VANIER COLLEGE – Computer Engineering Technology – Autumn 2021

Network Systems Design (247-509-VA)

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LABORATORY EXPERIMENT 8

Network Testing

NOTE:
To be completed in one lab session of 3 hrs.

No formal report required. Answer all question and include discussion and conclusion.

To be submitted via Lea by the deadline stated.

This exercise is to be done individually except where specified in the procedure. **Each** student must submit the work with original observations and conclusions.

OBJECTIVES:

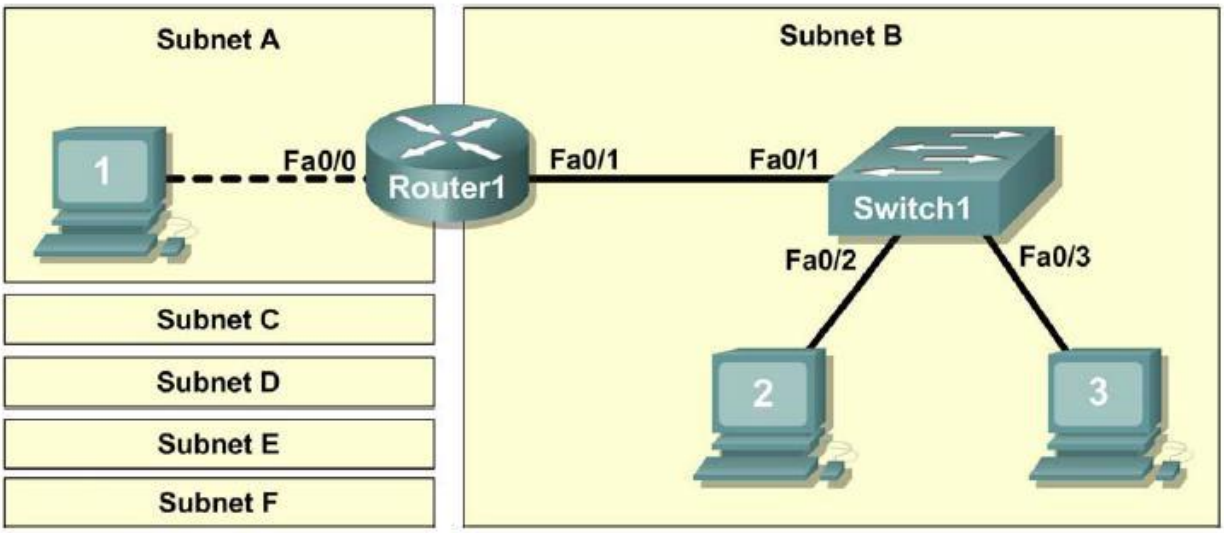
After performing this experiment, the student will be able to:

1. Design and configure logical lab network.
2. Configure the logical LAN topology.
3. Perform various network testing to verify LAN connectivity.

PROCEDURE (team up in a group of 2)

**if you have to form a group of 3, modify the results/data of your lab to include Host3*

In this lab you will create a small network that requires connecting network devices and configuring host computers for basic network connectivity. Subnet A and Subnet B are subnets that are currently needed. Subnet C, Subnet D, Subnet E and Subnet F are anticipated subnets, not yet connected to the network. The 1st subnet (subnet address of 0) will be used.



1. Given an IP address and mask of 172.20.0.0/24, design an IP addressing scheme that satisfies the following requirements:

Subnet	Number of Hosts
Subnet A	As shown in the topology diagram
Subnet B	Between 80 and 100
Subnet C	Between 40 and 52
Subnet D	Between 20 and 29
Subnet E	12
Subnet F	5

Provide the following information to each of your subnet.

Complete subnetting table for the above problem:

Given IP: 172.20.0.0
Subnet mask: 255.255.255.0

Subnets	Required Host bits	Subnet Address	Usable Range	Broadcast Address	Prefix (mask)
B: 100 hosts	7 (2^7 = 128)	172.20.0.0	172.20.0.1 to 172.20.0.126	172.20.0.127 (172.20.0.0111 1111)	/25 (255.255.255.1000 0000)
C: 52 hosts	6 (2^6 = 64)	172.20.0.128 (172.20.0.127 + 1)	172.20.0.129 to 172.20.0.190	172.20.0.191 (172.20.0.1011 1111)	/26 (255.255.255.1100 0000)
D: 29 hosts	5 (2^5 = 32)	172.20.0.192 (172.20.0.191 + 1)	172.20.0.193 to 172.20.0.222	172.20.0.223 (172.20.0.1101 1111)	/27 (255.255.255.1110 0000)
E: 12 hosts	4 (2^4 = 16)	172.20.0.224 (172.20.0.223 + 1)	172.20.0.225 to 172.20.0.238	172.20.0.239 (172.20.0.1110 1111)	/28 (255.255.255.1111 0000)
F: 5 hosts	3 (2^3 = 8)	172.20.0.240 (172.20.0.239 + 1)	172.20.0.241 to 172.20.0.246	172.20.0.247 (172.20.0.1111 0111)	/29 (255.255.255.1111 1000)
A: 1 host	2 (2^2 = 4)	172.20.0.248 (172.20.0.247 + 1)	172.20.0.249 to 172.20.0.250	172.20.0.251 (172.20.0.1111 1011)	/30 (255.255.255.1111 1100)

2. Connect up the physical lab topology. Make sure correct cables are used to form the connections.
3. Document all your logical network settings using the following guidelines:
    - Host computer use the first and second IP addresses.
    - Router interface uses the last network host address.

To properly route Layer 2 frames between LAN devices, Switch1 does not require Layer 3 configuration. The IP address assigned to Switch1, interface VLAN 1, is used to establish Layer 3 connectivity between external devices and the switch. Without an IP address, upper-layer protocols such as Telnet and HTTP will not work. The default gateway address permits the switch to respond to protocol requests from devices on distant networks. Switch1 uses the next-to-last host address.

Write down the IP address information for each device listed below, wherever applied.

Device	Subnet	IP Address	Mask	Gateway
Host1	A	172.20.0.249	/30	172.20.0.250
Router1 – Fa0/0	A	172.20.0.250	/30	N/A
Host2	B	172.20.0.1	/25	172.20.0.126
Switch1	B	172.20.0.125	/25	172.20.0.126
Router1 – Fa0/1	B	172.20.0.126	/25	N/A

4. Configure all your host computers.

5. Configure Router via console. Configuration for Router 1 includes the following tasks:
    - Specify the router name : Router1
    - Specify an encrypted privileged EXEC password : cisco
    - Specify a console access password : class
    - Configure the MOTD banner.
    - Configure Router1 interface Fa0/0 and Fa0/1 (this includes description and L3 address).

    Save the configuration in NVRAM.

    a) What command do you use to display the configuration contents of RAM? Attach a copy of your configuration file into your report.
        - The command used to display the contents of RAM was `<show running-config>` while in privileged EXEC mode. This command is used because the running-config of the router is stored in RAM.

    [Router1 running-config]

```
hostname Router1
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$4GGs$y0QTVQFgfKJ4W.QVYCiGs0
!
no aaa new-model
ip cef
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
description SubnetA
ip address 172.20.0.250 255.255.255.252
duplex auto
```

<continuation from previous page>

```
speed auto
!
interface FastEthernet0/1
description SubnetB
ip address 172.20.0.126 255.255.255.128
duplex auto
speed auto
!
interface Serial0/0/0
no ip address
shutdown
no fair-queue
clock rate 2000000
!
interface Serial0/0/1
no ip address
shutdown
clock rate 2000000
!
!
!
ip http server
no ip http secure-server
!
!
!
!
!
control-plane
!
!
banner motd ^C
**********************************************
*                                            *
* Network Systems Design                     *
* Day Yann Fong                              *
* Lab 8                                      *
*                                            *
* Team: Ezra & Leo                           *
* Device: Router1                            *
*                                            *
*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~*
*                                            *
*                    WARNING                 *
*          UNAUTHORIZED ACCESS FORBIDDEN     *
*                                            *
*              STAY OUT OF MY ROUTER!        *
```

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```
*                                                *
**************************************************
^C
!
line con 0
password class
login
line aux 0
line vty 0 4
login
!
scheduler allocate 20000 1000
end
```

<End of Router1 running-config>

b) What command do you use to display configuration information for interface Fa0/0?

- The command used to display configuration information for interface Fa0/0 was `<show interface fa0/0>` while in user EXEC mode.

Record the configuration specifications required below for both FastEthernet 0/0 and 0/1:

i. Interface status (up/down): up for Fa0/0 and Fa0/1 (see "Figure 1" below).

ii. Line protocol: up for Fa0/0 and Fa0/1 (see "Figure 1" below).

iii. MAC address: 0025.453e.d654 for Fa0/0 and 0025.453e.d265 for Fa0/1 (see "Figure 1" below).

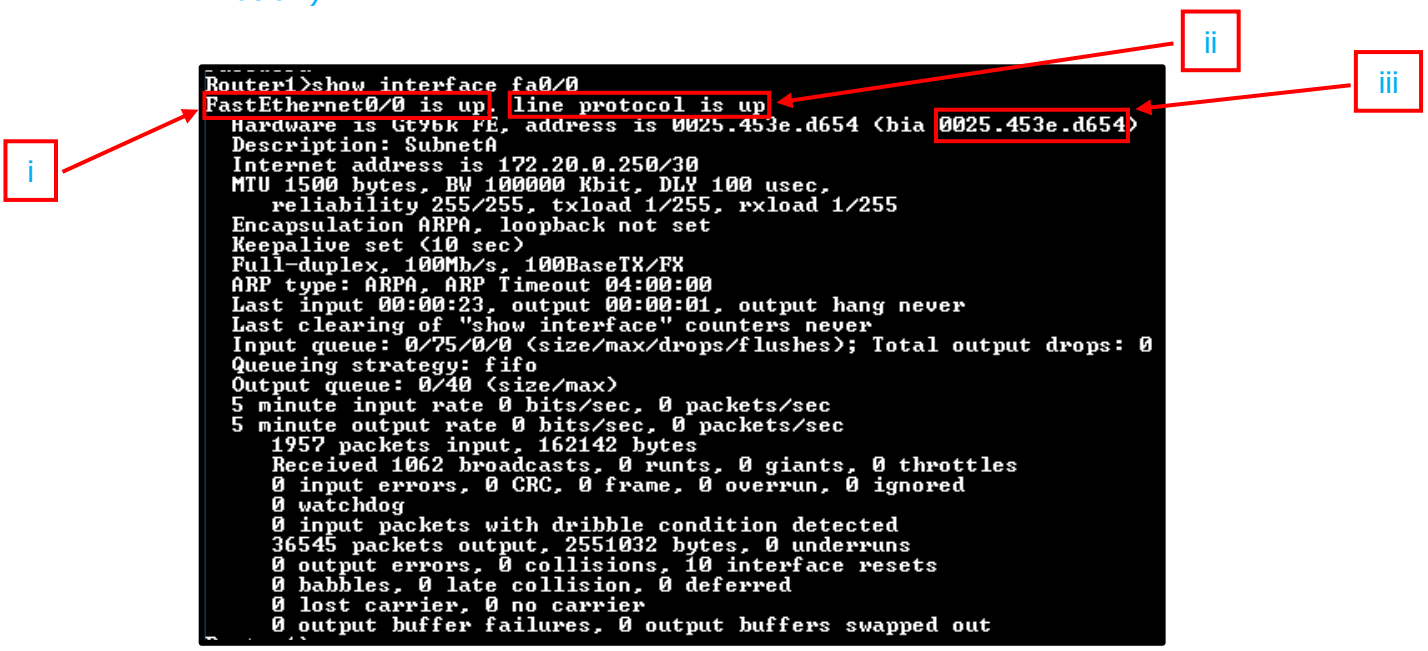


Figure 1. Various details about interface Fa0/0 on Router1 shown above. Screenshot for Fa0/1 not shown due to minor changes in details about interface Fa0/1.

c) What command to you use to display brief IP address information about each interface? Show the output of your command run.

- The command used to display brief IP address information about each interface was <show ip interface brief> while in user EXEC mode. Refer to "Figure 2" below for additional proof.

All installed physical interfaces.

Corresponding IP addresses.

Corresponding other info.

```
Router1#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
FastEthernet0/0        172.20.0.250    YES manual up                    up
FastEthernet0/1        172.20.0.126    YES manual up                    up
Serial0/0/0            unassigned      YES unset  administratively down down
Serial0/0/1            unassigned      YES unset  administratively down down
Router1#
```

Figure 2. Various details about all physical interfaces installed on Router1 shown above. Various details such as IP address for each of the installed physical interfaces are listed. 172.20.0.250 (Fa0/0) is the default gateway for Subnet A while 172.20.0.126 (Fa0/1) is the default gateway for Subnet B.

6. Configure Switch1. Configuration for Switch1 includes the following tasks:
   - Specify the switch name : Switch1
   - Specify an encrypted privileged EXEC password : cisco
   - Specify a console access password : class
   - Configure the MOTD banner.
   - Configure Switch1 interface Fa0/1, Fa0/2 and Fa0/3 (set the description).
   - Configure the management VLAN1 IP address (this includes description and L3 address).
   - Configure the default IP gateway address.

a) What command do you use to display the contents of RAM?

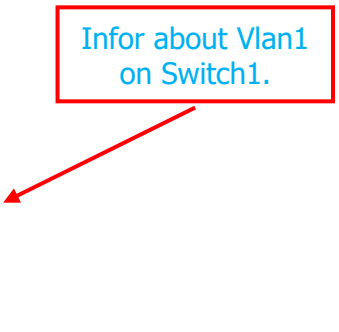
- Same as before, the command used to display the contents of RAM was <show running-config> while in privileged EXEC mode. This command is used because the running-config of the switch is stored in RAM.

Record the following configuration specifications:

i. Hostname: Switch1.
ii. MOTD banner: See output on next few pages.
iii. Interface VLAN1: See output on next few pages.
iv. Default IP gateway address: 172.20.0.126 .

[Switch1 running-config]

```
hostname Switch1
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$RMK9$oe7Nh.MlBnpo/vZz5HcD3.
!
no aaa new-model
system mtu routing 1500
ip subnet-zero
!
!
!
!
!
!
!
!
!
!
spanning-tree mode pvst
spanning-tree extend system-id
!
vlan internal allocation policy ascending
!
!
!
interface FastEthernet0/1
 description SubnetB
!
interface FastEthernet0/2
 description Host2
!
…
   <!output omitted for clarity!>
…
interface GigabitEthernet0/2
!
interface Vlan1
 description VLAN1
 ip address 172.20.0.125 255.255.255.128
 no ip route-cache
```



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```
!
ip default-gateway 172.20.0.126
ip http server
ip http secure-server
!
control-plane
!
banner motd ^C
**************************************************
*                                                *
* Network Systems Design                         *
* Day Yann Fong                                  *
* Lab 8                                          *
*                                                *
* Team: Ezra & Leo                               *
* Device: Switch1                                *
*                                                *
*~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~*
*                                                *
*                    WARNING                     *
*          UNAUTHORIZED ACCESS FORBIDDEN         *
*                                                *
*              STAY OUT OF MY SWITCH!            *
*                                                *
**************************************************
^C
!
line con 0
 password class
 login
line vty 0 4
 login
line vty 5 15
 login
!
end
```

MOTD banner on Switch1.

<End of Switch1 running-config>

b) What command do you use to display configuration information for interface VLAN1? Show the output of your command.

- The command used to display configuration information for interface VLAN1 was `<show interface VLAN1>` while in user EXEC mode. Refer to "Figure 3" below for additional proof.

Status and MAC address for VLAN1.

IP address for VLAN1.

Packet analyzer on VLAN1.

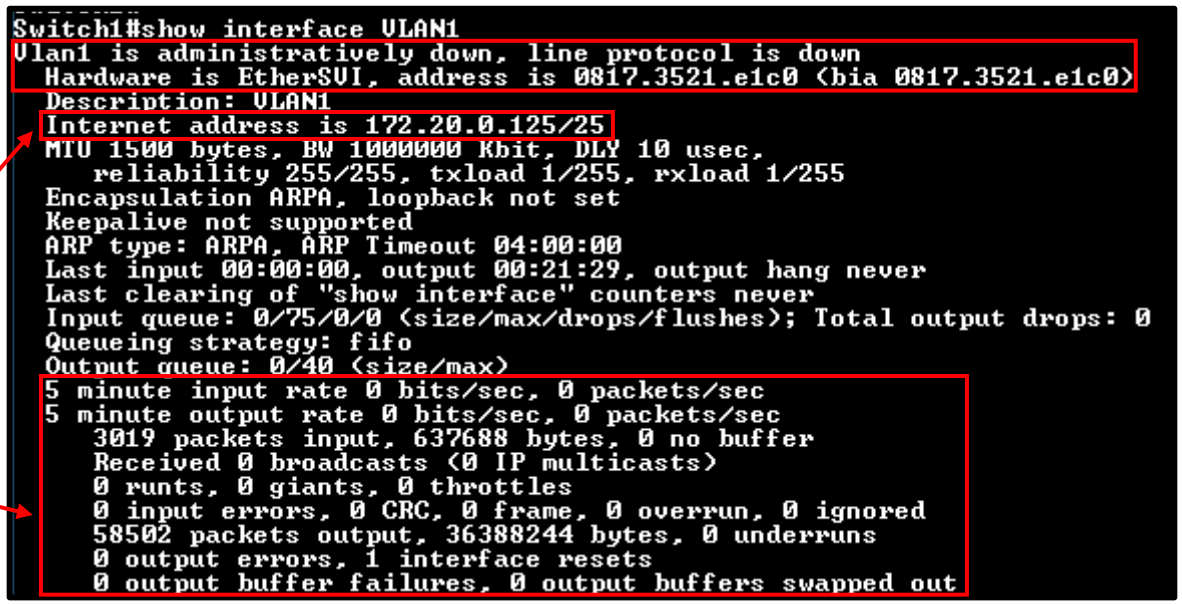

Figure 3. Various details about interface VLAN1 on Switch1 shown above. Status and line protocol shows "down" because a `<no-shutdown>` command was not issued during initial network configuration for interface VLAN1. This was corrected after the screenshot above was taken.

7. Verify your network connectivity using Windows ping command. Use the following table to methodically verify and record connectivity with each network device. Take corrective action to establish connectivity if a test fails, clearly explain any of this situation.

Perform a demo to instructor.

From	To	IP Address	Ping Results
Host1	LocalHost (127.0.0.1)	127.0.0.1	Success
Host1	NIC IP address	172.20.0.249	Success
Host1	Gateway	172.20.0.250	Success
Host2	NIC IP address	172.20.0.1	Success
Host2	Switch1	172.20.0.125	Success
Host2	Gateway	172.20.0.126	Success
Host2	Router1, Fa0/0	172.20.0.250	Success
Host2	Host1	172.20.0.249	Success

- Similar to previous labs, Windows firewall needs to be disabled or an exception has to be made in Windows firewall in order to see successful communication between Host1 to Host2 and vice versa.

8. Use **tracert** command to verify local connectivity. Tracert is a very useful tool for networking debugging and testing. From Host1, issue the tracert command to Host2 and Host3. What are your results?

- Refer to "Figure 4" below.

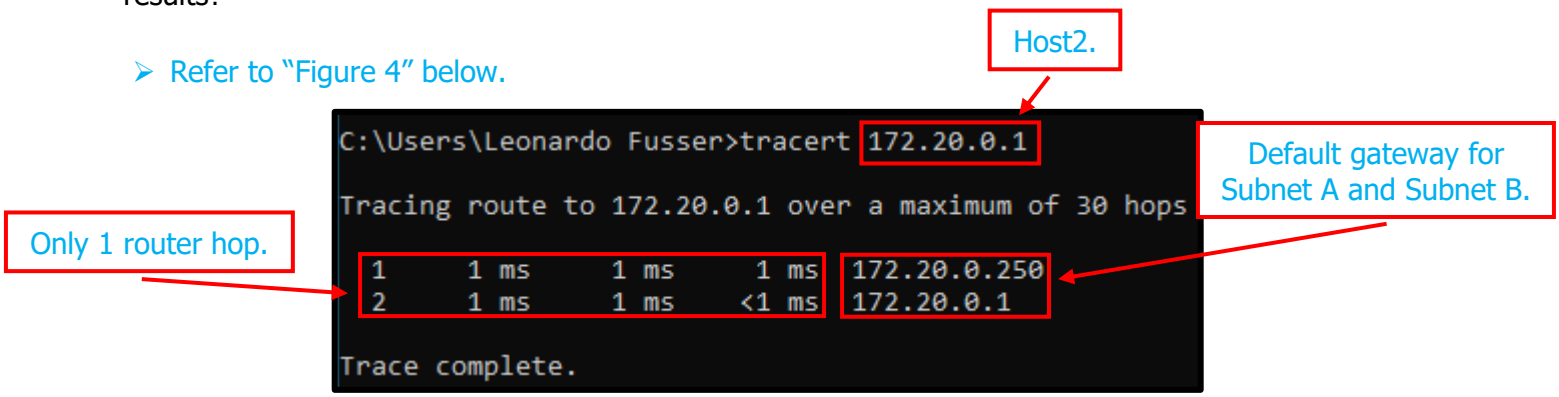

Figure 4. Results after executing tracert command in Windows command prompt on Host1. Above, tracert is being used to verify communication to Host2. There is only 1 hop since there is only 1 router in use. 172.20.0.250 is the default gateway for Subnet A (Host1 connected to it) and 172.20.0.1 is the default gateway for Subnet B (Host2 connected to it). Result above shows successful communication from Host1 to Host2. A tracert command was also executed from Host2 and the result yields the same (output is reverse of what is shown above here).

9. Verify Layer 2 connectivity. Access your Switch1 via console. Issue the command **`show mac-address-table`**. This command displays static (CPU) and dynamic, or learned, entries.
   List the MAC addresses and their corresponding switch ports in the table below. Are they static, or dynamically learned MAC addresses? Do these match your expectation? Explain.

   - Refer to "Figure 5" below.

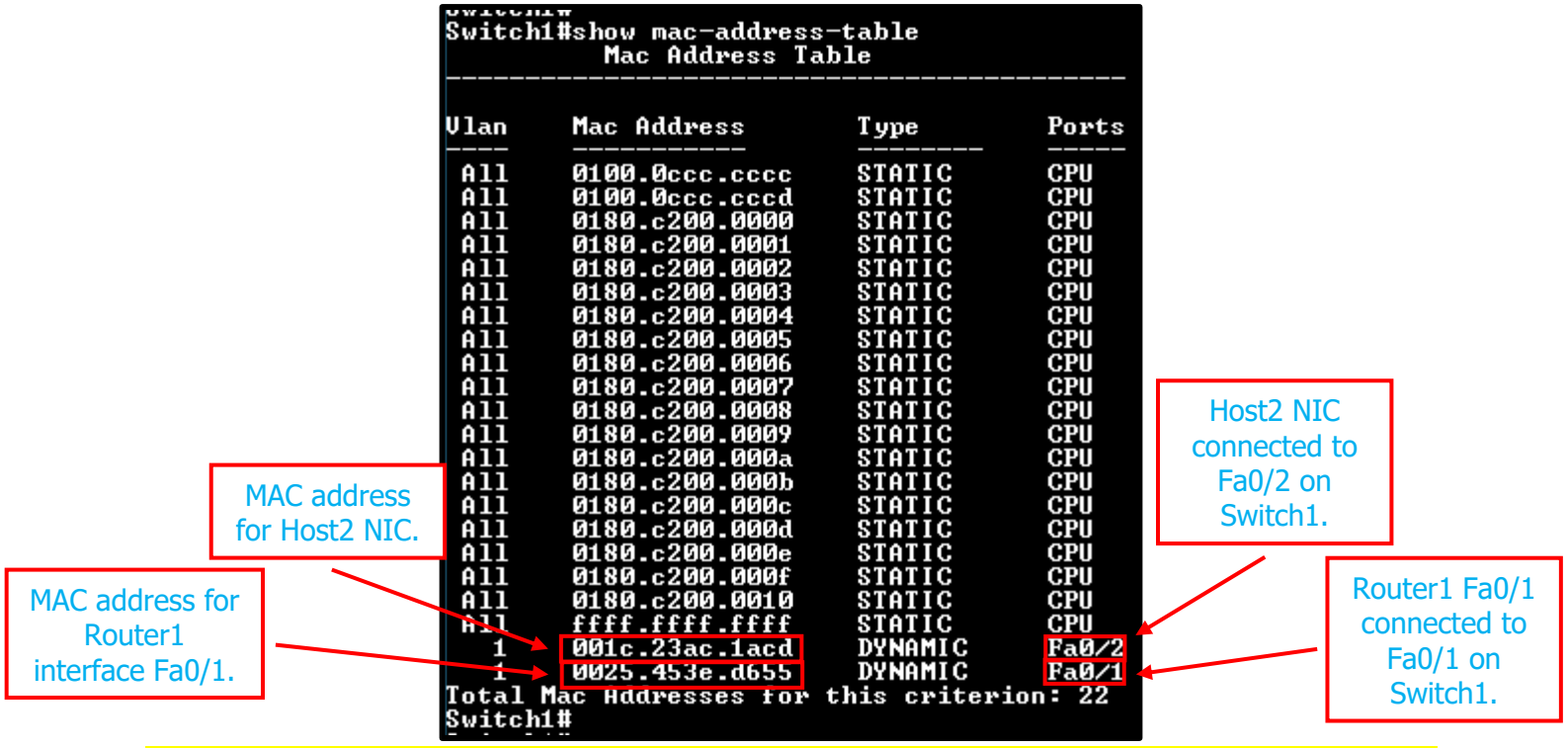

Figure 5. Output of this command shows that two out of the 24 possible MAC addresses are dynamic entries while the others are static entries. The ports that are dynamic are the only two that are being used for this lab and those are interfaces Fa0/1 and Fa0/2 on Switch1. The two MAC addresses that are listed as dynamic entries correspond to the MAC address of interface Fa0/1 on Router1 and the MAC address of the NIC on Host2. This is expected since interface Fa0/1 on Router 1 and the NIC on Host2 are directly connected to ports Fa0/1 and Fa0/2 on Switch1 respectively. When connected, the switch learned what were the MAC addresses of these two devices and the type is changed from static to dynamic (shown above). These two MAC addresses are saved on Switch1 so that it knows which frame to send to the correct port as they arrive.

10. Final cleanup of all router and switch settings. Before ending your lab session, remove the NVRAM configuration file from each device with the privileged EXEC command **`erase startup-config`**. Carefully remove all your cables.

11. Finish your lab work by including discussion/conclusion for this lab activity.

Discussion:

- To begin, we were given a network topology and we were asked to create a complete network from scratch based on the constraints given. A subnetting table was created, from a given IP address and the listed networking devices in the topology were assigned appropriate IP addresses from the subnetting table.

  Once the IP details were sorted out, we configured the Cisco Catalyst 2960 switch and the Cisco 1841 router. Tasks that needed to be done were configuring the interfaces, welcome banners, passwords and some other networking details on the switch and router. At the same time, we were asked to analyze various parameters (such as status and MAC address) about some of the physical interfaces on the switch and the router. We were also asked to save the appropriate configuration files and to include them in this report.

  For the last part, we were asked to verify network functionality of our network that we created and implemented thus far. All the networking devices and their physical interfaces were tested to ensure functionality from the side of Subnet A and the side of Subnet B. The results were recorded in a table in this report. Tests such as ping and tracert between Host1 and Host2 were done, and the results are recorded and shown in this report.

  As a final step of the last part for this lab, the local MAC address table was observed on the switch. All 24 entries were shown, and a thorough analysis was done and recorded in this lab report.

  The overall lab was a success.

Conclusion:

- Successfully designed and configured logical lab network.
- Successfully configure the logical LAN topology.
- Successfully configured and tested Cisco 1841 router.
- Successfully configured and tested Cisco Catalyst 2960 switch.
- Successfully performed various network testing to verify LAN connectivity.

Appendix – list of Cisco IOS commands used in this lab

Purpose	Command
Enter the global configuration mode.	**configure terminal** Example: Router>**enable** Router#**configure terminal** Router(config)#
Specify the name for the Cisco device.	**hostname** *name* Example: Router(config)#**hostname** **Router1** Router(config)#
Specify an encrypted password to prevent unauthorized access to the privileged EXEC mode.	**Enable secret** *password* Example: Router(config)#**enable** **secret cisco** Router(config)#
Specify a password to prevent unauthorized access to the console.	**password** *password* **login** Example: Router(config)#**line con 0** Router(config-line)#**password** **class** Router(config-line)#**login** Router(config)#
Specify a password to prevent unauthorized Telnet access. Router vty lines: 0 4 Switch vty lines: 0 15	**password** *password* **login** Example: Router(config)#**line vty 0 4** Router(config-line)#**password** **class** Router(config-line)#**login** Router(config-line)#
Configure the MOTD banner.	**Banner motd %** Example: Router(config)#**banner motd** **%** Router(config)#
Configure a Router interface. Router interface is OFF by default	Example: Router(config)#**interface Fa0/0** Router(config -if)#**description** *description* Router(config-if)#**ip address** *address mask* Router(config-if)#**no shutdown** Router(config-if)#
Switch interface is ON by default (VLAN interface is OFF by default)	Example: Switch(config)#**interface Fa0/0** Switch(config -if)#**description** *description* Switch(config)#**interface vlan1** Switch(config-if)#**ip address** *address mask* Switch(config-if)#**no shutdown** Switch(config-if)#

Switch- create a default IP gateway	Switch(config)#**ip default-gateway** *address*
Save the configuration to NVRAM.	**copy running-config startup-config** Example: Router# **copy running-config startup-config**