6
NETWORK MEDIA AND DEVICES

PROJECTS

Project 6.1 Understanding Key Concepts

Project 6.2 Comparing Physical Media Applications

Project 6.3 Identifying Physical Media Types

Project 6.4 Comparing Network Scenarios

Project 6.5 Choosing the Right Device

Project 6.1	Understanding Key Concepts
Overview	Media and hardware selections are critical decisions during network design and critical choices during network implementation. You need to make selections that not only meet current needs, but also continue as much as possible to support the network as it grows and as technology changes. Some choices, like whether to use twisted pair or coaxial cable, are obvious. Others, like the specific category of cable to use, require more thought. Because term definitions can sometimes vary depending on the context in which they are used, being able to recognize terms and how they are used in the context of network media and devices is important.
Outcomes	After completing this project, you will know how to: ▲ identify key terms and concepts related to network media and devices
What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	20 minutes
Precautions	None

The worksheet includes a list of networking terms on the left and descriptions on the right. Match each term with the description that it most closely matches. You will *not* use all descriptions. Each description can be used only once.

___	Bridging loop	A. Measurement of opposition to varying electrical current
___	Radio grade	B. Type of cable used in Thinnet and Thicknet network applications
___	STP	C. Interference affecting electronic signals and caused by a strong magnetic field
___	UTP	D. Area within an Ethernet network in which all devices compete for access to the same logical or physical cable segment
___	Coax	E. Specification for coaxial cable rated for network applications
___	Broadcast domain	F. Multiport bridge connection device operating at OSI layer 2
___	Collision domain	G. Type of cable used to connect devices in a 10BaseT network

___	Hub	H. Unit of measurement for resistance or impedance
___	Switch	I. Physical star connection device that connects all attached devices in the same collision domain
___	EMI	J. Teflon-based, fire-resistant cable installation used with cable run through walls and cable races
___	Impedance	K. Set of nodes configured to receive broadcasts as a group
___	Induction	L. Condition where packets are passed between devices without ever reaching the destination segment
___	Plenum	M. Cable containing multiple pairs of wires that are twisted periodically and covered with a foil or braid shield
___	Ohm	N. Process by which a moving electrical current causes a voltage on a nearby wire
		O. Plastic commonly used for cable insulation that can release toxic fumes when burned
		P. Thicknet cable tap

Project 6.2	Comparing Physical Media Applications
Overview	Different types of copper-wire cables are designed for use in different network applications. You need to be able to match up the cable type with the network application so that you can make appropriate decisions when designing your network. As a result, you should be able to identify a cable type by both its physical description and a description of its use. Doing so is complicated by the fact that some descriptions overlap, applying to more than one basic cable type. In this project you will be matching cable types to cable design and application descriptions. For now, you are concerned only about the basic cable type, not its specific category characteristics.
Outcomes	After completing this project, you will know how to: ▲ recognize a cable type by a description of its physical structure ▲ recognize a cable type based on how it is used

What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	20 minutes
Precautions	None

The worksheet includes Table 6-1 with different basic cable types and a list of statements that describe one or more of them. Check the boxes for the letters that best describe each cable type. Each statement applies to at least one type of cable. Some statements may apply to multiple cable types.

A. Has a single conductor
B. Has multiple conductors
C. Has a foil or braid shield to minimize EMI
D. Used to wire physical star networks
E. Used to wire physical bus networks
F. Used in Ethernet logical bus applications
G. Used in Token Ring logical bus applications
H. Can be used with an IBM hermaphroditic connector
I. Can be used with an RJ-45 connector
J. Can be used with a vampire tap

Table 6-1: Cable Types

Network cable type	A	B	C	D	E	F	G	H	I	J
UTP										
STP										
Coax										

Project 6.3 Identifying Physical Media Types

Overview

Each basic cable type includes multiple types or categories of cable, each with its own unique characteristics and physical applications. You not only need to know what kind of cable to use in a network application—either coax, STP, or UTP—but you also need to be able to select the appropriate type or category of cable. You also need to understand the type of connectors required for each.

When selecting cable for a networking project, you need to ensure that the cable will support the current network application and communication bandwidth. Whenever possible, you want to choose cable that will continue to meet your needs as the network expands and as network bandwidths increase.

	This project addresses each of the basic cable types separately so that you can identify the uses of coax, STP, and UTP cable types without concerning yourself with the possible overlap between the cable types. You will also identify common connector types.
Outcomes	After completing this project, you will know how to: ▲ identify coaxial cable types by application ▲ identify STP cable types by features and applications ▲ identify UTP cable categories by features and applications ▲ identify commonly used connectors
What you'll need	To complete this project, you will need: ▲ the following worksheet ▲ cable samples to examine, if possible
Completion time	30 minutes
Precautions	None

■ Part A: Coaxial Cable Grades

Match each coaxial cable grade with the best description of its characteristics and applications for which it is used. You will use each description only once. You will use all of the descriptions.

___	RG-6	A. 75-ohm cable used for cable TV only and having up to four layers of shielding
___	RG-8	B. Stranded-core thin Ethernet cable used for military applications only
___	RG-11	C. Solid-core thin Ethernet cable
___	RG-58/U	D. Used to connect IBM 3270 system to terminals
___	RG-58 A/U	E. 75-ohm cable used for ARCNET and cable TV, recognizable by its large outer housing
___	RG-58 C/U	F. 93-ohm cable used for cable TV transmission applications only
___	RG-59	G. Stranded-core thin Ethernet cable used for civilian network applications

___	RG-62	H. Used for thick Ethernet applications and requires a vampire tap and drop cable to connect to network devices

■ Part B: STP Cable Types

Match each STP cable type with the best description of its characteristics and applications for which it is used. You will use each description only once. You will use all of the descriptions.

___	Type 1	A. Two pairs of 26-gauge flat copper wire designed for routing under carpets, but limited by its tendency for signal loss over distance
___	Type 2	B. Two pairs of 22-gauge copper wire used to connect nodes to the MAU in an IBM Token Ring network
___	Type 6	C. Two pairs of 26-gauge copper wire with a solid or stranded core and plenum jacket, typically used in backbone implementations between floors
___	Type 8	D. Four pairs of 22-gauge copper wire used as a hybrid cable supporting multiple concurrent applications, such as voice and data
___	Type 9	E. Two pairs of 26-gauge copper that can be used as a patch cable or to connect nodes to a MAU

■ Part C: UTP Cable Categories

Match each UTP cable category with the best description of its characteristics and applications for which it is used. You will use each description only once. You will use all of the descriptions.

___	Cat 1	A. Used in legacy 4-Mbps Token Ring networks, but no longer recognized under the 568-A standard
___	Cat 2	B. Certified to 100 Mbps for use in Ethernet networks, but sometimes found in higher bandwidth networks, even though not certified for those applications

___	Cat 3	C. Used in 16-Mbps Token Ring networks only
___	Cat 4	D. Certified up to 10 Gbps for Ethernet, 625 MHz for transmission, and specified as the standard cable for 10GBaseT networks
___	Cat 5	E. Certified for no higher than 1000 Mbps (1 Gbps) and found in a large number of physical star Ethernet networks
___	Cat 5e	F. Found in legacy 10BaseT networks and certified at no more than 10 Mbps
___	Cat 6	G. Voice-grade cable not suitable for data transmission applications
___	Cat 6e	H. Certified for up to 1.2 GHz, depending on the application and used for full-motion video and special government manufacturing applications, but has no current LAN applications
___	Cat 7	I. Certified for up to 10 Gbps for Ethernet applications and up to 400-MHz transmissions

■ Part D: Common Connectors

Write in the name of the connector below each of the following figures. The connectors shown are for various cable types, including coaxial, UTP, STP, and fiber optic.

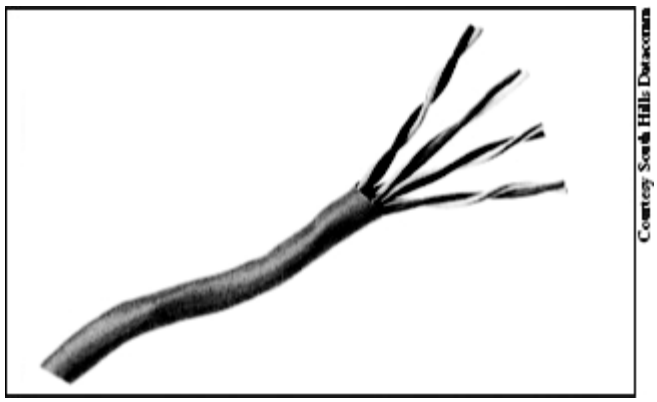

Figure 6-1: Connector #1

1. _____

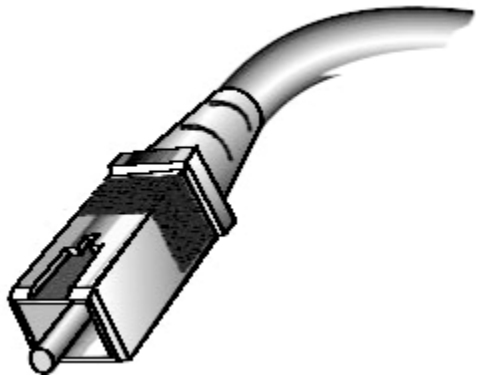

Figure 6-2: Connector #2

2. _____

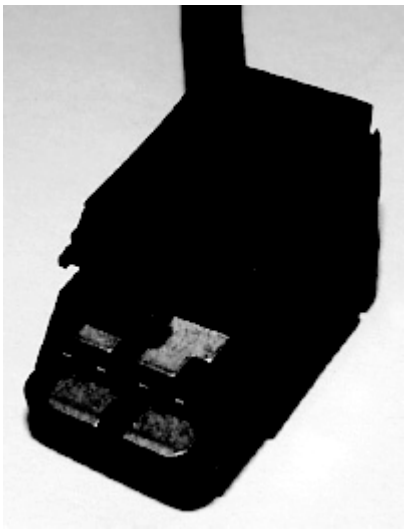

Figure 6-3: Connector #3

3. _____

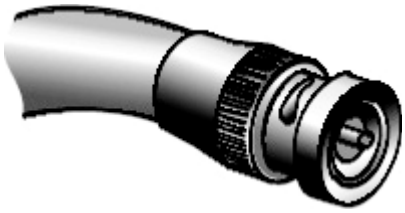

Figure 6-4: Connector #4

4. _____

Project 6.4	Comparing Network Scenarios
Overview	Not only do you need to understand the characteristics of different types of network media, you also need to be able to apply this knowledge to meet practical, real-world networking requirements. This means balancing several factors, such as the physical environment, equipment costs, existing networks (if any), computer operating systems and hardware, and communication requirements. The final solution is often a compromise based on networking requirements, budgetary restrictions, and even network administrator or IT personnel preferences. When designing a network, you make your best choices based on requirements, restrictions, and the existing environment. You need to remain flexible after developing your design because sometimes issues arise during implementation that were not obvious during the design phase. Unknown issues that may arise can make it necessary for you to make last-minute changes. However, try and avoid these changes whenever possible because changes tend to be more expensive and more complicated the later you make them in the process. Hence, you need to consider not only the technologies that you plan to use, but also other available technologies. In this project, you will look at three different network scenarios in which a company is moving into a new office space. Each scenario has a physical environment and different network requirements.
Outcomes	After completing this project, you will know how to: ▲ identify the appropriate media selections for a given network scenario ▲ identify additional hardware requirements ▲ discuss features, benefits, and drawbacks of a specific media type
What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	45 minutes
Precautions	None

■ Part A: Generic Network

A company is moving into a new office space with an open floor plan. The office partitions are designed to facilitate routing physical network cables. The network budget allows for the purchase of new cabling and connection hardware, including network adapters, as necessary. However, you have been directed to keep costs as low as possible. The company wants to install a network with a minimum bandwidth of at least 100 Mbps. The plan should allow for future expansion and for eventually taking the bandwidth to 1 Gbps. The final network should not have any routing requirements.

1. Compare the appropriateness of each of the following media types for this scenario:
   a. STP

   _____

   _____

   b. UTP

   _____

   _____

   c. Coax

   _____

   _____

   d. Fiber optic

   _____

   _____

   e. Wireless

   _____

   _____

2. Which media type should you use to wire the network (be as specific as possible)? Why?

   _____

   _____

3. Describe the general network configuration.

   _____

   _____

4. What types of connection hardware, including cable connectors, would you use to connect network devices?

_____

_____

5. What guidelines should you follow for wiring the network?

_____

_____

6. What would be necessary to upgrade the network to 1 Gbps, based on your initial design?

_____

_____

■ Part B: Wiring Concerns

A company is moving into new office space. The office has a small room to be used as a secure server room off the main part of the office. The servers will be wired using cables and a 100-Mbps switch brought over from the current office. Unfortunately, you have no way to route cable or network cables from this room to the rest of the office without running them across a concrete floor. The project budget includes funds to purchase new network and connection hardware, as necessary. Reliable connectivity is a higher concern than available bandwidth.

1. Compare the appropriateness of each of the following media types for this scenario:
   a. STP

_____

_____

   b. UTP

_____

_____

   c. Coax

_____

_____

   d. Fiber optic

_____

_____

e. Wireless

_____

_____

2. Except for the servers in the secure server room, which media type should you use to wire the network (be as specific as possible)? Why?

_____

_____

3. What types of connection hardware, including cable connectors, would you use to connect network devices?

_____

_____

4. Describe how you would connect the servers to the rest of the network.

_____

_____

5. What are potential concerns with this network configuration?

_____

_____

6. What actions can you take to avoid potential problems?

_____

_____

7. Which network device(s), if any, could be a bottleneck and potential point of failure bringing down the network?

_____

_____

■ Part C: Noise Concerns

A company is moving into a new shared office and manufacturing space. Most users work on the manufacturing floor. The manufacturing equipment emits high levels of both magnetic and radio frequency interference. The space is designed to physically protect network cables from damage when properly routed, but some cables will be routed next to or under manufacturing equipment. The in-house IT staff is responsible for network and computer equipment maintenance. The

network should use the same topology and media throughout to minimize the number and variety of spares that must be kept on hand.

1. Compare the appropriateness of each of the following media types for this scenario:
   a. STP

   _____

   _____

   b. UTP

   _____

   _____

   c. Coax

   _____

   _____

   d. Fiber optic

   _____

   _____

   e. Wireless

   _____

   _____

2. What is the primary concern in the ambient environment in relationship to network design and implementation?

   _____

   _____

3. Which media type should you use to wire the network (be as specific as possible)? Why?

   _____

   _____

4. What types of connection hardware, including cable connectors, would you use to connect network devices?

   _____

   _____

5. From the standpoint of cost, how does this network design compare to other common network configurations?

_____

_____

Project 6.5	Choosing the Right Device
Overview	Media is only part of the design decision when setting up a new network or expanding (or upgrading) an existing network. You must also select appropriate network devices, as needed, to meet communication, reliability, and configuration requirements. This project has you choose network devices based on network configuration and support requirements.
Outcomes	After completing this project, you will know how to: ▲ choose appropriate network devices to meet network requirements
What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	40 minutes
Precautions	None

For each of the following network requirement descriptions, choose the network device or devices that meet your support needs and answer the questions about your selections.

1. You have two unconnected network segments, one Token Ring and other Ethernet, both wired as physical stars. They should be treated as a single network connection after they are connected, but traffic local to a physical segment should be kept local to that segment.
   a. What kind of device should you use to connect the segments?

   _____

   _____

   b. How is traffic filtered?

   _____

   _____

   c. What are possible performance concerns with traffic moving between the segments?

   _____

   _____

2. Some employees have both computers and dumb terminals on their desks. Some employees have to share terminals, making for constant interruptions. The dumb terminals are required for accessing information from a mainframe computer. Applications and data are gradually being migrated from the mainframe to PC servers, but this process will take at least two more years to complete. You want to get rid of the terminals.
   a. What kind of device would let you get rid of the terminals and connect the computers to the mainframe?

   _____

   _____

   b. At what layer or layers of the OSI model does this type of device operate?

   _____

   _____

   c. What are the possible terminology concerns when discussing this configuration with others?

   _____

   _____

3. A network is wired as a physical bus. You are extending the cable to include another area of the office and add computers to the network. When you connect the additional cable, even before connecting any new computers, users start complaining about intermittent network problems. You cannot reliably reproduce any of the problems.
   a. What kind of device do you need to correct this problem?

   _____

   _____

   b. How would you rewire the network to correct the problem?

   _____

   _____

   c. What is the possible signal-quality concern with this configuration?

   _____

   _____

   d. What is the maximum number of devices of this type you can include on a single network segment?

   _____

   _____

4. Your Ethernet network is wired as a physical star. All of the necessary cables are in place. You purchase 50 computers on a sealed bid contract, buying them all from the lowest bidder. When the computers arrive, you discover you have no way of connecting them to the network.
   a. What kind of device do you need to correct this problem?

   _____

   _____

   b. How many will you need?

   _____

   _____

   c. How might this problem have been avoided?

   _____

   _____

5. Each floor of your office is wired as a 100-Mbps Ethernet network. You have a vertical backbone using UTP cable connecting the floors. You want to keep as much traffic as possible local to each floor and each floor should have a different network address.

   a. What kind of device should you use to connect each floor to the backbone?

   _____

   _____

   b. How is traffic filtered to keep traffic local to the network?

   _____

   _____

   c. What kind of network traffic is not propagated by the device?

   _____

   _____

   d. How would the requirement change if you had a fiber-optic backbone?

   _____

   _____

6. As your network has grown, network performance has degraded. It dropped significantly when you recently added 50 computers. Currently, hubs are used to connect the network computers and all of the hubs are directly connected to each other through uplink ports. You need to correct the problem, but want to avoid reconfiguring the network computers if at all possible. You also want to keep your additional hardware purchases to a minimum.
   a. What kind of device should you use to correct this problem?

   _____

   _____

   b. How would you reconfigure the network?

   _____

   _____

   c. What is the underlying problem and how does this help correct the problem?

   _____

   _____

   d. What changes, if any, must be made to the network computers?

   _____

   _____

7. Your network has four physical segments wired as physical stars. They connect through hubs to a backbone cable. The number of computers on each segment has increased to the point that each needs to be configured as a separate network segment. You want to keep configuration requirements to a minimum.
   a. With what kind of device do you need to replace the hubs?

   _____

   _____

   b. How does this change affect how traffic is managed by connection devices?

   _____

   _____

   c. What changes, if any, must be made to the network computers?

   _____

   _____