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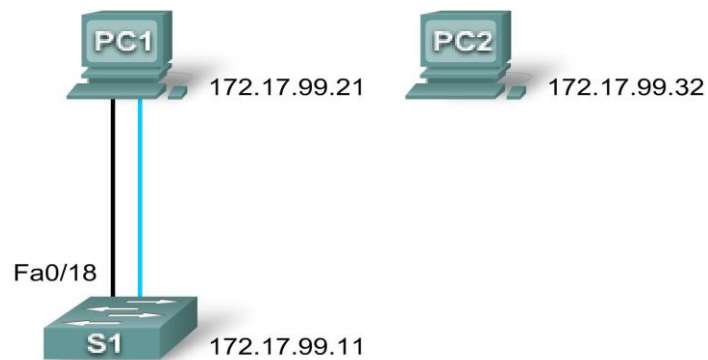
Faculty of Computer Science & Engineering

Course Title: Computer Networks Lab
Course Code: CE413L

CLO-01, PLO03

Lab 02

Basic Switch Configuration



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
PC1	NIC	172.17.99.21	255.255.255.0	172.17.99.1
PC2	NIC	172.17.99.32	255.255.255.0	172.17.99.1
S1	VLAN99	172.17.99.11	255.255.255.0	172.17.99.1

Learning Objectives

Upon completion of this lab, you will be able to:

- **Design** a network according to the topology diagram
- Clear an existing configuration on a switch
- Examine and verify the default configuration
- **Perform** a basic switch configuration, including a name and an IP address
- Configure passwords to ensure that access to the CLI is secured
- Configure switch port speed and duplex properties for an interface

Task 1: Cable, Erase, and Reload the Switch

Step 1: Cable a network.

Cable a network that is similar to the one in the topology diagram. Create a console connection to the switch,

You can use any current switch in your lab as long as it has the required interfaces shown in the topology. The output shown in this lab is from a 2960 switch. If you use other switches, the switch outputs and interface descriptions may appear different.

Note: PC2 is not initially connected to the switch. It is only used in Task 5.

Step 2: Clear the configuration on the switch.

Clear the configuration on the switch using the procedure in Appendix 1.

Task 2: Verify the Default Switch Configuration

Step 1: Enter privileged mode.

You can access all the switch commands in privileged mode. However, because many of the privileged commands configure operating parameters, privileged access should be password-protected to prevent unauthorized use. You will set passwords in Task 3.

The privileged EXEC command set includes those commands contained in user EXEC mode, as well as the **configure** command through which access to the remaining command modes are gained. Enter privileged EXEC mode by entering the **enable** command.

```
Switch>enable
Switch#
```

Notice that the prompt changed in the configuration to reflect privileged EXEC mode.

Step 2: Examine the current switch configuration.

Examine the current running configuration file.

```
Switch#show running-config
```

How many FastEthernet interfaces does the switch have? _____

How many Gigabit Ethernet interfaces does the switch have? _____

What is the range of values shown for the vty lines? _____

Examine the current contents of NVRAM:

```
Switch#show startup-config
startup-config is not present
```

Why does the switch give this response?

Examine the characteristics of the virtual interface VLAN1:

```
Switch#show interface vlan1
```

Is there an IP address set on the switch? _____

What is the MAC address of this virtual switch interface? _____

Is this interface up? _____

Now view the IP properties of the interface:

Switch#**show ip interface vlan1**

What output do you see? _____

Step 3: Display Cisco IOS information.

Examine the following version information that the switch reports.

Switch#**show version**

What is the Cisco IOS version that the switch is running? _____

What is the system image filename? _____

What is the base MAC address of this switch? _____

Step 4: Examine the FastEthernet interfaces.

Examine the default properties of the FastEthernet interface used by PC1.

Switch#**show interface fastethernet 0/18**

Is the interface up or down? _____

What event would make an interface go up? _____

What is the MAC address of the interface? _____

What is the speed and duplex setting of the interface? _____

Step 5: Examine VLAN information.

Examine the default VLAN settings of the switch.

Switch#**show vlan**

What is the name of VLAN 1? _____

Which ports are in this VLAN? _____

Is VLAN 1 active? _____

What type of VLAN is the default VLAN? _____

Step 6 Examine flash memory.

Issue one of the following commands to examine the contents of the flash directory.

Switch#**dir flash:**

or

Switch#**show flash**

Which files or directories are found?

Files have a file extension, such as .bin, at the end of the filename. Directories do not have a file extension. To examine the files in a directory, issue the following command using the filename displayed in the output of the previous command:

```
Switch#dir flash:c2960-lanbase-mz.122-25.SEE3
```

The output should look similar to this:

```
Directory of flash:/c2960-lanbase-mz.122-25.SEE3/
 6  drwx      4480   Mar 1 1993 00:04:42 +00:00  html
618 -rwx  4671175   Mar 1 1993 00:06:06 +00:00  c2960-lanbase-mz.122-25.SEE3.bin
619 -rwx      457   Mar 1 1993 00:06:06 +00:00  info
32514048 bytes total (24804864 bytes free)
```

What is the name of the Cisco IOS image file? _____

Step 7: Examine the startup configuration file.

To view the contents of the startup configuration file, issue the **show startup-config** command in privileged EXEC mode.

```
Switch#show startup-config
startup-config is not present
```

Why does this message appear? _____

Let's make one configuration change to the switch and then save it. Type the following commands:

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname S1
S1(config)#exit
S1#
```

To save the contents of the running configuration file to non-volatile RAM (NVRAM), issue the the command **copy running-config startup-config**.

```
Switch#copy running-config startup-config
Destination filename [startup-config]? (enter)
Building configuration...
[OK]
```

Note: This command is easier to enter by using the **copy run start** abbreviation.

Now display the contents of NVRAM using the **show startup-config** command.

```
S1#show startup-config
Using 1170 out of 65536 bytes
!
version 12.2
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname S1
!
```

<output omitted>

The current configuration has been written to NVRAM.

Task 3: Create a Basic Switch Configuration

Step 1: Assign a name to the switch.

In the last step of the previous task, you configured the hostname. Here's a review of the commands used.

```
S1#configure terminal
S1(config)#hostname S1
S1(config)#exit
```

Step 2: Set the access passwords.

Enter config-line mode for the console. Set the login password to **cisco**. Also configure the vty lines 0 to 15 with the password **cisco**.

```
S1#configure terminal
Enter the configuration commands, one for each line. When you are finished,
return to global configuration mode by entering the exit command or pressing
Ctrl-Z.
```

```
S1(config)#line console 0
S1(config-line)#password cisco
S1(config-line)#login
S1(config-line)#line vty 0 15
S1(config-line)#password cisco
S1(config-line)#login
S1(config-line)#exit
```

Why is the **login** command required? _____

Step 3. Set the command mode passwords.

Set the enable secret password to class. This password protects access to privileged EXEC mode.

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

Step 4. Configure the Layer 3 address of the switch.

Before you can manage S1 remotely from PC1, you need to assign the switch an IP address. The default configuration on the switch is to have the management of the switch controlled through VLAN 1.

However, a best practice for basic switch configuration is to change the management VLAN to a VLAN other than VLAN 1. The implications and reasoning behind this action are explained in the next chapter.

For management purposes, we will use VLAN 99. The selection of VLAN 99 is arbitrary and in no way implies you should always use VLAN 99.

First, you will create the new VLAN 99 on the switch. Then you will set the IP address of the switch to 172.17.99.11 with a subnet mask of 255.255.255.0 on the internal virtual interface VLAN 99.

```
S1(config)#vlan 99
S1(config-vlan)#exit
S1(config)#interface vlan99
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to down
```

```
S1(config-if)#ip address 172.17.99.11 255.255.255.0
S1(config-if)#no shutdown
S1(config-if)#exit
S1(config)#
```

Notice that the VLAN 99 interface is in the down state even though you entered the command **no shutdown**. The interface is currently down because no switchports are assigned to VLAN 99.

Assign all user ports to VLAN 99.

```
S1(config)#interface range fa0/1 - 24
S1(config-if-range)#switchport access vlan 99
S1(config-if-range)#exit
S1(config)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up
```

It is beyond the scope of this lab to fully explore VLANs. This subject is discussed in greater detail in the next chapter. However, to establish connectivity between the host and the switch, the ports used by the host must be in the same VLAN as the switch. Notice in the above output that VLAN 1 interface goes down because none of the ports are assigned to VLAN 1. After a few seconds, VLAN 99 will come up because at least one port is now assigned to VLAN 99.

Step 5: Set the switch default gateway.

S1 is a Layer 2 switch, so it makes forwarding decisions based on the Layer 2 header. If multiple networks are connected to a switch, you need to specify how the switch forwards the internetwork frames, because the path must be determined at Layer 3. This is done by specifying a default gateway address that points to a router or Layer 3 switch. Although this activity does not include an external IP gateway, assume that you will eventually connect the LAN to a router for external access. Assuming that the LAN interface on the router is 172.17.99.1, set the default gateway for the switch.

```
S1(config)#ip default-gateway 172.17.99.1
S1(config)#exit
```

Step 6: Verify the management LANs settings.

Verify the interface settings on VLAN 99.

```
S1#show interface vlan 99
Vlan99 is up, line protocol is up
  Hardware is EtherSVI, address is 001b.5302.4ec1 (bia 001b.5302.4ec1)
  Internet address is 172.17.99.11/24
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:06, output 00:03:23, 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
    4 packets input, 1368 bytes, 0 no buffer
    Received 0 broadcasts (0 IP multicast)
    0 runs, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    1 packets output, 64 bytes, 0 underruns
    0 output errors, 0 interface resets
```

0 output buffer failures, 0 output buffers swapped out

What is the bandwidth on this interface? _____

What are the VLAN states? VLAN99 is _____ Line protocol is _____

What is the queuing strategy? _____

Step 7: Configure the IP address and default gateway for PC1.

Set the IP address of PC1 to 172.17.99.21, with a subnet mask of 255.255.255.0. Configure a default gateway of 172.17.99.1. (If needed, refer to Lab 1.3.1 to configure the PC NIC.)

Step 8: Verify connectivity.

To verify the host and switch are correctly configured, ping the IP address of the switch (172.17.99.11) from PC1.

Was the ping successful? _____

If not, troubleshoot the switch and host configuration. Note that this may take a couple of tries for the pings to succeed.

Step 9: Configure the port speed and duplex settings for a FastEthernet interface.

Configure the duplex and speed settings on FastEthernet 0/18. Use the **end** command to return to privileged EXEC mode when finished.

```
S1#configure terminal
S1(config)#interface fastethernet 0/18
S1(config-if)#speed 100
S1(config-if)#duplex full
S1(config-if)#end
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/18, changed
state to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to down
%LINK-3-UPDOWN: Interface FastEthernet0/18, changed state to down
%LINK-3-UPDOWN: Interface FastEthernet0/18, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/18, changed
state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan99, changed state to up
```

The line protocol for both interface FastEthernet 0/18 and interface VLAN 99 will temporarily go down.

The default on the Ethernet interface of the switch is auto-sensing, so it automatically negotiates optimal settings. You should set duplex and speed manually only if a port must operate at a certain speed and duplex mode. Manually configuring ports can lead to duplex mismatches, which can significantly degrade performance.

Verify the new duplex and speed settings on the FastEthernet interface.

```
S1#show interface fastethernet 0/18
FastEthernet0/18 is up, line protocol is up (connected)
  Hardware is FastEthernet, address is 001b.5302.4e92 (bia 001b.5302.4e92)
  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 never, output 00:00:01, 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
  265 packets input, 52078 bytes, 0 no buffer
Received 265 broadcasts (0 multicast)
  0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
  0 watchdog, 32 multicast, 0 pause input
  0 input packets with dribble condition detected
4109 packets output, 342112 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
```

Step 10: Save the configuration.

You have completed the basic configuration of the switch. Now back up the running configuration file to NVRAM to ensure that the changes made will not be lost if the system is rebooted or loses power.

```
S1#copy running-config startup-config
Destination filename [startup-config]?[Enter] Building configuration...
[OK]
S1#
```

Step 11: Examine the startup configuration file.

To see the configuration that is stored in NVRAM, issue the **show startup-config** command from privileged EXEC mode.

```
S1#show startup-config
```

Are all the changes that were entered recorded in the file? _____

Task 4: Managing the MAC Address Table

Step 1: Record the MAC addresses of the hosts.

Determine and record the Layer 2 (physical) addresses of the PC network interface cards using the following commands:

Start > Run > cmd > ipconfig /all

PC1: _____

PC2: _____

Step 2: Determine the MAC addresses that the switch has learned.

Display the MAC addresses using the **show mac-address-table** command in privileged EXEC mode.

```
S1#show mac-address-table
```

How many dynamic addresses are there? _____

How many MAC addresses are there in total? _____

Does the dynamic MAC address match the PC1 MAC address? _____

Step 3: List the show mac-address-table options.

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

How many options are available for the **show mac-address-table** command? _____

Show only the MAC addresses from the table that were learned dynamically.

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

How many dynamic addresses are there? _____

View the MAC address entry for PC1.

S1#**show mac-address-table address** <PC1 MAC here>

Step 4: Clear the MAC address table.

To remove the existing MAC addresses, use the **clear mac-address-table** command from privileged EXEC mode.

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

Step 5: Verify the results.

Verify that the MAC address table was cleared.

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

How many static MAC addresses are there? _____

How many dynamic addresses are there? _____

Step 6: Examine the MAC table again.

More than likely, an application running on your PC1 has already sent a frame out the NIC to S1. Look at the MAC address table again in privileged EXEC mode to see if S1 has relearned the MAC address for PC1.

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

How many dynamic addresses are there? _____

Why did this change from the last display? _____

If S1 has not yet relearned the MAC address for PC1, ping the VLAN 99 IP address of the switch from PC1 and then repeat Step 6.

Step 7: Set up a static MAC address.

To specify which ports a host can connect to, one option is to create a static mapping of the host MAC address to a port.

Set up a static MAC address on FastEthernet interface 0/18 using the address that was recorded for PC1 in Step 1 of this task. The MAC address **00e0.2917.1884** is used as an example only. You must use the MAC address of your PC1, which is different than the one given here as an example.

```
S1(config)#mac-address-table static 00e0.2917.1884 vlan 99 interface
fastethernet 0/18
```

Step 8: Verify the results.

Verify the MAC address table entries.

```
S1#show mac-address-table
```

How many total MAC addresses are there? _____

How many static addresses are there? _____

Step 10: Remove the static MAC entry.

To complete the next task, it will be necessary to remove the static MAC address table entry. Enter configuration mode and remove the command by putting a **no** in front of the command string.

Note: The MAC address 00e0.2917.1884 is used in the example only. Use the MAC address for your PC1.

```
S1(config)#no mac-address-table static 00e0.2917.1884 vlan 99 interface
fastethernet 0/18
```

Step 10: Verify the results.

Verify that the static MAC address has been cleared.

```
S1#show mac-address-table
```

How many total static MAC addresses are there? _____

Task 5 Configuring Port Security

Step 1: Configure a second host.

A second host is needed for this task. Set the IP address of PC2 to 172.17.99.32, with a subnet mask of 255.255.255.0 and a default gateway of 172.17.99.1. Do not connect this PC to the switch yet.

Step 2: Verify connectivity.

Verify that PC1 and the switch are still correctly configured by pinging the VLAN 99 IP address of the switch from the host.

Were the pings successful? _____

If the answer is no, troubleshoot the host and switch configurations.

Step 3: Copy the host MAC addresses.

Write down the MAC addresses from Task 4, Step 1.

PC1 _____

PC2 _____

Step 4: Determine which MAC addresses that the switch has learned.

Display the learned MAC addresses using the **show mac-address-table** command in privileged EXEC mode.

```
S1#show mac-address-table
```

How many dynamic addresses are there? _____

Does the MAC address entry match the PC1 MAC address? _____

Step 5: List the port security options.

Explore the options for setting port security on interface FastEthernet 0/18.

```
S1# configure terminal
S1(config)#interface fastethernet 0/18
S1(config-if)#switchport port-security ?
aging          Port-security aging commands
mac-address    Secure mac address
maximum        Max secure addresses
violation      Security violation mode
<cr>
```

```
S1(config-if)#switchport port-security
```

Step 6: Configure port security on an access port.

Configure switch port FastEthernet 0/18 to accept only two devices, to learn the MAC addresses of those devices dynamically, and to block traffic from invalid hosts if a violation occurs.

```
S1(config-if)#switchport mode access
S1(config-if)#switchport port-security
S1(config-if)#switchport port-security maximum 2
S1(config-if)#switchport port-security mac-address sticky
S1(config-if)#switchport port-security violation protect
S1(config-if)#end
```

Step 7: Verify the results.

Show the port security settings.

```
S1#show port-security
```

How many secure addresses are allowed on FastEthernet 0/18? _____

What is the security action for this port? _____

Step 8: Examine the running configuration file.

```
S1#show running-config
```

Are there statements listed that directly reflect the security implementation of the running configuration?

Step 9: Modify the port security settings on a port.

On interface FastEthernet 0/18, change the port security maximum MAC address count to 1 and to shut down if a violation occurs.

```
S1(config-if)#switchport port-security maximum 1
S1(config-if)#switchport port-security violation shutdown
```

Step 10: Verify the results.

Show the port security settings.

```
S1#show port-security
```

Have the port security settings changed to reflect the modifications in Step 9? _____

Ping the VLAN 99 address of the switch from PC1 to verify connectivity and to refresh the MAC address table. You should now see the MAC address for PC1 “stuck” to the running configuration.

```
S1#show run
Building configuration...

<output omitted>
!
interface FastEthernet0/18
  switchport access vlan 99
  switchport mode access
  switchport port-security
  switchport port-security mac-address sticky
  switchport port-security mac-address sticky 00e0.2917.1884
  speed 100
  duplex full
!
<output omitted>
```

Step 11: Introduce a rogue host.

Disconnect PC1 and connect PC2 to port FastEthernet 0/18. Ping the VLAN 99 address 172.17.99.11 from the new host. Wait for the amber link light to turn green. Once it turns green, it should almost immediately turn off.

Record any observations: _____

Step 12: Show port configuration information.

To see the configuration information for just FastEthernet port 0/18, issue the following command in privileged EXEC mode:

```
S1#show interface fastethernet 0/18
```

What is the state of this interface?

FastEthernet0/18 is _____ Line protocol is _____

Step 13: Reactivate the port.

If a security violation occurs and the port is shut down, you can use the **no shutdown** command to reactivate it. However, as long as the rogue host is attached to FastEthernet 0/18, any traffic from the host disables the port. Reconnect PC1 to FastEthernet 0/18, and enter the following commands on the switch:

```
S1# configure terminal
```

```
S1(config)#interface fastethernet 0/18  
S1(config-if)# no shutdown  
S1(config-if)#exit
```

Note: Some IOS version may require a manual **shutdown** command before entering the **no shutdown** command.

Step 14: Cleanup

Unless directed otherwise, clear the configuration on the switches, turn off the power to the host computer and switches, and remove and store the cables.

Appendix 1

Erasing and Reloading the Switch

For the majority of the labs in Exploration 3, it is necessary to start with an unconfigured switch. Using a switch with an existing configuration may produce unpredictable results. These instructions show you how to prepare the switch prior to starting the lab. These instructions are for the 2960 switch; however, the procedure for the 2900 and 2950 switches is the same.

Step 1: Enter privileged EXEC mode by typing the enable command.

If prompted for a password, enter **class**. If that does not work, ask the instructor.

```
Switch>enable
```

Step 2: Remove the VLAN database information file.

```
Switch#delete flash:vlan.dat
Delete filename [vlan.dat]?[Enter]
Delete flash:vlan.dat? [confirm] [Enter]
```

If there is no VLAN file, this message is displayed:

```
%Error deleting flash:vlan.dat (No such file or directory)
```

Step 3: Remove the switch startup configuration file from NVRAM.

```
Switch#erase startup-config
```

The responding line prompt will be:

```
Erasing the nvram filesystem will remove all files! Continue? [confirm]
```

Press Enter to confirm.

The response should be:

```
Erase of nvram: complete
```

Step 4: Check that the VLAN information was deleted.

Verify that the VLAN configuration was deleted in Step 2 using the **show vlan** command.

If the VLAN information was successfully deleted in Step 2, go to Step 5 and restart the switch using the **reload** command.

If previous VLAN configuration information is still present (other than the default management VLAN 1), you must power-cycle the switch (hardware restart) instead of issuing the **reload** command. To power-cycle the switch, remove the power cord from the back of the switch or unplug it, and then plug it back in.

Step 5: Restart the software.

Note: This step is not necessary if the switch was restarted using the power-cycle method.

At the privileged EXEC mode prompt, enter the **reload** command.

```
Switch(config)#reload
```

The responding line prompt will be:

```
System configuration has been modified. Save? [yes/no]:
```

Type **n** and then press **Enter**.

The responding line prompt will be:

```
Proceed with reload? [confirm] [Enter]
```

The first line of the response will be:

```
Reload requested by console.
```

After the switch has reloaded, the line prompt will be:

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

Type **n** and then press **Enter**.

The responding line prompt will be:

```
Press RETURN to get started! [Enter]
```