



Objectives Covered in This Chapter

The following is a list of the objectives covered in this chapter. The list of CCDA exam design objectives and the chapters in which they are covered can be found in the Introduction of this book.

- | | |
|---|--|
| 1 | Design a network that meets a customer's requirements for performance, security, capacity, and scalability. |
| 3 | Upon completion of this introduction, you will be able to describe a framework you can use to simplify the complexities associated with analyzing customer network problems and creating Cisco scalable solutions. |
| 5 | Document the customer's current applications, protocols, topology, and number of users. |
| 6 | Document the customer's business issues that are relevant to a network design project. |
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Design Goals

To get you started in your preparation for the CCDA exam, this chapter contains a framework for gathering customer objectives when designing a network. This chapter also covers the steps of network design and contains an overview of all the major topics of network design. The chapters that follow will cover in more detail each of the topics overviewed in this chapter.

“Do I Know This Already?” Quiz

The questions in the following quiz are designed to help you gauge how well you know the material covered in this chapter. Compare your answers with those found in Appendix A, “Answers to Quiz Questions.” If you answered most or all of the questions thoroughly and correctly, you might want to skim the chapter and proceed to the “Q&A” section at the end of the chapter. If you find that you need to review only certain subject matter, search the chapter for those sections that cover the objectives you need to review, and then test yourself both with these questions and with the “Q&A” questions. If you find the following questions too difficult, read the chapter carefully until you feel that you can easily answer these and the “Q&A” questions.

- 1 What types of questions would you ask to determine a client’s application requirements?

- 2 What are samples of business constraints on design?

3 What is the first step in network design?

4 In the framework of small to medium-sized network design, what should be done if there are protocol-related problems on the network?

5 What information is gathered in the logical assessment of the existing network?

6 What are the three layers of hierarchical network design?

7 If there are problems involving media contention on networks using repeaters, what should be done to resolve it?

8 What are the five areas of network management?

9 If you customer has a small network, what type of demonstration should be used?

- 10** If higher bandwidth is required on the network, what technologies are suggested for small to medium-sized networks?

You can find the answers to these questions in Appendix A, “Answers to Quiz Questions.”

Foundation Topics

Customer Objectives

The following CCDA objectives are covered in this section:

- | | |
|---|---|
| 1 | Design a network that meets a customer's requirements for performance, security, capacity, and scalability. |
| 5 | Document the customer's current applications, protocols, topology, and number of users. |
| 6 | Document the customer's business issues that are relevant to a network design project. |
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A CCDA should design networks based on the customer's objectives. In other words, you will need to find out what the customer wants to solve. You then must create a design that solves the networking problem or issue the customer is having.

The first step in network design is to obtain the customer's requirements. To obtain a complete picture of the customer's objectives, the engineer needs to document the client's business requirements, technical requirements, and any business and political constraints.

Business Requirements of the Customer

For this aspect of determining the customer's objectives, think about the purpose of the project. Project how the business will improve. Find out if the network is affecting the company's capability or effectiveness to develop, produce, and track products. Find out if any business applications are being affected. Determine whether the company will be audited.

Scalability is a very important consideration, and it is wise for the network designer to build a network that can scale. You should figure out how much the company will grow in one year or in five years.

Technical Requirements of the Customer

Think about the type of technical problems you are trying to solve. Consider the network's topology. For example, it may be difficult to introduce Ethernet to a customer that religiously uses Token Ring. Also consider the company's use of modern technologies. Find out whether the client is willing to experiment with the latest, bleeding-edge technologies. Keep in mind scaling issues; decide whether switched Ethernet will provide the necessary bandwidth or whether Fast Ethernet is necessary to scale the network.

Technical requirements can be divided into the following areas:

- Performance requirements
- Applications requirements
- Network management requirements
- Security requirements

Performance Requirements

Determine the following performance requirements:

- Identify any issues concerning network latency and response times.
- Find out if there is high utilization on LAN segments or WAN links.
- Determine how often the WAN links go down.

Application Requirements

Consider existing application integration. The network design will need to seamlessly accommodate the existing applications. Investigate the current application flows, and incorporate those into the network design. Determine the following application requirements:

- Find out what new applications have been introduced to the network.
- Determine the number of users using these applications.
- Find out the traffic flow for these applications.
- Identify what new protocols are being introduced to the network.
- Determine what applications are used during the daytime hours and what are used during the nighttime hours.
- Determine the time of day that represents the peak usage hours of applications.

Network Management Requirements

Determine the following network management requirements:

- Determine how the network is managed.
- Determine whether there is a network management station to view network performance and faults.
- Ascertain whether there are any accounting and security management requirements.
- Find out whether the staff is training on the network management applications.
- Find out whether there is a station for configuration management.

NOTE Remember the acronym FCAPS: fault, configuration, accounting, performance, and security management.

Security Requirements

Determine the following security requirements:

- Determine what type of security is required.
- Find out what external connections are present in the network and why they are there.
- Determine whether additional security is required on Internet connections.

Business and Political Constraints

The final aspect of determining the customer's objectives is to identify any constraints. Consider the following and ascertain whether they are constraints in your design:

- Ascertain budget or resource limitations for the project.
- Determine the timeline to complete the project.
- Determine whether any internal politics play a role in the decision-making process. Find out what different sources or groups are providing input into the requirements.
- Make sure the client's staff is able to operate and manage the new network.
- Find out whether the customer wants to reuse or trade in any existing equipment

The network design must be cost-effective and efficient. The goal is to get the best solution at a reasonable price. For example, a Catalyst 5500 may not be best solution for a remote office LAN with only 14 users.

Framework for Small- to Medium-Sized Network Design

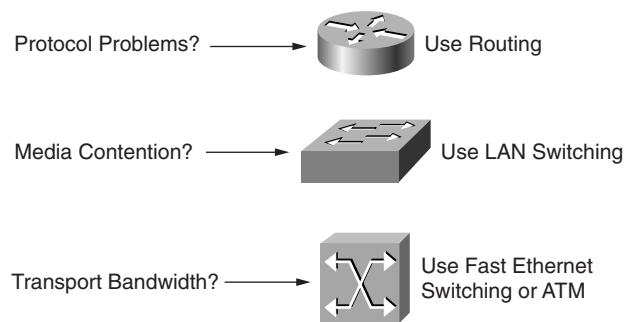
The following CCDA objective is covered in this section:

- 3 Upon completion of this introduction, you will be able to describe a framework you can use to simplify the complexities associated with analyzing customer network problems and creating Cisco scalable solutions.
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As you gather information from the customer, keep in mind that Cisco has proposed a framework to use when designing complex small to medium-sized networks. The framework proposes the following rules (which are summarized in Figure 1-1):

- If the problems are protocol-related, use routing. Many LAN protocols use periodic broadcasts and service advertisements and do not scale well as the network size increases. Routers can be used to further subnet your network and reduce broadcast domains. Access and security policies can be applied on routers.
- If the problem involves media contention, use LAN switching. To expand on this rule, if you have too many nodes on a shared network, you will expect to have high utilization; devices will have to compete to obtain access to the network, and application response may be slow. Introducing LAN switching will help resolve the contention on the network.
- If high bandwidth is required, consider switched Fast Ethernet. Switched Fast Ethernet offers a good cost-to-performance ratio for small to medium-sized networks. For larger networks in which high bandwidth and low latency is required, use ATM. Gigabit Ethernet now provides another option in the LAN for the backbone and for bandwidth-intensive application servers.

Figure 1-1 *Small to Medium-Sized Network Design Framework*



Steps for Network Design

The following CCDA objectives are covered in this section:

- 1 Design a network that meets a customer's requirements for performance, security, capacity, and scalability.
- 5 Document the customer's current applications, protocols, topology, and number of users.
- 6 Document the customer's business issues that are relevant to a network design project.

The steps for designing a network are as follows:

- 1 Gather information to support the business and technical requirements.
- 2 Assess the current network.
- 3 Consider the applications involved.
- 4 Design the local-area networks.
- 5 Design the wide-area network.
- 6 Design for specific network protocols.
- 7 Create the design document and select Cisco network management applications.
- 8 Test the design.

This section provides an overview of these steps. The remainder of the book fills in the details of these steps.

Gather Information to Support the Business and Technical Requirements

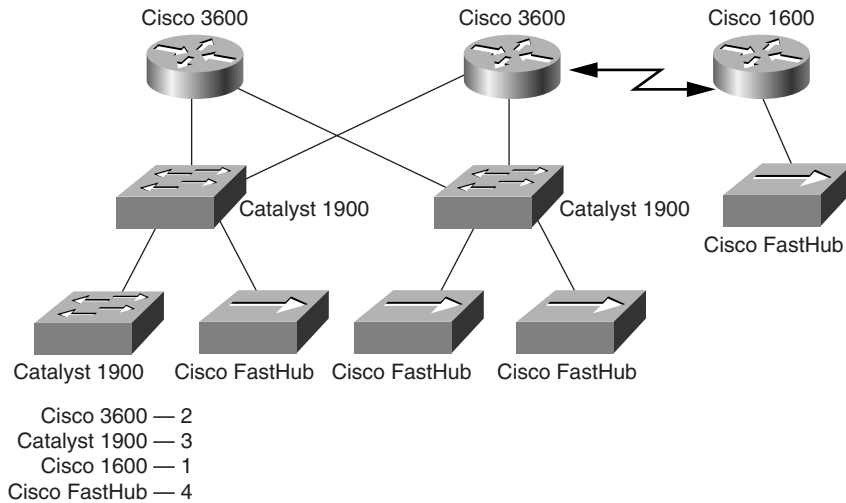
The section “Customer Objectives,” earlier in this chapter, covers step 1. Chapter 2, “Assessing the Existing Network and Identifying Customer Objectives,” covers this step in much more detail.

Assess the Current Network

This is the step during which you collect all data pertaining to physical, logical, traffic, and management information of the network. Chapter 2 covers this step in more detail. This section contains an overview of this step.

Physical Assessment

To perform a physical assessment, you need to document the physical topology of the network. Create a diagram with all routers, switches, and hubs. For example, in Figure 1-2, a list of network devices is created and the type and amount of devices is documented. Physical connectivity between devices should also be documented; also list the speed and type of media used between devices.

Figure 1-2 *Physical Assessment*

You will also need to list the LAN technologies being used. The following is a list of possible LAN technologies:

- Ethernet
- Token Ring
- FDDI
- Fast Ethernet
- Gigabit Ethernet

Finally, document the WAN circuit information and list the WAN technologies being used. The following is a list of possible WAN technologies used:

- Frame Relay
- Private lines
- ATM
- ISDN
- X.25

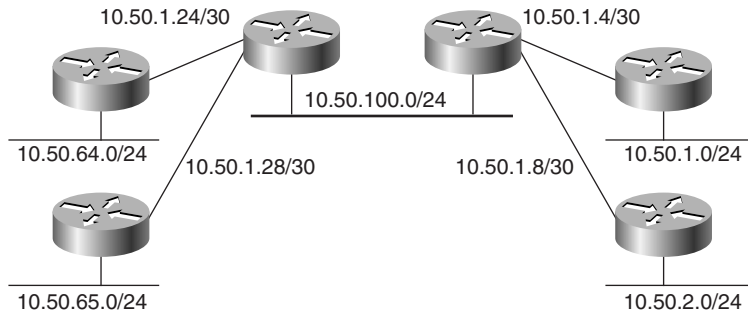
Logical Assessment

To perform the logical assessment, determine the following:

- The protocols that are being routed
- The IP address assignment scheme
- The Novell IPX address assignment
- The AppleTalk address assignment
- Whether any access list is used to filter addresses or broadcasts
- The Layer 3 architecture

Figure 1-3 provides an example of a logical assessment. Here, the IP address subnet information is documented. The figure shows five Ethernet segments with 24-bit subnet masks that can support up to 254 nodes each. This figure also shows four point-to-point links with 30-bit masks. With this mask, two IP addresses are used for each router on the link.

Figure 1-3 *Logical Assessment*



Traffic Assessment

To perform the traffic assessment, determine the following:

- Document the traffic flows on the network.
- Determine how much traffic is on each segment.
- Locate the servers.
- Determine how much traffic is local to the segment and how much traffic is external.

Management Assessment

Determine the current tools used for network management:

- Determine whether the customer has the necessary tools to manage the network.
- Determine whether there is a management station
- Find out whether CiscoWorks is being used to manage routers and switches.
- Verify whether there are capacity or performance monitoring tools.
- Determine whether a network protocol analyzer is available for LAN segment troubleshooting.
- Find out whether any RMON probes are in use.

Consider the Applications Involved

A good designer needs to take into consideration the applications that the network supports. The only reason the network is there is to provide a highway on which application information can flow. Never ignore the applications in use. Chapter 3, “Application Considerations,” covers this step in more detail. This section contains an overview of the applications to consider in this step.

Microsoft Workgroups

MS Networking uses the session-layer NetBIOS protocol for file and print sharing. NetBIOS over NetBEUI is not routable and must be bridged for all devices to communicate on the network. For this reason, NetBIOS over NetBEUI does not scale well. NetBIOS over TCP (NBT) scales better because it relies on TCP/IP for transport, thus enabling NetBIOS traffic to be routed.

Novell Application Services

Novell uses the Service Advertising Protocol (SAP) for devices to announce their services to the network. SAP broadcasts are generated by file servers, print servers, and so on. These broadcasts are sent every minute. As required by the protocol, a router adds all SAP broadcasts to its SAP table and broadcasts it every 60 seconds to its IPX interfaces. On larger networks, these broadcasts can overwhelm the network. Consider using access lists to filter SAP broadcasts from LAN segments.

IBM Networking

Traditional SNA networking involves the use of SDLC for WAN connectivity and Token Ring for LANs. Communication between hosts and terminals is bridged. The designer needs to document the Source-Route Bridging (SRB) requirements and consider Data-Link Switching Plus (DLSw+) for transporting SNA and NetBIOS traffic over WAN links in the IP network.

Multimedia Services

The network designer should investigate requirements to support multimedia services such as video and voice. Use techniques such as multicast routing to multicast video streams to reduce the total bandwidth used on the network. Multicast routing can transmit video streams to preselected end stations and reduce bandwidth consumption when compared to broadcasting. On networks supporting Voice over IP, use techniques such as RTP header compression on WAN links to reduce overhead. RSVP, policy routing, and tag switching are techniques used in the design of these time-sensitive applications.

Design the Local-Area Network

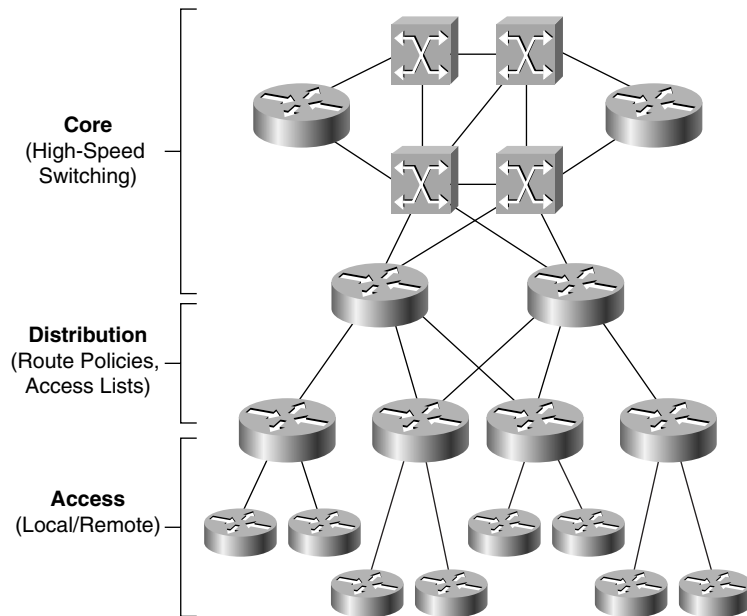
The Cisco Certified Design Associate must be able to design local-area networks that meet the customer's objectives on performance and scalability. A CCDA must design networks in a hierarchical manner to provide scalable solutions. A CCDA also must decide where to use hubs, switches, and routers to separate broadcast and collision domains. Know the differences between Layer 2 and Layer 3 switching as well. Chapter 4, "Network Topologies and LAN Design," covers this step in more detail. This section contains an overview of this step.

Hierarchical versus Flat Designs

The CCDA should understand that there is a limit on the number of nodes in flat network designs. Network broadcasts can overcome slow serial links. Build the network in a hierarchical manner with subnetting to reduce the amount of traffic on WAN links.

The CCDA must understand the three layers of the hierarchical model for network design: the core, distribution, and access layers. Figure 1-4 provides an example of these three layers.

At the core layer, high-speed switching is used with high availability and redundancy. Apply access and distribution lists at the distribution layer, which is where the security policies are applied. Address summarization and media translations are applied in the distribution layer as well. The access layer consists of the remote office sites using ISDN, Frame Relay, and DDR, and private lines accessing the corporate network. Local-area networks end segments are also part of the access layer.

Figure 1-4 *Hierarchical Design Model*

LAN Protocols

You need to understand the characteristics of LAN protocols, including physical distance limitations of LAN technologies: Ethernet (10Base2, 10Base5, and 10BaseT), Fast Ethernet, Gigabit Ethernet, Token Ring, and FDDI. Use these technologies to satisfy requirements ranging from user workstations to high-bandwidth servers.

LAN Physical Design

Select the equipment to be used, keeping in mind the LAN technologies and the number of ports required for the network.

Cisco LAN solutions include repeaters and switches.

Repeaters:

- Cisco 1500 hubs
- FastHub 100, 200, and 300 families

Switches:

- Catalyst 3000 Switch family
- Catalyst 5000 Switch family
- Catalyst 5500 family
- Catalyst 1900 family
- Catalyst 2800 family
- Catalyst 2900 family

Design the Wide-Area Network

The CCDA must design WAN networks that meet the customer's objectives of performance and scalability. Design networks in a hierarchical manner, and plan for bandwidth capacity to provide scalable solutions. Determine the WAN technologies to use, and plan for Cisco router solutions. Chapter 5, "WAN Design," covers this step in more detail. This section contains an overview of this step.

Transport Selection

Decide on the WAN technology to use. The following list will help you make this decision:

- Use leased lines where traffic flows are constant between point-to-point locations.
- Use ISDN for on-demand access to remote offices and for backup for another link type.
- Use Frame Relay as a high-bandwidth, cost-effective transport. This very popular WAN protocol provides permanent virtual circuits (PVC) between routers. Frame Relay provides characteristics such as congestion notification, discard eligibility (DE) bit, bursting, and the capability to have several PVCs on a physical port. These and other features (such as cost) made Frame Relay a very popular WAN technology in the 1990s.
- Use X.25 when the reliability of the WAN links is suspect. X.25 is an older WAN technology that is still widely in use and can be found running over low-speed (9600 to 64000 bps) lines. Throughput using X.25 suffers in comparison to Frame Relay due to X.25's additional error checking.
- Use ATM when high bandwidth (155+ Mbps) is required on the core. ATM offers different Quality of Service (QoS) types, allowing traffic with varying tolerances for bandwidth and latency to travel over the same network.

Bandwidth Planning

The CCDA must look at the applications being deployed at remote sites and decide on the sizing of WAN circuits. Rely on the analysis of existing traffic flows and past experience to help determine an appropriate bandwidth size for a circuit. If WAN circuit utilization is more than 70 percent for a long period of time, the circuit bandwidth should be increased. When planning bandwidth allocation, consider the following:

- The type of servers that are located at the remote site
- Whether the applications in the hub site will be accessed remotely and whether the intranet Web sites will be accessed remotely
- Whether there are Microsoft Domain controllers or MS Exchange servers at the remote sites
- Whether there are any database applications

Physical Design

Select the equipment to be used, keeping in mind the technologies and the number of interfaces required for the network. Take into consideration that the CCDA is focused on Cisco small to medium-sized network solutions.

The small to medium-sized network solutions include the following router series:

- Cisco 760/770 series
- Cisco 1000 series
- Cisco 1600 series
- Cisco 2500 series routers
- Cisco 3600 series routers
- Cisco MC3810 router
- Cisco 4500/4700 series routers
- Cisco 5200/5300 access servers
- Cisco 7200 series router

Design for Specific Network Protocols

In this step, take into consideration the type of protocols to be used on the network. Chapter 6, “Designing for Specific Protocols,” covers this step in more detail. This section contains an overview of this step.

IP

The CCDA needs to design an IP address assignment scheme based on a hierarchical model. Use VLSMs to assign networks based on the number of devices and areas on the network. A hierarchical model for address assignment with VLSMs allows the network to take advantage of routing summary features supported by protocols such as EIGRP and OSPF. Choose routing protocols that will not add significant traffic to the network. Understand the differences between distance vector and link-state routing protocols.

Novell

Create IPX addressing schemes. Consider the broadcast characteristics of Novell's distance vector Routing Information Protocol (RIP) and Service Advertising Protocol (SAP). RIP broadcasts its table every 60 seconds; SAP also broadcasts the SAP table every 60 seconds. Use access lists to filter specific SAP broadcasts. Consider the design of the distance vector IPX RIP versus NetWare Link-Service Protocol (NLSP). EIGRP can be used on WAN links to reduce IPX traffic.

AppleTalk

Consider the AppleTalk cable ranges to assign to each interface and the zones for each area. To overcome the limitations of the AppleTalk routing protocol RTMP, use methods such as AURP or EIGRP on the WAN.

Bridging

Transparent and source-route bridged networks have size limitations and do not scale well. To reduce the traffic of bridged protocols, limit the size of bridged networks.

Create the Design Document and Select Cisco Network Management Applications

After working with the LAN, WAN, and protocol design, incorporate the solutions into one design during this step. Verify that the total solution meets the customer's objectives on performance, scalability, and cost. Incorporate a proactive network management solution that satisfies the customer's network service goals. Chapter 7, "The Design Document and Cisco Network Management Applications," covers this step in more detail. This section contains an overview of this step.

The Design Document

The design document helps the designer explain how the solution meets the requirements of the project. It consists of the following primary sections:

- Executive Summary
- Design Requirements
- Design Solution
- Summary
- Appendixes
- Cost of Proposed Design (optional)

Management Applications

A CCDA must be able to select the appropriate management applications for the designed network. Chapter 7 covers several management applications with which the CCDA must be familiar and discusses which are appropriate for various networks.

Test the Design

After a design has been proposed, the next step is to verify that the design will work. For large networks, a prototype can be built; for smaller networks a pilot can be devised. Chapter 8, “Building a Prototype or Pilot,” covers the steps of building prototype and pilot test networks.

Q&A

The following questions are designed to test your understanding of the topics covered in this chapter. When you have answered the questions, look up the answers in Appendix A, “Answers to Quiz Questions.” After you identify the subject matter you missed, review those sections in the chapter until you feel comfortable with this material.

- 1 During which assessment do you find out what type of IP addressing scheme is used on the network?

- 2 What would help solve a network with a high amount of broadcasts?

- 3 What are the four sections of the design document, and what goes into each section?

- 4 In network management, what does FCAPS stand for?

- 5 You would do a prototype for what type of networks?

- 6 Which section of the design document contains topology diagrams of the existing network?

7 Briefly describe Frame Relay.

8 Give three examples of bridged protocols.

9 What does SAP stands for? What is it used for?

10 List the nine steps for network design.

11 If higher bandwidth is required on the network, what technologies are suggested for small to medium-sized networks?

12 How often is the Novell SAP table broadcasted onto the network?

13 What are examples of business constraints?

Case Studies

Because passing the CCDA exam requires you to answer design questions about an ongoing case study, “Case Studies” and “Case Study Answers” sections will appear at the end of each body chapter in this book. Each “Case Studies” section asks questions based on one or more of the case studies presented in this section. Each “Case Study Answers” section answers those questions with detailed explanations. Each chapter’s questions in the “Case Studies” section deal with the subject matter covered in that chapter. In some chapters, other case study background information will be presented in the question in addition to the general case study information here. This is so that you can answer that chapter’s specific questions.

The remainder of this section introduces the three case studies that will be referred to at the end of each chapter. When you come across a question on a particular case study, refer back to these sections so that you can go about answering the questions on that case study.

Case Study #1: GHY Resources

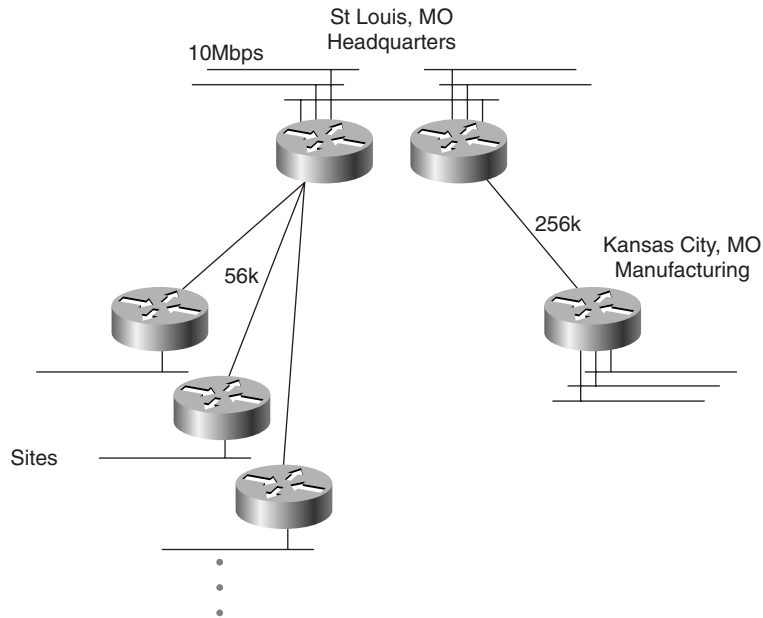
Mr. Martin of GHY Resources is responsible for the company’s network. He has invited you to a meeting to discuss some issues.

GHY Resources is a manufacturing company with its headquarters based in St. Louis. In the past 10 years, GHY has grown from 10 employees to more than 400. It now has a manufacturing site in Kansas City, and a new site is opening in Nashville, Tennessee, in three months. The manufacturing sites connect back to St. Louis via a 256 K circuit. Sales offices exist in more than seven cities throughout the United States. Each sales office connects back to the headquarters via a 56 K leased line. These leased lines run at more than 70 percent utilization at certain times during the day. The company currently uses a mix of routers from different vendors and wants to standardize on Cisco’s if the price is right. The current routing protocol is RIPv1. Figure 1-5 shows the current topology of GHY Resources.

Novell NetWare file servers are used throughout the company, with one server at each of the sales offices. Local offices have print servers also. The headquarters’ local-area network consists of Ethernet using 10BaseT hubs. These Ethernet segments constantly run at about 45 percent utilization. There are around 10 segments connecting to a pair of Cisco 4000 routers. One of the network analysts mentioned that the protocol analyzer reported broadcast storms on some of the Ethernet segments.

Business applications run on an HP 3000 machine located on one of the segments at the headquarters. An HP 3000 is located at the manufacturing site. The manufacturing site has two NetWare file servers. Mr. Martin expects the new manufacturing site to have the same business applications. The LAN in Kansas City consists of three Ethernet segments with 30 stations each. Network utilization is at 35 percent on each segment.

Figure 1-5 GHY Resources Logical Diagram



Mr. Martin has mentioned that he is interested in Frame Relay as an alternative for his WAN links. He would like to upgrade his LANs as well. He has requested a LAN/WAN solution that would help reduce the utilization problems he is having on the network. He also would like a solution to reduce the SAP traffic on the network. In addition, he wants to find a way to conserve IP addresses on his network. Mr. Martin needs to get a proposal in one week to have his managers approve the money. The design needs to be installed before the new manufacturing site becomes operational.

Look for questions on the GHY Resources case study at the end of some of the book's chapters.

Case Study #2: Pages Magazine, Inc.

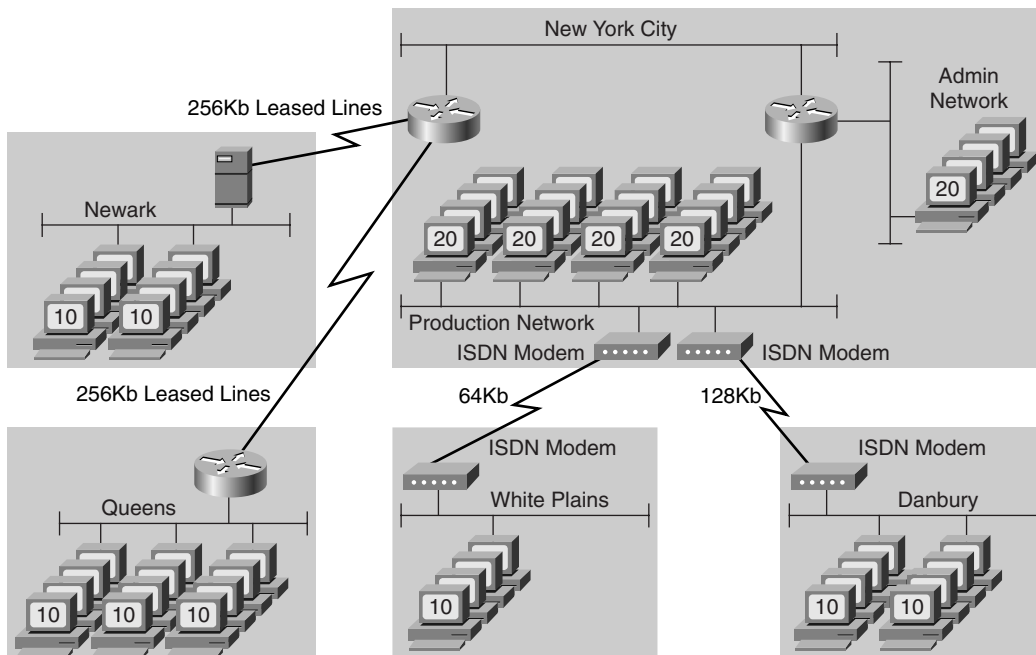
Ms. Phillips is the newly appointed Director of IT at Pages Magazine, Inc. Pages Magazine realizes that to aggressively compete in its market, this company needs changes to its infrastructure that will support new applications and Internet access, allowing them to increase their productivity and to follow market trends. Pages wants to use the Internet to gain clients and find new opportunities. Ms. Phillips is faced with many options but needs your help in developing a solution that is both cost-effective and scalable. She needs to make sure that the solution will address her immediate needs and also be scalable enough to support future applications.

Pages Magazine, Inc., is a conglomerate of four periodicals. Pages Magazine is expecting at least two periodical acquisitions per year for the next three years. Each magazine acts independently and has a mix of both small and medium-sized offices throughout the continental United States. Each magazine has various access methods back to the corporate headquarters located in New York City. Table 1-1 summarizes the current layout of the Pages Magazine, Inc., offices as they are presented in Figure 1-6.

Table 1-1 *Pages Magazine, Inc., Office Layout*

Office Location	Description	# of Nodes	Access Back to HQ
New York City, New York	Corporate headquarters	100	
Newark, New Jersey	Fashion magazine	20	256 K leased line
White Plains, New York	Entertainment news magazine	10	64 K ISDN
Queens, New York	Fashion magazine	30	256 K leased line
Danbury, Connecticut	Home improvement magazine	20	128 K ISDN

Figure 1-6 *Pages Magazine, Inc., Logical Diagram*



These leased lines have provided enough bandwidth to support basic e-mail and file transfer services. Each office has its own Novell servers that are currently managed independently, running on a flat 10BaseT Ethernet environment. A T1 will be installed at the NYC office to provide Internet access to the remote offices. Internet access and e-mail are the first critical applications that need to be addressed. Currently, the offices use CC:mail as their e-mail platform.

Pages Magazine has not standardized on MS Office applications and currently uses a mix of Apple and Microsoft application products. All the routers route IPX, AppleTalk, and IP; however, Pages Magazine wants to migrate to a purely IP environment with Novell GroupWise as the e-mail platform. Each office will have a GroupWise server that needs to be synchronized with the NYC office for Internet e-mail. After the two new offices go online, every office will slowly migrate to Netware 5, using native IP for transport. Until then, AppleTalk still needs to be supported as a routed protocol. The new Novell servers will also have a synchronized NDS directory structure that will manage the user access and login process.

Network manageability has been difficult since different vendor products are being used to provide WAN access. Ms. Phillips is looking for a single vendor solution that can be managed more effectively with her limited staff.

The additional offices for the new network are another concern, and she is looking to implement a network management solution that will support her staff. She has three remote IT support people in addition to three NYC-based people. One support person is located in Danbury and the other is in White Plains. The third supports Queens. Most of her staff have desktop and moderate networking skills.

The network used RIPv1, but Ms. Phillips plans to use DHCP to readdress her network so that she can conserve the valid IP address and to create a more scalable IP addressing scheme. Pages Magazine, Inc., will require a new routing protocol that will support subnetting and possible VLSM. Ms. Phillips is also interested in finding a more cost-effective WAN solution that will support the additional two offices that will go online within two months.

Ms. Phillips must present an infrastructure upgrade and Internet access plan to the CEO and CFO in three weeks. The presentation will include a network design to show how the network will scale to support new offices and to address any return on investment issues.

Look for questions on the Pages Magazine, Inc., case study at the end of some of the book's chapters.

Case Study #3: MediBill Services, Inc.

MediBill Services, Inc., started out providing billing support and services for a small community of independent medical offices. These offices used MediBill to service medical claims and provide patient data storage. After five years of service, MediBill has decided to grow and provide online medical information and Internet access to service its expanding client

base. The company also is looking to provide the security for file transfers for disaster recovery purposes. MediBill is looking to ensure that the integrity of the information transferred will not going be in question.

MediBill's CIO, Mr. Lee, is responsible for approving a design strategy that would support MediBill's future goals of providing secured remote storage of medical files, as well as Internet/e-mail services and desktop support to the small to medium-sized medical offices.

MediBill currently has a T1 out to the Internet but isn't sure whether this is enough bandwidth to support its client base. The company has just acquired eight more offices that will need access within three months. MediBill has already begun the PC installation process and is waiting to coordinate the installation of the WAN connections. Prior to the WAN installations, Mr. Lee will need to purchase routers and security equipment for the Internet access.

Mr. Lee has asked several consultants to respond to the following information provided in a Request for Proposal (RFP).

MediBill has maintained an NT SQL database in its main office, which connects to the six remote doctors offices via 56 kbps dialup connections. These connections will have to be upgraded to support new services provided by the Internet. The connections will have to support Internet Web, e-mail, and file transfers as well as network management traffic. Mr. Lee is looking to implement the Microsoft Systems Management Server (SMS) for remote monitoring and management. MediBill has decided to standardize on the Microsoft platform to simplify IT management issues. MediBill has already implemented Microsoft Exchange and Outlook as the e-mail system.

MediBill is going to start by providing its clients with basic Web access, FTP, and e-mail.

After the Internet access and WAN upgrades, Mr. Lee wants to roll out a full network management solution that includes the management of each of the company's customers as well as its own network. Currently, each remote office must provide its own PC equipment, but with MediBill's new services, the company has decided to provide the PCs and all the customer premise equipment (CPE) necessary. Each office will have five to ten PCs per office, all running Microsoft Windows 98.

MediBill also won a contract with the MetroCenter Hospital, where the company will provide Internet services as well as secured disaster recovery services for data and files. The hospital will be connected to MediBill via a dedicated T1 circuit. The hospital has contracted MediBill to manage the 50 Internet workstations that will be distributed throughout the hospital, as well as the 10 data-transfer stations.

The client needs to review its WAN strategy and provide a design plan to upgrade the WAN network to support its growing client base. The client wants a demonstration of the security that his network will provide so that he can use that information in MediBill's marketing strategy.

Mr. Lee wants a proposal that will provide a baseline of the existing network and WAN connections as a comparison to a new network. Due to the large scale of changes that need to be made with MediBill, Mr. Lee is looking for a proposal that will outline how the company will migrate from its previous network to the new, more scalable network.

Additional Case Studies

Chapter 9, “Additional Case Studies,” consists entirely of case studies that cover an array of CCDA topics. When you have completed all the chapters in the book, work on these case studies to fine tune your CCDA case study skills.