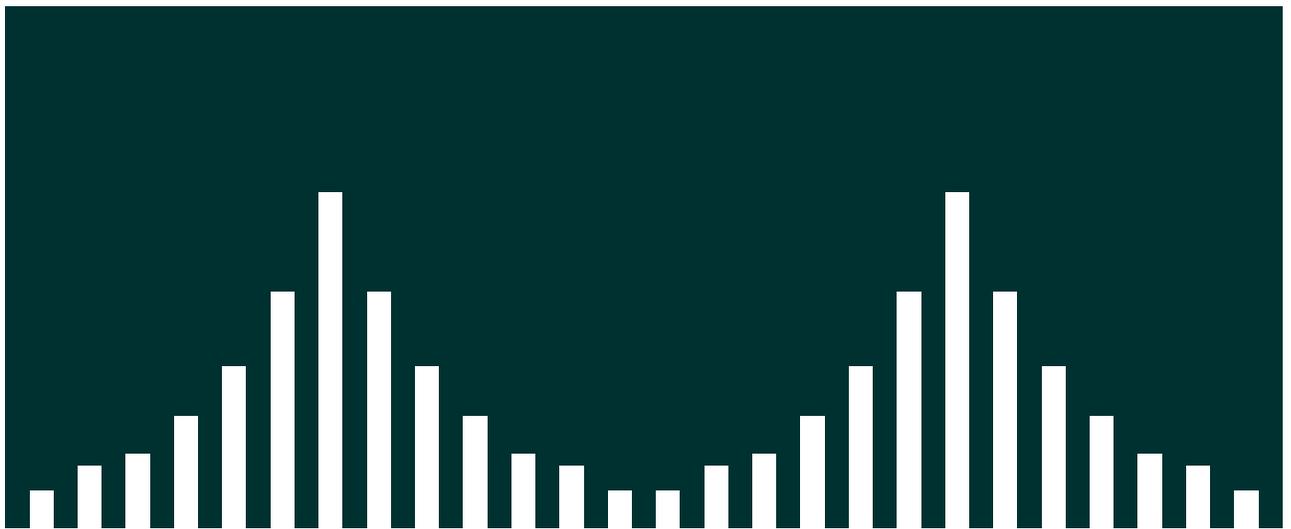


*Semester Two  
Journal and  
Study Guide*

**CISCO SYSTEMS**



**NETWORKING  
Academy**

# CCNA 2 Chapter 1

## WANs and Routers

One major characteristic of a wide-area network (WAN) is that the network operates beyond the local LAN's geographic scope. It uses the services of carriers, such as regional Bell operating companies (RBOCs), Sprint, and MCI. WANs use serial connections of various types to access bandwidth over wide-area geographies. By definition, the WAN connects devices that are separated by wide areas. WAN devices include the following:

- Routers, which offer many services, including internetworking and WAN interface ports
- Switches, which connect to WAN bandwidth for voice, data, and video communication
- Modems, which interface voice-grade services and channel service units/digital service units
- Channel service units/data service units (CSUs/DSUs) that interface T1/E1 services and Terminal Adapters/Network Termination 1 (TA/NT1s)
- TA/NT1s that interface Integrated Services Digital Network (ISDN) services
- Communication servers, which concentrate on dial-in and dial-out user communication

### Concept Questions

1. A WAN is used to interconnect local-area networks (LANs) that are typically separated by a large geographic area. A WAN operates at the OSI reference model physical and data link layers. The WAN provides for the exchange of data packets/frames between routers/bridges and the LANs that they support. Draw a WAN that includes three LANs.



# CCNA 2 Chapter 1

## WANs and Routers

### Vocabulary Exercise

Define the following terms as completely as you can. Refer to the online curriculum or CCNA 2 Chapter 1 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

Auxiliary port

Console port

CSU

DCE

DSU

DTE

E1

Frame Relay

HDLC

ISDN

PPP

PTT

RBOC

T1

# CCNA 2 Chapter 1

## WANs and Routers

### Focus Questions

1. Name and briefly describe four WAN devices.
2. Name two ways in which WANs differ from LANs.
3. What do the acronyms DTE and DCE stand for?
4. List three WAN physical layer standards.
5. List four WAN data link layer protocols.



# **CCNA 2 Chapter 1 WANs and Routers**

# CCNA 2 Chapter 1

## WANs and Routers

### CCNA Exam Review Questions

1. Which of the following best describes a WAN?
  - A. It connects LANs that are separated by a large geographic area.
  - B. It connects workstations, terminals, and other devices that are in a metropolitan area.
  - C. It connects LANs that are within a large building.
  - D. It connects workstations, terminals, and other devices that are within a building.
2. Which of the following are WAN technologies?
  - A. Token Ring and ARCnet
  - B. Frame Relay and SMDS
  - C. Star and Banyan VINES
  - D. CSU/DSU and ARCview
3. What service does a WAN provide to LANs?
  - A. High-speed multiple access to data networks
  - B. IP addressing and secure data transfer
  - C. Exchange of data packets between routers and the LANs those routers support
  - D. Direct routing with error checking
4. What type of connections do WANs use that LANs typically do not use?
  - A. Parallel, lower speed
  - B. Multiple, higher speed
  - C. Multiple, lower speed
  - D. Serial, lower speed
5. At which layers of the OSI model does a WAN operate?
  - A. Physical and application
  - B. Physical and data link
  - C. Data link and network
  - D. Data link and presentation
6. Which layers of the OSI model do WAN standards describe?
  - A. Data link and network
  - B. Data link and presentation
  - C. Physical and application
  - D. Physical and data link
7. How do WANs differ from LANs?
  - A. WANs typically exist in defined geographic areas.
  - B. WANs provide high-speed multiple access services.
  - C. WANs use tokens to regulate network traffic.
  - D. WANs use services of common carriers.

## CCNA 2 Chapter 1 WANs and Routers

8. How are operational and functional connections for WANs obtained?
  - A. From your local telephone company
  - B. From InterNIC
  - C. From RBOCs
  - D. From the WWW Consortium (W3C)
  
9. What do the WAN physical layer standards describe?
  - A. Interface between SDLC and HDLC
  - B. How frames are sent and verified
  - C. How voice and data traffic are routed
  - D. Interface between DTE and DCE
  
10. Which of the following best describes what WAN data link protocols define?
  - A. How frames are carried between systems on a single data link
  - B. Methods for determining optimum path to a destination
  - C. How data packets are transmitted between systems on multiple data links
  - D. Methods for mapping IP addresses to MAC addresses
  
11. Which of the following is a WAN data link protocol?
  - A. TCP/IP
  - B. Point-to-Point Protocol
  - C. EIGRP
  - D. OSPF
  
12. Which of the following best describes data terminal equipment (DTE)?
  - A. It is a physical connection between networks and users.
  - B. It generates clocking signals to control network traffic.
  - C. It is a device at the user end of a network.
  - D. It is a physical device such as a modem and interface card.
  
13. Which of the following is an example of DTE?
  - A. Interface card
  - B. Modem
  - C. Computer
  - D. CSU/DSU
  
14. Which of the following best describes data circuit-terminating equipment (DCE)?
  - A. It is a device at the user end of a network.
  - B. It serves as the data source or destination.
  - C. It is physical devices such as protocol translators and multiplexers.
  - D. It is a physical connection between networks and users.
  
15. Which is an example of DCE?
  - A. Multiplexer
  - B. Modem
  - C. Translator

# CCNA 2 Chapter 1

## WANs and Routers

D. Computer

16. Which of the following best describes High-Level Data Link Control (HDLC)?
- A. It is a digital service that transmits voice and data over existing phone lines.
  - B. It uses high-quality digital facilities and is the fastest WAN protocol.
  - C. It provides router-to-router and host-to-network connections over synchronous and asynchronous circuits.
  - D. It supports point-to-point and multipoint configurations and uses frame characters and checksums.
17. Which WAN protocol can be described as supporting point-to-point and multipoint configurations?
- A. HDLC
  - B. Frame Relay
  - C. PPP
  - D. ISDN
18. Which WAN protocol can be described as using frame characters and checksums?
- A. ISDN
  - B. Frame Relay
  - C. PPP
  - D. HDLC
19. Which of the following best describes Frame Relay?
- A. It uses high-quality digital facilities and is the fastest WAN protocol.
  - B. It supports point-to-point and multipoint configurations, and it uses frame characters and checksums.
  - C. It is a digital service that transmits voice and data over existing telephone lines.
  - D. It provides router-to-router and host-to-network connections over synchronous and asynchronous circuits.
20. Which of the following are not used in a WAN?
- A. Hub
  - B. Modem
  - C. Router
  - D. Communications server
21. Which WAN protocol can be described as the fastest WAN protocol?
- A. HDLC
  - B. PPP
  - C. Frame Relay
  - D. ISDN
22. Which of the following best describes PPP?
- A. It uses high-quality digital facilities and is the fastest WAN protocol.
  - B. It supports point-to-point and multipoint configurations, and it uses frame characters and checksums.

## CCNA 2 Chapter 1 WANs and Routers

- C. It provides router-to-router and host-to-network connections over synchronous and asynchronous circuits.
  - D. It is a digital service that transmits voice and data over existing telephone lines.
23. Which WAN protocol can be described as providing router-to-router and host-to-network connections over synchronous and asynchronous circuits?
- A. HDLC
  - B. Frame Relay
  - C. PPP
  - D. ISDN
24. Which of the following best describes ISDN?
- A. It is a digital service that transmits voice and data over existing phone lines.
  - B. It provides router-to-router and host-to-network connections over synchronous and asynchronous circuits.
  - C. It uses high-quality digital facilities and is the fastest WAN protocol.
  - D. It supports point-to-point and multipoint configurations, and it uses frame characters and checksums.
25. Which of the following is stored in NVRAM?
- A. The active Cisco IOS software image
  - B. The backup configuration file for the router
  - C. The backup Cisco IOS software image
  - D. The active routing table
26. Which of the following cannot be accomplished using the console port?
- A. Troubleshoot problems
  - B. Monitor the system
  - C. Configure the router
  - D. Capture data packets from a LAN
27. What type of cable do you use to connect a PC to the console port?
- A. Patch cable
  - B. Rollover
  - C. Crossover
  - D. EIA/TIA 568B
28. What type of cable do you use to connect a PC to a switch?
- A. Patch cable
  - B. Rollover
  - C. Crossover
  - D. EIA/TIA 568B
29. What type of cable do you use to connect a switch to a hub?
- A. Patch cable
  - B. Rollover
  - C. Crossover
  - D. EIA/TIA 568B

# **CCNA 2 Chapter 1 WANs and Routers**

## CCNA 2 Chapter 2

### Introduction to Routers

The startup routines for Cisco IOS Software have the goal of starting router operations. The router uses information from the configuration file when it starts up. The configuration file contains commands to customize router operation. As you saw in Chapter 1, "WANs and Routers," if no configuration file is available, the system configuration dialog setup guides you through creating one. The router must deliver reliable performance connecting the user networks that it was configured to serve. To do this, the startup routines must do the following:

- Make sure that the router comes up with all its hardware tested.
- Find from memory and load the Cisco IOS Software image that the router uses for its operating system.
- Find from memory and apply the configuration statements about the router, including protocol functions and interface addresses.

The router makes sure that it comes up with tested hardware. When a Cisco router powers up, it performs a power-on self-test (POST). During this self-test, the router executes diagnostics from ROM on all modules. These diagnostics verify the basic operation of the CPU, memory, and network interface ports. After the router verifies the hardware functions, it proceeds with software initialization. You configure Cisco routers from the user interface that runs on the router console or terminal. You also can configure Cisco routers by using remote access. You must log in to the router before you can enter an EXEC command. For security purposes, the router has two levels of access to commands:

- **User mode**—Typical tasks include those that check the router status. In this mode, router configuration changes are not allowed.
- **Privileged mode**—Typical tasks include those that change the router configuration.

#### Concept Questions

1. Configuration files can come from the console, NVRAM, or a TFTP server. What are the different router modes?
  
  
  
  
  
  
  
  
  
  
2. What does it mean to configure a router?





## CCNA 2 Chapter 2

### Introduction to Routers

12. You can use the following advanced help features: Command completion, command prompting, and syntax checking. Why would you need to use syntax checking?
13. Why is it important to have two different levels of command access?
14. Cisco router IOS has a naming convention to provide the network administrator details about the software. What are the major components of IOS naming?
15. There are two types of enable passwords. What are differences between these passwords?

# CCNA 2 Chapter 2

## Introduction to Routers

### Vocabulary Exercise

Define the following terms as completely as you can. Refer to the online curriculum or CCNA 2 Chapter 2 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

Configure terminal

CPU

DB 9 adapter

erase startup-config

Privileged mode

Reload

ROM monitor

User mode

# CCNA 2 Chapter 2

## Introduction to Routers

### Focus Questions

1. How do you access a router?
2. Distinguish between user mode and privileged mode.
3. What does it mean to configure a router? Why must routers be configured?
4. What do the prompts for user EXEC mode, privileged EXEC mode, and global configuration mode look like?
5. What are two basic tasks when first configuring a router?
6. In Cisco IOS Software, what is the user mode prompt and what is the privileged mode prompt?
7. What must you type at the user or privileged mode prompts to display a list of commonly used commands?
8. When in user mode, what must you do to enter privileged mode?



# CCNA 2 Chapter 2

## Introduction to Routers

### CCNA Exam Review Questions

1. What are the two modes of access to router commands for Cisco routers?
  - A. User and privileged
  - B. User and guest
  - C. Privileged and guest
  - D. Guest and anonymous
2. Why are there two modes of access to router commands on Cisco routers?
  - A. One mode is for remotely working on the router, whereas the other mode is for directly working on the router via a console.
  - B. One mode, which has many automatic sequences, is for new users, whereas the other mode is for experienced users who can issue direct commands.
  - C. One mode lets a number of users see what's happening on the router, whereas the other mode lets a few users change how the router operates.
  - D. One mode is for the initial router configuration and startup, whereas the other mode is for maintaining, updating, and changing the router after initial startup.
3. What can be done only in privileged mode on Cisco routers?
  - A. Change the configuration.
  - B. Enter commands.
  - C. Check routing tables.
  - D. Monitor performance.
4. How do you switch from user to privileged mode on Cisco routers?
  - A. Type admin and enter a password.
  - B. Type root and enter a password.
  - C. Type enable and enter a password.
  - D. Type privileged and enter a password.
5. What happens if you type enable on a Cisco router user interface?
  - A. You switch to user mode.
  - B. The last command entered is activated.
  - C. A new LAN is added to the router table.
  - D. You switch to privileged mode.
6. Which of the following commands is not available in the user access mode?
  - A. show
  - B. ppp
  - C. trace
  - D. ping
7. Which of the following is the user-mode prompt for Cisco router user interfaces?
  - A. #
  - B. >
  - C. <
  - D. |#

## CCNA 2 Chapter 2 Introduction to Routers

8. Which of the following is the privileged-mode prompt for Cisco router user interfaces?
  - A. #
  - B. >
  - C. <
  - D. |#
  
9. How do you log out of a Cisco router user interface?
  - A. Press Control-Q.
  - B. Type quit.
  - C. Type exit.
  - D. Press Control-X.
  
10. How can you get a list of commonly used commands from a Cisco router user interface?
  - A. Type list.
  - B. Press Control-C.
  - C. Press Control-?.
  - D. Type ?.
  
11. What does the "More" prompt at the bottom of a screen on a Cisco router user interface mean?
  - A. Multiple screens are available as output.
  - B. Additional detail is available in the manual pages.
  - C. Multiple entries are required in the command.
  - D. Additional conditions must be stated.
  
12. How do you get to the next screen if "More" is indicated at the bottom of the current screen on a Cisco router user interface?
  - A. Press the Page Down key.
  - B. Press the spacebar.
  - C. Press End.
  - D. Press Tab.
  
13. Which keystroke(s) automatically repeat(s) the previous command entry on a Cisco router user interface?
  - A. Left arrow
  - B. Right arrow
  - C. Ctrl-R
  - D. Ctrl-P
  
14. What happens if you press ? in a Cisco router user interface?
  - A. You see all users logged in to the router.
  - B. You list the last command you typed.
  - C. You enter the help system.
  - D. You find out which mode you are currently in.

## CCNA 2 Chapter 2 Introduction to Routers

15. What does it mean if you see the symbol ^ on a Cisco router user interface?
- A. There is an error in the command string.
  - B. You are in Help mode.
  - C. You must enter more information to complete the command.
  - D. You are in privileged mode.
16. What would you type at the router user prompt if you wanted to see which show subcommands were available?
- A. ?
  - B. command ?
  - C. show ?
  - D. list ?
17. What would you type at the router user prompt if you wanted to see which configuration subcommands were available?
- A. ?
  - B. command ?
  - C. list ?
  - D. config ?
18. Which of the following commands is only available at the privileged access mode?
- A. ping
  - B. show
  - C. trace
  - D. ppp
19. Which of the following is the correct order of steps in the Cisco router system startup routine?
- A. Locate and load the operating system, load the bootstrap, test the hardware, and locate and load the configuration file.
  - B. Test the hardware, load the bootstrap, locate and load the operating system, and locate and load the configuration file.
  - C. Load the bootstrap, locate and load the configuration file, test the hardware, and locate and load the operating system.
  - D. Test the hardware, load the bootstrap, locate and load the configuration file, and locate and load the operating system.
20. Which of the following is *not* a step in the Cisco router system startup routine?
- A. Loading the bootstrap
  - B. Power-up hardware self-test
  - C. Enabling CDP on each interface
  - D. Locating and loading the configuration file

## CCNA 2 Chapter 2 Introduction to Routers

21. Which of the following is an important function of POST?
- A. Determining the router hardware and software components and listing them on the console terminal
  - B. Causing other instructions to be loaded into memory
  - C. Executing diagnostics that verify the basic operation of router hardware
  - D. Starting routing processes, supplying addresses for interfaces, and setting up media characteristics
22. Which of the following is an important result of Cisco IOS Software loading onto a router?
- A. Determining the router hardware and software components and listing them on the console terminal
  - B. Causing other instructions to be loaded into memory
  - C. Executing diagnostics that verify the basic operation of router hardware
  - D. Starting routing processes, supplying addresses for interfaces, and setting up media characteristics
23. Which of the following is an important result of the configuration file loading onto a router?
- A. Determining the router hardware and software components and listing them on the console terminal
  - B. Causing other instructions to be loaded into memory
  - C. Executing diagnostics that verify the basic operation of router hardware
  - D. Starting routing processes, supplying addresses for interfaces, and setting up media characteristics
24. Which of the following is *not* a function of the router system startup routine?
- A. Verifying the routing of protocol packets
  - B. Testing of the basic operations of router hardware
  - C. Causing other instructions to be loaded into memory
  - D. Starting routing processes, supplying addresses for interfaces, and setting up media characteristics
25. When is the router setup mode executed?
- A. After the saved configuration file is loaded into the main memory
  - B. When the network administrator needs to enter complex protocol features on the router
  - C. When the router begins software initialization
  - D. When the router cannot find a valid configuration file
26. Which of the following does *not* describe features of the router setup mode?
- A. Many default settings appear in square brackets.
  - B. The prompt and command for the setup mode are "router# setup".
  - C. The first line and title of the setup dialog is "System Configuration Dialog".

## CCNA 2 Chapter 2 Introduction to Routers

- D. Pressing the Enter key cancels dialog prompts.
27. Which of the following correctly describes a procedure for setup of router global and interface parameters on a router?
- A. A default parameter is shown in square brackets at every prompt.
  - B. The router host name must be set.
  - C. An enable secret password can be set, but it is not required.
  - D. For each installed interface, a series of questions must be answered.
28. Which of the following does *not* correctly describe a procedure for setup of global and interface parameters on a router?
- A. An enable secret password must be entered.
  - B. A default parameter is shown in square brackets at every prompt.
  - C. Configuration values that you have determined for the installed interfaces are entered as parameters at the interface prompts.
  - D. The router hostname must be set.
29. What information do you need to gather before starting a global or interface configuration session on a router?
- A. Brand and model of router and type of networks the router connects to directly
  - B. Cisco IOS Software version and current register setting
  - C. Which routing protocols will be needed, IP addresses of interface and subnets, and which interfaces are being used
  - D. IP addresses of neighboring routers and size of Flash memory
30. Which of the following correctly describes the router setup script review?
- A. The setup command program displays the configuration that was created from your answers to the setup prompts.
  - B. The setup command program asks you whether you want to change any of your answers.
  - C. If you choose to use the displayed configuration, you select a location to save it to.
  - D. If you choose not to use the configuration, you must reboot the router.
31. Which of the following correctly describes the procedure for modifying the script displayed upon completion of the router configuration process?
- A. The setup command program prompts you at each of the script lines as to whether you want to change your answers.
  - B. When you choose not to accept the configuration, the router reboots.
  - C. When you select the dialog lines that you want to change, the program prompts you again at those lines.
  - D. The script tells you to use configuration mode to modify the configuration.
32. Which keystroke will take you to the end of the line?
- A. Ctrl-A
  - B. Ctrl-B

## CCNA 2 Chapter 2 Introduction to Routers

- C. Ctrl-E
- D. Ctrl-Z

33. Which keystroke will allow you to exit configuration mode?

- A. Ctrl-A
- B. Ctrl-B
- C. Ctrl-E
- D. Ctrl-Z

34. Which of the following is not a Cisco IOS naming convention?

- A. Hardware platform
- B. Special features and capabilities
- C. Amount of RAM required
- D. Where the image runs

35. Which of the following is not listed by issuing the show version command?

- A. Hardware platform
- B. Configuration register setting
- C. Where the IOS was loaded
- D. How the router was restarted
- E. All of the above



## CCNA 2 Chapter 3

### Configuring a Router

4. Router interface descriptions are very useful during troubleshooting and network documentation. The interface description can contain the circuit identification, point of contact, phone number of point of contact, and what the interface connects to. Describe the process to add a description to an interface.
5. Explain the router password recovery procedure on 2600 and 2500 series routers.
6. The router has modes for examining, maintaining, and changing the components. What does the router do in examining mode?
7. When you issue the command show interface serial 0 on an unconfigured router. What

# CCNA 2 Chapter 3

## Configuring a Router

### Focus Questions

1. Describe the procedure for setting the hostname on a Cisco router?
2. List three external configuration sources for Cisco routers.
3. The commands `copy running-config tftp` and `copy running-config startup-config` store the currently running configuration from RAM to \_\_\_\_\_ and \_\_\_\_\_, respectively.
4. List and describe the different router modes and interfaces that can be password protected.
5. List at least seven commands that can show router status and the configurable components about which they display information. Commands for examining a router's status include the following:
6. List the steps to completely erase all configuration information from a router.

# CCNA 2 Chapter 3

## Configuring a Router

### CCNA Exam Review Questions

1. Which of the following describes a location from which a router is configured?
  - A. After a router is installed on the network, it can be configured from virtual terminals.
  - B. Upon initial configuration, a router is configured from the virtual terminals.
  - C. After a router is installed on the network, it can be configured via modem from the console terminal.
  - D. Upon initial configuration, a router is configured via modem using the auxiliary port.
2. Which of the following does *not* describe external configuration of routers?
  - A. Upon initial configuration, a router is configured from the console terminal.
  - B. The router can be connected via modem using the console port.
  - C. After a router is installed, it is configured from the console terminal.
  - D. Configuration files can be downloaded from a TFTP server on the network.
3. Which of the following router components has these characteristics: stores routing tables, fast-switching cache, and packet hold queues?
  - A. NVRAM
  - B. RAM/DRAM
  - C. Flash
  - D. ROM
4. Which of the following router components has these characteristics: holds the operating system and microcode, retains its contents when you power down or restart, and allows software updates without replacing chips?
  - A. NVRAM
  - B. RAM/DRAM
  - C. Flash
  - D. ROM
5. Which of the following best describes the function of NVRAM?
  - A. It provides temporary or running memory for the router's configuration file while the router is powered on.
  - B. It stores the router's backup configuration file. The content is retained when you power down or restart.
  - C. It holds the operating system image and microcode and enables you to update software without removing and replacing chips on the processor.
  - D. It contains power-on diagnostics, a bootstrap program, and operating system software.

## CCNA 2 Chapter 3

### Configuring a Router

6. Which of the following does *not* describe a function of working storage RAM in a router?
  - A. A bootstrap program performs tests and then loads the Cisco IOS software into memory.
  - B. A saved version of the configuration file is accessed from NVRAM and loaded into main memory when the router initializes.
  - C. The EXEC part of the IOS software handles packet buffering and the queuing of packets.
  - D. The operating system image is usually executed from the main RAM and loaded from an input source.
  
7. Which of the following is the router mode that supports debugging and testing commands, manipulation of configuration files, and detailed examination of the router?
  - A. Global configuration mode
  - B. RXBOOT mode
  - C. Privileged EXEC mode
  - D. Setup mode
  
8. Which of the following describes functions of the user EXEC mode of a router?
  - A. It presents an interactive prompted dialog that helps the new user create a first-time basic configuration.
  - B. It implements powerful one-line commands that perform simple configuration tasks.
  - C. It is used for recovery from catastrophe, such as to retrieve lost passwords.
  - D. It allows the user to view some information about the router but not change anything.
  
9. If you are in global configuration mode, what does the router prompt look like?
  - A. router #
  - B. router (config) #
  - C. router-config #
  - D. r-config #
  
10. When you are in user mode, what does the router prompt look like?
  - A. router -
  - B. router >
  - C. router #
  - D. router
  
11. What is the command you enter to gain access to privileged EXEC mode?
  - A. ena
  - B. p exec
  - C. exec

## CCNA 2 Chapter 3

### Configuring a Router

- D. enable p-exec
12. Which of the following does *not* correctly describe the function of a router status command?
- A. show version—Displays configuration of the system hardware, the names and sources of configuration files, and the boot images.
  - B. show mem—Displays statistics about the router's memory, including Memory-free pool statistics.
  - C. show buffers—Displays statistics for the buffer pools on the router.
  - D. show interfaces—Displays statistics for all interfaces that are configured on the router.
13. If you type show ? at the router > prompt, what appears on the screen?
- A. Nothing; this is not a valid command.
  - B. All the items that can be shown in user mode.
  - C. The status of the router.
  - D. Information about the version of the IOS that is currently running.
14. Which of the following describes a function of the show running-config Cisco IOS Software command?
- A. It enables an administrator to see the image size and startup configuration commands that the router will use on the next restart.
  - B. It displays a message at the top showing how much nonvolatile memory has been used.
  - C. It enables an administrator to see the configuration of the processes and interrupt routines.
  - D. It enables an administrator to see the current running configuration on the router.
15. Which of the following describes a function of the show startup-config Cisco IOS Software command?
- A. It enables an administrator to see the current running configuration on the router.
  - B. It displays a message at the top showing how much nonvolatile memory has been used.
  - C. It enables an administrator to see the reason for the last system reboot.
  - D. It displays this message at the top: Current Configuration.
16. The show interface serial Cisco IOS Software router command can display which one of the following lines of information?
- A. IOS 4500 Software (C4500-J-M), Experimental Version 11.2.
  - B. DECNET routing is enabled.
  - C. Serial1 is up, line protocol is up.
  - D. System image file is c4500-j-mz.
17. The show version Cisco IOS Software router command can display which one of the

## CCNA 2 Chapter 3

### Configuring a Router

- following lines of information?
- A. IOS 4500 Software (C4500-J-M), Experimental Version 11.2.
  - B. Hardware is MK5025.
  - C. Internet Protocol routing is enabled.
  - D. Internet address is 183.8.64.129.
18. The show protocols Cisco IOS Software router command can display which one of the following lines of information?
- A. Serial1 is up, line protocol is up.
  - B. Compiled Fri 28-Jun-96.
  - C. AppleTalk routing is enabled.
  - D. ROM; System Bootstrap, Version 5.1(1).
19. What kind of information *cannot* be obtained when you enter show interface in the user mode?
- A. The MAC address for all interfaces
  - B. The IP address for all interfaces
  - C. The number of users who are logged in to each interface
  - D. The encapsulation protocol for each interface
20. If you type show interface E0 at the prompt router#, which of the following best shows what the first lines of the response would look like if the interface were up?
- A. Ethernet0 is up, line protocol is up Address is 0000.0f92.c54b (bia 0000.0f92.c54b) Internet address is 223.8.151.1/24 MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255 Encapsulation ARPA, loopback not set, keepalive set (10sec)
  - B. Ethernet0 is up, line protocol is up Hardware is Lance, address is 0000.0f92.c54b (bia 0000.0f92.c54b) Internet address is 223.8.151.1/24 ARP type: ARPA, ARP Timeout 05:00:00 Encapsulation ARPA, loopback not set, keepalive set (10sec)
  - C. Ethernet0 is up, line protocol is up Hardware is Lance, address is 0000.0f92.c54b (bia 0000.0f92.c54b) Internet address is 223.8.151.1/24 MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec, rely 255/255, load 1/255 Encapsulation ARPA, loopback not set, keepalive set (10sec)
  - D. Ethernet0 is up, line protocol is up Address is 0000.0f92.c54b (bia 0000.0f92.c54b) Internet address is 223.8.151.1/24 Subnet Mask is 255.255.255.255/24 Encapsulation ARPA, loopback not set, keepalive set (10sec)
21. Why might you want to issue show startup-config and show running-config commands?
- A. It is time to update the Cisco IOS Software image and you need to kill certain router processes before proceeding.
  - B. You want to determine the time since the router booted and the current register setting.
  - C. The router suddenly isn't working right and you want to compare the initial state to the present state.
  - D. You want to find out where the Cisco IOS Software image booted from and which

## CCNA 2 Chapter 3

### Configuring a Router

version is being used.

22. Why should the enable password be different from the enable secret password?
- A. The router asks that the passwords be changed monthly if they are the same.
  - B. It provides an additional category of users.
  - C. The enable password can be read directly from the configuration file.
  - D. Cisco IOS Software behaves badly if the passwords are the same.
23. What file(s) would you find in NVRAM?
- A. Cisco IOS Software and configuration files
  - B. Configuration file
  - C. Backup copy of Cisco IOS Software
  - D. Limited version Cisco IOS Software and Registry files
24. Which of the following is *not* a function of the privileged EXEC configure command?
- A. Configuring a router from a virtual terminal
  - B. Configuring a TFTP server from a virtual terminal
  - C. Configuring a router from the console terminal
  - D. Loading a configuration from a network TFTP server
25. Which of the following is *not* a step in using the copy running-config tftp command to store the current router configuration? (The steps are listed in order.)
- A. Enter the copy running-config tftp command.
  - B. Enter the IP address of the router.
  - C. Enter the name you want to assign to the configuration file.
  - D. Confirm your choices.
26. Which of the following is *not* a step in using the copy tftp running-config command to load a router configuration file that is stored on a TFTP server? (The steps are listed in order.)
- A. Enter the copy tftp running-config command.
  - B. Select either a host configuration file or a network configuration file.
  - C. Enter the IP address of the remote host from which you retrieve the configuration file.
  - D. Enter the name of the server to which you will load the file.
27. Which of the following does *not* correctly describe using a TFTP server to maintain router configuration files?
- A. A host configuration file contains commands that apply to all routers and terminal servers on the network.
  - B. The convention for all filenames is UNIX-based.
  - C. The default filename is hostname-config for the host file.
  - D. Reconfiguration of the router occurs as soon as a new file is downloaded to the router.

## CCNA 2 Chapter 3

### Configuring a Router

28. What is the function of the configure memory router command?
- A. It loads configuration information from NVRAM.
  - B. It erases the contents of NVRAM.
  - C. It stores in NVRAM the current configuration that is in RAM.
  - D. It displays the configuration that is saved in NVRAM.
29. You want to replace your current configuration file with one that is located on a TFTP server. What is the process you need to go through to do this?
- A. router (config)# copy tftp running-config  
Host or network configuration file [host]?  
  
IP address of remote host [255.255.255.255]? 131.108.6.155  
  
Name of configuration file [Router-config]? paris.3  
Configure using paris.3 from 131.108.6.155 [confirm] y  
Booting paris.3 from 131.108.6.155: !! [OK – 874/16000 bytes]  
Router (config)#
  - B. router # copy tftp running-config  
Host or network configuration file [host]?  
  
IP address of remote host [255.255.255.255]? 131.108.6.155  
Configure using paris.3 from 131.108.6.155 [confirm] y  
Booting paris.3 from 131.108.6.155: !! [OK – 874/16000 bytes]  
Router#
  - C. router # copy tftp running-config  
Host or network configuration file [host]?  
Name of configuration file [Router-config]? paris.3  
Configure using paris.3 from 131.108.6.155 [confirm] y  
Booting paris.3 from 131.108.6.155: !! [OK – 874/16000 bytes]  
Router#
  - D. router # copy tftp running-config  
Host or network configuration file [host]?  
  
IP address of remote host [255.255.255.255]? 131.108.6.155  
Name of configuration file [Router-config]? paris.3  
Configure using paris.3 from 131.108.6.155 [confirm] y  
Booting paris.3 from 131.108.6.155: !! [OK – 874/16000 bytes]  
Router#
30. What is the function of the copy running-config startup-config router command?
- A. It loads configuration information from NVRAM.
  - B. It erases the contents of NVRAM.
  - C. It stores in NVRAM the current configuration that is in RAM.
  - D. It displays the configuration that is saved in NVRAM.

## CCNA 2 Chapter 3

### Configuring a Router

31. You added a new LAN onto your network; therefore, you updated your routing table and other parts of your configuration file. What command do you need to issue to save the new configuration file?
- A. copy config startup-config
  - B. copy running-config startup-config
  - C. configure memory
  - D. copy startup-config config-running
32. Which router mode is a subset of the EXEC commands that are available at the privileged EXEC mode?
- A. Global configuration mode
  - B. User EXEC mode
  - C. Interface configuration mode
  - D. Router configuration mode
33. What is the system prompt for the user EXEC router mode?
- A. Router>
  - B. Router#
  - C. Router(config)#
  - D. User EXEC
34. What happens when you type exit at a router mode prompt?
- A. A configuration mode prompt appears.
  - B. The router logs you off.
  - C. The router backs out one mode level.
  - D. A question prompt appears, requesting a network device location.
35. What does the router prompt look like when you are in global configuration mode?
- A. Router#
  - B. Router (config-router)#
  - C. Router (config)#
  - D. Router-config#
36. If you want to back completely out of configuration mode, what must you enter?
- A. exit
  - B. no config-mode
  - C. Ctrl-E
  - D. Ctrl-Z
37. If you press Ctrl-Z to get out of configuration mode, where do you end up?
- A. User EXEC mode
  - B. Privileged EXEC mode

## CCNA 2 Chapter 3

### Configuring a Router

- C. Global configuration mode
  - D. Router mode
38. If you are planning to configure an interface, what prompt should be on the router?
- A. Router (config)#
  - B. Router (config-in)#
  - C. Router (config-intf)#
  - D. Router (Config-if)#
39. Which of the following does *not* describe a procedure for using the router global configuration mode?
- A. You type configure to enter global configuration mode.
  - B. You can specify the terminal, NVRAM, or a file on a server as the source of configuration commands.
  - C. You can type commands to configure specific interfaces.
  - D. You can type a command to reach a prompt for the interface configuration mode.
40. Which of the following is the system prompt for the global configuration mode?
- A. Router#
  - B. Router(config)#
  - C. Router(config-global)#
  - D. Router(config-router)#
41. Which of the following does *not* describe a step in the procedure for using the router configuration mode?
- A. Enter a global router protocol command type at the global configuration prompt.
  - B. The Router(config-router)# prompt indicates that you are in router configuration mode.
  - C. Defaults can be selected for all available command options.
  - D. Finish using this mode with the command exit.
42. Which of the following does *not* describe a step in the procedure for using the interface configuration mode?
- A. Enter a global interface type and number command at the global configuration prompt.
  - B. The Router(config-if)# prompt indicates that you are in interface configuration mode.
  - C. Interfaces can be turned on and off by using commands in this mode.
  - D. Interface types are enabled at subcommands in this mode.
43. Which of the following is the correct order for the process of configuring a router?

## CCNA 2 Chapter 3

### Configuring a Router

(Assume that you have already made router changes in configuration mode.)

- A. Save the changes to backup, decide whether the changes are your intended results, examine the results, and examine the backup file.
  - B. Examine the results, decide whether the changes are your intended results, save the changes to backup, and examine the backup file.
  - C. Decide whether the changes are your intended results, examine the backup file, save the changes to backup, and examine the results.
  - D. Examine the results, save the changes to backup, decide whether the changes are your intended results, and examine the backup file.
44. Which of the following best describes the process of configuring a router?
- A. Examine the results, make the changes in configuration mode, remove the changes, and decide whether the changes are your intended results.
  - B. Decide whether the changes are your intended results, make changes in the configuration mode, examine the results, and remove the changes.
  - C. Make the changes in configuration mode, decide whether the changes are your intended results, examine the results, and remove the changes.
  - D. Make the changes in configuration mode, examine the results, decide whether the changes are your intended results, and remove the changes.
45. Which of the following commands can you use to save router configuration changes to a backup?
- A. Router# copy running-config tftp
  - B. Router# show running-config
  - C. Router# config mem
  - D. Router# copy tftp running-config
46. Which of the following is *not* a command to remove router configuration changes?
- A. Router(config)# no ...
  - B. Router# config mem
  - C. Router# copy running-config startup-config
  - D. Router# copy tftp running-config
47. Which of the following correctly describes password configuration on routers?
- A. All passwords are established in the privileged EXEC mode.
  - B. All passwords alter the password character string.
  - C. A password can be established on all incoming Telnet sessions.
  - D. The enable password command restricts access to user EXEC mode.

## CCNA 2 Chapter 3

### Configuring a Router

48. Which of the following does *not* describe password configuration on routers?
- A. Passwords can be established in every configuration mode.
  - B. A password can be established on any console terminal.
  - C. The enable secret password uses an encryption process to alter the password character string.
  - D. All password establishment begins in the global configuration mode.
49. When you are setting passwords for vty 0 4, for what access point to the router are you setting a password for?
- A. Line consoles
  - B. Telnet sessions
  - C. Remote host router
  - D. Virtual hosts
50. The password that is set up with the enable-secret command is to control direct access to what?
- A. User EXEC mode
  - B. Configure Interface mode
  - C. Privileged EXEC mode
  - D. Global configuration mode
51. Which of the following correctly describes procedures for confirming router identification?
- A. Routers should be named only after initial testing of the network.
  - B. If no name is configured, the system automatically assigns the router a number.
  - C. You name the router in global configuration mode.
  - D. The login banner can be configured to display system error messages.
52. Which of the following does *not* describe procedures for confirming router identification?
- A. If no name is configured, the system default router name is Router.
  - B. Naming your router to be the host should be one of the first network configuration tasks.
  - C. The login banner is configured in global configuration mode.
  - D. You can configure a message-of-the-day banner to display on specified terminals.
53. You want to create a message to let people know a little something about the network when they log in. What command enables you to do this?
- A. banner mesg
  - B. banner motd
  - C. daily mesg

## CCNA 2 Chapter 3

### Configuring a Router

- D. daily motd
54. What is the function of the erase startup-config command?
- A. It deletes the backup configuration file in NVRAM.
  - B. It deletes the bootstrap image from Flash memory.
  - C. It deletes the current Cisco IOS Software image from NVRAM.
  - D. It deletes the current running configuration from Flash memory.
55. What is the function of the reload command?
- A. It loads a backup configuration file from a TFTP server.
  - B. It saves the new Cisco IOS Software image to Flash memory.
  - C. It reboots the router.
  - D. It loads the new configuration file in NVRAM.
56. Which router command deletes the backup configuration file in NVRAM?
- A. delete backup-config
  - B. erase backup-config
  - C. delete startup-config
  - D. erase startup-config
57. Which router command causes the router to reboot?
- A. reload
  - B. restart
  - C. reboot
  - D. rerun
58. What are the major elements of a typical router configuration?
- A. Passwords, interfaces, routing protocols, DNS
  - B. Boot sequence, interfaces, tftp server, NVRAM
  - C. NVRAM, ROM, DRAM, interfaces
  - D. Interfaces, routing protocols, configuration register, flash
59. In a password recovery procedure, immediately after issuing a Ctrl-Break upon router startup, what should the configuration register setting be?
- A. 0x2102
  - B. 0x2142
  - C. 0x0000
  - D. 0x10F
60. In a password recovery procedure, just before saving the running configuration and after you enable a new secret password, what should the configuration register setting be?
- A. 0x2102
  - B. 0x2142
  - C. 0x0000
  - D. 0x10F

## **CCNA 2 Chapter 4**

### **Learning About Other Devices**

Cisco Discovery Protocol (CDP) is a Layer 2 protocol that connects lower physical media and upper network layer protocols. CDP is used to obtain information about neighboring devices. This information shows the types of devices that are connected, the router interfaces they are connected to, the interfaces that are used to make the connections, and the model numbers of the devices. CDP is media and protocol independent, and it runs on all Cisco equipment as well as on the Subnetwork Access Protocol.

#### **Concept Questions**

1. The command `show cdp neighbors` displays layer 2 information about directly connected devices. List and describe the information obtained with CDP.
  
  
  
  
  
  
  
  
  
  
2. Test network connectivity layer by layer. Testing commands include ping, trace, and debug. What is the difference between trace and ping?
  
  
  
  
  
  
  
  
  
  
3. Cisco Discovery Protocol operates a layer 2 of the OSI model. How is CDP useful in troubleshooting layer three problems?
  
  
  
  
  
  
  
  
  
  
4. The command `cdp enable` is used to enable CDP on an interface. Why might a network administrator turn off CDP on an interface?
  
  
  
  
  
  
  
  
  
  
5. Telnet is used to test layer seven of the OSI model. Telnet is used to log in and issue commands to a remote router. Why would a network administrator want to suspend and then resume a Telnet session to a router?

## CCNA 2 Chapter 4 Learning About Other Devices

### Vocabulary Exercise

Define the following terms as completely as you can. Use the online curriculum or CCNA 2 Chapter 4 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

CDP

CDP enable

CDP run

CDP timers

Interface

Ping

Resume

Telnet

Trace



## CCNA 2 Chapter 4

### Learning About Other Devices

4. Briefly describe what the show cdp command can tell you about a router.
5. Briefly describe the function of the cdp timers command.
6. Briefly describe the difference between the resume command or pressing the Enter key during a suspended Telnet session.
7. Briefly why Telnet is an excellent network-troubleshooting tool.

# CCNA 2 Chapter 4

## Learning About Other Devices

### CCNA Exam Review Questions

1. Which one of the following is a function of CDP?
  - A. It provides a way to use an echo to evaluate the path-to-host reliability.
  - B. It provides a way to determine whether a routing table entry exists.
  - C. It provides a way to see the current running configuration on the local router.
  - D. It provides a way to access summaries of configurations on directly connected devices.
2. Which of the following is a characteristic of CDP?
  - A. It runs over OSI Layer 3.
  - B. It allows CDP devices that support different network layer protocols to learn about each other.
  - C. It obtains information about neighboring devices only if the administrator enters commands.
  - D. It obtains information only about devices that are running TCP/IP.
3. What steps does the network administrator have to take to make CDP run at system startup?
  - A. Type `cdp enable` at the first router prompt.
  - B. Type `cdp enable` at the first privilege EXEC router prompt.
  - C. CDP runs automatically at startup.
  - D. Type `cdp enable` at any prompt and then save the config file.
4. Which of the following is a function of the `show cdp` command?
  - A. It displays information about any CDP-enabled router on the network.
  - B. It displays information on a console that is connected to any node in the network.
  - C. It helps evaluate delays over network paths and path-to-host reliability.
  - D. It identifies neighboring routers' host names and IP addresses.
5. Which of the following is *not* provided by the `CDP show` command to tell about neighbor routers?
  - A. Processes list, with information about the active processes
  - B. Port identifier, such as Ethernet0, Serial1, and so forth
  - C. The device's hardware platform
  - D. Address list, with addresses for supported protocols
6. Which of the following is a function of the `cdp enable` command?
  - A. It boots up the Cisco IOS software and implements diagnostic testing.
  - B. It displays values of the CDP timers.
  - C. It begins CDP's dynamic discovery function on the router's interfaces.
  - D. It discards expired hold-time values.
7. Which of the following is *not* a function of the `show cdp interface` command?
  - A. It displays the values of the CDP timers.
  - B. It displays the reasons for system reboot.
  - C. It displays the interface status.

## CCNA 2 Chapter 4

### Learning About Other Devices

- D. It displays the encapsulation that CDP uses.
8. Which of the following is a function of the show cdp entry [device\_name] command?
- A. It establishes a connection to a remote router.
  - B. It displays the cached CDP entry for every directly connected CDP router.
  - C. It enables an administrator to see the IP addresses of the targeted router.
  - D. It displays version information about the network protocols that are running on the router.
9. Which of the following is *not* a function of the show cdp entry [device\_name] command?
- A. It displays the cached CDP entry for every directly connected CDP router.
  - B. It displays all Layer 3 addresses that are present on the router.
  - C. It displays how long ago the CDP frame arrived from the router.
  - D. It displays version information about the router.
10. Which of the following is a function of the show cdp neighbors command?
- A. It displays the device capability code of remote routers.
  - B. It displays the path-to-host reliability of a network connection.
  - C. It displays the encapsulation of the protocols that neighbor routers use.
  - D. It displays the neighbor's remote port type and number.
11. Which of the following is *not* a function of the show cdp neighbors command?
- A. It displays the cached CDP entry for every directly connected CDP router.
  - B. It displays the CDP updates that are received on any network router.
  - C. It displays information like that from show cdp entry when show cdp neighbors detail is used.
  - D. It displays neighbor device IDs.
12. Why would you use the show cdp neighbors command?
- A. To get a snapshot view of the routers in the network
  - B. To get an overview of the routers that are directly connected to you
  - C. To get the IP addresses for neighboring routers
  - D. To build a routing table for all routers that are in the network neighborhood
13. Which of the following is a feature of Telnet router operations?
- A. Telnet is typically used to connect a router to neighbor routers.
  - B. A router can have only one incoming Telnet session at a time.
  - C. A Telnet session can be suspended and then resumed.
  - D. To initiate a Telnet session, you must know the name of the host.
14. Which of the following layer 3 protocols does CDP not provide information?
- A. Appletalk
  - B. IP
  - C. IPX
  - D. SNMP

## CCNA 2 Chapter 4

### Learning About Other Devices

15. Which of the following is a feature of CDP
- A. Obtains information about only directly connected Cisco devices
  - B. Runs on all Cisco equipment
  - C. Operates at layer two of the OSI model.
  - D. Media and protocol dependent
16. Which of the following is not a feature of Ping
- A. Used to test the application layer of the OSI model
  - B. Uses echo and echo reply
  - C. Verifies reachability
  - D. Very basic testing tool
17. What is the key sequence to suspend a Telnet session?
- A. Ctrl-B
  - B. Ctrl-Shift
  - C. Ctrl-Shift-6, then x
  - D. Ctrl-Alt-Shift-Delete

## CCNA 2 Chapter 5

# Managing Cisco IOS Software

The default source for Cisco IOS Software depends on the hardware platform; most commonly, though, the router looks to the configuration commands that are saved in NVRAM. Cisco IOS Software offers several alternatives. You can specify other sources where the router should look for software or the router uses its own fallback sequence as necessary to load software.

Settings in the configuration register enable alternatives for where the router will bootstrap Cisco IOS Software. You can specify enabled configuration-mode boot system commands to enter fallback sources for the router to use in sequence. Save these statements in NVRAM to use during the next startup with the command **copy running-config startup-config**. The router uses these commands as needed, in sequence, when it restarts.

If NVRAM lacks boot system commands that the router can use, the system has its own fallback alternatives. The router falls back and uses the default Cisco IOS Software image in Flash memory. If Flash memory is empty, the router tries its next TFTP alternative. The router uses the configuration register value to form a filename from which to boot a default system image that is stored on a network server.

Cisco develops many versions of IOS. The IOS supports different types of hardware and features. To identify the different versions of IOS Cisco developed a naming convention. The main fields in the naming convention are:

- Hardware Platform
- Feature Set
- File Format
- Version Number

### Concept Questions

Routers boot Cisco IOS Software from

- Flash
- TFTP server
- ROM (not full Cisco IOS)
- Multiple source options that provide flexibility and fallback alternatives

1. Explain the process by which a router locates Cisco IOS software.





# **CCNA 2 Chapter 5**

## **Managing Cisco IOS Software**

# CCNA 2 Chapter 5

## Managing Cisco IOS Software

### Vocabulary Exercise

Define the following terms as completely as you can. Refer to the online curriculum or CCNA 2 Chapter 5 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

Boot field

Boot system

Checksum

Configuration register

copy flash tftp

copy run start

copy start tftp

copy tftp flash

copy tftp start

copy tftp run

EEPROM

Feature set

file format

Flash

Hardware platform

NVRAM

ROM monitor

TFTP Server

Version number

Xmodem

# CCNA 2 Chapter 5

## Managing Cisco IOS Software

### Focus Questions

1. Why might there be different versions of router operating systems?
2. Where can routers boot Cisco IOS Software from?
3. Can the router cannot be configured to look elsewhere if Cisco IOS Software is not in Flash memory?
4. The configuration register is an  $n$ -bit register in NVRAM. What is the value of  $n$ ?
5. What command would you use to check the configuration register setting?
6. What does the first  $E$  in EEPROM stand for?
7. Which component is not required by a router to operate correctly?

# CCNA 2 Chapter 5

## Managing Cisco IOS Software

### CCNA Exam Review Questions

1. Which of the following correctly describes a method for specifying how a router loads Cisco IOS Software?
  - A. Designate fallback sources for the router to use in sequence from NVRAM.
  - B. Configure the Cisco IOS Software image for the location where it will bootstrap.
  - C. Manually boot a default system image at a virtual terminal.
  - D. Manually boot a default system image at the network server.
2. Which of the following is the sequence that the router uses for automatic fallback to locate Cisco IOS Software?
  - A. Flash, NVRAM, TFTP server
  - B. NVRAM, TFTP server, Flash
  - C. NVRAM, Flash, TFTP server
  - D. TFTP server, Flash, NVRAM
3. Which of the following does *not* describe configuration register settings for Cisco IOS Software bootstrapping?
  - A. The order in which the router looks for system bootstrap information depends on the boot field setting.
  - B. You change the configuration register setting with the command config-register.
  - C. Use a hexadecimal number when setting the configuration register boot field.
  - D. Use the show running-config command to check the boot field setting.
4. Which of the following information does the Cisco IOS Software show version command display?
  - A. Statistics about the router's memory
  - B. Name of the system image
  - C. Information about the Flash memory device
  - D. Status of configured network protocols
5. Which of the following commands is used to discover the configuration register setting?
  - A. show register
  - B. show running-config
  - C. show version
  - D. show startup-config
6. Which of the following does *not* correctly describe a fallback option for booting Cisco IOS Software?
  - A. Flash memory provides storage that is not vulnerable to network failures.
  - B. Loading Cisco IOS Software from a TFTP server is a good option if Flash memory becomes corrupted.
  - C. The system image that is booted from ROM is usually a complete copy of Cisco IOS Software.
  - D. ROM might contain an older version of Cisco IOS Software.

## CCNA 2 Chapter 5

### Managing Cisco IOS Software

7. Which of the following correctly describes preparing to use a TFTP server to copy software to Flash memory?
  - A. The TFTP server must be another router or a host system such as a UNIX workstation or a laptop computer.
  - B. The TFTP host must be a system that is connected to an Ethernet network.
  - C. The name of the router that contains the Flash memory must be identified.
  - D. The Flash memory must be enabled.
  
8. Which of the following is *not* a step in preparing to copy software from a TFTP host to Flash memory?
  - A. Check the router to make sure you can see and write into Flash.
  - B. Verify that the router has sufficient room to accommodate Cisco IOS Software.
  - C. Use the show ip route command to make sure you can access the TFTP server over the TCP/IP network.
  - D. Check the TFTP server to make sure you know the file or file space for the Cisco IOS Software image.
  
9. Which of the following does *not* describe the procedure to verify sufficient room in Flash memory for copying software?
  - A. Use the show flash command.
  - B. Identify the total memory in Flash, which is the available memory.
  - C. Compare the available memory with the length of the Cisco IOS Software image to be copied.
  - D. If there is not enough available memory, you can try to obtain a smaller Cisco IOS Software image.
  
10. How would you determine the size of the Cisco IOS Software image file on a TFTP server?
  - A. Go to the Cisco website and consult the image file size table.
  - B. Type show version on your router.
  - C. Type dir or ls on the TFTP server.
  - D. Telnet to the TFTP server and issue a show files command.
  
11. Which of the following is the fastest way to make sure the TFTP server is reachable prior to trying to transfer a Cisco IOS Software image file?
  - A. Trace the TFTP server.
  - B. Ping the TFTP server.
  - C. Telnet to the TFTP server.
  - D. Call the TFTP server administrator.
  
12. Why do you need to determine the file size of the Cisco IOS Software image on the TFTP server before transferring it to your router?
  - A. To check that there is enough space in Flash to store the file.
  - B. To verify that the file is the correct Cisco IOS Software for your router.
  - C. To complete a trivial File Transfer Protocol (FTP) operation, the file size must be known.

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### Managing Cisco IOS Software

- D. To calculate the download time for the file and the amount of time that the router will be out of service.
13. What information is *not* provided in the Cisco IOS Software image filename system?
- A. Capabilities of the image
  - B. Platform on which the image runs
  - C. Where the image runs
  - D. Size of the image
14. Which of the following is *not* part of the procedure for creating a Cisco IOS Software image backup to a TFTP server?
- A. Use the show flash command to learn the name of the system image file.
  - B. Enter the copy flash tftp command to begin the copy process.
  - C. Enter the IP address of the router that is holding the image file.
  - D. Rename the file during transfer.
15. Why does an administrator create a Cisco IOS Software image backup?
- A. To verify that the copy in Flash is the same as the copy in ROM
  - B. To provide a fallback copy of the current image prior to copying the image to a new router
  - C. To create a fallback copy of the current image as part of procedures during recovery from system failure
  - D. To create a fallback copy of the current image prior to updating with a new version
16. Which of the following is *not* part of the procedure for loading a new Cisco IOS Software image to Flash memory from a TFTP server? (The procedures are listed in correct order.)
- A. Back up a copy of the current software image to the TFTP server.
  - B. Enter the copy flash tftp command to download the new image from the server.
  - C. The procedure asks if you are willing to erase Flash.
  - D. A series of Vs on the display indicates successful check run verification.
17. Which of the following is *not* part of the procedure for loading a backup Cisco IOS Software image to Flash memory from a TFTP server? (The procedures are listed in correct order.)
- A. Enter the copy tftp flash command.
  - B. A prompt asks you for the IP address of the TFTP server.
  - C. If a file with the same name exists in Flash memory, the file that is being copied automatically replaces it.
  - D. Enter the reload command to boot up the router using the newly copied image.
18. What is the initial boot attempt if the router register is set to Ox2100?
- A. ROM monitor
  - B. TFTP server
  - C. ROM
  - D. Flash

## CCNA 2 Chapter 5

### Managing Cisco IOS Software

19. What is the initial boot attempt if the router register is set to 0x2101?
- A. ROM monitor
  - B. TFTP server
  - C. ROM
  - D. Flash
20. What is the initial boot attempt if the router register is set to 0x2102?
- A. ROM monitor
  - B. TFTP server
  - C. ROM
  - D. Flash
21. Which one of the following commands will boot a router while in ROM monitor mode?
- A. rommon22>config-register 0x2102
  - B. rommon2>boot flash
  - C. rommon5>boot flash:ios image name
  - D. rommon17>boot system flash: ios image name
22. Which of the following is not a part of the Cisco IOS naming convention?
- A. Hardware Platform
  - B. Feature Set
  - C. Version Number
  - D. Flash size
23. Which hardware platform is supported by the image named c2600-d-l-120-5.bin?
- A. 1205
  - B. 2500
  - C. 2600
  - D. 1720

## CCNA 2 Chapter 6

# Routing and Routing Protocols

Which path should traffic take through the cloud of networks? Path determination occurs at Layer 3 of the OSI reference model, which is the network layer. The path determination function enables a router to evaluate the available paths to a destination and to establish the preferred handling of a packet.

Routing services use network topology information when evaluating network paths. This information can be configured by the network administrator or collected through dynamic processes that are running in the network.

The network layer interfaces to networks and provides best-effort, end-to-end packet delivery services to its user, the transport layer. The network layer sends packets from the source network to the destination network based on the IP routing table.

After the router determines which path to use, it proceeds with forwarding the packet. The router takes the packet it accepted on one interface and forwards it to another interface or port that reflects the best path to the packet's destination.

### Concept Questions

1. Internetworking functions of the network layer include network addressing and best path selection for traffic. What is best-path selection?
2. In network addressing, one part of the address is used to identify the path that the router uses and the other is used for ports or devices on the network. Which part of the address is used to identify the path that the router uses?
3. Routed protocols allow routers to direct user traffic, and routing protocols work between routers to maintain path tables. Explain this key difference.

## CCNA 2 Chapter 6

### Routing and Routing Protocols

4. Network discovery for distance-vector routing involves exchange of routing tables; problems can include slow convergence. What other problems can occur as a result of exchanging routing tables?
  
5. The distance vector routing protocol RIP has a metric and update timers. What is the metric and what is the default update timer setting?
  
6. The distance vector routing protocol IGRP has metrics and update timers. What are the IGRP metrics and default update timer settings?
  
7. For link-state routing, routers calculate the shortest paths to other routers. Problems can include inconsistent updates. What other problems might occur with link-state routing?
  
8. A link-state routing protocol can provide for faster convergence over a distance vector routing protocol. What are some other advantages of using a link-state routing protocol over a distance vector routing protocol?
  
9. Balanced hybrid routing uses attributes of both link-state and distance-vector routing, and can apply paths to several protocols. What advantages does balanced hybrid routing offer?

# **CCNA 2 Chapter 6**

## **Routing and Routing Protocols**

# CCNA 2 Chapter 6

## Routing and Routing Protocols

### Vocabulary Exercise

Define the following terms as completely as you can. Refer to the online curriculum or CCNA 2 Chapter 6 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

Administrative distance

Convergence

Default route

Delay

Dynamic routing

EIGRP

Header

Hop

Hop count

IGRP

OSPF

RIP

Routing metric

Routing protocol

Static route

Stub network

# CCNA 2 Chapter 6

## Routing and Routing Protocols

### Focus Questions

1. What is the purpose of a routing protocol?
2. Distinguish between routed protocols and routing protocols.
3. Describe the process to add the directly connected networks 192.5.5.0 and 172.16.0.0 to be advertised by RIP?
4. List and briefly describe at least five examples of routing metrics.

## **CCNA 2 Chapter 6**

### **Routing and Routing Protocols**

5. Briefly describe distance-vector routing.

6. Briefly describe how a router learns about routes to a network.

7. Briefly describe how to configure a static route.

# CCNA 2 Chapter 6

## Routing and Routing Protocols

### CCNA Exam Review Questions

1. What function allows routers to evaluate available routes to a destination and to establish the preferred handling of a packet?
  - A. Data linkage
  - B. Path determination
  - C. SDLC interface protocol
  - D. Frame Relay
2. What information do routing services use to evaluate network paths?
  - A. MAC addresses
  - B. Name server tables
  - C. Network topology
  - D. ARP requests
3. Where can routing services obtain the network topology information that is needed to evaluate network paths?
  - A. From RARP and ARP tables
  - B. From network name servers
  - C. From bridges talking to routers during messaging sessions
  - D. From information that dynamic processes collect
4. What two functions does a router use to relay packets from one data link to another?
  - A. Link-state testing and convergence
  - B. Convergence and switching
  - C. Path determination and link-state testing
  - D. Path determination and switching
5. How does the network layer send packets from the source to the destination?
  - A. It uses an IP routing table.
  - B. It uses ARP responses.
  - C. It refers to a name server.
  - D. It refers to the bridge.
6. What happens at the router during a switching operation?
  - A. The router changes from link-state to distance-vector mode.
  - B. A packet that is accepted on one interface is forwarded to another interface or port that reflects the best path to the destination.
  - C. A test message is sent over the proposed route to make sure it is operational.
  - D. The received packet has the header stripped, read, and a new header attached listing the next stop on the route.

## CCNA 2 Chapter 6

### Routing and Routing Protocols

7. Which one of the following has the lowest administrative distance?
  - A. A static route with an IP address as the next hop
  - B. IGRP
  - C. RIP
  - D. A dynamic route with an IP address as the next hop
  
8. How does the network layer avoid unnecessary broadcast messages?
  - A. By using error-trapping algorithms
  - B. By using consistent end-to-end addressing
  - C. By using name servers to do lookup functions
  - D. By using link-state detection
  
9. Which one of the following is not a factor that should be considered when implementing a routing protocol?
  - A. Bandwidth requirements.
  - B. Processing requirements
  - C. Router memory requirements
  - D. Router location
  
10. What two parts of an address do routers use to forward traffic through a network?
  - A. Network address and host address
  - B. Network address and MAC address
  - C. Host address and MAC address
  - D. MAC address and subnet mask
  
11. Which term below means all routers have the same or consistent routing knowledge of the network?
  - A. converged
  - B. balanced
  - C. congruent
  - D. concave
  
12. How does a router make path selections?
  - A. By looking at the network portion of the address
  - B. By looking at the host portion of the address
  - C. By looking at mean distances between routers
  - D. By looking at the port or device on the network
  
13. What does the host address specify?
  - A. Type of device
  - B. Distance to the nearest network hub
  - C. Specific port or device on the network
  - D. Network the device is on

## CCNA 2 Chapter 6

### Routing and Routing Protocols

14. How does the host portion of an address help a router in its path determination function?
- A. It defines a path through the network.
  - B. It contains distance information that can be used to calculate the shortest route.
  - C. It refers to a specific port on the router that leads to an adjacent router in that direction.
  - D. It tells the router the type of device and its distance from the router.
15. What does the switching function of a router do?
- A. It allows greater throughput and capacity by multitasking.
  - B. It allows the router to accept a packet on one interface and forward it on another interface.
  - C. It exchanges the old header of a data packet for a new header that includes path information for the next router.
  - D. It changes the router from receive and send mode to broadcast mode when part of the network fails.
16. Which of the following best describes a routed protocol?
- A. It provides enough information to allow a packet to be forwarded from host to host.
  - B. It provides information that is necessary to pass data packets up to the next highest network layer.
  - C. It allows routers to communicate with other routers to maintain and update address tables.
  - D. It allows routers to bind MAC and IP addresses together.
17. Which of the following is an example of a routed protocol?
- A. RIP
  - B. IP
  - C. IGRP
  - D. OSPF
18. Which of the following best describes a routed protocol?
- A. It passes data packets to the next highest network layer.
  - B. It binds MAC and IP addresses together.
  - C. It defines the format and use of fields within a packet.
  - D. It exchanges routing tables and shares routing information between routers.
19. Which of the following best describes a routing protocol?
- A. It provides information to allow a packet to be forwarded from host to host.
  - B. It binds MAC and IP addresses together.
  - C. It defines the format and use of fields within a data packet.
  - D. It allows routers to communicate with other routers to maintain and update address tables.

## CCNA 2 Chapter 6

### Routing and Routing Protocols

20. Which of the following best describes the difference between routed versus routing protocols?
- A. Routed protocols are used between routers to maintain tables, whereas routing protocols are used between routers to direct traffic.
  - B. Routed protocols use distance-vector algorithms, whereas routing protocols use link-state algorithms.
  - C. Routed protocols are used between routers to direct traffic, whereas routing protocols are used between routers to maintain tables.
  - D. Routed protocols use dynamic addressing, whereas routing protocols use static addressing.
21. What happens when a data-link frame is received on a router interface?
- A. The packet header is removed and a new one with additional routing information is attached.
  - B. A frame header is sent to check the path integrity prior to sending the packet on toward its destination.
  - C. The packet is sent to the nearest bridge, which forwards it to the next router or the final destination.
  - D. The header is examined to determine the destination network and consults the routing table to see which outgoing interface is associated with that network.
22. What happens after a router has matched the destination network with an outgoing interface?
- A. The packet is sent to the nearest bridge that forwards it to the next router or the final destination.
  - B. A frame header is sent to check the path integrity prior to sending the packet on toward its destination.
  - C. The packet is queued for delivery to the next hop in the path.
  - D. The packet header is removed and a new one with additional routing information is attached.
23. Which of the following static routes has the lowest administrative distance?
- A. Router(config)#ip route 10.10.10.0 255.255.255.0 172.16.5.1 200
  - B. Router(config)#ip route 10.10.10.0 255.255.255.0 172.16.5.1
  - C. Router(config)#ip route 10.10.10.0 255.255.255.0 s0
  - D. Router(config)#ip route 10.10.10.0 255.255.255.0 172.16.5.1 101
24. What is the control information called that is placed in front of data in a data packet?
- A. Addressing
  - B. Header
  - C. Trailer
  - D. Encapsulate

## CCNA 2 Chapter 6

### Routing and Routing Protocols

25. Which of the following best describes a hop?
- A. Passage of a data packet between two routers
  - B. Device that connects two or more networks
  - C. Shortest distance between source and destination
  - D. Exchange and copying of ARP tables between two noncontiguous network devices
26. What is the passage of a data packet between two routers called?
- A. Exchange
  - B. Hop
  - C. Transmittal
  - D. Signaling
27. Which of the following best describes multiprotocol routing?
- A. Capability to send packets simultaneously out different ports
  - B. Capability to shift from static to dynamic routing as network loads change
  - C. Capability to maintain routing tables for several routed protocols concurrently
  - D. Capability to rewrite frame headers to formats that are compatible with different networks
28. What does multiprotocol routing allow routers to do?
- A. Rewrite frame headers to formats that are compatible with different networks
  - B. Shift from static to dynamic routing as network loads change
  - C. Send packets simultaneously out different ports
  - D. Deliver packets from several routed protocols over the same data links
29. Which of the following best describes static routing?
- A. A route that the network administrator manually enters into a routing table
  - B. A route that is received from the local name server
  - C. A route that is automatically entered into a routing table
  - D. An optimum route between devices as determined by the RARP table
30. Which of the following best describes dynamic routing?
- A. Automatic updating of routing tables whenever new information is received from the internetwork
  - B. Manual entry of data into a routing table by the network administrator
  - C. Following preset paths from device to device
  - D. RARP server determining optimum route between devices and copying those routes into a routing table
31. What type of routing occurs without the intervention of a network administrator?
- A. Default
  - B. Dynamic
  - C. Progressive

## CCNA 2 Chapter 6 Routing and Routing Protocols

D. Static

32. What is one advantage of static routing?
- A. It is more secure because parts of an internetwork can be hidden.
  - B. It requires little active management by the network administrator.
  - C. It adjusts automatically to topology or traffic changes.
  - D. It can compensate for router failures by using alternate paths.
33. What is one advantage of using static routing on a stub network?
- A. It compensates for route failures by using alternative paths.
  - B. It requires little active management by the network administrator.
  - C. It adjusts automatically to topology or traffic changes.
  - D. It avoids the network overhead required by dynamic routing.
34. What are the two major classes of routing algorithms?
- A. Checksum and link state
  - B. Checksum and traffic load
  - C. Distance vector and traffic load
  - D. Distance vector and link state
35. Which of the following best describes a distance vector protocol?
- A. It determines the direction and distance to any link in the internetwork.
  - B. Each router maintains a complex database of internetwork topology information.
  - C. Computationally, it is rather complex.
  - D. Its method of routing prevents loops and minimizes counting to infinity.
36. What do distance vector algorithms require of routers?
- A. Default routes for major internetwork nodes in case of corrupted routing tables
  - B. Sending its entire routing table in each update to its neighbors
  - C. Fast response times and ample memory
  - D. Maintaining a complex database of internetwork topology information
37. Why is it important in distance vector algorithms for routers to send copies of their routing table to neighboring routers?
- A. To prevent error propagation
  - B. To stop routing loops
  - C. To enable split horizon mapping
  - D. To communicate topology changes quickly
38. What is a major drawback of distance vector algorithms?
- A. More network traffic
  - B. Computationally difficult
  - C. Prone to routing loops

## CCNA 2 Chapter 6 Routing and Routing Protocols

- D. Cannot implement hold-down timers
39. What is one disadvantage of distance vector algorithms?
- A. Routers do not know the exact topology of an internetwork, only distances between points.
  - B. They have more network traffic.
  - C. Computationally, they are difficult.
  - D. They cannot implement hold-down timers.
40. What is one advantage of distance vector algorithms?
- i. They are not likely to count to infinity.
  - ii. They implement easily on large networks.
  - iii. They are not prone to routing loops.
  - iv. They are simpler computationally.
41. Which of the following best describes link-state algorithms?
- A. They recreate the exact topology of the entire internetwork.
  - B. They require minimal computations.
  - C. They determine distance and direction to any link on the internetwork.
  - D. They use little network overhead and reduce overall traffic.
42. Which of the following best describes link-state algorithms?
- A. They use little network overhead and reduce overall traffic.
  - B. Each router broadcasts information about the network to all nodes on the network.
  - C. They determine distance and direction to any link on the internetwork.
  - D. They use little network overhead and increase overall traffic.
43. Which of the following is true about link-state routing algorithms?
- A. They require less network traffic than distance-vector algorithms.
  - B. Computationally, they are rather simple.
  - C. They require less router memory and slower response times.
  - D. They maintain full knowledge of distant routers and how they interconnect.
44. Which of the following best describes convergence?
- A. When messages simultaneously reach a router and a collision occurs
  - B. When several routers simultaneously route packets along the same path
  - C. When all routers in an internetwork have the same knowledge of the structure and topology of the internetwork
  - D. When several messages are being sent to the same destination
45. Which of the following terms describes an internetwork state in which all routers have the same knowledge of the structure and topology of the internetwork?

## CCNA 2 Chapter 6

### Routing and Routing Protocols

- A. Congruence
  - B. Equivalence
  - C. Correspondence
  - D. Convergence
46. Why is fast convergence a desirable attribute of a routing protocol?
- A. It reduces the time period over which routers make incorrect routing decisions.
  - B. It reduces network traffic.
  - C. It reduces routing loop time.
  - D. It reduces memory requirements of local routers.
47. After a network topology change, which of the following routing protocol characteristics reduces incorrect or wasteful routing decisions?
- A. Symmetry
  - B. Convergence
  - C. Equivalence
  - D. Correspondence
48. What is a routing loop?
- A. A route to often-requested destinations
  - B. A network path that is circular and has no branches
  - C. A packet that cycles repeatedly through a constant series of network nodes
  - D. A process that routers go through when performing self diagnostics
49. What is the process called in which packets never reach their destination but instead cycle repeatedly through the same series of network nodes?
- A. Split horizon
  - B. End-to-end messaging
  - C. Convergence
  - D. Routing loop
50. Why do routing loops occur?
- A. There is slow convergence after a modification to the internetwork.
  - B. Split horizons are artificially created.
  - C. Network segments fail catastrophically and take other network segments down in a cascade effect.
  - D. The network administrator never established or initiated default routes.
51. Why do routing loops occur?
- A. Split horizons are artificially created.
  - B. A network device fails, and that information is slowly passed to all the routers in the internetwork.
  - C. The network administrator never established or initiated default routes.
  - D. Network segments fail catastrophically and take other network segments down in a cascade effect.

## CCNA 2 Chapter 6

### Routing and Routing Protocols

52. Why does the problem of counting to infinity occur?
- A. Split horizon
  - B. Noncongruence
  - C. Slow convergence
  - D. Router inequivalence
53. Which of the following best describes the count to infinity problem?
- A. Routers continuously increment the hop count as a routing loop proceeds.
  - B. Packets cycle repeatedly through a constant series of network nodes.
  - C. During heavy traffic periods, freak collisions can occur and damage the packet headers.
  - D. After a split horizon occurs, two sets of metrics exist for the same destination, and neither matches that in the routing table.
54. How can the count to infinity problem be prevented?
- A. By forcing a routing loop
  - B. By invoking a split horizon process
  - C. By tracking network traffic levels and regulating flow
  - D. By imposing an arbitrary hop-count limit
55. How can the count to infinity problem be solved?
- i. By initiating a routing loop
  - ii. By defining infinity as some maximum number
  - iii. By switching from distance-vector to link-state mode
  - iv. By forcing a router convergence and reconciliation
56. What happens when the hop count exceeds the maximum in a routing loop?
- A. The loop ends and the data packet is returned to the source for retransmission later.
  - B. The default route is recalled and used.
  - C. The network is considered unreachable, and the loop ends.
  - D. A count to infinity is initiated, and a split horizon is invoked.
57. How can the count to infinity problem be prevented?
- A. By using routing loops
  - B. By using split horizon routing systems
  - C. By increasing router memory
  - D. By using hold-down timers
58. Which of the following best describes hold-down timers?
- A. Timer that synchronizes the router table update process
  - B. Time during which messages are held if network segment is temporarily unavailable
  - C. Time that is allowed before intervention to halt routing loop
  - D. Time during which routers will neither send nor receive updated routing tables

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### Routing and Routing Protocols

59. Why are hold-down timers useful?
- A. They flush bad information about a route from all routers in the network.
  - B. They force all routers in a segment to synchronize switching operations.
  - C. They reduce the amount of network traffic during high traffic periods.
  - D. They provide a mechanism for bypassing failed sections of the network.
60. When are routers placed in a hold-down state?
- A. When a routing loop occurs
  - B. When a link in a route fails
  - C. When a routing table becomes corrupted
  - D. When convergence occurs too slowly
61. How does a hold-down timer work?
- A. By holding messages in routing loops for a given time period, the hold-down timer reduces network traffic at peak times.
  - B. When the hop count exceeds a fixed value, the hold-down timer holds the message until a split horizon is established.
  - C. When a router receives an update indicating that a network is inaccessible, the router marks the route and starts a hold-down timer.
  - D. When a count is started, a hold-down timer is started, too; if the count continues after a given time period, the timer halts the process and returns control to the nearest router.
62. What are the major two link-state concerns?
- A. Split horizons and convergence
  - B. Processing and memory requirements
  - C. Routing loops and equivalence
  - D. Table copying and counting to infinity
63. Which of the following best describes link-state advertisement (LSA)?
- A. Broadcast message that occurs in response to a convergence call
  - B. Broadcast message that relays state of data links (up or down) to all routers
  - C. Broadcast packet that contains information about neighbors and path costs
  - D. Broadcast packet that is initiated by an active routing loop
64. What are LSAs used for?
- A. To halt routing loops
  - B. To determine path metrics
  - C. To broadcast convergence calls
  - D. To maintain routing tables of receiving routers
65. What is the most complex and important aspect of link-state routing?
- A. Making sure all routers get all the necessary LSA packets
  - B. Ensuring that convergence occurs rapidly

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### Routing and Routing Protocols

- C. Avoiding routing loops during initial startup
  - D. Providing mechanisms for split horizons and count to infinity avoidance
66. What happens if routers have different sets of LSAs?
- A. A checksum procedure is initiated and faulty routing tables are repaired.
  - B. Routes become unreachable because routers disagree about a link.
  - C. A master comparison is forced, and subsequent convergence on a single routing table occurs.
  - D. A broadcast message is sent with the master copy of the routing table to all routers.
67. What is one problem with link-state updating?
- A. It is easy to start a routing loop and subsequent count to infinity.
  - B. Routers can become unreachable because they do not have a complete picture of the internetwork.
  - C. In synchronizing large networks, it is difficult to tell which updates are correct.
  - D. If the master routing table is corrupted, the entire network will go down.
68. What is one problem with link-state updating?
- A. Routers can become unreachable because they don't have a complete picture of the internetwork.
  - B. It is easy to start a routing loop and subsequent count to infinity.
  - C. If the master routing table is corrupted, the entire network will go down.
  - D. The order of router startup alters the topology that was learned.
69. Which of the following is correct?
- A. Distance-vector routing gets all topological data from the routing tables of its neighbors, whereas link-state routing develops a map of the network by accumulating LSAs.
  - B. Distance-vector routing develops a map of the network, whereas link-state routing gets topological data from the routing tables of its neighbors.
  - C. Distance-vector routing requires a lot of bandwidth and network overhead, whereas link-state routing requires considerably less.
  - D. Distance-vector routing has a quick convergence time, whereas link-state routing has a slow convergence time and is prone to routing loops.
70. Which of the following is correct?
- A. Distance-vector routing requires a lot of bandwidth and network overhead, whereas link-state routing requires considerably less.
  - B. Distance-vector routing determines the best path by adding to the metric value it receives, whereas link-state routing has the routers calculating their own shortest path to destinations.
  - C. Distance-vector routing has quick convergence time, whereas link-state routing has a slow convergence time and is prone to routing loops.
  - D. Distance-vector routing has the routers calculate their own shortest path to destinations, whereas link-state routing determines the best path by adding to the metric value it receives from its neighbors.

## CCNA 2 Chapter 6

### Routing and Routing Protocols

71. Which of the following is correct?

- A. Distance-vector routing has a quick convergence time, whereas link-state routing has a slow convergence time and is prone to routing loops.
- B. Distance-vector routing requires a lot of bandwidth and network overhead, whereas link-state routing requires considerably less.
- C. Distance-vector routing updates for topology change with periodic table updates, whereas link-state routing updates are triggered by topology changes.
- D. Distance-vector routing updates are triggered by topology changes, whereas link-state routing updates for topology change with periodic scheduled table updates.

72. Which of the following best describes hybrid routing?

- A. It uses distance vectors to determine best paths, but topology changes trigger routing table updates.
- B. It uses distance-vector routing to determine best paths between topology during high-traffic periods.
- C. It uses topology to determine best paths but does frequent routing table updates.
- D. It uses topology to determine best paths but uses distance vectors to circumvent inactive network links.

## CCNA 2 Chapter 7

# Distance Vector Routing Protocols

As you know, routers can be configured to use one or more IP routing protocols. In this chapter, you learn the initial configuration of the router to enable the Routing Information Protocol (RIP) and the Interior Gateway Routing Protocol (IGRP). In addition, you learn how to monitor IP routing protocols.

After the router tests the hardware and loads the Cisco IOS system image, it finds and applies the configuration statements. These entries provide the router with details about router-specific attributes, protocol functions, and interface addresses. Remember that if the router cannot locate a valid startup-config file, it enters an initial router configuration mode called setup mode or system configuration dialog.

With the setup mode command facility, you can answer questions in the system configuration dialog. This facility prompts you for basic configuration information. The answers that you enter allow the router to build a sufficient but minimal router configuration that includes the following:

- An inventory of interfaces
- An opportunity to enter global parameters
- An opportunity to enter interface parameters
- A setup script review
- An opportunity to indicate whether or not you want the router to use this configuration

After you confirm setup mode entries, the router uses the entries as a running configuration. The router also stores the configuration in NVRAM as a new startup-config, and you can start using the router. For additional protocol and interface changes, you can use the enable mode and enter the command **configure**.

### Concept Questions

1. Routers can be configured to use one or more IP routing protocols. Identify and briefly explain the different IP routing protocols.



# CCNA 2 Chapter 7

## Distance Vector Routing Protocols

### Vocabulary Exercise

Define the following terms as completely as you can. Refer to the online curriculum or CCNA 2 Chapter 7 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

adjacent neighbor

Autonomous system

Bandwidth

Convergence

count to infinity

Delay

Distance-vector routing algorithm

Dynamic routing

Holddown timer

Link-state routing algorithm

MTU

Poison reverse

Reliability

routing metric

routing protocol

routing table

routing update

split horizon

Static route

triggered update

# CCNA 2 Chapter 7

## Distance Vector Routing Protocols

### Focus Questions

1. The system administrator manually defines default routes as the route to take when no route to the destination is known. Default routes are also known as?
2. Default routes are configured by using the \_\_\_\_\_ command, while in the \_\_\_\_\_ prompt.
3. What is used to communicate within a given autonomous system?
4. Routing protocols can be configured on a router while in which mode?
5. What protocol sends updated routing table information onto the network every 90 seconds?

# CCNA 2 Chapter 7

## Distance Vector Routing Protocols

### CCNA Exam Review Questions

1. What kind of entries does a router initially refer to?
  - A. Entries about networks or subnets that are directly connected
  - B. Entries that it has learned about from the Cisco IOS software
  - C. Entries whose IP address and mask information are known
  - D. Entries that it has learned about from other routers
2. Which of the following best describes a static route?
  - A. A routing table entry that is used to direct frames for which a next hop is not explicitly listed in the routing table
  - B. A route that is explicitly configured and entered into the routing table and that takes precedence over routes that dynamic routing protocols choose
  - C. A route that adjusts automatically to network topology or traffic changes
  - D. A route that adjusts involuntarily to direct frames within a network topology
3. Which of the following best describes a default route?
  - A. A routing table entry that directs frames for which a next hop is not explicitly listed in the routing table
  - B. A route that is explicitly configured and entered into the routing table
  - C. A route that adjusts automatically to network topology or traffic changes
  - D. A route that adjusts involuntarily to direct frames within a network topology
4. What are exterior routing protocols used for?
  - A. They transmit between nodes on a network.
  - B. They deliver information within a single autonomous system.
  - C. They communicate between autonomous systems.
  - D. They set up a compatibility infrastructure between networks.
5. What are interior routing protocols used for?
  - A. They set up a compatibility infrastructure between networks.
  - B. They communicate between autonomous systems.
  - C. They transmit between nodes on a network.
  - D. They are used within a single autonomous system.
6. Which of the following is a global task?
  - A. Addressing IP network numbers by specifying subnet values
  - B. Enabling a routing protocol: RIP or IGRP
  - C. Assigning network/subnet addresses and the appropriate subnet mask
  - D. Setting up a routing metric to find the best path to each network
7. What metric does RIP use to determine the best path for a message to travel on?
  - A. Bandwidth
  - B. Hop count
  - C. Varies with each message
  - D. Administrative distance

## CCNA 2 Chapter 7

### Distance Vector Routing Protocols

8. You suspect that one of the routers that is connected to your network is sending bad routing information. What command can you use to check this?
  - A. `router(config)# show ip route`
  - B. `router# show ip route`
  - C. `router> show ip protocol`
  - D. `router(config-router)# show ip protocol`
9. Why would you display the IP routing table?
  - A. To set the router update schedule
  - B. To identify destination network addresses and next-hop pairs
  - C. To trace where datagrams are coming from
  - D. To set the parameters and filters for the router
10. If you wanted to learn which routing protocol a router was configured with, what command structure would you use?
  - A. `router> show router protocol`
  - B. `router(config)> show ip protocol`
  - C. `router(config)# show router protocol`
  - D. `router# show ip protocol`
11. In the following command, what does the last number stand for? `Router (config)# ip route 2.0.0.0 255.0.0.0 1.0.0.2 5`
  - A. The number of hops
  - B. The number of routes to the destination
  - C. The administrative distance
  - D. The destination's reference number in the routing table
12. An administrative distance of 15 indicates which of the following?
  - A. The IP address is static.
  - B. The IP address is dynamic.
  - C. The routing information source is relatively trustworthy.
  - D. The routing information source is relatively untrustworthy.
13. If you just added a new LAN to your internetwork and you want to manually add the network to your routing table, what command structure would you use?
  - A. `router (config)> ip route 2.0.0.0 255.0.0.0 via 1.0.0.2`
  - B. `router (config)# ip route 2.0.0.0 255.0.0.0 1.0.0.2`
  - C. `router (config)# ip route 2.0.0.0 via 1.0.0.2`
  - D. `router (config)# ip route 2.0.0.0 1.0.0.2 using 255.0.0.0`
14. If you want to add IGRP routing with autonomous system 10 to your router, which command below is correct?
  - A. `Singapore(config)#router igrp 10`
  - B. `Singapore(config-router)#router igrp 10`
  - C. `Singapore#router igrp 10`
  - D. `Singapore(config)#router igrp 100`

## CCNA 2 Chapter 7

### Distance Vector Routing Protocols

15. If IGRP routing has been enabled and the last update was received 30 seconds ago, when should the next update be expected?
- A. 30 seconds
  - B. 60 seconds
  - C. 90 seconds
  - D. 100 seconds
16. What types of routes within an autonomous system will not include subnet mask information?
- A. system routes
  - B. border routes
  - C. interior routes
  - D. exterior routes
17. What kind of entries does a router initially refer to?
- A. Entries about networks or subnets that are directly connected
  - B. Entries it has learned about from the Cisco IOS software
  - C. Entries whose IP address and mask information are known
  - D. Entries it has learned about from other routers
18. Which of the following best describes a static route?
- A. It is a routing table entry that is used to direct frames for which a next hop is not explicitly listed in the routing table.
  - B. It is a route that is explicitly configured and entered into the routing table and takes precedence over routes that dynamic routing protocols choose.
  - C. It is a route that adjusts automatically to network topology or traffic changes.
  - D. It is a route that adjusts involuntarily to direct frames within a network topology.
19. What is the administrative distance according to the output of the show ip route command?
- ```
172.16.0.0/16 [120/7] via 192.168.1.1, 00:00:22, Serial 0/1
```
- A. 7
  - B. 16
  - C. 22.
  - D. 120
20. What command will stop the IGRP routing process?
- A. Birmingham#no router igrp
  - B. Birmingham(config)no router igrp 55
  - C. Birmingham(config)no router igrp
  - D. Birmingham(config)no igrp router 55
21. An administrative distance of 15 would indicate which of the following?
- A. The IP address is static.
  - B. The IP address is dynamic.

## CCNA 2 Chapter 7 Distance Vector Routing Protocols

- C. The routing information source is trustworthy.
  - D. The routing information source is untrustworthy.
22. Why are routing updates not sent to a link if it is only defined by a static route?
- A. Because each node in the network already knows the route
  - B. To conserve bandwidth
  - C. To keep routing tables small
  - D. To keep routing tables organized
23. In the following command, what does the last number stand for? `router (config)# ip route 2.0.0.0 255.0.0.0 1.0.0.2 5`
- A. The number of hops
  - B. The number of routes to the destination
  - C. The administrative distance
  - D. The destination's reference number in the routing table
24. Why would you set the administrative distance really high?
- A. The network uses Enhanced IGRP.
  - B. The dynamic address might be better.
  - C. The network uses OSPF.
  - D. The network uses only default network addresses.
25. If you just added a new LAN onto your network and you want to add the routes to the new devices to your routing table, what command structure would you use?
- A. `router (config)> ip route 2.0.0.0 255.0.0.0 1.0.0.2 5`
  - B. `router (config)# ip route 2.0.0.0 255.0.0.0 1.0.0.2 5`
  - C. `router (config)# ip route 2.0.0.0 1.0.0.2 5`
  - D. `router (config)# ip route 2.0.0.0 255.0.0.0 1.0.0.2`
26. What command will allow you to view RIP updates as they are being sent and received?
- A. `debug ip rip`
  - B. `debug rip updates`
  - C. `debug ip rip updates`
  - D. `show ip rip`
27. What routing protocol is being used according to the output of the `show ip route` command?
- ```
172.16.0.0/16 [120/7] via 192.168.1.1, 00:00:22, Serial 0/1
```
- A. OSPF
  - B. IGRP
  - C. RIP
  - D. EGP

## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

Troubleshooting tools that you might use for network devices that are running Cisco IOS Software include **ping**, **trace ip route**, **telnet**, and **show arp**. The function of the IP protocol is to facilitate network communication between hosts. The design of the IP protocol allows for the addressing of hosts and networks. This distinguishes the IP protocol from nonroutable protocols that can address individual hosts but are not designed to make distinctions between networks. The acceptance of IP is so widespread that it is not just the protocol used for data delivery over the Internet; IP has also become the default internal protocol for small LANs that do not necessarily require routing capabilities.

The limitation of IP is that it is a best-effort delivery system. IP has no mechanism to ensure that the data is delivered regardless of the problems it might encounter on the network. Data might fail to reach its destination for a variety of reasons, such as hardware failure, improper configuration, or incorrect routing information. To help identify these failures, IP uses the Internet Control Message Protocol (ICMP). ICMP notifies the sender of the data that there was an error in the delivery process.

This section reviews the different types of ICMP error messages and the forms they take. Knowledge of ICMP error messages and an understanding of the potential causes of these messages are essential parts of network troubleshooting.

#### Concept Questions

1. What is the ping utility used for?

2. What is Telnet used for?

## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

3. ICMP uses messages to accomplish various tasks. Fill in the following table with the list of ICMP message types.

Message	Purpose
Destination unreachable	
Time Exceeded	
Source Quench	
Redirect	
Echo	
Parameter problem	
Timestamp	
Address mask request/reply	
Router advertisement and Selection	

4. What is the single most important tool used to discover Layer 1 and Layer 2 problems with a router? Why?

## **CCNA 2 Chapter 8**

### **TCP/IP Suite Error and Control Messages**

5. What is CDP used for?

6. What is an ICMP redirect?

7. What is an ICMP source-quench message?

8. What is the function of an ICMP redirect message?

9. What is the function of an ICMP address mask reply message?

10. What is the function of the ICMP timestamp request message?

11. What does a router do if it is unable to deliver a packet?

# CCNA 2 Chapter 8

## TCP/IP Suite Error and Control Messages

### Vocabulary Exercise

Define the following terms as completely as you can. Use the online curriculum or CCNA 2 Chapter 8 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

BOOTP

Broadcast

Datagram

DHCP

ICMP

Multicast

Ping

TCP/IP

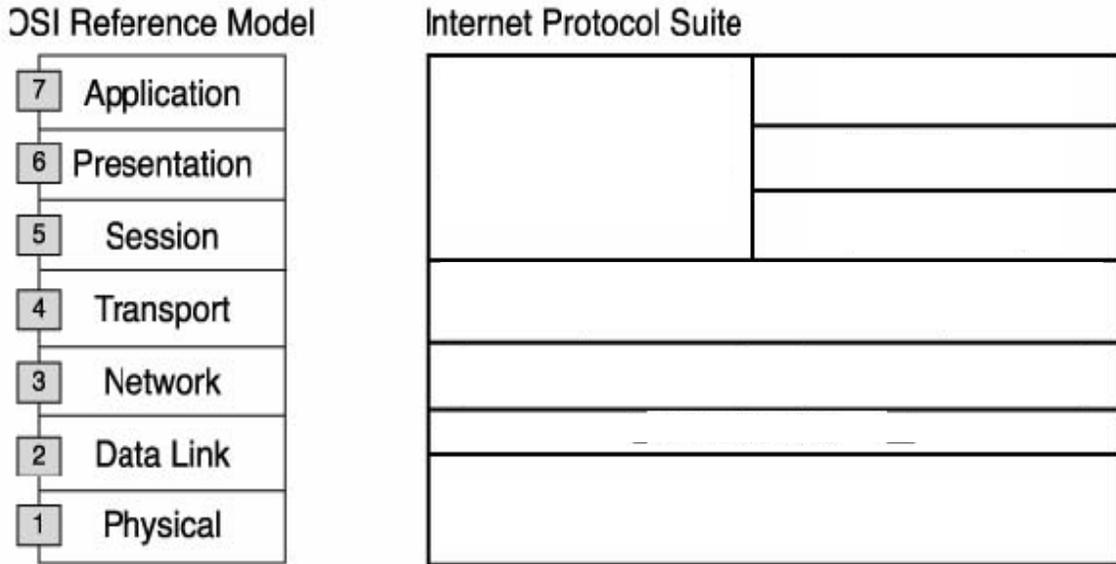
Unicast

# CCNA 2 Chapter 8

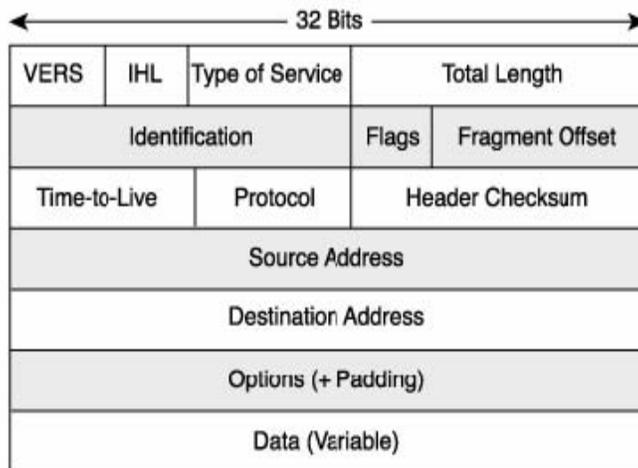
## TCP/IP Suite Error and Control Messages

### Focus Questions

- In Figure 8-1, fill in the blanks with some of the important protocols as they relate to the OSI reference model.



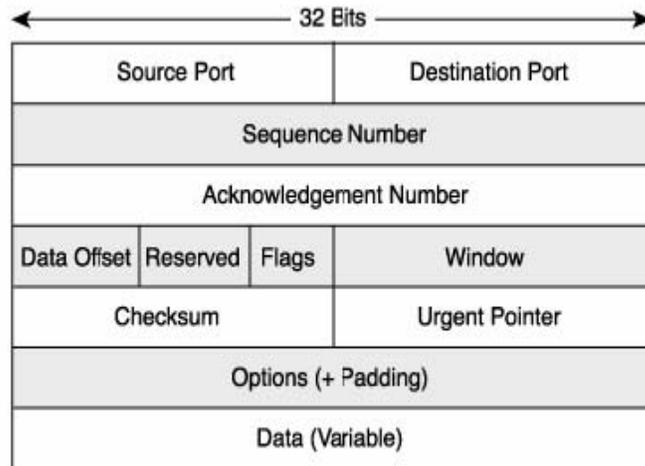
- Figure 8-2 shows the parts of an IP packet. Fill in the descriptions that follow based on this figure.



## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

3. Figure 8-3 shows a **TCP** packet. Fill in the descriptions that follow based on the figure.



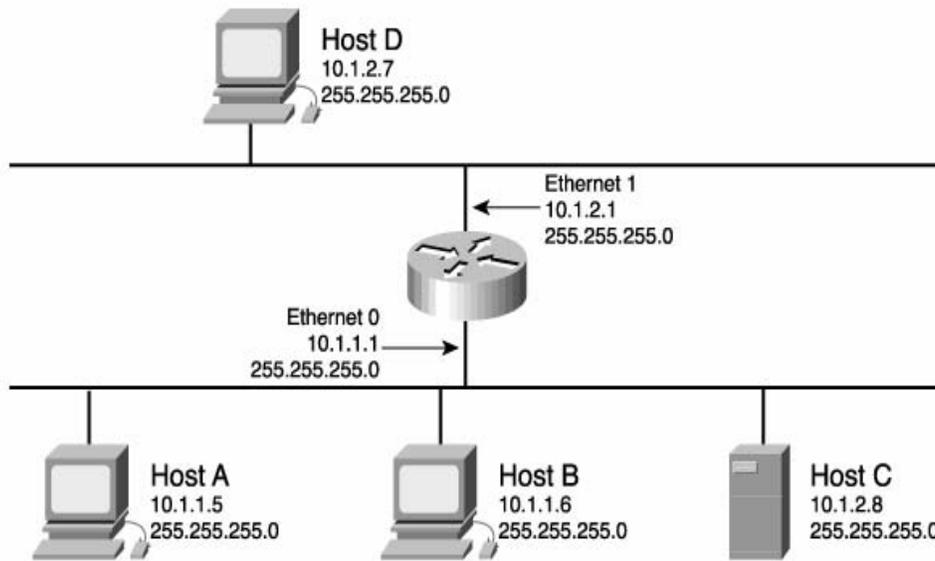
4. In the following table, which protocols go with the listed applications?

Application	Protocols
File Transfer	
Terminal Emulation	
Electronic Mail	
Network Management	
Distributed File Services	

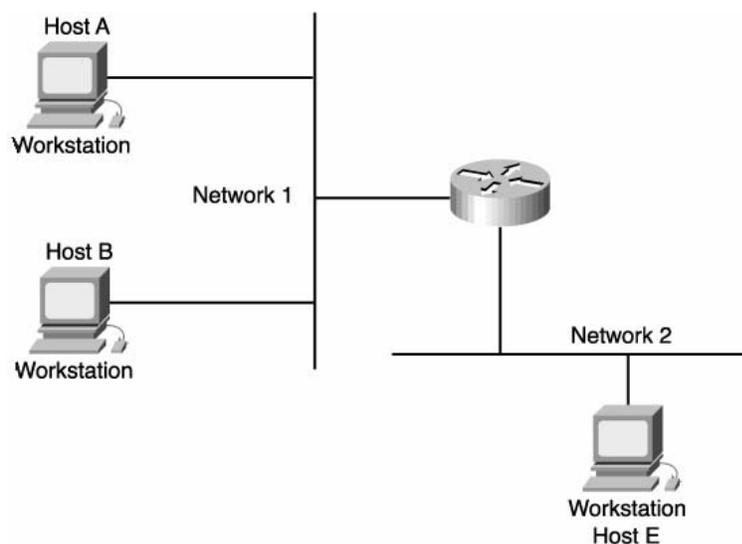
## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

5. The network in Figure 8-4 is experiencing a problem: Hosts that are on a network can communicate with specific hosts on the other side of the router, but they are unable to communicate with certain other hosts. Based on this information, what is a likely cause of the problem?



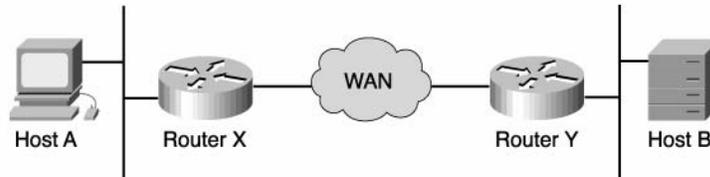
6. The network in Figure 8-5 is experiencing a problem. A router or host is unable to communicate with other routers or hosts that are known to be directly connected to the same router. What is the first thing you should check to resolve this problem?



## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

7. The network in Figure 8-6 is experiencing a problem. In some cases, you might be able to connect to hosts using some protocols or applications, but not with others. For example, you might be able to ping a host and FTP a host, but Telnet does not succeed. Based on this information, what is a likely cause of the problem?



8. The principal reason that Internet Control Message Protocol (ICMP) was created was to report routing failures to the source. In addition, ICMP provides helpful messages such as the following:

9. In the following table, provide a description for the listed **ping** replies.

Character	Description
!	
.	
U	
N	
P	
Q	

## CCNA 2 Chapter 8 TCP/IP Suite Error and Control Messages

<b>M</b>	
?	

## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

#### CCNA Exam Review Questions

1. ICMP is an error-reporting protocol for IP.
  - A. True
  - B. False
  
2. What does ICMP stand for?
  - A. Internal Control Mail Protocol
  - B. Internet Control Message Portal
  - C. Internal Control Message Protocol
  - D. Internet Control Message Protocol
  
3. ICMP messages are encapsulated as data in datagrams in the same way that any other data is delivered by using IP.
  - A. True
  - B. False
  
4. A default gateway must be configured if datagrams are to travel outside of the local network.
  - A. True
  - B. False
  
5. TTL stands for what?
  - A. Time-to-list
  - B. Time-To-Live
  - C. Terminal-to-live
  - D. Terminal-to-list
  
6. All ICMP message formats start with which of these fields?
  - A. Type
  - B. Code
  - C. Checksum
  - D. All of the above
  
7. Default gateways only send ICMP Redirects/Change Requests when which of the following conditions are met?
  - A. The interface on which the packet comes into the router is the same interface on which the packet is routed out.
  - B. The subnet/network of the source IP address is the same subnet/network of the next-hop IP address of the routed packet.
  - C. The datagram is not source-routed.
  - D. The route for the redirect is not another ICMP redirect or a default route.
  - E. All of the above

## CCNA 2 Chapter 8

### TCP/IP Suite Error and Control Messages

8. What else can the Type field on an ICMP timestamp message be besides 13 timestamp request??
  - A. 14 timestamp reply
  - B. 14 time
  - C. 14 reply
  - D. 26 timestamp reply
  - E. All of the above
  
9. Not all ICMP timestamp reply messages contain the originate, receive, and transit timestamps.
  - A. True
  - B. False
  
10. What is the ICMP type number for a router solicitation message?
  - A. 9
  - B. 10
  - C. 17
  - D. 18
  
11. Which one of the following is not a valid destination unreachable code value?
  - A. network unreachable
  - B. host unreachable
  - C. protocol unreachable
  - D. gateway unreachable
  
12. Which of the following is an example of an ICMP control message?
  - A. Source squelch
  - B. ARP
  - C. Gateway service
  - D. Echo request
  
13. What action will the router take when there is not enough information to forward a packet to the destination network?
  - A. The router will send an ICMP destination unreachable message to the source.
  - B. The router will return the packet to the source
  - C. The router will notify the sender with an ICMP delay message
  - D. The router will send a EIT message to the last router
  
14. What IOS command is used to disable ICMP redirects on a router interface?
  - A. router (config)#no ip redirects
  - B. router(config-if)#no ip redirects
  - C. router(config)#no icmp redirects
  - D. router(config-if)#no icmp redirects

## CCNA 2 Chapter 9

# Basic Router Troubleshooting

This chapter offers an introduction to network testing and emphasizes the necessity of using a structured approach to troubleshooting. It also describes the fundamentals of troubleshooting routers.

Basic testing of a network should proceed in sequence from one OSI reference model layer to another. It is best to begin with Layer 1 and work to Layer 7, if necessary. Beginning with Layer 1, look for simple problems such as power cords that are unplugged in the wall. The most common problems that occur on IP networks result from errors in the addressing scheme. It is important to test the address configuration before continuing with further configuration steps.

Each test that is presented in this section focuses on network operations at a specific layer of the OSI model. **telnet** and **ping** are just two of the commands that allow for the testing of a network.

### Concept Questions

1. Describe typical Layer 1 errors.

2. Describe typical Layer 2 errors.

## CCNA 2 Chapter 9

### Basic Router Troubleshooting

3. Describe typical Layer 3 errors.

4. Describe some network troubleshooting strategies.

5. The debug commands may disrupt normal router operations because of high processor overhead. What other problems may occur?

# CCNA 2 Chapter 9

## Basic Router Troubleshooting

### Vocabulary Exercise

Define the following terms as completely as you can. Use the online curriculum or CCNA 2 Chapter 9 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

ip default-network

Keepalive

Spanning-Tree Protocol

Traceroute

undebug all

# CCNA 2 Chapter 9

## Basic Router Troubleshooting

### CCNA Exam Review Questions

1. When a technician performs basic testing of a network, which of the following is true?
  - A. The technician should proceed in sequence from one OSI reference model layer to the next.
  - B. The technician should proceed with any desired OSI layer.
  - C. The technician should proceed with the management level.
  - D. The technician should start at Layer 4 of the OSI model.
2. When a technician troubleshoots a network, which of the following is true?
  - A. The technician should start with a structured approach.
  - B. The technician should start with an approach of his choice.
  - C. The technician can start with any approach.
  - D. The technician should start with client servers.
3. When a technician troubleshoots a problem on a network, he or she should do which of the following?
  - A. Begin with Layer 1.
  - B. Begin with Layer 2.
  - C. Begin with Layer 3.
  - D. Begin with Layer 4.
4. If a technician would like to test network connectivity, which basic command should he or she use?
  - A. telnet
  - B. ping
  - C. debug
  - D. show
5. When a network administrator wants to verify the application layer software between source and destination stations, which of the following commands should he or she use?
  - A. ping
  - B. telnet
  - C. debug
  - D. show
6. You suspect that one of the routers that is connected to your network is sending bad routing information. Which of the following commands can you use to verify this?
  - A. router(config)# show ip route
  - B. router# show ip route
  - C. router> show ip protocol
  - D. router(config-router)# show ip protocol

## CCNA 2 Chapter 9

### Basic Router Troubleshooting

7. Why would you display the IP routing table?
  - A. To set the router update schedule
  - B. To identify destination network addresses and next-hop pairs
  - C. To trace where datagrams are coming from
  - D. To set the parameters and filters for the router
  
8. If you want to see RIP routing updates as they are sent and received, what command structure should you use?
  - A. router# show ip rip
  - B. router# debug ip protocols
  - C. router# debug ip rip
  - D. router# show ip rip update
  
9. The dynamic output of the debug command comes at a performance cost, which produces \_\_\_\_\_ processor overhead.
  - A. High
  - B. Low
  - C. Medium
  - D. Maximum
  
10. By default, what does the router send the debug output and system messages to?
  - A. The console
  - B. The switch
  - C. The PC
  - D. The user
  
11. The telnet command provides what type of terminal?
  - A. Register
  - B. Virtual
  - C. IOS
  - D. Command
  
12. What does ICMP stand for?
  - A. Internet Control Message Parameter
  - B. Internal Control Message Protocol
  - C. Internet Control Message Protocol
  - D. Internet Control Message Performance
  
13. Most interfaces or NICs will have what type of lights that show whether there is a valid connection?
  - A. Indicator
  - B. Catalyst
  - C. Responsive
  - D. Inactive

## CCNA 2 Chapter 9

### Basic Router Troubleshooting

14. Telnet is used at what layer of the OSI model?
  - A. Layer 1
  - B. Layer 5
  - C. Layer 6
  - D. Layer 7
  
15. Basic testing of a network should start at what layer of the OSI reference model?
  - A. Layer 1
  - B. Layer 2
  - C. Layer 3
  - D. Layer 4
  
16. Which of the following would not be a cause of “Serial 0 is down, line protocol is down” in the show interface output?
  - A. A Layer 1 issue is the problem
  - B. Keepalive messages are not being received
  - C. The IP address is wrong
  - D. There is a bent pin in the connector
  
17. What would cause a “Serial 0 is up, line protocol is down” in the show interface output?
  - A. A Layer 1 issue is the problem
  - B. A Layer 2 issue is the problem
  - C. A Layer 3 issue is the problem
  - D. A Layer 7 issue is the problem
  
18. Which of the following is not an advantage of a static route?
  - A. Adapts to change rapidly
  - B. Secure
  - C. Low overhead
  - D. Always predictable
  
19. If a route has an administrative distance of 0 in the routing table, what does this mean?
  - A. The route is not available
  - B. The next hop is an IP address
  - C. The next hop is a connected interface
  - D. The route is always available for all traffic
  
20. If a route has an administrative distance of 1 in the routing table, what does this mean?
  - A. The route is not available
  - B. The next hop is an IP address
  - C. The next hop is a connected interface
  - D. The route is always available for all traffic

## CCNA 2 Chapter 10

### Intermediate TCP

The Transmission Control Protocol/Internet Protocol (TCP/IP) suite of protocols was developed as part of the research that the Defense Advanced Research Projects Agency (DARPA) did. Later, TCP/IP was included with the Berkeley Software Distribution of UNIX. The Internet protocols can be used to communicate across any set of interconnected networks. They are equally well suited for both LAN and WAN communication. The IP suite includes not only Layer 3 and Layer 4 specifications (such as IP and TCP), but also specifications for such common applications as e-mail, remote login, terminal emulation, and file transfer.

#### Concept Questions

The TCP/IP protocol stack has the following components:

- Protocols to support file transfer, e-mail, remote login, and other applications
  - Reliable and unreliable transports
  - Connectionless datagram delivery at the network layer ICMP to provide control and message functions at the network layer
1. The TCP/IP protocol stack maps closely to the lower layers of the OSI reference model. What function do the application protocols perform?

2. The transport layer performs two functions. What are they?

3. What kind of protocol is TCP?

## CCNA 2 Chapter 10 Intermediate TCP

### Vocabulary Exercise

Define the following terms as completely as you can. Use the online curriculum or CCNA 2 Chapter 10 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

Acknowledgment number

ARP

Checksum

Destination port

Flow control

Handshake

HLEN-

PAR

RARP

Sequence number

Source port

TCP

UDP

Window

Window size

# CCNA 2 Chapter 10

## Intermediate TCP

### Focus Questions

1. How do the TCP/IP conceptual layers relate to the OSI layers?
2. Compare and contrast TCP and UDP.
3. Briefly describe everything you know about the fields in a TCP segment.
4. Briefly describe everything you know about the fields in an IP datagram.

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5. Briefly distinguish among IP, ICMP, ARP, and RARP.
6. Briefly describe how TCP uses port numbers to keep track of conversations between hosts.
7. A SYN flooding denial of service attack occurs when a host sends a packet with a spoofed IP address. Briefly describe how a network administrator could defend against a denial of service SYN attack.

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### CCNA Exam Review Questions

1. Which of the following best describes TCP/IP?
  - A. A suite of protocols that can be used to communicate across any set of interconnected networks
  - B. A suite of protocols that allow LANs to connect into WANs
  - C. Protocols that allow for data transmission across a multitude of networks
  - D. Protocols that allow different devices to be shared by interconnected networks
2. Which of the following best describes the purpose of TCP/IP protocol stacks?
  - A. They map closely to the OSI reference model in the upper layers.
  - B. They support all standard physical and data-link protocols.
  - C. They transfer information in a sequence of datagrams.
  - D. They reassemble datagrams into complete messages at the receiving location.
3. Which of the following best describes the function of the application layer of the TCP/IP conceptual layers?
  - A. It is responsible for breaking messages into segments and then reassembling them at the destination.
  - B. It acts as a protocol to manage networking applications.
  - C. It exists for file transfer, e-mail, remote login, and network management.
  - D. It resends anything that is not received and reassembles messages from the segments.
4. Why are TCP three-way handshake/open connections used?
  - A. To ensure that lost data can be recovered if problems occur later
  - B. To determine how much data the receiving station can accept at one time
  - C. To provide users with more efficient use of bandwidth
  - D. To change binary ping responses into information in the upper layers
5. What does a TCP sliding window do?
  - A. It makes the window larger so that more data can come through at once, which results in more efficient use of bandwidth.
  - B. The window size slides to each section of the datagram to receive data, which results in more efficient use of bandwidth.
  - C. It allows the window size to be negotiated dynamically during the TCP session, which results in more efficient use of bandwidth.
  - D. It limits the incoming data so that each segment must be sent one by one, which is an inefficient use of bandwidth.

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6. What do the TCP sequence and acknowledgment numbers do?
  - A. They break datagrams into their binary coefficients, number them sequentially, and send them to their destination, where the sender acknowledges their receipt.
  - B. They break down messages into datagrams that are numbered and then sent to a host according to the sequence that the source TCP sets.
  - C. They provide a system for sequencing datagrams at the source and acknowledging them at the destination.
  - D. They provide sequencing of segments with a forward reference acknowledgment, number datagrams before transmission, and reassemble the segments into a complete message.
  
7. Why does UDP use application layer protocols to provide reliability?
  - A. It speeds up transmission over the network.
  - B. The lack of reliability protocols makes the software less expensive and easier to configure.
  - C. It lacks a protocol to sequence datagrams and negotiate window size.
  - D. It does not use windowing or acknowledgements.
  
8. What does the acronym ICMP stand for?
  - A. Internetwork Connection Model Protocol
  - B. Internet Connection Monitor Protocol
  - C. Internet Control Message Protocol
  - D. Internetwork Control Mode Protocol
  
9. What is the purpose of ICMP messages?
  - A. They put the internetwork in control mode so that protocols can be set up.
  - B. They are messages that the network uses to monitor connection protocols.
  - C. They are standard binary messages that act as model internetwork protocols.
  - D. They are messages carried in IP datagrams that are used to send error and control messages.
  
10. When are TCP segments numbered?
  - A. After transmission
  - B. Before transmission
  - C. TCP segments are not numbered
  - D. TCP uses packets and not segments
  
11. What is the function of the three-way handshake process used by TCP?
  - A. It completes research for a destination address for a datagram.
  - B. It develops a cache of usable hosts
  - C. It establishes a round trip connection between hosts
  - D. It sends a broadcast message looking for the host TCP address.

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12. How does a sender find out the destination's MAC address?
- A. It consults its routing table.
  - B. It sends a message to all the addresses that are searching for the address.
  - C. It sends a broadcast message to the entire LAN.
  - D. It sends a broadcast message to the entire network.
13. Which of the following is used by TCP to ensure reliable delivery?
- A. Upper layer protocols
  - B. Lower layer protocols
  - C. Sequence numbers
  - D. Port numbers
14. Which of the following best describes the purpose of checksum?
- A. It is a method for comparing IP addresses against those who are permitted access to allow entry by a host.
  - B. It is a method for checking the integrity of transmitted data.
  - C. It is a method for computing a sequence of octets taken through a series of arithmetic operations.
  - D. It is a method for recomputing IP address values at the receiving end and comparing them for verification.
15. Which of the following best describes flow control?
- A. It is a device at the destination side that controls the flow of incoming data.
  - B. It is a buffer at the source side that monitors the outflow of data.
  - C. It is a technique that ensures that the source does not overwhelm the destination with data.
  - D. It is a suspension of transmission until the data in the source buffers has been processed.
16. Which of the following is not a function of TCP?
- A. Path determination
  - B. Synchronization
  - C. Flow control
  - D. Reliability
17. What is the purpose of SNMP?
- A. It monitors and controls network devices and manages configurations, statistics collection, performance, and security.
  - B. It monitors the devices that are connected to one router and assigns a regular address to each host on the node network.
  - C. It provides the network administrator with the ability to manage the devices on the network and control who has access to each node.
  - D. It allows for the management of network security, performance, and configuration from a remote host.

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18. Which of the following best describes TTL?
- A. It is a field in the datagram header that determines how long the data is valid.
  - B. It is a field in an IP header that indicates how long a packet is considered valid.
  - C. It is a field within an IP datagram that indicates the upper-layer protocol that is sending the datagram.
  - D. It is a field in a datagram head that indicates when the next data packet will arrive.
19. Which of the following best describes UDP?
- A. It is a protocol that acknowledges flawed or intact datagrams.
  - B. It is a protocol that detects errors and requests retransmissions from the source.
  - C. It is a protocol that processes datagrams and requests retransmissions when necessary.
  - D. It is a protocol that exchanges datagrams without acknowledgments or guaranteed delivery.
20. Which of the following best describes window size?
- A. It is the maximum size of a window that software can have and still process data rapidly.
  - B. It is the number of messages that can be transmitted while awaiting an acknowledgment.
  - C. It is the size of the window, in picas, that must be set ahead of time so that data can be sent.
  - D. It is the size of the window opening on a monitor, which is not always equal to the monitor size.

## CCNA 2 Chapter 11

### Access Control Lists (ACLs)

Network administrators face a dilemma: They must figure out how to deny unwanted access while allowing appropriate access. Although security tools such as passwords, callback equipment, and physical security devices are helpful, they often lack the flexibility of basic traffic filtering and the specific controls that most administrators prefer. For example, a network administrator might want to allow users on the LAN to go out to the Internet through the LAN but not want the users outside the LAN to use the Internet to telnet into the LAN.

Routers provide basic traffic-filtering capabilities such as blocking Internet traffic with access control lists (ACLs). In this chapter, you learn about using standard and extended ACLs as a means to control network traffic and how ACLs are used as part of a security solution. An ACL is a sequential collection of permit or deny statements that apply to addresses or upper-layer protocols.

This chapter focuses on standard, extended, and named ACLs. In addition, this chapter includes tips, considerations, recommendations, and general guidelines for how to use ACLs and the commands and configurations that are needed to create ACLs. Finally, this chapter provides examples of standard and extended ACLs and how to apply ACLs to router interfaces.

#### Concept Questions

1. Each school needs two networks: one for curriculum and one for administration. Draw the LAN design for each of these networks including separate Ethernet ports on the router.

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### **Access Control Lists (ACLs)**

2. Devise an ACL for the router that denies users from the curriculum LAN segment access to the administrative LAN, yet gives the administrative LAN users complete access to the curriculum LAN segment. Describe how you would proceed.

3. How would you accommodate e-mail traffic and maintain security?



## **CCNA 2 Chapter 11 Access Control Lists (ACLs)**

7. Outline, in detail, the security needs of this network.

8. What is the purpose of ACLs?

## CCNA 2 Chapter 11 Access Control Lists (ACLs)

9. What condition does a standard ACL use for IP data packets?

10. How do extended ACLs differ from standard ACLs?

11. How are standard and extended ACLs differentiated in the router?

12. The first step to configure an ACL is to write it. What is the second step?

13. Describe the significance of the wildcard mask 0.0.0.7 ?

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## **Access Control Lists (ACLs)**

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## Access Control Lists (ACLs)

### Vocabulary Exercise

Define the following terms as completely as you can. Use the online curriculum or CCNA 2 Chapter 11 from the *Cisco Networking Academy Program CCNA 1 and 2 Companion Guide*, Revised Third Edition, for help.

ACL

Address filtering

Bit bucket

DDR

Deny

DNS

Extended access

Firewall

Packet

PDU

Permit

Queuing

Standard access lists

TCP

TCP/IP

UDP

Wildcard bits

Wildcard masking

# CCNA 2 Chapter 11

## Access Control Lists (ACLs)

### CCNA Exam Review Questions

1. Which of the following commands would you use to find out whether ACLs are set on an interface?
  - A. show running-config
  - B. show ip protocols
  - C. show ip interface
  - D. show ip network
2. What do you call the additional 32 bits of information in the access-list statement?
  - A. Wildcard bits
  - B. Access bits
  - C. Zero bits
  - D. One bits
3. Using Router (config)# access-list 156.1.0.0 0.0.255.255 is equivalent to saying which of the following?
  - A. Deny my network only.
  - B. Permit a specific host.
  - C. Permit my network only.
  - D. Deny a specific host.
4. When you issue a permit entry into an ACL that is accompanied by an implicit deny all, all traffic except that which is listed in the permit statement will be denied.
  - A. True
  - B. False
5. The show access-lists command is used to do which of the following?
  - A. Monitor whether ACLs are set.
  - B. Monitor ACL statements.
  - C. Monitor ACL debugging.
  - D. Monitor groupings.
6. Which wild card mask will match a host?
  - A. 0.0.0.0
  - B. 0.0.0.1
  - C. 255.255.255.255
  - D. 255.255.255.0
7. What bit in a wildcard means match?
  - A. 0
  - B. 1
  - C. 254
  - D. 255

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8. What bit in a wildcard means who cares or no match?
  - A. 0
  - B. 1
  - C. 254
  - D. 255
  
9. If you do not supply a wildcard mask, what wildcard mask is applied automatically?
  - A. 0.0.0.0
  - B. 255.255.255.0
  - C. 255.255.255.254
  - D. 255.255.255.255
  
10. Which statement below does *not* describe the processing of an ACL?
  - A. There is an implicit deny all at the end of all ACLs
  - B. A packet can be permitted or denied based on the ACL
  - C. Each line of an ACL is checked until a match is made.
  - D. A packet that is denied by one statement may be permitted by another statement.
  
11. Which command below will create a standard ACL?
  - A. Atlanta#access-list 101 permit any
  - B. Atlanta#access-list 10 permit any
  - C. Atlanta#(config)#access-list 10 permit any
  - D. Atlanta#(config)#access-list 101 permit any
  
12. Which command below will create an extended standard ACL?
  - A. Atlanta#access-list 150 permit ip any any
  - B. Atlanta#access-list 150 permit ip any any
  - C. Atlanta#(config)#access-list 150 permit ip any any
  - D. Atlanta#(config)#access-list 150 ip permit any any
  
13. Which of the following is not a parameter for an ACL?
  - A. Protocol suite
  - B. Source address
  - C. Destination address
  - D. Packet size
  
14. A router has two Ethernet ports and two serial ports routing IP. What is the maximum number of IP ACLs that can be configured to filter packets?
  - A. 4
  - B. 8
  - C. 12
  - D. 16

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15. If a match is not found in an ACL what will happen to the packet?
- A. It will be forwarded back to the source
  - B. It will be forwarded
  - C. It will be dropped
  - D. It will be held in the output queue
16. What is the meaning of the wildcard mask 0.0.0.31?
- A. The first 26 bits will be ignored
  - B. The last 31 bits must match
  - C. The last 5 bits will be ignored
  - D. The first 26 bits must match
17. What is the meaning of the wildcard mask 0.0.0.15?
- A. The first 27 bits will be ignored
  - B. The last 31 bits must match
  - C. The last 5 bits will be ignored
  - D. The first 28 bits must match
18. What is the meaning of access-list 150 deny tcp 192.168.5.0 0.0.0.3 any eq 80?
- A. All traffic will be permitted
  - B. All web traffic to the 192.168.5.0 network will be denied
  - C. All web traffic from the 192.168.5.0 network will be denied
  - D. Some of the web traffic from the 192.168.5.0 network will be denied
19. What will happen if the access-list 150 deny tcp 192.168.5.0 0.0.0.3 any eq 80 is applied to an interface with no other statements?
- A. All traffic will be denied
  - B. All web traffic to the 192.168.5.0 network will be denied
  - C. All web traffic from the 192.168.5.0 network will be denied
  - D. Some of the web traffic from the 192.168.5.0 network will be denied