Lab 6.2.2.8 Viewing Host Routing Tables



1. Objective

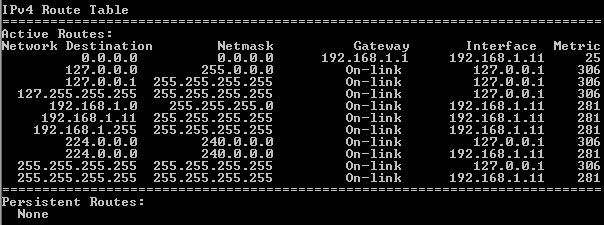
Examine IPv4 Host Routing Table Entries

1. Background / Scenario

To access a resource on a network, your host will determine the route to the destination host using its routing table. In this lab, you will display and examine the information in the host routing table of your PC using the **netstat –r** and **route print** commands. You will determine how packets will be routed by your PC depending on the destination address.

Examine IPv4 Host Routing Table Entries

In this part, you will examine the IPv4 **host routing table**. This table is in the second section as a result of the **netstat –r** output. It lists all the known IPv4 routes, including direct connections, local network, and local default routes.



The output is divided in five columns: **Network Destination, Netmask, Gateway, Interface,** and **Metric**.

* The **Network Destination** column lists the reachable network. The Network Destination is used with Netmask to match the destination IP address.
* The **Netmask** lists the subnet mask that the host uses to determine the network and host portions of the IP address.
* The **Gateway** column lists the address that the host uses to send the packets to a remote network destination. If a destination is directly connected, the gateway is listed as On-link in the output.
* The **Interface** column lists the IP address that is configured on the local network adaptor. This is used to forward a packet on the network.
* The **Metric** column lists the cost of using a route. It is used to calculate the best route to a destination. A preferred route has a lower metric number than other routes listed.

The output displays five different types of active routes:

* The local **default route 0.0.0.0** is used when the packet does not match other specified addresses in the routing table. The packet will be sent to the gateway from the PC for further processing. In this example, the packet will be sent to 192.168.1.1 from 192.168.1.11.
* The **loopback addresses**, **127.0.0.0 – 127.255.255.255**, are related to direct connection and provide services to the local host.
* The **addresses for the subnet**, **192.168.1.0 – 192.168.1.255**, are all related to the host and the local network. If the final destination of the packet is in the local network, the packet will exit 192.168.1.11 interface.
  1. The local route address 192.168.1.0 represents all devices on the 192.168.1.0/24 network.
  2. The address of the local host is 192.168.1.11.
  3. The network broadcast address 192.168.1.255 is used to send messages to all the hosts on the local network.
* The special **multicast class D addresses 224.0.0.0** are reserved for use through either the loopback interface (127.0.0.1) or the host (192.168.1.11).
* The local **broadcast address 255.255.255.255** can be used through either the loopback interface (127.0.0.1) or host (192.168.1.11).

Based on the contents of the IPv4 routing table, if the PC wanted to send a packet to **192.168.1.15**, what would it do and where would it send the packet?

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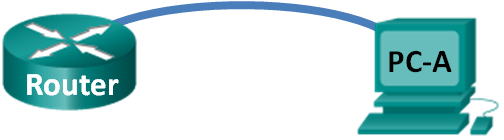
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If the PC wanted to send a packet to a remote host located at **172.16.20.23**, what would it do and where would it send the packet?

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\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab 6.3.2.7 Exploring Router Characteristics



1. Objectives

In this lab, you will identify the internal components and characteristics of the IOS by consoling into the router and issuing various commands, such as **show version** and **show interfaces**, from the CLI.

Examine Router Internal Characteristics Using Show Commands

Part 1: Establish a console connection to the router and use the show version command

* + 1. Start **Tera Term** and click the **Serial** radio button. Verify that the COM1 port is selected and click **OK** to continue. From the **Tera Term Setup** menu, choose the **Serial port** to verify the proper serial settings:
* Port: COM1
* Bits per second: 9600
* Data bits: 8
* Parity: None
* Stop bits: 1
* Flow Control: None

Would you like to enter the initial configuration dialog? [yes/no]: no

Press RETURN to get started!

**Router>**

* + 1. Enter privileged EXEC mode using the **enable** command:

Router> **enable**

Router#

* + 1. Display information about the router by using the **show version** command. Use the Spacebar on the keyboard to page through the output.

Router# **show version**

**Cisco IOS Software**, C1900 Software (C1900-UNIVERSALK9-M), **Version 15.2(4)M3**, RELEASE SOFTWARE (fc1)

Technical Support: http://www.cisco.com/techsupport

Copyright (c) 1986-2011 by Cisco Systems, Inc.

Compiled Thu 26-Jul-12 19:34 by prod\_rel\_team

**ROM: System Bootstrap, Version 15.0(1r)M15,** RELEASE SOFTWARE (fc1)

**Router uptime is 1 day, 14 hours, 46 minutes**

System returned to ROM by power-on

System restarted at 07:26:55 UTC Mon Dec 3 2012

**System image file is "flash0:c1900-universalk9-mz.SPA.152-4.M3.bin"**

**<output omitted>**

If you require further assistance please contact us by sending email to

export@cisco.com.

**Cisco CISCO1941/K9 (revision 1.0) with 487424K/36864K bytes of memory.**

Processor board ID FGL16082318

**2 Gigabit Ethernet interfaces**

**2 Serial(sync/async) interfaces**

1 terminal line

1 Virtual Private Network (VPN) Module

DRAM configuration is 64 bits wide with parity disabled.

**255K bytes of non-volatile configuration memory.**

**250880K bytes of ATA System CompactFlash 0 (Read/Write)**

**<output omitted>**

Technology Package License Information for Module:'c1900'

----------------------------------------------------------------

Technology Technology-package Technology-package

Current Type Next reboot

------------------------------------------------------------------

ipbase ipbasek9 Permanent ipbasek9

security securityk9 Permanent securityk9

data None None None

**Configuration register is 0x2102**

* + 1. Based on the output of the **show version** command, answer the following questions about the router. If you are examining a different model router, include the information about it here.
       1. What is the **version** of the **Cisco IOS** and what is the **system image file**?

Version: 15.1(4)M4

System image file: "flash0:c1900-universalk9-mz.SPA.151-1.M4.bin"

What is the **Bootstrap** program version in ROM BIOS? \_\_\_

Version 15.1(4)M4\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTE:** The System Bootstrap in ROM contains the minimum code to bring up the Cisco device and permit you to operate minimally.

* + - 1. How long has the router been running without a restart (also known as its uptime)?

7 minutes, 35 seconds

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* + - 1. How much **dynamic random-access memory (DRAM)** does the router have?

\_\_\_\_\_ 491520K/32768K bytes of memory.

491 520 kbytes

+ 32 768 kbytes

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**524 288 kbytes**

**512 Mbytes**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. What network **interfaces** does the router have?

\_\_\_2 Gigabit Ethernet interfaces

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* + - 1. How much **CompactFlash memory** for IOS storage does the router have? \_\_\_\_
      2. 249856K bytes\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      3. How much **nonvolatile random-access memory (NVRAM)** for configuration file storage does the router have? \_\_\_\_\_**255K bytes**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
      4. What is the setting of the **configuration register**? \_\_\_\_\_ 0x2102\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**NOTE:** The **configuration register** can be used to change Cisco router behavior in several ways, such as: How the router boots, options while booting (ignore **configuration**, disable boot messages), etc.

* **0x2102**is the factory-default configuration register value.
  + Boots into ROM if initian boot fails
* **0x2142** boots from flash without using NVRAM contents (good for password recovery).
  + Boots into ROM if initial boot fails
  + Ignores the contents of Non-Volatile RAM (NVRAM) (ignores configuration)

1. Use the show interface command to examine the network interfaces.
   * 1. Use the **show interface gigabitEthernet 0/0** command to see the status of the Gigabit Ethernet 0/0 interface.

Router# **show interface gigabitEthernet 0/0**

**GigabitEthernet0/0 is administratively down, line protocol is down**

Hardware is CN Gigabit Ethernet, **address is 442b.031a.b9a0 (bia 442b.031a.b9a0)**

MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,

reliability 255/255, txload 1/255, rxload 1/255

**<output omitted>**

* What is the MAC address of the Gigabit Ethernet interface? \_\_\_0090.0c4c.b401\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Is the interface up or down? \_\_\_\_\_\_down\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  + 1. Use the **show interfaces serial 0/0/0** command to view the status of the Serial 0/0/0 interface.

Router# **show interface serial 0/0/0**

**Serial0/0/0 is administratively down, line protocol is down**

Hardware is WIC MBRD Serial

MTU 1500 bytes, BW 1544 Kbit/sec, DLY 20000 usec,

reliability 255/255, txload 1/255, rxload 1/255

Encapsulation HDLC, loopback not set

**<output omitted>**

* Is the interface up or down? \_\_\_\_\_\_down\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab 6.5.1.2 Building a Switch and Router Network

1. Topology



1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| R1 | G0/0 | 192.168.0.1 | 255.255.255.0 | N/A |
| G0/1 | 192.168.1.1 | 255.255.255.0 | N/A |
| PC-A | NIC | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| PC-B | NIC | 192.168.0.3 | 255.255.255.0 | 192.168.0.1 |

1. Objectives

Part 1: Set Up the Topology and Initialize Devices

Part 2: Configure Devices and Verify Connectivity

Part 3: Display Device Information

1. Background / Scenario

In this lab, you will cable the equipment as shown in the topology diagram. You will then configure the devices to match the addressing table. After the configurations have been saved, you will verify your configurations by testing for network connectivity.

After the devices have been configured and network connectivity has been verified, you will use IOS commands to retrieve information from the devices to answer questions about your network equipment.

Part 1: Set Up Topology and Initialize Devices

Cable the network as shown in the topology.

1. Attach the devices shown in the topology diagram, and cable, as necessary.
2. Power on all the devices in the topology.

Part 2: Configure Devices and Verify Connectivity

In Part 2, you will set up the network topology and configure basic settings, such as the interface IP addresses, device access, and passwords. Refer to the Topology and Addressing Table at the beginning of this lab for device names and address information.

Configure the router

1. Enter configuration mode.

Router# **conf t**

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#

1. Assign a device name to the router.

Router(config)# **hostname R1**

1. Disable DNS lookup to prevent the router from attempting to translate incorrectly entered commands as though they were host names.

R1(config)# **no ip domain-lookup**

1. Assign **class** as the privileged EXEC encrypted password.

R1(config)# **enable secret class**

1. Assign **cisco** as the console password and enable login.

R1(config)# **line con 0**

R1(config-line)# **password cisco**

R1(config-line)# **login**

R1(config-line)# **exit**

R1(config)#

1. Assign **cisco** as the vty password and enable login.

R1(config)# **line vty 0 4**

R1(config-line)# **password cisco**

R1(config-line)# **login**

R1(config-line)# **exit**

R1(config)#

1. Encrypt the clear text passwords.

R1(config)# **service password-encryption**

1. Create a banner that warns anyone accessing the device that unauthorized access is prohibited.

R1(config)# **banner motd # Unauthorized access prohibited! #**

R1(config)#

1. Configure and activate both interfaces on the router.

R1(config)# **int g0/0**

R1(config-if)# **description Connection to PC**

R1(config-if)# **ip address 192.168.0.1 255.255.255.0**

R1(config-if)# **no shut**

R1(config-if)# **exit**

R1(config)# **int g0/1**

R1(config-if)# **description Connection to Switch**

R1(config-if)# **ip address 192.168.1.1 255.255.255.0**

R1(config-if)# **no shut**

R1(config-if)# **exit**

R1(config)# **exit**

R1# **sh run**

R1# **copy run start**

1. Save the running configuration to the startup file.

R1# **copy run start**

Destination filename [startup-config]?

Building configuration...

1. Retrieve hardware and software information from Switch
   1. Display information from the Switch

* Change the console cable from the **Router** to the **Switch**.
* Use the **show version** command to answer the following questions about the **Switch**.

Switch# **show version**

Cisco IOS Software, C2960 Software (C2960-LANBASEK9-M), Version 15.0(2)SE, RELEASE SOFTWARE (fc1)

Technical Support: http://www.cisco.com/techsupport

Copyright (c) 1986-2012 by Cisco Systems, Inc.

ROM: Bootstrap program is C2960 boot loader

BOOTLDR: C2960 Boot Loader (C2960-HBOOT-M) Version 12.2(53r)SEY3, RELEASE SOFTWARE (fc1)

S1 uptime is 1 hour, 2 minutes

System returned to ROM by power-on

**System image file is "flash:/c2960-lanbasek9-mz.150-2.SE.bin"**

**<output omitted>**

A summary of U.S. laws governing Cisco cryptographic products may be found at:

http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

**cisco WS-C2960-24TT-L (PowerPC405) processor (revision R0) with 65536K bytes of memory.**

Processor board ID FCQ1628Y5LE

Last reset from power-on

1 Virtual Ethernet interface

24 FastEthernet interfaces

2 Gigabit Ethernet interfaces

The password-recovery mechanism is enabled.

**64K bytes of flash-simulated non-volatile configuration memory.**

Base ethernet MAC Address : 0C:D9:96:E2:3D:00

Motherboard assembly number : 73-12600-06

Power supply part number : 341-0097-03

Motherboard serial number : FCQ16270N5G

Power supply serial number : DCA1616884D

Model revision number : R0

**<output omitted>**

Switch Ports **Model** SW Version SW Image

------ ----- ----- ---------- ----------

\* 1 26 **WS-C2960-24TT-L** 15.0(2)SE C2960-LANBASEK9-M

Configuration register is 0xF

* What is the name of the **IOS image** that the switch is running?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_No esta

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* How much **dynamic random-access memory (DRAM)** does the switch have? \_\_\_\_\_ 21039K bytes of memory.
* \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_
* How much **nonvolatile random-access memory (NVRAM)** for configuration file storage does the switch have? \_\_\_\_\_\_\_\_\_\_\_\_\_63488K bytes \_\_\_\_\_\_\_\_\_\_\_\_\_
* What is the **model number** of the switch? \_\_\_\_WS-C2960-24TT
* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  1. Assign static IP information to the PC interfaces.
     1. Configure the IP address, subnet mask, and default gateway settings on PC-A.
     2. Configure the IP address, subnet mask, and default gateway settings on PC-B.
     3. Ping PC-B from a command prompt window on PC-A. Were the pings successful? \_\_\_\_\_\_SI\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. Display the routing table on the router.
* Change the console cable from the **Switch** to the **Router**.
* Use the **show ip route** command on the router to answer the following questions.

R1# **show ip route**

Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP

D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area

N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

E1 - OSPF external type 1, E2 - OSPF external type 2

i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2

ia - IS-IS inter area, \* - candidate default, U - per-user static route

o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP

+ - replicated route, % - next hop override

Gateway of last resort is not set

192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks

C 192.168.0.0/24 is directly connected, GigabitEthernet0/0

L 192.168.0.1/32 is directly connected, GigabitEthernet0/0

192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks

C | is directly connected, GigabitEthernet0/1

L 192.168.1.1/32 is directly connected, GigabitEthernet0/1

* What code is used in the routing table to indicate a directly connected network? \_\_\_\_\_
* How many route entries are coded with a C code in the routing table? \_\_\_\_\_\_\_\_\_
* What interface types are associated to the C coded routes?

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* 1. Display interface information on the router.

Use the **show interface g0/1** to answer the following questions.

* What is the operational status of the **G0/1 interface (up / down)**? \_\_\_\_\_\_\_up\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* What is the **Media Access Control (MAC)** address of the **G0/1 interface**?

\_\_\_\_\_\_\_\_\_\_\_\_0090.0c4c.b402 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* How is the **Interne**t **address (IP)** displayed in this command?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_192.168.1.1/24\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Display a summary list of the interfaces on the router and switch.

There are several commands that can be used to verify an interface configuration. One of the most useful of these is the **show ip interface brief** command. The command output displays a summary list of the interfaces on the device and provides immediate feedback to the status of each interface.

* + 1. Enter the **show ip interface brief** command on the router.

R1# **show ip interface brief**

**Interface IP-Address OK? Method Status Protocol**

Embedded-Service-Engine0/0 unassigned YES unset administratively down down

GigabitEthernet0/0 192.168.0.1 YES manual up up

GigabitEthernet0/1 192.168.1.1 YES manual up up

Serial0/0/0 unassigned YES unset administratively down down

Serial0/0/1 unassigned YES unset administratively down down

* + 1. Enter the **show ip interface brief** command on the switch.

Change the console cable from the **Router** to the **Switch**.

Switch# **show ip interface brief**

**Interface IP-Address OK? Method Status Protocol**

Vlan1 unassigned YES manual up up

FastEthernet0/1 unassigned YES unset down down

FastEthernet0/2 unassigned YES unset down down

FastEthernet0/3 unassigned YES unset down down

FastEthernet0/4 unassigned YES unset down down

FastEthernet0/5 unassigned YES unset up up

FastEthernet0/6 unassigned YES unset up up

FastEthernet0/7 unassigned YES unset down down

FastEthernet0/8 unassigned YES unset down down

FastEthernet0/9 unassigned YES unset down down

FastEthernet0/10 unassigned YES unset down down

FastEthernet0/11 unassigned YES unset down down

FastEthernet0/12 unassigned YES unset down down

**<output omitted>**

FastEthernet0/23 unassigned YES unset down down

FastEthernet0/24 unassigned YES unset down down

GigabitEthernet0/1 unassigned YES unset down down

GigabitEthernet0/2 unassigned YES unset down down

1. Reflection
   1. If the **G0/1** interface showed administratively down, what interface configuration command would you use to turn the interface up?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_no shut

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. What would happen if you had incorrectly configured interface **G0/1** on the router with an IP address of 192.168.1.2?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_