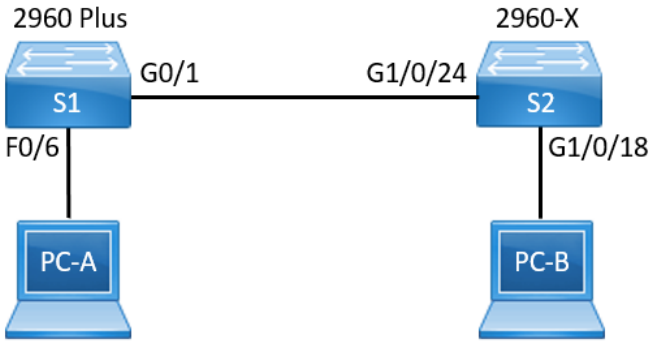
Lab - Building a Simple Switched Network

Topology



Addressing Table

Device	Interface	IP Address	Subnet Mask
PC-A	NIC	192.168.1.10	255.255.255.0
PC-B	NIC	192.168.1.11	255.255.255.0

Objectives

Part 1: Set Up the Network Topology (Ethernet only)

Part 2: Configure PC Hosts

Part 3: Examine Ethernet MAC Addresses

Part 4: Examine Switch MAC Address Table

Background / Scenario

Networks are constructed of three major components: hosts, switches, and routers. In this lab, you will build a simple network with two hosts and two switches.

You will apply IP addressing for this lab to the PCs to enable communication between these two devices. Use the **ping** utility to verify connectivity.

Note: The switches used are Cisco Catalyst 2960s with Cisco IOS Release 15.0(2) (lanbasek9 image). Other 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. You may wish to initialize and reload the switches to their default state.

Required Resources

- 2 Switches (Cisco 2960 with Cisco IOS Release 15.0(2) lanbasek9 image or comparable)
- 2 PCs (Windows 10 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

Part 1: Set Up the Network Topology (Ethernet only)

In Part 1, you will cable the devices together according to the network topology.

Step 1: Power on the devices.

Power on all devices in the topology. The switches do not have a power switch; they will power on as soon as you plug in the power cord.

Step 2: Connect the two switches.

Connect one end of an Ethernet cable to G0/1 on S1 and the other end of the cable to G1/0/24 on S2. You should see the lights for G0/1 on S1 and G1/0/24 on S2 turn amber and then green. This indicates that the switches have been connected correctly.

Step 3: Connect the PCs to their respective switches.

a. Connect one end of the second Ethernet cable to the NIC port on PC-A. Connect the other end of the cable to F0/6 on S1. After connecting the PC to the switch, you should see the light for F0/6 turn amber and then green, indicating that PC-A has been connected correctly.

b. Connect one end of the last Ethernet cable to the NIC port on PC-B. Connect the other end of the cable to G1/0/18 on S2. After connecting the PC to the switch, you should see the light for G1/0/18 turn amber and then green, indicating that the PC-B has been connected correctly.

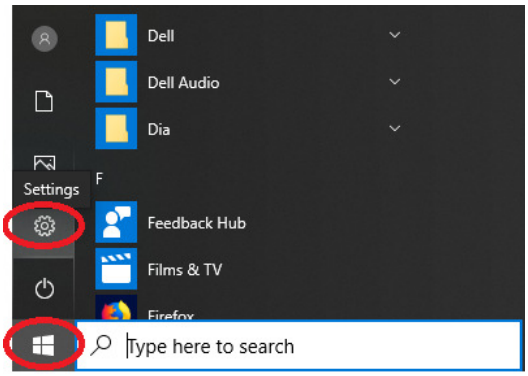
Step 4: Visually inspect network connections.

After cabling the network devices, take a moment to carefully verify the connections to minimize the time required to troubleshoot network connectivity issues later.

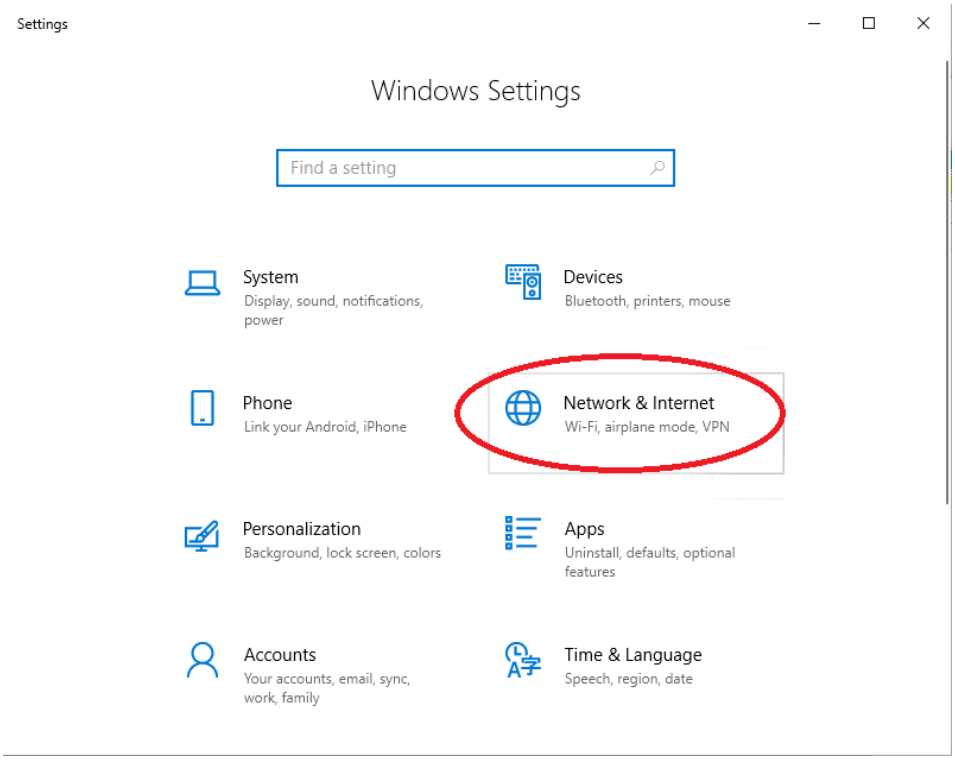
Part 2: Configure PC Hosts

Step 1: Configure static IP address information on the PCs.

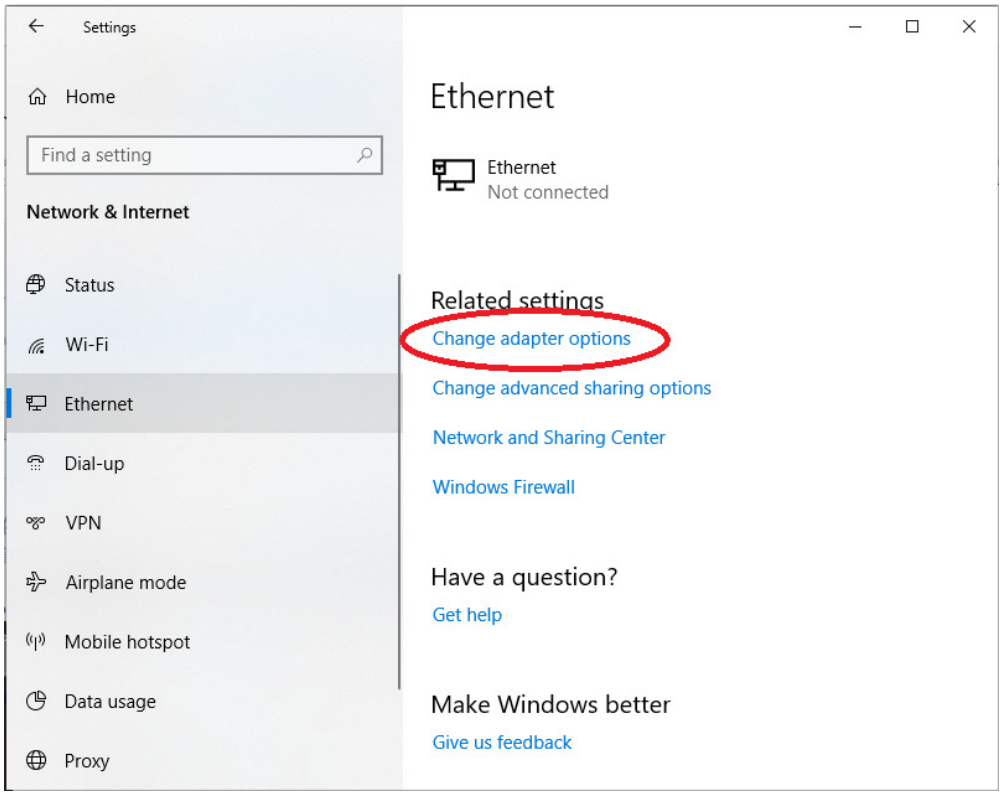
a. Click the **Windows Start** icon and then select **Settings**.



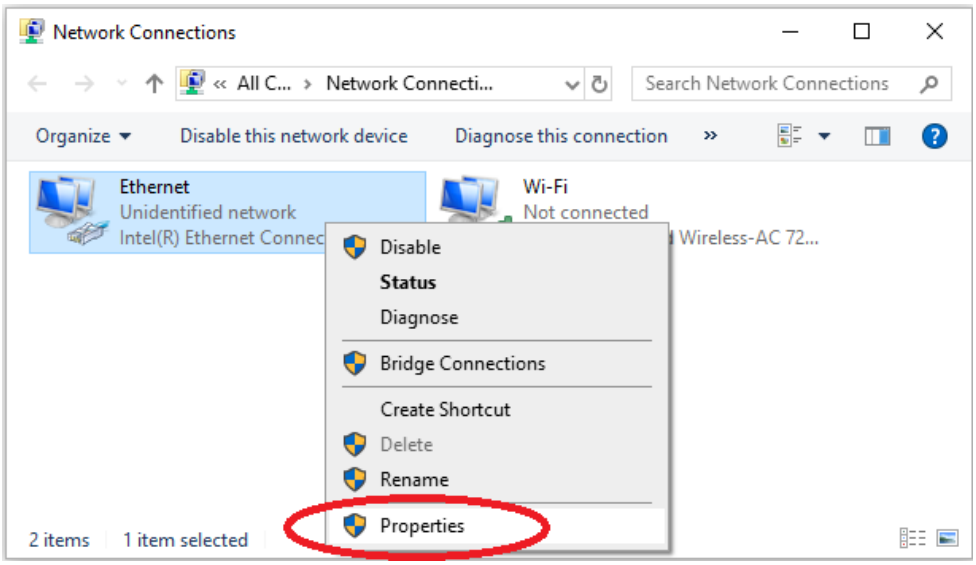
b. In the Windows Settings pop-up window, click **Network & Internet**.



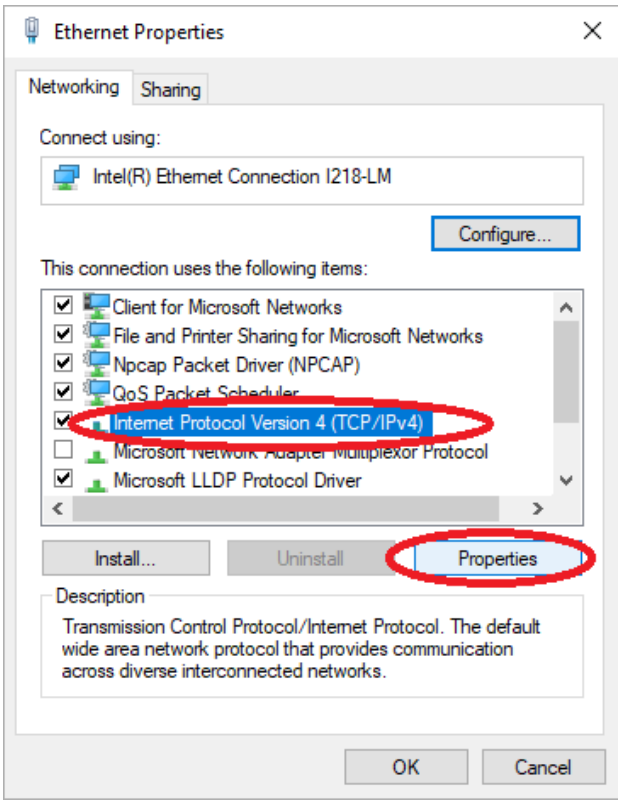
c. In the Network & Internet section, select **Ethernet** and then **Change adapter options**.



d. The Network Connections window displays the available interfaces on the PC. Right-click the **Ethernet** interface and select **Properties**.

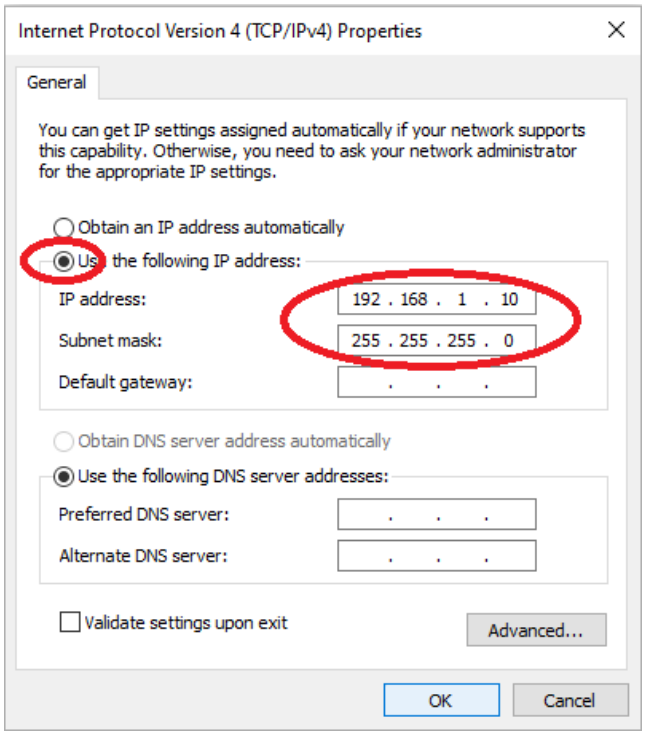


e. Select the **Internet Protocol Version 4 (TCP/IPv4)** option and then click **Properties**.



Note: You can also double-click **Internet Protocol Version 4 (TCP/IPv4**) to display the Properties window.

f. Click the **Use the following IP address** radio button to manually enter an IP address, subnet mask, and default gateway.



Note: In the above example, the IP address and subnet mask have been entered for PC-A. The default gateway has not been entered, because there is no router attached to the network.

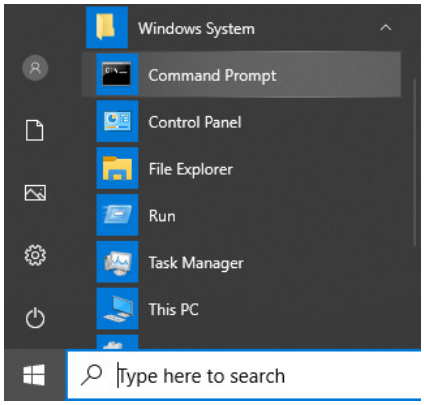
g. After all the IP information has been entered, click **OK**. Click **OK** on the Ethernet Properties window to assign the IP address to the LAN adapter.

h. Repeat the previous steps to enter the IP address information for **PC-B**. Refer to the Addressing Table on page 1 for PC-B's IP address information.

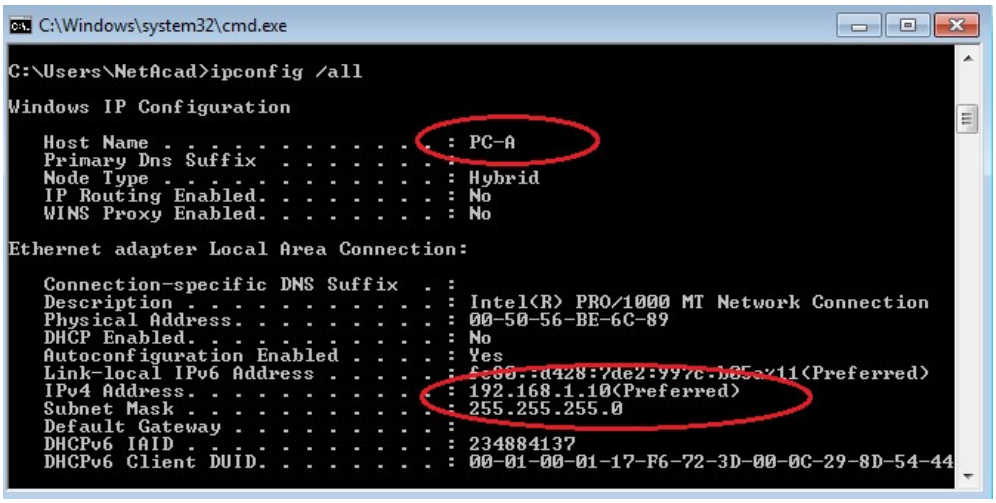
Step 2: Verify PC settings and connectivity.

Use the Command Prompt (**cmd.exe**) window to verify the PC settings and connectivity.

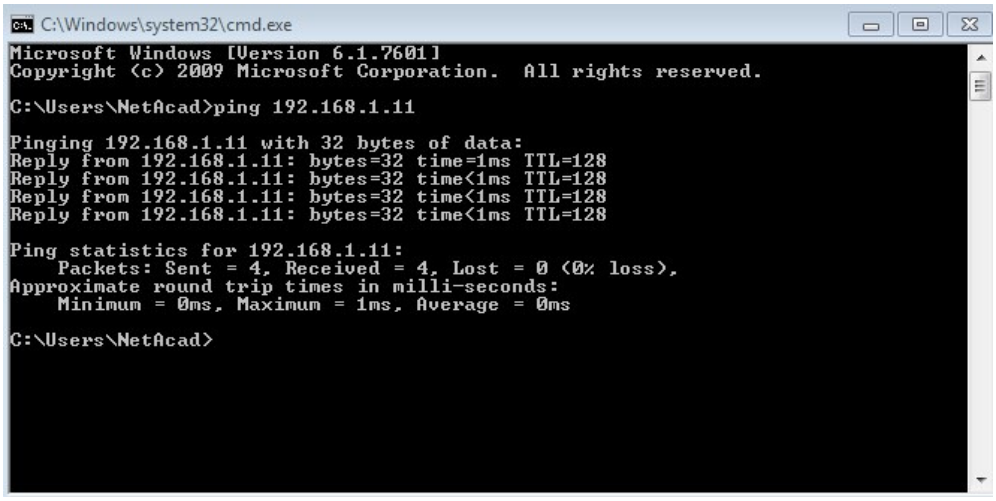
a. From PC-A, click the **Windows Start** icon, scroll down to select **Windows System**, and then **Command Prompt** icon.



b. The Command Prompt window is where you can enter commands directly to the PC and view the results of those commands. Verify your PC settings by using the **ipconfig /all** command.



c. Type **ping 192.168.1.11** and press Enter.



Were the ping results successful? _____

If not, troubleshoot as necessary.

Note: If you did not get a reply from PC-B, try to ping PC-B again. If you still do not get a reply from PC-B, try to ping PC-A from PC-B. If you are unable to get a reply from the remote PC, then have your instructor help you troubleshoot the problem.

Part 3: Examine Ethernet MAC Addresses

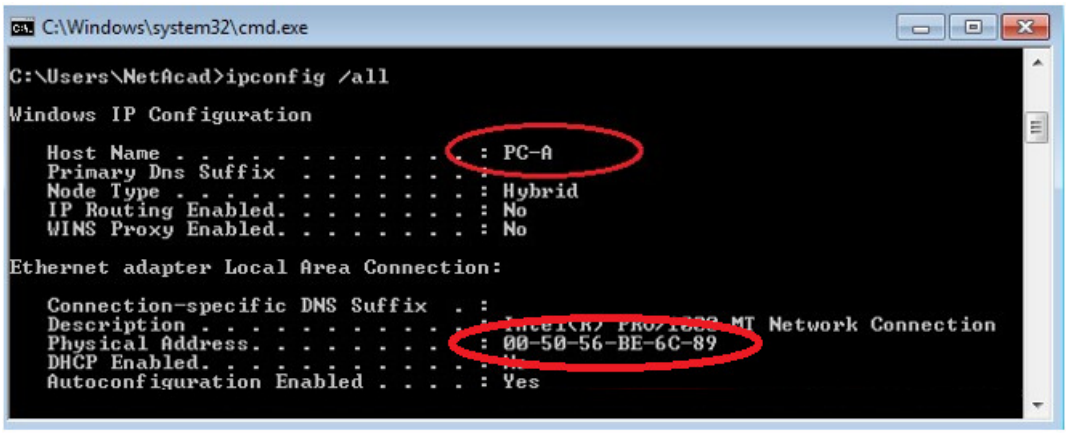
Every device on an Ethernet LAN has a MAC address that is assigned by the manufacturer and stored in the firmware of the NIC. Ethernet MAC addresses are 48-bits long. They are displayed using six sets of hexadecimal digits that are usually separated by dashes, colons, or periods. The following example 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 burned-in addresses (bia). You will issue commands to display and examine the MAC addresses on a PC and a switch.

Step 1: Examine the MAC addresses for PC-A and PC-B NICs.

Similarly, you can issue the **ipconfig /all** command to view the MAC address of your NICs. 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 such as www.macvendorlookup.com . The last six digits are the NIC serial number assigned by the manufacturer.



a. Using the output from your **ipconfig /all** command, answer the following questions.

What is the OUI portion of the MAC address for the NIC of PC-A?

What is the serial number portion of the MAC address for the NIC of PC-A?

What is the name of the vendor that manufactured the NIC of PC-A?

b. Repeat the previous step for PC-B.

What is the OUI portion of the MAC address for the NIC of PC-B?

What is the serial number portion of the MAC address for the NIC of PC-B?

What is the name of the vendor that manufactured the NIC of PC-B?

Step 2: View the MAC addresses on the switch.

a. Console into the switch S1 and use the **show version** command to display the base Ethernet MAC address of the switch.

```
S1# 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.
Compiled Sat 28-Jul-12 00:29 by prod_rel_team

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, 38 minutes
System returned to ROM by power-on
System image file is "flash:/c2960-lanbasek9-mz.150-2.SE.bin"

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply third-
party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to
export@cisco.com.

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
Motherboard revision number     : A0
Model number                    : WS-C2960-24TT-L
System serial number            : FCQ1628Y5LE
Top Assembly Part Number        : 800-32797-02
Top Assembly Revision Number    : A0
Version ID                      : V11
CLEI Code Number                : COM3L00BRF
Hardware Board Revision Number  : 0x0A

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 base Ethernet MAC address of your switch S1?

b. Use the **show interfaces** command for port 6 to display MAC address information. A sample is shown below. Use output generated by your switch to answer the questions.

```
S1# show interfaces f0/6
FastEthernet0/6 is up, line protocol is up (connected)
  Hardware is Fast Ethernet, address is 0cd9.96e2.3d06 (bia 0cd9.96e2.3d06)
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, media type is 10/100BaseTX
  input flow-control is off, output flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:45, output 00:00:00, 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
     3362 packets input, 302915 bytes, 0 no buffer
     Received 265 broadcasts (241 multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 241 multicast, 0 pause input
     0 input packets with dribble condition detected
     38967 packets output, 2657748 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 PAUSE output
     0 output buffer failures, 0 output buffers swapped out
```

What is the MAC address for F0/6 on your switch S1? _____

Issue similar command and write down the MAC address for G0/1 of S1. _____

c. Repeat previous steps for switch S2.

What is the base Ethernet MAC address of your switch S2?

What is the MAC address for G1/0/18 on your switch S2? _____

What is the MAC address for G1/0/24 on your switch S2? _____

Part 4: 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: Clear switch MAC address table and display the MAC address table.

Console into switch S1 and view the MAC address table, both before and after running network communication tests with ping.

a. Establish a console connection to S1 and enter privileged EXEC mode.

b. Type the **clear mac address-table dynamic** command and press **Enter**.

```
S1# clear mac address-table dynamic
```

c. Quickly type the **show mac address-table** command. A sample is shown below.

```
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
Total Mac Addresses for this criterion: 22
```

By default, the switch is statically configured with MAC addresses as shown above to receive frames with those matching destination MAC addresses.

What is the MAC address ffff.ffff.ffff used for?

What is the multicast MAC address 0180.c200.0000 used for?

Step 2: From PC-A, ping PC-B and observe the switch MAC address table.

a. From the PC-A command prompt, ping PC-B. Did you receive successful replies? If not, check your cabling and IP configurations.

b. From the console connection to S1, enter the **show mac address-table** command again. Has the switch added dynamic MAC addresses to the MAC address table? If so, which addresses and the associated ports?

c. From the console connection to S2, enter the **show mac address-table** command also.

Which dynamic MAC addresses and the associated ports are added into the MAC address table?