SIXTH EDITION

NETWORKING ESSENTIALS

A CompTIA® Network+ N10-008 Textbook

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5
CHAPTER

Interconnecting
the LANs

Chapter Outline

Objectives

- Describe how a bridge is used to interconnect LANs
- Describe how a switch is used to interconnect LANs
- Discuss the advantages of using a switch instead of a hub
- Describe the function of a router when used to interconnect LANs
- Describe the interface associated with a router
- Describe the function of a gateway in a computer network
- Describe the concept of a network segment
- Describe the concept of auto-negotiation

Key Terms

campus network
bridge
bridge table
association
broadcast
ARP
broadcast storm
network slowdown
ARP cache
ARP table
transparent bridge
translation bridge
layer 2 switch
multiport bridge
multicast
managed switch
Cisco Network Assistant (CNA)
dynamic assignment
static assignment
secure addresses
aging time

isolating the collision domains
content-addressable memory (CAM)
flooding
broadcast domain
store-and-forward
switch latency
cut-through
adaptive cut-through
error threshold
multilayer switch (MLS)
wire speed routing
network address
logical address
router interface
RS-232
DB-9
DB-25
console cable
COM1, COM2, …
rollover cable
enterprise network

media converter
FastEthernet port (FA0/0, FA0/1, FA0/2, …)
serial port (S0/0, S0/1, S0/2, …)
routing table
gateway
HSSI
OC
DS-0 to DS-3; T1 to T3
DS
telco
telco cloud
multiplexed
point of presence (POP)
line of demarcation
CSU/DSU
HDLC
PPP
Metro Optical Ethernet (MOE)
Carrier Ethernet

Metro Ethernet Forum (MEF)	Ethernet Virtual Connection (EVC)	E-LAN Service Type (E-LAN)
User–Network Interface (UNI)	E-Line Service Type (E-Line)	E-Tree Service Type (E-Tree)
Ethernet Service Definition		

The utility of LANs led to the desire to connect two or more networks together. For example, a large corporation might have at one time had separate networks for research and engineering and another network for its manufacturing units. These network systems probably used totally different networking technologies and specifications for communicating and were located in different cities, states, or even countries, but it was deemed necessary to "tie" them together. The objective of this and subsequent chapters is to introduce the concepts and issues involved in interconnecting LANs. Interconnecting LANs in a campus network and interconnecting LANs in wide area networks (WANs) involve similar concepts and issues. A **campus network** is a collection of two or more interconnected LANs, either within a building or housed externally in multiple buildings.

Campus Network

A collection of two or more interconnected LANs in a limited geographic area

5-1   INTRODUCTION

The OSI model provides a framework that defines the network layers for linking networks together (refer to Chapter 1, "Introduction to Computer Networks"). The OSI model ensures compatibility in the network hardware and software. Concepts related to the hardware technologies used to interconnect LANs are presented in in this chapter. The properties of a networking bridge are defined in Section 5-2, "The Network Bridge." The layer 2 switch is examined in Section 5-3, "The Network Switch," and the router is introduced in Section 5-4, "The Router." The procedure for configuring a router through the router's console port is presented in Section 5-5, "The Console Port Connection." This section provides an overview of configuring a computer's serial communication software and selecting the proper cable and hardware for connecting the console port to a computer. An example of interconnecting LANs is provided in Section 5-6, "Interconnecting LANs with the Router," which examines how routers can be used to interconnect LANs. Section 5-7, "Interconnecting LANs and WANs introduces well-known LAN architecture, data center architecture, and WAN technologies such as high-speed serial connections and Metro Optical Ethernet that are used to connect LANs or to connect the enterprise network to the outside world.

Table 5-1 outlines the CompTIA Network+ objectives related to this chapter and identifies the chapter section that covers each objective. At the end of each chapter section you will find a review with comments on the Network+ objectives presented in that section. These comments are provided to help reinforce your understanding of each Network+ objective. The chapter review also includes "Test Your Knowledge" questions to help you understand key concepts before you advance to the next section of the chapter. At the end of the chapter you will find a complete set of questions as well as sample certification exam-type questions.

**TABLE 5-1 Chapter 5 CompTIA Network+ Objectives**

Domain/Objective Number	Domain/Objective Description	Section Where Objective Is Covered
1.0	**Networking Fundamentals**	
1.2	Explain the characteristics of network topologies and network types.	5-4, 5-6, 5-7
1.4	Given a scenario, configure a subnet and use appropriate IP addressing schemes.	5-2, 5-3, 5-6
1.5	Explain common ports and protocols, their application, and encrypted alternatives.	5-3, 5-5
1.6	Explain the use and purpose of network services.	5-3
1.7	Explain basic corporate and datacenter network architecture.	5-7
1.8	Summarize cloud concepts and connectivity options.	5-7
2.0	**Network Implementations**	
2.1	Compare and contrast various devices, their features, and their appropriate placement on the network.	5-2, 5-3, 5-4, 5-5, 5-6
2.2	Compare and contrast routing technologies and bandwidth management concepts.	5-4, 5-6
2.3	Given a scenario, configure and deploy common Ethernet switching features.	5-2, 5-5
3.0	**Network Operations**	
3.1	Given a scenario, use the appropriate statistics and sensors to ensure network availability.	5-2, 5-3, 5-4
3.3	Explain high availability and disaster recovery concepts and summarize which is the best solution.	5-3, 5-4, 5-6
4.0	**Network Security**	
4.5	Explain the importance of physical security.	5-3
5.0	**Network Troubleshooting**	
5.2	Given a scenario, troubleshoot common cable connectivity issues and select the appropriate tools.	5-3, 5-5
5.3	Given a scenario, use the appropriate network software tools and commands.	5-5
5.5	Given a scenario, troubleshoot general networking issues.	5-3, 5-6

5-2 THE NETWORK BRIDGE

Bridge

A networking device that uses MAC address information to forward data and interconnect LANs

A bridge can be used in computer networks to interconnect two LANs or separate network segments. Recall that a *segment* is a section of a network separated by bridges, switches, and routers. A **bridge** is a layer 2 device in the OSI model, meaning that it uses MAC address information to make decisions regarding forwarding of data packets. Only the data that needs to be sent across a bridge to the adjacent network segment is forwarded. This makes it possible to isolate or segment the network data traffic. Figure 5-1 provides an example of using a bridge to segment two Ethernet LANs. It shows LAN A connected to port 1 on the bridge and LAN B connected to port 2 on the bridge, creating two segments. There are four computers in LAN A and three computers in LAN B. It is important to note that bridges are now legacy networking devices, but studying them will help you better understand the functionality of switches, especially how data traffic is sent to connected LANs.
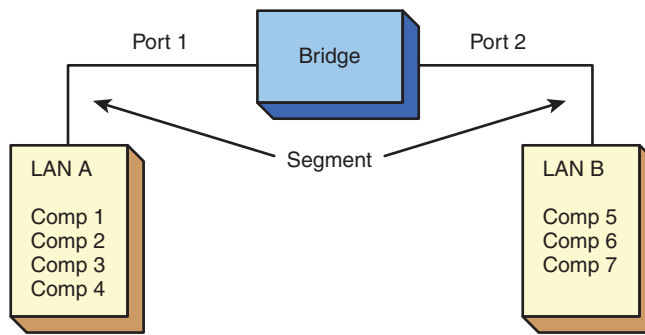
FIGURE 5-1 Using a bridge to interconnect two Ethernet LANs.

A bridge monitors all data traffic in each of the LAN segments connected to its ports. Recall that a *port* is an input/output connection on a networking device. Bridges use MAC addresses to build a **bridge table** of MAC addresses and port locations for hosts connected to the bridge ports. A sample bridge table is provided in Table 5-2, which shows the stored MAC addresses and the port where each address was obtained.

Bridge Table

A list of MAC addresses and port locations for hosts connected to the bridge ports

TABLE 5-2   **Bridge Table**

MAC Address	Port
00-40-96-25-85-BB	1
00-40-96-25-8E-BC	1
00-60-97-61-78-5B	2
00-C0-4F-27-20-C7	2