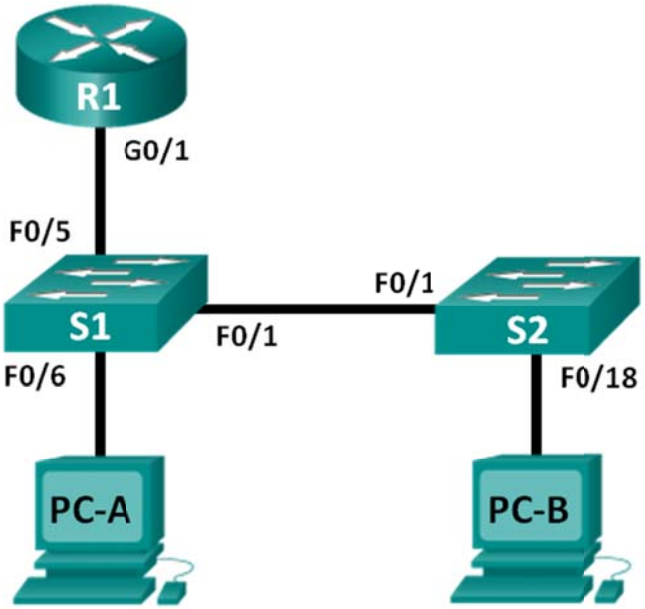
Lab - Using IOS CLI with Switch MAC Address Tables

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.1.1	255.255.255.0	N/A
S1	VLAN 1	192.168.1.11	255.255.255.0	192.168.1.1
S2	VLAN 1	192.168.1.12	255.255.255.0	192.168.1.1
PC-A	NIC	192.168.1.3	255.255.255.0	192.168.1.1
PC-B	NIC	192.168.1.2	255.255.255.0	192.168.1.1

Objectives

Part 1: Build and Configure the Network

- Cable the network according to the topology diagram.
- Configure the network devices according to the Addressing Table.

Part 2: Examine the Switch MAC Address Table

- Use **show** commands to observe the process of building the switch MAC address table.

Background / Scenario

The purpose of a Layer 2 LAN switch is to deliver Ethernet frames to host devices on the local network. The switch records host MAC addresses that are visible on the network, and maps those MAC addresses to its own Ethernet switch ports. This process is called building the MAC address table. When a switch receives a frame from a PC, it examines the frame's source and destination MAC addresses. The source MAC address

is recorded and mapped to the switch port from which it arrived. Then the destination MAC address is looked up in the MAC address table. If the destination MAC address is a known address, then the frame is forwarded out of the corresponding switch port of the MAC address. If the MAC address is unknown, then the frame is broadcast out of all switch ports, except the one from which it came. It is important to observe and understand the function of a switch and how it delivers data on the network. The way a switch operates has implications for network administrators whose job it is to ensure secure and consistent network communication.

Switches are used to interconnect and deliver information to computers on local area networks. Switches deliver Ethernet frames to host devices identified by network interface card MAC addresses.

In Part 1, you will build a multi-switch and router topology with a trunk linking the two switches. In Part 2, you will ping various devices and observe how the two switches build their MAC address tables.

Note: The routers used with CCNA hands-on labs are Cisco 1941 Integrated Services Routers (ISRs) with Cisco IOS Release 15.2(4)M3 (universalk9 image). The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other routers, switches and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of this lab for the correct interface identifiers.

Note: Make sure that the routers and switches have been erased and have no startup configurations. If you are unsure contact your instructor.

Required Resources

- 1 Router (Cisco 1941 with Cisco IOS Release 15.2(4)M3 universal image or comparable)
- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 PCs (Windows 7, Vista, or XP with terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology

Note: The Fast Ethernet interfaces on Cisco 2960 switches are autosensing and an Ethernet straight-through cable may be used between switches S1 and S2. If using another model Cisco switch, it may be necessary to use an Ethernet crossover cable.

Part 1: Build and Configure the Network

Step 1: Cable the network according to the topology.

Step 2: Configure PC hosts.

Step 3: Initialize and reload the routers and switches as necessary.

Step 4: Configure basic settings for each switch.

a. Configure device name as shown in the topology.

b. Configure IP address and default gateway as listed in Addressing Table.

c. Assign **cisco** as the console and vty passwords.

d. Assign **class** as the privileged EXEC password.

Step 5: Configure basic settings for the router.

a. Disable DNS lookup.

b. Configure IP address for the router as listed in Addressing Table.

c. Configure device name as shown in the topology.

d. Assign **cisco** as the console and vty passwords.

e. Assign **class** as the privileged EXEC password.

Part 2: Examine the Switch MAC Address Table

A switch learns MAC addresses and builds the MAC address table, as network devices initiate communication on the network.

Step 1: Record network device MAC addresses.

a. Open a command prompt on PC-A and PC-B and type **ipconfig /all**. What are the Ethernet adapter physical addresses?

PC-A MAC Address:

PC-B MAC Address:

b. Console into router R1 and type the **show interface G0/1** command. What is the hardware address?

R1 Gigabit Ethernet 0/1 MAC Address:

c. Console into switch S1 and S2 and type the **show interface F0/1** command on each switch. On the second line of command output, what is the hardware addresses (or burned-in address [bia])?

S1 Fast Ethernet 0/1 MAC Address:

S2 Fast Ethernet 0/1 MAC Address:

Step 2: Display the switch MAC address table.

Console into switch S2 and view the MAC address table, both before and after running network communication tests with ping.

a. Establish a console connection to S2 and enter privileged EXEC mode.

b. In privileged EXEC mode, type the **show mac address-table** command and press Enter.

```
S2# show mac address-table
```

Even though there has been no network communication initiated across the network (i.e., no use of ping), it is possible that the switch has learned MAC addresses from its connection to the PC and the other switch.

Are there any MAC addresses recorded in the MAC address table?

What MAC addresses are recorded in the table? To which switch ports are they mapped and to which devices do they belong? Ignore MAC addresses that are mapped to the CPU.

If you had not previously recorded MAC addresses of network devices in Step 1, how could you tell which devices the MAC addresses belong to, using only the output from the **show mac address-table** command? Does it work in all scenarios?

Step 3: Clear the S2 MAC address table and display the MAC address table again.

a. In privileged EXEC mode, type the **clear mac address-table dynamic** command and press Enter.

```
S2# clear mac address-table dynamic
```

b. Quickly type the **show mac address-table** command again. Does the MAC address table have any addresses in it for VLAN 1? Are there other MAC addresses listed?

Wait 10 seconds, type the **show mac address-table** command, and press Enter. Are there new addresses in the MAC address table?

Step 4: From PC-B, ping the devices on the network and observe the switch MAC address table.

a. From PC-B, open a command prompt and type **arp -a**. Not including multicast or broadcast addresses, how many device IP-to-MAC address pairs have been learned by ARP?

b. From the PC-B command prompt, ping the router/gateway R1, PC-A, S1, and S2. Did all devices have successful replies? If not, check your cabling and IP configurations.

c. From a console connection to S2, enter the **show mac address-table** command. Has the switch added additional MAC addresses to the MAC address table? If so, which addresses and devices?

From PC-B, open a command prompt and retype **arp -a**. Does the PC-B ARP cache have additional entries for all network devices that were sent pings?

Reflection

On Ethernet networks, data is delivered to devices by their MAC addresses. For this to happen, switches and PCs dynamically build ARP caches and MAC address tables. With only a few computers on the network this process seems fairly easy. What might be some of the challenges on larger networks?

Router Interface Summary Table

Router Interface Summary				
Router Model	**Ethernet Interface #1**	**Ethernet Interface #2**	**Serial Interface #1**	**Serial Interface #2**
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)

Note: To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.