9
ENTERPRISE NETWORKING SERVICES

PROJECTS

Project 9.1	Understanding Key Concepts
Overview	As companies grow, so do their networks. That means that just because you're responsible for a LAN today doesn't guarantee you won't be managing a WAN tomorrow, or at least some time in the near future. This also means that network design, for most networks, is no longer a task you do once and forget.
	If you are preparing to work with enterprise networks, you need to understand the terminology related to those networks. Many of these terms apply to both LAN and WAN environments.
	During this project, you will match various management-related terms to the definitions and descriptions of how they are used.
Outcomes	After completing this project, you will know how to:
	▲ identify key terms and concepts related to WANs and network design
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 management-related 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.

___ Capacity planning

A. Network technology closest to the user, typically the LAN or remote access connection

___ Circuit loading

B. Network design process based on lengthy, detailed analysis and often taking up to two years to complete the design

___ Local loop circuit

C. Network design process based on the concept that networks using a few standard components are less expensive in the long run than networks that use a wide variety of components

___ Upstream circuit

D. Process of estimating the size and type of network circuits needed

___ Downstream circuit

E. Place at which an ISP provides services to its customers (the customers' connections to the ISP)

___   Access layer

___   Distribution layer

___   Core layer

___   Building-block process

___   Turnpike effect

___   Shared multipoint circuit

___   Physical network design

___   Logical network design

___   POP

___   ARP

F. Innermost part of the network connecting distribution layer networks, as with WAN connections

G. Result of the technology design process, identifying the network hardware and software needed, typically as design diagrams

H. Term referring to the amount of traffic that a circuit must carry

I. Circuit design in which several customers connect to the same circuit, sharing the available bandwidth

J. Part of the network that connects the access layer to the rest of the network as with a backbone network

K. Term referring to traffic from the carrier or ISP to the customer

L. Goal of the needs assessment design phase, consisting of a statement of the required network elements

M. Term referring to the circuit carrying traffic from the customer to the carrier or ISP

N. When network use exceeds original estimates simply because the network and its services are available to the users

O. TCP/IP protocol that resolves a device's IP address from its MAC address

P. The connection between the carrier's central office and the customer

Q. TCP/IP protocol that resolves a device's MAC address from its IP address

Project 9.2	Identifying Network Design Requirements
Overview	The network design process is usually treated as a series of design phases. Often, these phases are broken down into needs analysis, technology design, and cost assessment. However, neither of these phases is completely isolated. Each impacts the other, and during the design process you often have to go back and forth between the design phases until you are finished. Understanding the design process, including the design phases and what you should do during each phase, is important. You also need to know the expected deliverable for each phase. This project focuses on network design phases, including the requirements of each and expected deliverables.
Outcomes	After completing this project, you will know how to: ▲ identify network design phases ▲ identify design phase deliverables
What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	30 minutes
Precautions	None

■ Part A: Design Phases

Part A includes Table 9-1 with the network design phases and a list of statements that describe one or more of them. Check the boxes for the letters that best describe each design phase. Each statement applies to at least one design phase. Some statements may apply to multiple design phases.

A. Deliverables include a set of network diagrams
B. Product brands and models are determined
C. Product vendors are identified
D. Router placement is determined
E. Includes identification of the access, distribution, and core layers
F. Includes determining circuit loading
G. RFP is one of the deliverables
H. Requirements are organized as mandatory, desireable, and wish list
I. Includes identification of application servers
J. Sometimes uses network discovery tools and simulations

Table 9-1: Network Design Phases

Design phase	A	B	C	D	E	F	G	H	I	J
Needs analysis										
Technology design										
Cost assessment										

■ Part B: Network Design

Part B includes Table 9-2 with the network and a logical network diagram (Figure 9-1). Match each labeled area on the network diagram with the geographic scope layer in Table 9-2. Each letter applies to one and only one layer.

Table 9-2: Network Layers

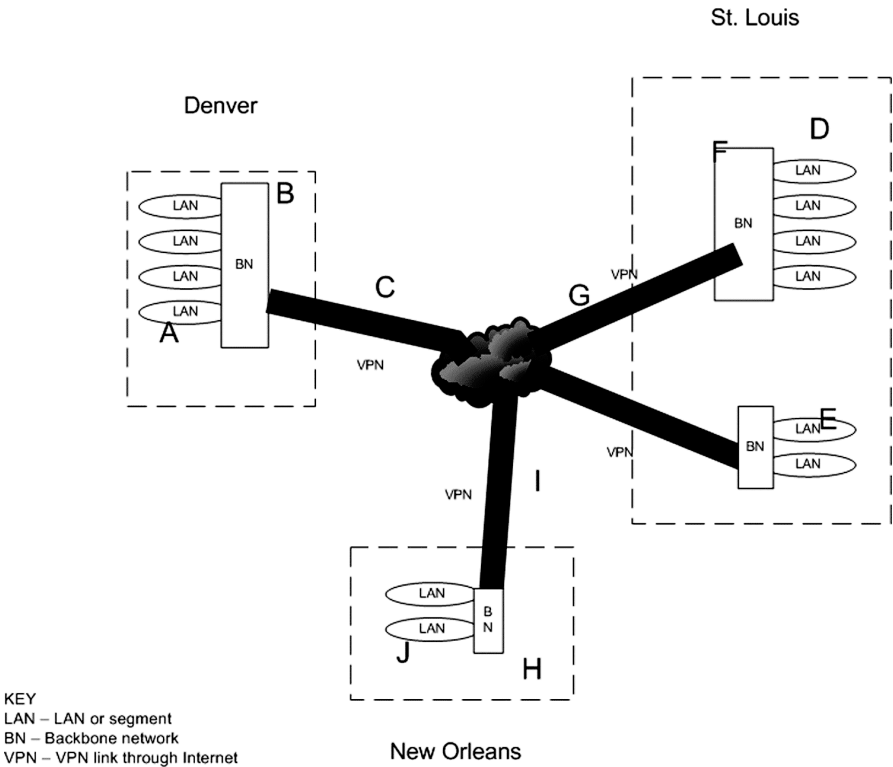| Network layer	A	B	C	D	E	F	G	H	I	J
Access										
Distribution										
Core										

Figure 9-1: Logical network

■ Part C: Physical Network Design

Part C includes Table 9-3 with the network and a physical network diagram (Figure 9-2). This is a detailed diagram of the Denver LAN based on the logical network diagram shown in Figure 9-1. The network connects to other networks through a VPN link through the Internet. It also has a connection to the public Internet for client access and to support public web servers. LAN traffic needs to support a circuit load of up to 100 Mbps.

Match each labeled area on the network diagram with the appropriate network hardware. One or more devices of that type could be installed at each labeled area. A letter can apply to more than one type of hardware. Some types of hardware may not be used.

Table 9-3: Network Layer

Network layer	A	B	C	D	E	F	G	H	I
Hub									
Switch									
Bridge									
Router									
RRAS Server									
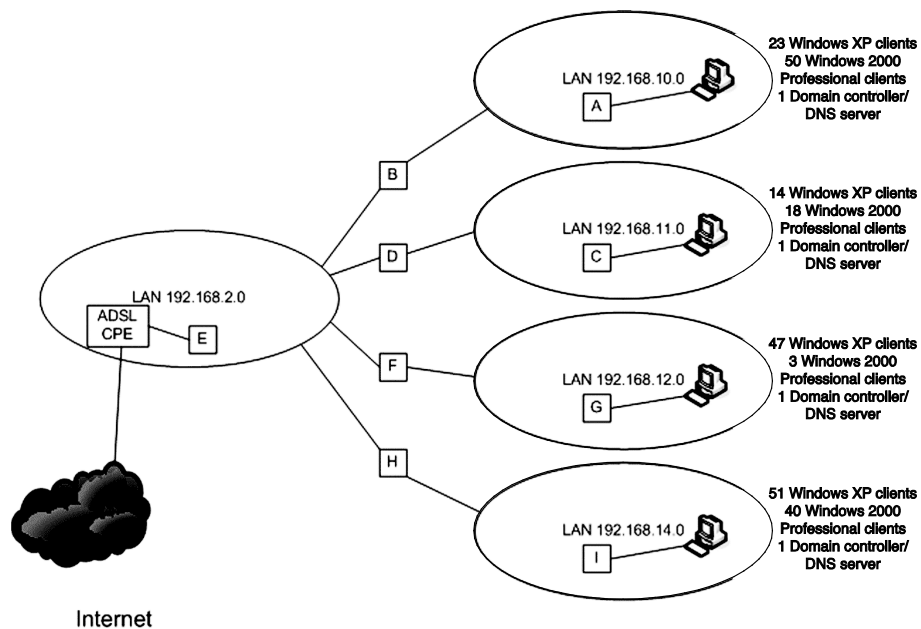
Figure 9-2: Physical Denver network

Project 9.3	Designing a Network
Overview	The network design process includes careful analysis and detailed network design. Several design decisions must be made along the way. Sometimes rethinking some of your decisions later in the process is necessary when conditions change or you discover additional information.
	When dealing with an existing network, a key part of the process is completing your network inventory. You need to identify the computers (clients and servers) that are on the network and information about each. Automated tools are available to assist with the process, but other tools like checklists can also be helpful.
	This project has you go through selected network design activities in some detail. This project includes information gathering and making design decisions based on what you know about the network.
Outcomes	After completing this project, you will know how to: ▲ inventory network resources ▲ identify and rank network resources ▲ identify network devices
What you'll need	To complete this project, you will need: ▲ a computer running Windows Server 2008 ▲ the following worksheet
Completion time	30 minutes
Precautions	This project makes some assumptions concerning to your server's configuration, based on earlier projects. If your server is configured differently, your answers will vary, which doesn't necessarily mean that your answers are incorrect.

■ Part A: Computer Inventory

In this part of the project, you will inventory your domain controller. You should be logged on as an Administrator at the beginning of this project. This part of the project includes a computer inventory worksheet. As you work through the project steps, complete the worksheet.

Computer name: _____

Operating system: _____

Server roles: _____

IP address: _____

Primary DNS: _____

WINS: _____

NIC make and model: _____

Video adapter: _____

■ Part B: Identify Network Requirements

In this part of the project, you will answer questions related to network design decisions. Refer to Figure 9-3 for this project.
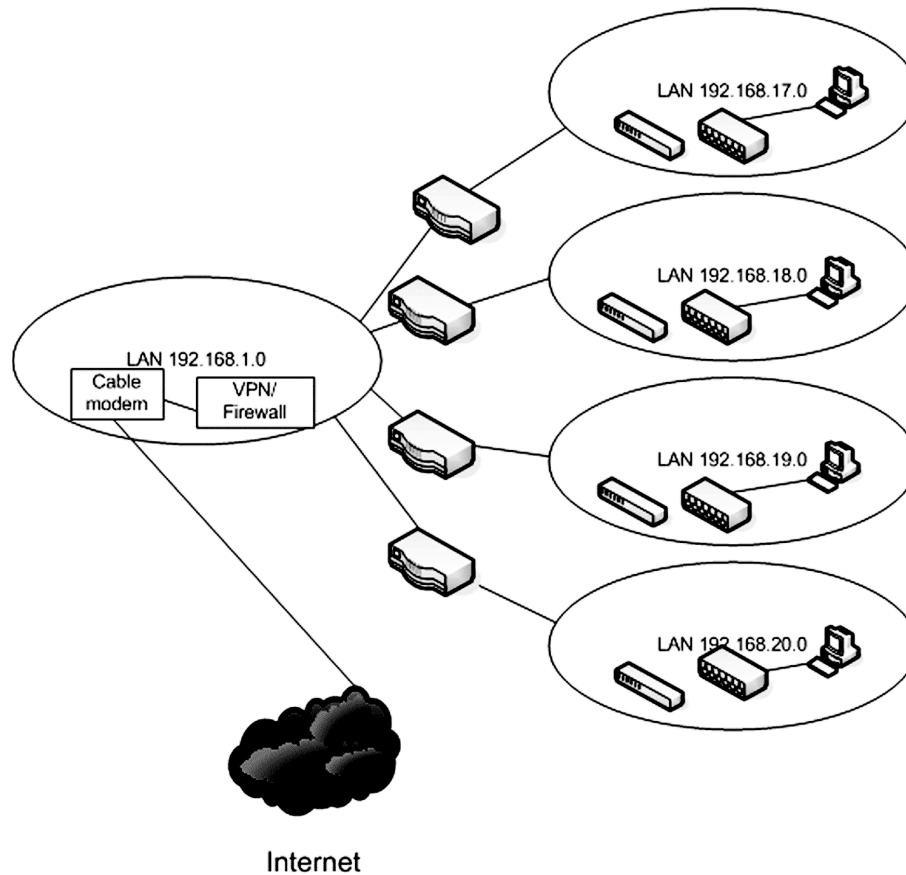

Internet
Figure 9-3: Downtown St. Louis LAN

Busicorp has one office location in downtown St. Louis. The office connects to the WAN via VPN connections over the Internet. The company has no plans at this time to modify the downtown LAN. You will be deploying the West County areas of St. Louis County after you complete the network design. Both LANs will be part of the same Windows Active Directory domain.

In the existing network, you have a domain controller that is also configured as a DNS server in each subnet. You have a DHCP server in network 192.168.17.0 that also supports network 192.168.18.0 and a DHCP server in network 192.168.19.0 that also supports network 192.168.20.0.

Details of the West County LAN are as follows:

- Thirty initial clients evenly spread between two subnets with planned growth to 30 or more in each.
- Two private subnets (192.168.21.0 and 192.168.22.0) connected to a 100-Mbps backbone (192.168.5.0).

- Design must include network hardware except cable plant, which will be handled by building facilities.
- A separate connection will provide Internet connectivity for client computers.
- Initial servers must include domain controllers, DNS servers, a file/print server, and internal web server.

Clients will receive their addresses through DHCP. You need to be able to establish eight collision domains on the new LAN to cover communication requirements as the office grows. Hardware costs should be kept to a minimum.

You are not responsible for the wide area connection or any of its related hardware. A different design group will separately handle it. The wide area link will connect to your backbone.

1. What servers must you include as mandatory requirements in the new LAN?

   _____

2. What servers should you include as desired requirements, if any (explain why)?

   _____

   _____

3. Assuming you are directed to deploy no more than three physical servers, how should you configure them to meet the mandatory requirements?

   _____

   _____

4. Explain your reasoning for the server configurations.

   _____

   _____

   _____

   _____

5. You want to deploy a WAP/router with one public-side connector for the cable modem and four private-side connectors on LAN 192.168.21.0. It supports client network address translation and has a built-in firewall. What are the advantages, if any, of using this device?

   _____

   _____

   _____

6. What are the potential disadvantages?

   _____

   _____

   _____

7. Describe how it would be connected to the network.

_____

_____

_____

8. Add a sketch of the new LAN to Figure 9-3. Do not include the servers, just connection devices.

■ Part C: Identify Network Hardware

Part C uses the same LAN segments as Part B. Base your answers on your physical network design in Part B.

The company's purchase guidelines call for using routers with two NICs installed, 8-port switches, and 16-port hubs in all network designs.

1. How many access layer segments are present in your new design (old and new LANs) and what are they?

_____

_____

_____

2. Distribution layer?

_____

3. Core layer?

_____

4. How many of each of the following will you need for your initial deployment. Explain your answers:
   a. Switches

_____

   b. Hubs

_____

   c. Routers

_____

5. What fault tolerance for network services, if any, is built into your server deployment design?

_____

_____

6. What would be the advantage of purchasing all client computers with the same hardware
    configuration?

    _____

    _____

Project 9.4	Researching Network Hardware
Overview	During the technical design phase you work on creating the network's physical network design. During this process you identify the network devices that you need and determine their placement, which includes ensuring that the equipment can support the projected circuit load.
	Often overlapping this process is cost assessment. During this phase, you identify the potential vendors and then have them provide cost estimates. Technical design and cost assessment often overlap. You might choose to adjust your physical design based on hardware availability and cost.
	During this project you will research network hardware availability from three online vendors.
Outcomes	After completing this project, you will know how to: ▲ research hardware cost and availability ▲ estimate network hardware cost
What you'll need	To complete this project, you will need: ▲ a computer with Internet access ▲ to first complete Project 9.3 ▲ the following worksheet
Completion time	30 minutes
Precautions	The retailers for this project were chosen because they are representative of their type of business, have a presence throughout the United States, and are accessible through their Web sites. It should not be taken as an endorsement or recommendation of these retailers or their products. Your instructor may choose to have you research different retailers during this project.
	If working on an existing network, you must review the project steps with your network administrator. Your network administrator may need to make changes or additions to the instructions.

During this project you will research hardware availability and cost from three vendors. These are:

- **Office Depot** (www.officedepot.com): Office Depot is a traditional "brick-and-mortar" retailer that also has an online retail presence. Office Depot is a general office supply retailer that, in recent years, has branched out to include computer hardware and other office-related consumer electronics.

- **Amazon** (www.amazon.com): Amazon started out as an online bookseller, but has become the web's most popular one-stop shop. Its product mix includes both consumer electronics and a wide variety of computer and network hardware.

- **CDW** (www.cdw.com): CDW does business under a variety of names, including PC Warehouse, MacWarehouse, and Warehouse.com. Its primary business is computer and network hardware and software. It focuses on supporting small-to-large business customers.

For each of the devices, if the vendor does not offer a device of that type or you can't find the information requested, enter **N/A**.

■ Part A: Hub

In Part A, research each of the retailer sites, find the hubs offered for sale, and complete Table 9-4.

Table 9-4: Hubs

Feature	Office Depot	Amazon	CDW
Make/model			
Price			
Speed			
Supported standards			

■ Part B: Switches

In Part B, research each of the retailer sites, find the switches offered for sale, and complete Table 9-5.

Table 9-5: Switches

Feature	Office Depot	Amazon	CDW
Make/model			
Price			
Speed			
Supported standards			

■ Part C: WAP/broadband Routers

In Part C, research each of the retailer sites, find the broadband DSL-cable modem/wireless routers offered for sale, and complete Table 9-6.

Table 9-6: WAP/broadband routers

Feature	Office Depot	Amazon	CDW
Make/model			
Price			
Wired speed			
Wired ports			
Hub/switch			
Supported standards			

■ Part D: Routers

In Part D, research each of the retailer sites, find the wired routers offered for sale, and complete Table 9-7. You are looking for wired routers only. Do not include wireless routers.

Table 9-7: Routers

Feature	Office Depot	Amazon	CDW
Make/model			
Price			
Number of ports			
Relevant features			

■ Part E: Cost Estimates

Complete Table 9-8 based on your equipment estimates from Project 9.3 and cost estimates from this project. Use the best price you found for each item. If the best price you found for switches is better than the best price for hubs, feel free to substitute switches for hubs. Do not consider any costs other than the hardware price in this table. After completing the table, answer the questions that follow.

Table 9-8: Cost Estimates

Equipment	Number required	Cost for each	Total cost
Hub			
Switch			
WAP			
Router			

1. What is the total hardware cost?

    _____

2. What network hardware is not included in this estimate?

    _____

3. What other costs might you need to consider when ordering the hardware?

    _____

4. Some businesses assign a specific salesperson to your account after you register as a customer. What are potential benefits of doing so?

    _____

    _____

5. What are potential drawbacks?

    _____

    _____

Project 9.5	Investigating Service Options
Overview	Internet connection options have expanded in recent years. DSL and cable Internet providers have shifted their focus from home consumers to business customers. The bandwidths supported by their connection options more than meet the needs of most small- to medium-sized businesses. Some also offer services targeted at large businesses and enterprise networks, including business-specific services such as static IP addresses, VPN connections, and so on.
	During this project, you will research the service offerings of two high-speed Internet ISPs.
Outcomes	After completing this project, you will know how to: ▲ configure a VPN connection
What you'll need	To complete this project, you will need: ▲ a computer with Internet access ▲ the following worksheet

Completion time	30 minutes
Precautions	Internet access is required to complete this project. The completion time will vary depending on various factors, such as connection speed and how long it takes you to navigate the provider's Web site. Specific navigation hints have not been given because the sample providers frequently update and modify their Web sites.
	Selection of the service providers used in the project should not be taken as an endorsement or recommendation of these providers or their services. Your instructor may choose to have you research different providers during this project.

You will be researching two high-speed Internet service providers, comparing prices for DSL business services provided by EarthLink and high-speed cable business services provided by Charter Communications. Your instructor may have you use different service providers. The Web site URLs are:

- EarthLink: www.earthlink.com
- Charter Communications: www.charter.com

You will need to navigate through each of the Web sites to locate the information you need. Look for connection rates between 3 and 5 Mbps (preferably 5 Mbps). Focus your search on business services provided by each of the ISPs. Because companies often change their Web sites to keep the content fresh, the project does not provide any navigation hints. However, business service links are clearly identified on both providers' Web sites and both include a search function to let you search for specific services.

If you are prompted for address information at any point, use the following, or another address provided by your instructor:

Street address: 100 Main
ZIP: 63601

If you are unable to find an answer, write **Could not find** in the space.

■ Part A: DSL Service

EarthLink is an ISP company that provides an array of services. Traditionally, it provided dial-up telephone service only, but has added support for ISDN, DSL, and even fiber-optic WAN connections. Visit the EarthLink Web site and answer the following questions regarding the support for small- to medium-sized businesses:

1. What is the cost per month?

    _____

2. What is the access speed (download/upload)?

    _____

3. Is the line speed guaranteed?

   _____

4. How many static IP addresses, if any, are provided?

   _____

5. How many e-mail accounts are provided?

   _____

6. How much space per mailbox is provided?

   _____

7. What is the access technology?

   _____

8. Does it support VPNs?

   _____

9. Does it support Web servers?

   _____

10. Does it support SSL?

   _____

■ Part B: Cable Modem Service

Charter Communications is one of the largest cable television providers in the United States. In recent years it has added support for high-speed Internet access and voice-over IP (VoIP) telephone service. It has business service options designed to meet the needs of various sized businesses. Visit the Charter Web site and answer the following questions regarding their support for small- to medium-sized businesses.

1. What is the cost per month?

   _____

2. What is the access speed (download/upload)?

   _____

3. Is the line speed guaranteed?

   _____

4. How many static IP addresses, if any, are provided?

   _____

5. How many e-mail accounts are provided?

   _____

6. How much web space is provided?

   _____

7. Does the company support VPN?

   _____

8. Does the company support Web hosting?

   _____