Unit 1
Internetworking Overview

Overview

Description

This unit contains four lessons.

- The first lesson covers the types of basic networks, including LANs, WANs, MANs, Backbone, and Enterprise networks. It also introduces the concepts of peer-to-peer and client/server networks.

- The second lesson gives a brief overview of the connectivity and internetworking devices used to interconnect network resources networks. Comparisons are made between the functionality of devices and where they fit in the OSI model.

- The third lesson introduces three types of cables, their attributes, and structural components. It also provides procedures for crimping Category 5, unshielded twisted-pair (UTP) cable.

- The fourth lesson covers structured cabling systems including bus, ring, star, and hybrid topologies. This lesson also covers the TIA/EIA 568 standard elements of structured cable systems.

Unit Table of Contents

This unit contains the following four lessons:

<table>
<thead>
<tr>
<th>Lessons</th>
<th>Pages</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1-1: Basic Network Types</td>
<td>2-34</td>
<td>5 hours</td>
</tr>
<tr>
<td>Lesson 1-2: Connectivity and Internetworking Devices</td>
<td>35-62</td>
<td>5 hours</td>
</tr>
<tr>
<td>Lesson 1-3: Cabling</td>
<td>63-88</td>
<td>5 hours</td>
</tr>
<tr>
<td>Lesson 1-4: Structured Cabling Systems</td>
<td>89-116</td>
<td>5 hours</td>
</tr>
</tbody>
</table>
Lesson 1-1: Basic Network Types

At a Glance

In the past, sharing files between computers occurred via *sneakernet*, literally walking a file stored on a floppy disk from one computer to another. In an effort to improve the transfer of information, the modern computer network was born. A network is simply two or more computers connected together to share information and resources.

The Evolution of Modern Networking

Computer networks allow people to:

- Exchange information (for example, databases, documents, and graphics) via connected workstations.
- Share resource equipment (for example, computers, printers and scanners).
- Use shared applications (for example, spreadsheets and word processing programs).
- Collaborate and communicate electronically.

There are many types of networks. Choosing the best network structure depends on an organization's productivity needs, its budgetary restrictions, and the types of resources to be connected. To make the best choices requires understanding the basic types of networks and their functions.
What You Will Learn

After completing this lesson you will be able to:

• Define LAN, Workgroup LAN, Departmental LAN, WAN, MAN, and Enterprise Network.

• Graphically represent LANs, MANs, and WANs.

• Describe the differences between a peer-to-peer network and a client/server network.

• Identify common resources shared within a network.

• Question a network manager or client about network design, issues, and benefits.
Tech Talk

- **Network**—The physical media, routers, and switches, that transfers data between a user and their resources.

- **Client**—A computer that uses the shared resources located on a network. The computer it accesses to obtain these shared resources is sometimes called a host or a server.

- **Client/Server Network**—In a client/server relationship, client computers request resources and information from a central, usually more powerful, server computer. The main alternative to peer-to-peer.

- **Enterprise Network**—A combination of LAN, MAN, or WAN networks and nodes, managed and owned by a private organization.

- **Local Area Network**—Two or more computers linked together for the purpose of sharing information and resources.

- **Metropolitan Area Networks**—A series of LAN networks connected together over a local geographical area.

- **Node**—A device connected to the network. It might be a printer, a workstation, a file server, a client, a mainframe, and so on.

- **Peer-to-Peer Network**—Computers that share resources and information equally. There are no powerful central computers (servers) sharing information and resources. The main alternative to client/server.

- **Resources**—Computer hardware (printers, computers, servers, and so on) and software applications shared over a network.

- **Server**—A computer on a network that shares resources with other computers. There are different types of servers such as file servers, database servers, print servers, and so on.

- **Wide Area Networks**—Two or more LANs or MANs connected together generally spanning a geographic area; they may even span the globe.

- **Workstation**—A standalone computer that has its own CPU, used for common computer practices. Your home or school computer is most likely a workstation. Workstations can be networked together.
Basic Network Types

Schools, businesses, and other organizations select network types according to their individual needs and finances. Although network designs are quite diverse, basic network types are relatively few. They include the following:

- Local Area Networks
- Metropolitan Area Networks
- Wide Area Networks

Local Area Networks

A Local Area Network (LAN) connects computers and hardware devices together over a small geographic area. These computers and hardware devices are frequently referred to as nodes.

LAN: Peer-to-Peer Network

A LAN typically consists of several computers connected to one another, usually located in close proximity such as a computer lab. LANs are the most common form of networks found in most small businesses and schools. A LAN is often created for several computers to share an intermittently used resource such as a laser printer.
In earlier days of networking, most LANs used peer-to-peer networking to facilitate communication. A peer-to-peer network is built without the use of a central server, a computer used as the central storage unit for data. Each peer computer can share its resources with the other computers on the network independently. Today LANs often include central server computers.

Special software protocols, such as Microsoft NetBEUI, and Apple’s LocalTalk, are used for establishing communication across a peer-to-peer network.

**Check Your Understanding**

- Why have peer-to-peer networks been replaced overall by client/server networks?
- Describe in your own words, a Local Area Network.
- Sketch a Local Area Network.
**Metropolitan Area Networks**

Two or more LANs in the same metropolitan area connected together are called Metropolitan Area Networks, MANs.

Using high-speed (1.544 Mbps to 155 Mbps) transmission, MANs connect smaller networks within a campus, a city, and/or neighboring suburbs.

Companies usually pay an outside local carrier to supply the physical media necessary for transmitting data. The equipment and services provided by these vendors are usually on a monthly fee-for-service basis, with a one-time installation and set-up charge. One example is when a company leases telephone lines from a telecommunications company.
Wide Area Networks

Wide Area Networks (WANs) span large geographical distances, even over oceans or across continents. WANs overcome the distance limitations imposed by LANs.

WANs can be used to connect:

- LANs within a school campus
- Networks within a city, a state, a country, or across the world

WANs can use either analog (telephone lines) or digital (such as satellite transmission) signals, or a combination of both. WANs can be privately owned by large corporations or they can be public. One difference between public MANs and WANs is that the telephone company used is a long distance rather than local carrier.
Enterprise Networks

An Enterprise Network is the sum of the networked parts of an organization, encompassing all of the organization's LANs, MANs (Metropolitan Area Network), and WANs, as well as clients, servers, printers, and other networked nodes.

Check Your Understanding

- Networks lower costs of doing work by allowing users to share resources. Sharing resources also increases efficiency. Give several examples of common resources a LAN might share.
- What security issues do you think might arise within a network environment?
- Which type of network might use peer-to-peer networking?
- Describe a situation where you might want to share resources with another individual.
- What is the difference between a WAN and an Enterprise Network?
- Describe a client/server network environment.
- Describe a situation where you might want to set up a client/server network.
- Name at least two software protocols used for peer-to-peer networking.
- Diagram and label a Metropolitan Area Network.
Networks at Work

When making a purchase at a modern supermarket chain, information can be exchanged between Local, Metropolitan, and Wide Area Networks. Consider a typical supermarket transaction:

1. Each day, information, including item names, prices and stock numbers, is transmitted from the in-store server to each client checkout computer’s hard drive.

2. As an item is slid across the scanner, a laser beam reads the product’s bar code and displays the name and price of the item on the alphanumeric display. The bar code “tells” the computer the name and cost of the item, the name of the manufacturer, and so on.

3. At the same time, the item purchased is subtracted from inventory.
4. To pay for the purchase, a debit or charge card may be slid through the swipe-card reader.

5. Approval is requested via the company’s network from the central computer (server) at the headquarters. In this example, the headquarters is located in the same metropolitan area.

6. If sufficient funds are available, a signal is sent back approving the transaction.

7. At the end of the business day, the in-store central computer (server) receives updated information from each cash register computer’s hard drive.

8. New items, prices, and stock numbers are entered and transmitted to each computer for the next business day.
9. Data about the day’s transactions are transmitted to the headquarters’ server.
10. The headquarters' server indicates when stock is low and sends instructions to the warehouses for more supply deliveries.

11. Banking is also handled through the network. A payment request is sent electronically by the supermarket computer to your bank.

12. In turn, the bank subtracts the amount from your account and directs a credit to the supermarket's account.
Check Your Understanding

♦ Which type of network relationship is taking place between the checkout counter computer and the in-store central computer?

♦ Which type of relationship takes place among the swipe-card display computer, bar code reader computer, and checkout counter computer?

♦ Which type of network is used within the supermarket?

♦ Which type of network is used among the individual stores and the headquarters?

♦ Which type of network is used between the local banks, individual stores, the headquarters and the warehouse?
Try It Out

Network Components/Configurations

In the lab, you are going to configure your computer, enabling it to share resources over a local area network. This involves enabling file and print share permissions and configuring client, protocol, and service components.

Windows 95 CDs come with networking software. The software may already be installed on your computer workstation, or you may have to install it yourself from the Windows 95 CD. You may also need to download additional drivers from the Internet. See your instructor for assistance.

It is important to note that not all of the windows illustrated in this lab (and in subsequent labs) will look exactly like the windows on your personal desktop. If you have any questions regarding differences, see your instructor for assistance.

**Materials Needed**

- Networked Computer
- Windows 95 Operating System - CD-ROM
- A folder and/or files to share

**Directions**

1. Work in teams of three or four.
2. As you progress through this lab, keep a record of your experiences in your log book. Include any observations you think important, such as the following:
   - Did you encounter any difficulties? What were they? How did you solve them?
   - How would you change the lab if you were to do it again?
   - What were some positive experiences?
   - How long did it take to complete the lab?
   - Did you understand what you were doing?
   - Any other comments you want to include.
3. Upon completion of the lab, discuss the group dynamics of teamwork.
   - Did your team work well together?
   - Did you listen to your team members?
   - Did they listen to you?
4. After the teamwork discussion, write a short summary of your discussion and put your teamwork summary into your portfolio. Include observations such as the following:
   - Why do you think teamwork is important?
   - What was positive?
• What was negative?
• How might you improve interactions with team members in the future?

Procedures: Creating File and Print Sharing Permissions

1. Start your computer.
2. Click the Start button.
   • Select Settings.
   • Select Control Panel.

3. In the Control Panel window, double-click the Network icon.
4. In the Network window, highlight File and print sharing for Microsoft Networks.

5. Click the Add button.
Configuring Adapters

6. In the Select Network Component Type window, highlight Adapter.

7. Click Add.

8. A window similar to the one below will appear on the desktop.
   - See your instructor for the name of the manufacturer of the network interface adapter installed in your computer workstation. If the manufacturer of your adapter does not appear in this window, you will have to download the driver from the Internet or use the software that comes with the adapter; see your instructor.

9. In the Select Network adapters window, highlight the correct manufacturer and network adapter.

10. Click OK.
Configuring the Service Components

1. Follow steps 1-5 above under Creating File and Print Sharing Permissions.
2. In the select Network Component Type window, highlight Service.

3. Click [Add...].
4. In the Select Network Service window, highlight Microsoft and File and printer sharing for Microsoft Networks. (At this point, you may have to install the network service. See your instructor.)

5. Click [OK].
Lesson 1-1: Basic Network Types

Configuring Protocol Components

NetBEUI is a protocol used in small LANs for communicating over a network. You will learn more about NetBEUI later in this course. It comes with Windows95/98. Before enabling NetBEUI to communicate over a network, its driver must be installed on your computer. In this activity, you will set up the NetBEUI protocols for your workstation.

1. Follow steps 1-5 above under Creating File and Print Sharing Permissions.
2. In the Select Network Component Type window, highlight Protocol.

   ![Select Network Component Type](image)

3. Click Add.
4. In the Select Network Protocol window, highlight Microsoft and NetBEUI.

   ![Select Network Protocol](image)

5. Click OK.
6. You will see the Network Configuration window next. Notice that the NetBEUI protocol has been added.
7. In the Network Configuration window, highlight NetBEUI (adapter manufacturer name).
8. Click `Properties` and check to see that Client for Microsoft Networks and File and printer sharing for Microsoft Network boxes are checked. If they are not checked, please select them and click `OK`.

9. **Reminder**: your window may not look the same as the illustration below.

![NetBEUI Properties](image)

9. At this point, you are ready to share the folder you created at the beginning of this lab.

10. On the Configuration tab page in the Network window, click `File and Print Sharing...`.
11. Select both the printer and file sharing boxes.

12. Click [OK]. This will return you to the Configuration tab page of the Network window.

13. Click [OK] to close the Network dialog box.

15. Double-click the C Drive icon.
16. Check with your teacher for the name of the folder and or files to be shared. Right-click this folder.
17. Highlight Properties.

18. In the “Name of the Document” window, click the Sharing tab.

19. Click the Shared As button and the Full button.
20. When you click Full, the folder and or files can be accessed, read, and modified by anyone on the network.
   • Why would you want to give a user full access to a folder?
   • Describe a situation where full access might be needed.
   • Why would you want to give read-only access to a user?
   • Describe a situation where read-only access might be important.
   • Why would you want to use a password?
   • Describe a situation where you would want to use a password for user access.

17. Click [Apply].

18. Click [OK].
   • What happened to the folder and or files you are sharing?
   • Who can access this folder and or files? Why?
   • What is the significance of the hand on the folder and or files?
   • What are some resources that you can share over a network?

Procedures: Identifying Your Computer for a LAN

1. Start your computer.
2. Click [Start].
   • Select Settings.
   • Select Control Panel.

3. In the Control Panel window, double-click the Network icon.
4. In the Network window, click the Identification tab.
5. Enter the computer name and workgroup name supplied by your instructor.

6. Click OK.

Procedures: Connect to a LAN and Share Resources

Earlier in this lab, you created a folder and/or files to share. You then configured your computer, enabling it to communicate over a network. Now you will access a shared resource from one of your peers.

1. From the desktop window, double click Computer Neighborhood.
2. Double-click Entire Network.
3. Computers in your workgroup will appear as icons.
4. Double-click your workgroup, folder and/or files to be shared.
5. At this point, follow your instructor’s directions.
Rubric: Suggested Evaluation Criteria and Weightings

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<td>Participation in Activity</td>
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<tr>
<td>Questions answered accurately and thoroughly</td>
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</tr>
<tr>
<td>Recorded pertinent information in log book for</td>
<td>25</td>
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<td>future reference purposes</td>
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<td></td>
</tr>
<tr>
<td>Teamwork</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Summary integrated into portfolio</td>
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<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
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</table>
Stretch Yourself

Interview and Role-Play

Materials Needed

- None

Directions

1. Pair with another student in the class for this activity.
2. Together, in person or by phone, interview the manager of a supermarket chain or another company that uses a network.
3. Prior to the interview, create a questionnaire to use as a checklist and as a place to record your notes or answers. Avoid questions with “yes” or “no” answers. When you have finalized your questionnaire, place a copy in your portfolio for future use.
4. In your questions to the manager, inquire about the advantages and disadvantages of the network system and what changes would he or she make to improve the system.
5. Immediately after the interview, expand your notes with details of your interviewee’s answers. Record the responses in your portfolio.
6. With the questionnaire and responses in hand, create a script for role-playing your interview in front of the class. One of you will be the interviewer and the other the interviewee.
7. Remember that you must demonstrate the same professionalism in the role-play that you did during the actual interview. Be creative in your presentation to the class. Make it interesting.

Procedures: Conducting the Interview-Sample Scripts & Questions

Sample Script for Interview

- To the receptionist or whomever answers the phone:
  1. Hello. Our names are (your name) and (your partner’s name).
  2. We are students in (teacher’s name) Internetworking Fundamentals
  3. Our assignment is to interview a manager of a networked company about the benefits and issues associated with the company’s network.
  4. May we speak to the manager of your company for a few minutes?
5. We have just a few questions to ask about the operation of your network.

- To the company manager:
  1. (Repeat numbers 1-3 from above)
  2. Is now a good time to answer our questions? We estimate needing 15 minutes of your time. Or would another time be more convenient?
  3. Thank the manager for his/her time and either proceed with the interview or set another time.

Sample questions

1. What type of network do you have?
2. What type of changes have you seen take place in your company due to the addition of networking technology?
3. Has the networking technology been difficult for the employees to learn?
4. What problems have you or your employees had using the network?
5. How does your company use the network?
6. Has the network increased productivity or collaboration in your company?
7. What resources are shared over your network?
8. What do you see as the major advantages and disadvantages of using a network in your company?
9. What changes would you make to the network?
10. Do you have a designated network administrator? What is the position title?
    Is the person full or part-time?
11. How many people maintain the network?
12. Do you subcontract for any services?

Checklist for the Interview

1. Be sure to have your questions prepared ahead of time. You do not want to take more time than necessary.
2. If you go in person, consider your appearance. You represent not only your school, but also yourself. One day you may be designing a network for this company.
3. Take a pen or pencil and writing paper. You will want to appear efficient.
4. Be polite and be sure to thank your interviewee.
5. Follow up your interview with a short thank you note by mail or email.

Rubric: Suggested Evaluation Criteria and Weightings

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<td>Completion of assignment within deadline</td>
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<td>Clarity and thoroughness of questionnaire</td>
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<td>Details of notes on responses</td>
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<td></td>
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<tr>
<td>Organization and preparation of role play</td>
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<tr>
<td>Quality and creativity of role play presentation</td>
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<td><strong>TOTAL</strong></td>
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</table>
Lesson 1-1: Basic Network Types

Network Wizards

Researching a Network

Materials Needed

- None

Directions

1. Select and research how networking is used in one of the following environments:
   - Airline/hotel/concert reservations
   - Telephone
   - Cable television
   - The Internet
2. Use the supermarket example found in the content manual of this lesson as a guide.
3. Diagram the path of a transaction across the network.
4. Present your diagram and research in an oral presentation to the class.
5. Prepare a list of the resources and references used to complete this task.
6. Add your diagram, resource list, and presentation outline to your portfolio.

Rubric: Suggested Evaluation Criteria and Weightings

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<tr>
<th>Criteria</th>
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<tbody>
<tr>
<td>On-time delivery of assignment</td>
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<tr>
<td>Resources and references list</td>
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<tr>
<td>Content analysis and synthesis</td>
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</tr>
<tr>
<td>Quality and creativity of the oral presentation and diagram</td>
<td>40</td>
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Summary

In this lesson, you learned the following:

- The definition of Local Area Network, Peer to Peer and Client/Server Relationships, Wide Area Network, Metropolitan Area Network, and Enterprise Network.
- The graphical representation of LANs, MANs, and WANs.
- The differences between a peer-to-peer network and a client/server network.
- The common resources shared within a network.
- How to develop a questionnaire and interview a network manager or client about network design, issues, and benefits.

Review Questions

Lesson 1-1: Basic Network Types

Part A

Matching

Colleges and universities often have campuses at several different locations. Each campus typically has several buildings; examples include the science building, the library, the administration building, and so on. Within each of the buildings are various departments and workgroups. The computer and biology departments have several labs, the administration has a dean’s office, an accounting group, and so on. As a rule, university systems are networked to the Internet. Using this information, complete the matching questions.

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.____</td>
<td>Wide Area Network</td>
<td>A. The biology lab</td>
</tr>
<tr>
<td>2.____</td>
<td>Metropolitan Area Network</td>
<td>B. The Internet</td>
</tr>
<tr>
<td>3.____</td>
<td>Peer to Peer</td>
<td>C. The south and north campuses of a college</td>
</tr>
<tr>
<td>4.____</td>
<td>Client/Server</td>
<td>D. The science department</td>
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Lesson 1-1: Basic Network Types

True/False

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>A Metropolitan Area Network is usually found in one building.</td>
</tr>
<tr>
<td>2.</td>
<td>Two computers connected together are considered a network.</td>
</tr>
<tr>
<td>3.</td>
<td>The most common type of network in small organizations is a WAN.</td>
</tr>
<tr>
<td>4.</td>
<td>Peer to Peer LANs connect 1000s of computer devices.</td>
</tr>
<tr>
<td>5.</td>
<td>An enterprise network is owned and operated by the corporation using the network.</td>
</tr>
</tbody>
</table>

Short Essay

1. Name and define the two Local Area Network types.
2. What is the difference between a MAN and a WAN? Give an example of each type.

Part B

Network Design Questions

1. Draw a diagram of a Local Area Network. Label and show both a Peer to Peer and a Client/Server environment.
2. Draw a diagram of an Enterprise Network. Label and include a LAN and a MAN in your diagram.
3. Draw a diagram of a Metropolitan Area Network. Label the networks.

Part C

Short Essay

1. Describe peer-to-peer networking and client/server networking.

Part D

List at least 5 common resources shared over a network.
# Scoring

**Rubric: Suggested Evaluation Criteria and Weightings**

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<thead>
<tr>
<th>Criteria</th>
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<tr>
<td>Part A: Define the following: Local Area Network, Wide Area Network, Metropolitan Area Network, and Enterprise Network</td>
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<td>Part B: Graphically represent LANs, MANs, and WANs</td>
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<td>Part C: Describe the differences between a peer-to-peer network and a client/server network.</td>
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<td>Part D: Identify common resources shared within a network.</td>
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<tr>
<td><strong>Try It Out</strong></td>
<td><strong>100</strong></td>
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<tr>
<td><strong>Stretch Yourself</strong></td>
<td><strong>100</strong></td>
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<tr>
<td><strong>Network Wizards:</strong> How to develop a questionnaire and interview a network manager or client about network design, issues, and benefits.</td>
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# Resources


