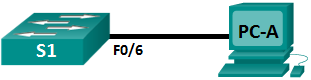
Lab 5.1.2.8 Viewing Network Device MAC Addresses

1. Topology



1. Addressing Table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Device | Interface | IP Address | Subnet Mask | Default Gateway |
| S1 | VLAN 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 |

1. Objectives

Part 1: Configure Devices and Verify Connectivity

Part 2: Display, Describe, and Analyze Ethernet MAC Addresses

1. Background / Scenario

Every device on an Ethernet LAN is identified by a Layer 2 MAC address. This address is assigned by the manufacturer and stored in the firmware of the NIC. This lab will explore and analyze the components that make up a MAC address, and how you can find this information on a switch and a PC.

You will cable the equipment as shown in the topology. You will configure the switch and PC to match the addressing table. 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 various commands to retrieve information from the devices to answer questions about your network equipment.

1. Configure Devices and Verify Connectivity

In this part, you will set up the network topology and configure basic settings, such as the interface IP addresses and device name. For device name and address information, refer to the Topology and Addressing Table.

* 1. Cable the network as shown in the topology.
     1. Attach the devices shown in the topology and cable as necessary.
     2. Power on all the devices in the topology.
  2. Configure the IPv4 address for the PC.
     1. Configure the IPv4 address, subnet mask, and default gateway address for PC-A.
     2. From the command prompt on PC-A, ping the switch address.

Were the pings successful? Explain.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_No\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. Configure basic settings for the switch.

In this step, you will configure the device name and the IP address, and disable DNS lookup on the switch.

1. Start **Tera Term** and click the **Serial** radio button. Verify that the COM1 port is selected and click **OK** to continue.
   * 1. 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!

Switch>

* + 1. Console into the switch and enter global configuration mode.

Switch> **enable**

Switch# **configure terminal**

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

Switch(config)#

* + 1. Assign a hostname to the switch based on the Addressing Table.

Switch(config)# **hostname S1**

* + 1. Disable DNS lookup.

S1(config)# **no ip domain-lookup**

* + 1. Configure and enable the SVI interface for VLAN 1.

S1(config)# **interface vlan 1**

S1(config-if)# **ip address 192.168.1.1 255.255.255.0**

S1(config-if)# **no shutdown**

S1(config-if)# **end**

\*Mar 1 00:07:59.048: %SYS-5-CONFIG\_I: Configured from console by console

* 1. Verify network connectivity.

Ping the switch from PC-A. Were the pings successful? \_\_\_\_SI\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Display, Describe, and Analyze Ethernet MAC Addresses

Every device on an Ethernet LAN has a MAC address that is assigned by the manufacturer and stored in the firmware of the NIC. Ethernet MAC addresses are 48-bits long. They are displayed using six sets of hexadecimal digits that are usually separated by dashes, colons, or periods. The following example shows the same MAC address using the three different notation methods:

**00-05-9A-3C-78-00 00:05:9A:3C:78:00 0005.9A3C.7800**

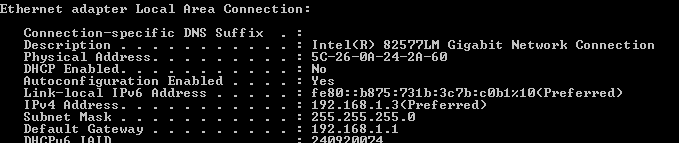
**Note**: MAC addresses are also called physical addresses, hardware addresses, or Ethernet hardware addresses.

You will issue commands to display the MAC addresses on a PC and a switch, and you will analyze the properties of each one.

* 1. Analyze the MAC address for the PC-A NIC.

Before you analyze the MAC address on PC-A, look at an example from a different PC NIC. You can issue the **ipconfig /all** command to view the MAC address of your NIC. An example screen output is shown below. When using the **ipconfig /all** command, notice that MAC addresses are referred to as physical addresses. Reading the MAC address from left to right, the first six hex digits refer to the vendor (manufacturer) of this device. These first six hex digits (3 bytes) are also known as the organizationally unique identifier (OUI). This 3-byte code is assigned to the vendor by the IEEE organization. To find the manufacturer, you can use a tool like [www.macvendorlookup.com](http://www.macvendorlookup.com) or go to the IEEE web site to find the registered OUI vendor codes. The IEEE web site address for OUI information is <http://standards.ieee.org/develop/regauth/oui/public.html>. The last six digits are the NIC serial number assigned by the manufacturer.

* + 1. Using the output from the **ipconfig /all** command, answer the following questions.



**NOTE:** **OUI (Organizational Unique Identifier)**, the first 24 bits (6 HEX) of a MAC address for a network-connected device, indicate the **specific vendor** for that device.

What is the **OUI portion** of the MAC address for this device? \_\_\_\_\_\_5C 26 0A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the **serial number portion** of the MAC address for this device? \_\_\_24 2A 60\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Using the example above, find the **name of the vendor** that manufactured this NIC.\_\_\_\_Dell\_\_\_\_\_\_\_\_\_

* + 1. From the command prompt on PC-A, issue the **ipconfig /all** command and identify the **OUI portion** of the MAC address for the NIC of PC-A.\_\_\_\_\_\_\_\_\_\_\_00 60 70

Identify the serial number portion of the MAC address for the NIC of PC-A.\_\_\_\_\_\_375A1C\_\_\_\_\_\_\_\_\_\_\_

Identify the name of the vendor that manufactured the NIC of PC-A.\_\_\_\_\_\_\_CISCO

* 1. Analyze the MAC address for the S1 F0/6 interface.

You can use a variety of commands to display MAC addresses on the switch.

* + 1. Console into S1 and use the **show interfaces vlan 1** command to find the MAC address information. A sample is shown below. Use output generated by your switch to answer the questions.

S1# **show interfaces vlan 1**

Vlan1 is up, line protocol is up

Hardware is EtherSVI, address is 001b.0c6d.8f40 (bia 001b.0c6d.8f40)

Internet address is 192.168.1.1/24

MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,

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

Encapsulation ARPA, loopback not set

Keepalive not supported

ARP type: ARPA, ARP Timeout 04:00:00

Last input never, output 00:14:51, output hang never

Last clearing of "show interface" counters never

Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0

Queueing strategy: fifo

Output queue: 0/40 (size/max)

5 minute input rate 0 bits/sec, 0 packets/sec

5 minute output rate 0 bits/sec, 0 packets/sec

0 packets input, 0 bytes, 0 no buffer

Received 0 broadcasts (0 IP multicasts)

0 runts, 0 giants, 0 throttles

0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored

34 packets output, 11119 bytes, 0 underruns

0 output errors, 2 interface resets

0 unknown protocol drops

0 output buffer failures, 0 output buffers swapped out

What is the MAC address for VLAN 1 on S1? \_\_\_\_\_0060.3e10.c672

What is the **OUI** for VLAN 1? \_\_\_\_\_\_\_\_\_0060.3e

What is the MAC **serial number** for VLAN 1? \_\_\_\_\_\_10.c672

Based on this OUI, what is the **name of the vendor**? \_\_\_\_\_CISCO\_\_\_

What does **bia** stand for? \_\_**burned in address**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why does the output show the same MAC address twice?

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

* + 1. Another way to display the MAC address on the switch is to use the **show arp** command. Use the **show arp** command to display MAC address information. This command maps the Layer 2 address to its corresponding Layer 3 address. A sample is shown below. Use output generated by your switch to answer the questions.

S1# **show arp**

Protocol Address Age (min) Hardware Addr Type Interface

Internet 192.168.1.1 - 001b.0c6d.8f40 ARPA Vlan1

Internet 192.168.1.3 0 5c26.0a24.2a60 ARPA Vlan1

What Layer 2 addresses are displayed on S1?

\_\_\_\_\_\_\_\_\_\_\_00 60 3E 10 C6 72\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_00 60 70 37 5a 1C\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What Layer 3 addresses are displayed on S1?

\_\_\_\_\_\_\_\_\_\_\_\_192.168.1.1\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_192.168.1.3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* 1. View the MAC addresses on the switch.

Issue the **show mac address-table** command on S1. A sample is shown below. Use output generated by your switch to answer the questions.

S1# **show** **mac address-table**

Mac Address Table

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

Vlan Mac Address Type Ports

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

All 0100.0ccc.cccc STATIC CPU

All 0100.0ccc.cccd STATIC CPU

All 0180.c200.0000 STATIC CPU

All 0180.c200.0001 STATIC CPU

All 0180.c200.0002 STATIC CPU

All 0180.c200.0003 STATIC CPU

All 0180.c200.0004 STATIC CPU

All 0180.c200.0005 STATIC CPU

All 0180.c200.0006 STATIC CPU

All 0180.c200.0007 STATIC CPU

All 0180.c200.0008 STATIC CPU

All 0180.c200.0009 STATIC CPU

All 0180.c200.000a STATIC CPU

All 0180.c200.000b STATIC CPU

All 0180.c200.000c STATIC CPU

All 0180.c200.000d STATIC CPU

All 0180.c200.000e STATIC CPU

All 0180.c200.000f STATIC CPU

All 0180.c200.0010 STATIC CPU

All ffff.ffff.ffff STATIC CPU

1 5c26.0a24.2a60 DYNAMIC Fa0/6

Total Mac Addresses for this criterion: 21

Did the switch display the MAC address of PC-A? If you answered yes, what port was it on?

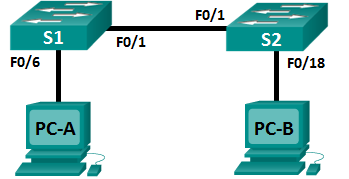
\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Si\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Reflection

Can you have broadcasts at the Layer 2 level? If so, what would the MAC address be?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_FF FF FF FF FF FF FF ARP

Lab 5.2.1.7 Viewing the Switch MAC Address Table



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

1. Objectives

Part 1: Build and Configure the Network

Part 2: Examine the Switch MAC Address Table

1. 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 associated with that MAC address. If the MAC address is unknown, then the frame is broadcasted 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 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.

1. Build and Configure the Network
   1. Cable the network according to the topology.
   2. Configure PC hosts.
   3. Configure basic settings for each switch.
      1. Configure device name as shown in the topology. Configure the switch name for **S1** and **S2**

Switch# configure t

Switch(config)# hostname S1

S1(config)#

* + 1. Configure IP address as listed in Addressing Table. Configure the Switch Virtual Interface (SVI) IP address for **S1** (192.168.1.11) and **S2** (192.168.1.12).

S1(config)# interface vlan 1

S1(config-if)# shut

S1(config-if)# ip address 192.168.1.11 255.255.255.0

S1(config-if)# no shut

S1(config-if)# exit

S1(config)#

* + 1. Assign **cisco** as the console and vty passwords.

S1(config)# line con 0

S1(config-line)# password cisco

S1(config-line)# login

S1(config-line)# exit

S1(config)#

S1(config)# **line vty 0 4**

S1(config-line)# **password cisco**

S1(config-line)# **login**

S1(config-line)# **exit**

S1(config)#

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

S1(config)# **enable secret class**

S1(config)# **exit**

S1#

1. 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.

* 1. Record network device MAC addresses.
     1. 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: \_\_\_\_\_\_\_0060.7037.5A1C

PC-B MAC Address: \_\_\_\_\_\_\_00E0.B006.6624

* + 1. 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: \_\_\_\_\_\_\_\_\_0002.1731.9e01

S2 Fast Ethernet 0/1 MAC Address: \_\_\_\_\_\_\_\_0060.3e1d.1e01

S1# **show interface f0/1**

FastEthernet0/1 is up, line protocol is up (connected)

Hardware is Fast Ethernet, address is 0cd9.96d2.3d81 **(bia 0cd9.96d2.3d81)**

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

<output omitted>

S1#

S2# **show interface f0/1**

FastEthernet0/1 is up, line protocol is up (connected)

Hardware is Fast Ethernet, address is 0cd9.96d2.4581 **(bia 0cd9.96d2.4581)**

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

<output omitted>

S2#

* 1. Clear the S2 MAC address table and display the MAC address table.
     1. Console into switch S2. In privileged EXEC mode, type the **clear mac address-table dynamic** command and press **Enter**.

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

* + 1. Quickly type the **show mac address-table** command.

**S2# show 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.

MAC-Address Device

\_\_\_\_\_\_\_\_\_\_\_\_\_\_0002.1731.9e01\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_S1 F0/1

S2# show mac address-table

Mac Address Table

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

Vlan Mac Address Type Ports

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

All 0100.0ccc.cccc STATIC CPU

All 0100.0ccc.cccd STATIC CPU

...

All 0180.c200.000f STATIC CPU

All 0180.c200.0010 STATIC CPU

All ffff.ffff.ffff STATIC CPU

1 0cd9.96d2.3d81 DYNAMIC Fa0/1

Total Mac Addresses for this criterion: 22

S2#

* 1. From PC-B, ping the devices on the network and observe the switch MAC address table.
     1. 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?

\_\_\_\_\_\_\_\_\_\_\_\_\_Ninguna\_\_\_\_\_\_\_\_\_\_\_\_

Answers will vary. The ARP cache may have no entries in it, or it may have the gateway IP address to MAC address mapping.

C:\Users\PC-B> arp -a

**NO ARP Entries Found**

* + 1. From the **PC-B** command prompt, ping **PC-A**, **S1**, and **S2**. Did all devices have successful replies? If not, check your cabling and IP configurations.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_SI\_\_\_\_\_\_\_\_\_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? \_\_\_\_\_\_\_\_\_

C:\Users\PC-B> **arp -a**

Interface: 192.168.1.2 --- 0xb

Internet Address Physical Address Type

192.168.1.3 1c-c1-de-91-c3-5d dynamic

192.168.1.11 0c-d9-96-d2-3d-c0 dynamic

192.168.1.12 0c-d9-96-d2-45-c0 dynamic

C:\Users\PC-B>

If so, which addresses and devices?

MAC-Address Device

\_\_\_\_\_\_\_\_\_0060.7037.5a1c\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_PC-A\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_0060.3e10.c672\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_S1 \_VLAN 1

\_\_\_\_\_\_\_\_\_\_\_0009.7c3b.c3a8 \_\_\_\_\_\_\_\_ S2 VLAN 1

* + 1. From the **PC-B** command prompt, re-ping to **PC-A**, **S1**, and **S2**.
    2. 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?

MAC-Address Device

\_\_\_\_\_\_\_\_\_\_\_0002.1731.9e01\_\_\_ S1 Fa0/1

\_\_\_\_\_\_\_\_\_0060.3e10.c672\_\_\_\_\_\_\_\_\_\_\_ S1 VLAN 1

\_\_\_\_\_\_\_\_\_\_\_\_0060.7037.5a1c\_\_\_\_\_\_\_\_\_\_\_\_PC A

\_\_\_\_\_\_\_\_\_\_\_\_\_00e0.b006.6624\_\_\_\_\_\_\_\_\_\_ PC B

S2# **show mac address-table**

Mac Address Table

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

Vlan Mac Address Type Ports

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

All 0100.0ccc.cccc STATIC CPU

...

All 0180.c200.0010 STATIC CPU

All ffff.ffff.ffff STATIC CPU

1 0021.700c.050c DYNAMIC Fa0/18 **(PC-B)**

1 0cd9.96d2.3d81 DYNAMIC Fa0/1 **(S1 f0/1)**

1 0cd9.96d2.3dc0 DYNAMIC Fa0/1 **(S1 VLAN 1)**

1 1cc1.de91.c35d DYNAMIC Fa0/1 **(PC-A)**

Total Mac Addresses for this criterion: 24

S2#