CHAPTER 4

work Topologies and LAN sign

This chapter reviews the topologies used in network design and covers the technologies and design approaches used when designing a local-area network (LAN). The hierarchical, redundant, and secure topology models are covered. Technologies like Ethernet, Fast Ethernet, FDDI, and Token Ring are also covered in this chapter. This chapter also discusses the characteristics of repeaters, bridges, switches, and routers, as well as how to apply these devices in a LAN environment. Finally, this chapter covers the Cisco products used in local-area networks.

"Do 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 answer most or all of the questions thoroughly and correctly, you might want to skim the chapter and proceed to the "Q&A" and "Case Studies" sections at the end of the chapter. If you find you need to review only certain subject matter, search the chapter for only those sections that cover the objectives you need to review and then test yourself with those question again, as well as the "Q&A" and "Case Studies" questions. If you find the following questions too difficult, read the chapter carefully until you feel you can easily answers these and the "Q&A" and "Case Studies" questions.

1 What OSI layer does a bridge operate?

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2 The 10Base2 Ethernet media is commonly referred as?

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3 What is the recommended maximum number of nodes that should be used in a multi-protocol LAN segment?

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4 Bridges control collision domains, broadcast domains, or both?

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5 What is the maximum segment size in a 100BaseT network?

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6 What is the maximum segment size in a 10Base2 network?

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7 Routers operate on what OSI layer?

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8 Fast Ethernet is covered by which IEEE standard?

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9 What is 10Base5 commonly referred to as?

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10 What device controls a broadcast domain?

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

Foundation Topics

LAN Topology Design

The CCDA objectives covered in this section are as follows:

13	Describe the advantages, disadvantages, scalability issues, and applicability of standard internetwork topologies.
14	Draw a topology map that meets the customer's needs and includes a high-level view of internetworking devices and interconnecting media.

This section covers CCDA exam objectives about designing network topologies for the LAN. LANs provide data transfer rates that are typically much faster than wide-area networks (WANs). While most companies own their own LAN infrastructure, wide-area connections between LANs are usually leased on a monthly basis from an outside carrier. With the recent developments in Gigabit Ethernet technologies, LAN designs are now capable of 1000 Mbps speeds. High-speed Gigabit links can connect servers to LAN switches. At these speeds, the capacity is there to meet the performance requirements of current high-bandwidth applications.

Various speeds of Ethernet have evolved into the de facto standard for LANs. Ethernet uses a contention-based access method, meaning each device competes simultaneously for access to the network. All devices attached to the same Ethernet segment form a collision domain. Each device transmitting on that segment may attempt to transmit at the same time as another device on the same segment, resulting in a collision. As the number of devices in the same collision domain increases, so do the collisions, resulting in poorer performance.

Although not discussed in newer switched (bridged) networks, legacy Ethernet networks with repeaters and hubs should limit the size of the collision domain. To scale multiprotocol networks and networks with high-bandwidth applications, limit the size of collision domains using bridges, switches, and routers. This is covered in the section "LAN Hardware" later in the chapter.

Three different network topology models are discussed in the following sections:

- Hierarchical models
- Redundant models
- Secure models

Hierarchical Models

Hierarchical models enable you to design internetworks in layers. To understand the importance of layering, consider the Open System Interconnection (OSI) reference model, which is a

layered model for implementing computer communications. Using layers, the OSI model simplifies the tasks required for two computers to communicate. Hierarchical models for internetwork design also use layers to simplify the tasks required for internetworking. Each layer can be focused on specific functions, allowing you to choose the right systems and features for each layer. Hierarchical models apply to both LAN and WAN design.

Benefits of Hierarchical Models

The many benefits of using hierarchical models for your network design include the following:

- Cost savings
- Ease of understanding
- Easy network growth
- Improved fault isolation

After adopting hierarchical design models, many organizations report cost savings because they are no longer trying to do it all in one routing/switching platform. The modular nature of the model enables appropriate use of bandwidth within each layer of the hierarchy, reducing wasted capacity.

Keeping each design element simple and small facilitates ease of understanding, which helps control training and staff costs. Management responsibility and network management systems can be distributed to the different layers of modular network architectures, which also helps control management costs.

Hierarchical design facilitates changes. In a network design, modularity allows creating design elements that can be replicated as the network grows, facilitating easy network growth. As each element in the network design requires change, the cost and complexity of making the upgrade is contained to a small subset of the overall network. In large, flat, or meshed network architectures, changes tend to impact a large number of systems.

Improved fault isolation is facilitated by structuring the network into small, easy-to-understand elements. Network managers can easily understand the transition points in the network, which helps identify failure points.

Today's fast-converging protocols were designed for hierarchical topologies. To control the impact of routing overhead processing and bandwidth consumption, modular hierarchical topologies must be used with protocols designed with these controls in mind, such as EIGRP.

Route summarization is facilitated by hierarchical network design. Route summarization reduces the routing protocol overhead on links in the network and reduces routing protocol processing within the routers.