember about the LLC sublayer is that it manages data flow control and error control for the other IEEE LAN standards.

Notes:

802.3 – CSMA/CD

The IEEE 802.3 standard defines the characteristics for Ethernet. CSMA/CD stands for Carrier Sense Multiple Access with Collision Detection, and describes how Ethernet works. Ethernet devices will listen to the *wire* to see if there is another device in use, or in other words, it will *sense* the *carrier*. If there isn't another device in use, it will begin to transmit, listening for a *collision*, or two devices trying to use the cable at the same time. If a collision is *detected*, the device will stop transmitting for a random amount of time and will try again.

A conglomeration of Digital, Intel, and Xerox developed Ethernet. Ethernet networks are commonly called names like 10BaseT, 100BaseT, and so forth. They can also be referred to as Fast Ethernet or Gigabit.

Ethernet operates at 10 Mbps (Megabits per second). Fast Ethernet operates at 100 Mbps, while Gigabit operates at 1000 Mbps. That's what the 10 in 10BaseT stands for is 10 Mbps, or the 100 in 100BaseT, for 100 Mbps. The word *Base* stands for Baseband (the opposite of Broadband).

802.5 – Token Ring Networks

The IEEE 802.5 standard defines the characteristics of a token ring network. A token ring network is a network configured in a logical ring (see Ring Topology in the previous section). A computer is able to talk on the network only when it has the *token*, which is an electronic signal sent specifically to that computer. Once it is finished sending it's traffic, or if it doesn't have any traffic for the network, it passes the token on to the next computer.

Although a token ring network is in a logical ring topology, it forms a physical star topology. Each computer is connected to a central device called a MAU or MSAU, which stands for Multistation Access Unit.

Token ring networks have lost popularity over the last few years, mainly because of transmission speeds. Token ring networks are limited to either 4 Mbps or 16 Mbps, while Ethernet is operating at 1000 Mbps. It's important to consider though that is token ring and Ethernet networks were operating at the same Mbps, token ring would be a much faster network because there are no collisions on a token ring network.

Notes:

It's also important to remember that all devices on a token ring network must be set to operate at the same speed. If a device, usually a NIC (network interface card) is replaced and it causes problems on the network, it's probably set to the wrong speed.

802.11 – Wireless Networks

The IEEE 802.11 standard defines the characteristics of wireless networks. A wireless network is just that, a network that doesn't use wiring or cabling to connect the computers, but uses radio frequency instead.

Currently, there are three different wireless standards; 802.11a, 802.11b, and 802.11g. The most common wireless network conforms to an 802.11b standard. An 802.11b network has a transfer rate of 11 Mbps and operates at 2.4GHz.

The main differences between each of these standards are speed of transmission and frequency of operation. Instead of using CSMA/CD as Ethernet does, wireless networks use CSMA/CA, or Carrier Sense Multiple Access with Collision Avoidance. The network device which wants to transmit first listens for traffic, and then sends a small transmission. If that transmission is collision free, then the network device is free to send its transmission.

FDDI

Fiber Distributed Data Interface, commonly referred to as FDDI (pronounced *fidy*), is a fiber-based standard that was developed by the American National Standards Institute (ANSI). A FDDI network operates in a logical ring, similar to token ring networks, and passes a token, just as in token ring networks. Devices on a FDDI network are either referred to as a *single-attached station* or as a *dual-attached station*.

A major component of a FDDI network is the ability to incorporate dual rings (only for dual-attached stations), operating in opposite directions, thereby adding a level of fault tolerance that isn't available in other network topologies. FDDI networks are used when fault tolerance is more important than other considerations, such as cost.

It's fairly rare to see a FDDI network. FDDI networks are used mainly in data centers and in isolated LANs where network reliability is very important. It would be very uncommon to run into a FDDI network in a normal networking environment.

Notes:

Lesson Summary/Review

Description

This is a group discussion covering all of the presentations and exercises of this lesson. It includes the following topics:

1. Introduction to Networking
    - What is a Network?
    - What is a LAN?
    - What is a WAN?
    - What is a Peer-to-Peer Network?
    - What is a Client/Server Network?
2. Network Topologies
    - Introduction to Network Topology
    - Physical Bus Topology
    - Ring Topology
    - Star Topology
    - Mesh Topology
    - Wireless Networking
3. Networking Standards
    - IEEE (Institute of Electrical and Electronic Engineers)
    - 802.2 – The LLC (Logical Link Control) Sublayer
    - 802.3 – CSMA/CD (Carrier Sense Multiple Access with Collision Detection)
    - 802.5 – Token Ring Networks
    - 802.11 – Wireless Networks
    - FDDI (Fiber Distributed Data Interface)

Notes:

Glossary

ANSI - American National Standards Institute.

CAN – Campus Area Network. A CAN is a network that connects several buildings together. An example of a CAN might be a university campus.

CA – Collision Avoidance.

CD – Collision Detection.

CSMA/CA - Carrier Sense Multiple Access with Collision Avoidance.

CSMA/CD – Carrier Sense Multiple Access with Collision Detection.

FDDI – Fiber Distributed Data Interface.

GHz – Gigahertz. One billion cycles per second.

IEEE - Institute of Electrical and Electronic Engineers. Among other thing, the IEEE defines standards for networks.

LAN – Local Area Network. A network that connects several computers together, even hundreds or thousands of computers.

LLC – Logical Link Control.

MAC – Media Access Control.

MAN – Municipal Area Network. A MAN is a network that connects several buildings together all within the same city.

MAU – Multistation Access Unit. A device similar to a hub, but used on token ring networks. Also referred to as a MSAU.

Mbps – Megabits per second.

MSAU – Multistation Access Unit. A device similar to a hub, but used on token ring networks. Also referred to as a MAU.

NIC – Network Interface Card or Network Interface Controller.

OSI – Open System Interconnect.

Notes:

WAN – Wide Area Network. A WAN connects multiple geographical regions together. An example of a WAN would be when a company has offices on both the east coast and the west coast of the United States. These two offices would be connected with a WAN.

WAP – Wireless Access Point. A WAP replaces a hub in a wireless network.

Notes: