DEPARTMENT OF TELECOMMUNICATION ENGINEERING
MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO
COMPUTER COMMUNICATION & NETWORKING
(1st Semester, 4th Year) LAB HANDOUT # 4

Name :karan _____ Roll No: __20ES62_____

Score:_____ Signature of the Lab Tutor:_____ Date: _____

OBJECTIVES

#	Topic	#. Of Lectures	CLO	Taxonomy level
4	To **make** console and telnet connections with network devices (e.g., switch and router) using opensource terminal emulator software.	3	2	P5

OUTCOME(S)

a. An ability to apply knowledge of math, science, and engineering	PLO1: Engineering Knowledge:
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	**PLO5:** Modern Tool Usage

RUBRICS:

Performance Metric	Exceeds expectation (4-5)	Meets expectations (2-3)	Does not meet expectations (0-1)	Score
Knowledge and application [PLO1]	Applies the appropriate knowledge and concepts to the problem with accuracy and proficiency; shows precise understanding of these knowledge and concepts.	Applies the relevant knowledge and concept to the problem, possibly in a roundabout way; understands the major points of the knowledge, with possible misunderstanding or failure to recall minor points;	Fails to apply relevant knowledge and concepts to the problem; misunderstands or fails to recall critical points.	
Modern Tool Usage [PLO5]	Computer and software are extensively used in the course	Computer and software are somewhat utilized, effort was put into learning new software	Computer and software are not utilized, no attempt was made at learning new software	
			Total Score	

EQUIPMENT

- Catalyst 2950 /1920 Switch
- 2 PC's with NIC installed
- 2 Straight through UTP cables
- RJ-45 TO DB-9 adapter
- RJ-45 TO RJ 45 rollover cable <u>DISCUSSION & CONFIGRATION:</u>

Navigation between different switch command modes

Cisco switches run on proprietary OS known as Cisco IOS. IOS is a group of commands used for monitoring, configuring and maintaining cisco devices. For security and easy administration, IOS commands are divided in the set of different command modes. Each command mode has its own set of commands. Which commands are available to use, depend upon the mode we are in.

Navigation between Cisco IOS modes

Mode	Purpose	Prompt	Command to enter	Command to exit
User EXEC	Allow you to connect with remote devices, perform basic tests, temporary change terminal setting and list system information	Router >	Default mode after booting. Login with password, if configured.	Use exit command
Privileged EXEC	Allow you to set operating parameters. It also includes high level testing and list commands like show, copy and debug.	Router #	Use enable command from user exec mode	Use exit command
Global Configuration	Contain commands those affect the entire system	Router(config)#	Use configure terminal command from privileged exec mode	Use exit command

Interface Configuration	Contain commands those modify the operation of an interface	Router(configif)#	Use interface type number command from global configuration mode	Use exit command to return in global configuration mode
Sub-Interface Configuration	Configure or modify the virtual interface created from physical interface	Router(configsubif)	Use interface type sub interface number command from global configuration mode or interface configure mode	Use exit to return in previous mode. Use end command to return in privileged exec mode.
ROMMON	If router automatically enter in this mode, then it indicates that it fails to locate a valid IOS image. Manual entrance in this mode Allow you to perform low-level diagnostics.	ROMMON>	Enter reload command from privileged exec mode. Press CTRL + C key combination during the first 60 seconds of booting process	Use exit command

How to get help on Cisco Switch command mode

Switch provides two types of context sensitive help, word help and command syntax help.

Word help

Word help is used to get a list of available commands that begin with a specific letter. For example, if we know that our command begins with letter e, we can hit enter key after typing e? at command prompt. It will list all possible commands that begin with letter e.

```
Switch>
Switch>e?
enable  exit
Switch>e
```

We can list all available commands, if we don't know the initials of our command. For example, to list all available commands at User exec mode, just type? at command prompt and hit enter key.

```
Switch>?
Exec commands:
  <1-99>      Session number to resume
  connect     Open a terminal connection
  disable     Turn off privileged commands
  disconnect  Disconnect an existing network connection
  enable      Turn on privileged commands
  exit        Exit from the EXEC
  logout      Exit from the EXEC
  ping        Send echo messages
  resume      Resume an active network connection
  show        Show running system information
  telnet      Open a telnet connection
  terminal    Set terminal line parameters
  traceroute  Trace route to destination
Switch>
```

Command syntax help

Command syntax help can be used to get the list of keyword, commands, or parameters
that are available starting with the keywords that we had already entered. Enter? (Question
mark) after hitting Space key and prompt will return with the list of available command
options. For example, to know the parameters required by show ip command type show ip?
and prompt will return with all associate parameters. If prompt returns with <CR> only as
an option, that means switch does not need any additional parameters to complete the
command. You can execute the command in current condition.

```
Switch>show ip ?
  arp        IP ARP table
  interface  IP interface status and configuration
  ssh        Information on SSH
Switch>show ip arp
<cr>
Switch>
```

Lab equipment requirements

To perform this lab, you need 1 Cisco Catalyst 2950 Switch and at least 1 PC. However,
most of the commands will work on other switch models as well. We are going to use two
different PCs but they can be one and the same physical PC. You will need to connect them
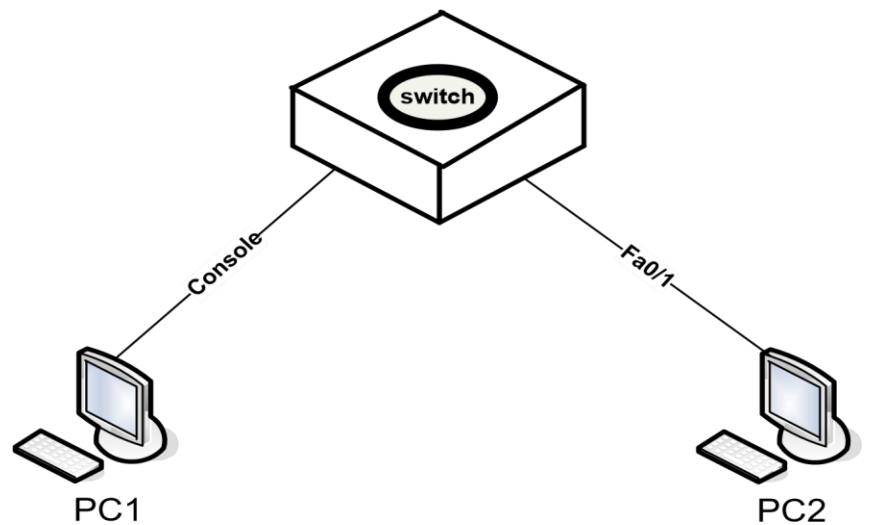as depicted in the following the network diagram:

Fig: Network Diagrm

Connect the console cable to the to the console port on the switch and the other end to the serial port of PC1. Connect PC2 to first Fast Ethernet port (i.e. FA0/1) using an UTP/STP cable. PC1 must have a terminal client (i.e. Windows HyperTerminal) installed, and PC2 must be able to setup a telnet connection.

Configuring the Switch

Before you start with the configuration of the switch, clear the switch configuration by using the **erase startup-config command** or the erase nvram: command in Privileged EXEC mode, and then use the reload command to reboot the switch. After the switch rebooted, the following message will be displayed:

% Please answer 'yes' or 'no'.
Would you like to enter the initial configuration dialog? [yes/no]

Type no and press ENTER.

Press ENTER when the message Press RETURN to get started appears.

Type enable at the **Switch>** command prompt.

Switch>enable
a.   What prompt does *enable* command display and what does it mean? It is used to enable the switch to configure it based on the requirements.

STEP 1: Change the switch's host name to SWR-2024

Enter configuration mode using the following command:
Switch#configure terminal

a. Enter **configure terminal** at the privilege mode prompt.
   Switch#**configure terminal**
b. Which prompt switch will display after typing above command?
   Switch(config)# this prompt will displayed after typing command.
   c. What does this prompt mean?
  This means the switch is in configuration mode and it is ready to be configured.

Change the host name of the switch to **"SWR-2024"** using the following command:
Switch(config)#hostname SWR-2024

a. Which prompt this Switch will display? It will display, SWR-2024(config)#.
b. What does this prompt mean?
Using above command the switch's hostname has been changed to SWR-2024.
c. Why this change in the prompt is required?
If there are wide variety of switches in the network, and each switch has its own dedicated functionality. So for differentiating one switch from others and to recognize the functionality one can set its hostname with respect to its functionality.

STEP 2: Configure passwords.

First set the enable password to cisco using the following command:
SWR2024(config)#enable password cisco

Next, set the enable secret to cisco123 using the following command:
SWR2024(config)#enable secret cisco123

Next, set the password for all telnet lines to 'cisco456' using the following commands:
SWR-2024 (config)#line vty 0 15 SWR-2024 (config-line)#password cisco456 SWR-2024 (config-line)#login
Although the enable secret is encrypted, other passwords stored in the switch's configuration are still in clear text like enable password. You can see this by returning to Privileged EXEC mode and running the show running config:

SWR-2024 (config)#end (or press CTRL-Z) SWR-2024#show running-config

Notice the enable secret is replaced by a hashed version, for example: **enable secret 5 1iUjJ$cDZ03KKGh7mHfX2RSbDq**

When you log on with the enable *secret*, the switch calculates the hash value again and compares it with the hash value stored in the configuration. If they match, you typed in the correct secret and will enter Privileged EXEC mode. You can configure a password by using the enable password command instead, but in contrary to the enable secret, the enable password is not encrypted by default. If an enable password *and* an enable secret are configured, you will need to enter the enable secret to logon. In other words, there's no need to configure an enable password if you configured an enable secret.

Near the end of the configuration, you will notice the vty password you just configured, and that it is stored in plain text format. To ensure this password, as well as others such as the console password are also encrypted, use the service password-encryption command in Global configuration mode:

SWR-2024#configure terminal SWR-2024(config)#service password-encryption

If you would run the show running-config command in Privileged EXEC mode again, you will notice the vty password is now also encrypted. For example: **1511021F07257F717E**

You can also set a password on the aux or console connection, for example to set the password to cisco789:

SWR-2024 (config)#line con 0 SWR-2024 (config-line) #password cisco789 SWR-2024 (config-line) #login

a. At Privileged EXEC mode type **'show running-config'** and follow the details.

b. Is there an encrypted password?
Mention Yes there was encrypted password , 7 870154B1A4D5D

c. Are there any other passwords?
Mention 5 1mERr$lUHzHNTEX78Sj.QsAglF./

d. Are any of the other passwords encrypted?
Mention enable to see any other one except above two.

STEP 3: Configure Banner on switch

The banner or MOTD (message of the day) is to display a temporary notice to users, such as issues with system availability. However, because the message displays when a user

connects to the device prior to login, most network administrators are now using it to display legal notices regarding access to the switch, such as unauthorized access to this device is prohibited and violators will be prosecuted to the full extent of the law and other such cheery endearments.

Use the following commands to set the banner or motd on switch which alerts unauthorized users not to access the switch.

SWR-2024(config)#banner motd #this device is for authorized person only if you Haven't been provided with the permission to access this device   Exit at once#

Notice that each of the banner lines ends with a # symbol; this is a delimiter to identify the end of the message. You can specify any character you want, but the character you choose is the one you will use to end the banner message. Here is what these messages look like when you connect to the switch:

STEP 4: show mac-address-table

Switch stores MAC address of devices those are attached with its interfaces in CAM table. We can use show mac-address-table command to list all learned devices.

```
Switch>enable
Switch#show mac-address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

  1     0001.643a.5501    DYNAMIC     Gig1/1
  1     0003.e439.2190    DYNAMIC     Gig1/1
  1     00e0.8f33.8539    DYNAMIC     Fa0/1
Switch#
```

a. How switches use this table to forward data?
Mention_____
b. In mac   table   under type   column   what   does   dynamic   refers
   to?   Mention_____

How to clear mac address table

Switch stores MAC addresses in MAC address table. Gradually it could be full. Once it full, switch automatically starts removing old entries. You can also clear these tables manually from privileged exec mode. To delete all entries use following command

To delete only dynamic entries use
switch#clear mac address-table dynamic

How to add static MAC address in CAM table

switch#clear mac address-table

For security purpose sometime we have to add mac address in CAM table manually. To add static MAC address in CAM table use following command

Switch(config)#mac address-table static aaaa.aaaa.aaaa vlan 1 interface fastethernet 0/1

In above command we entered an entry for static MAC address aaaa.aaaa.aaaa assigned to FastEnternet 0/1 with default VLAN1. STEP 5: How to set duplex mode

Switch automatically adjust duplex mode depending upon remote device. We

could change this mode with any of other supported mode. For example, to

Switch(config)# #interface fastethernet 0/1
Switch(config-if)#duplex full

To use half duplex use
Switch(config)# #interface fastethernet 0/1
Switch(config-if)#duplex half

STEP 5: Display interface status

force switch to use full duplex mode use show interface command displays

information about interfaces. Without argument it would list all interfaces. To get

information about specific interface we need to pass its interface number as an argument.

For example, to view details about FastEthernet 0/1, use show interface fastethernet 0/1.

First line from output below provides information about the status of interface.

FastEthernet0/1 is up, line protocol is up (connected), The first up indicates the status of

the physical layer, and the second up indicates to the status of the data link layer.

```
Switch#show interface
FastEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0060.2f9d.9101 (bia 0060.2f9d.9101
 BW 100000 Kbit, DLY 1000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s
  input flow-control is off, output flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
 --More--
Switch#show interface fastethernet 0/1
FastEthernet0/1 is up, line protocol is up (connected)
  Hardware is Lance, address is 0060.2f9d.9101 (bia 0060.2f9d.9101
 BW 100000 Kbit, DLY 1000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s
  input flow-control is off, output flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:08, output 00:00:05, output hang never
 --More--  |
```

a. What will be status of line protocol if at data link layer we use two different protocols? Mention_____

Possible interface status
✦   up and up :- Interface is operational.

✦   up and down :- Its data link layer problem.

✦   down and down :- Its physical layer problem.

✦   Administratively down Interface is disabled with shutdown command.

Possible values for physical layer status

✦   Up :- Switch is sensing physical layer signal.

✦   Down :- Switch is not sensing physical layer signal. Possible reasons could be cable is not connected, wrong cable type is used and remote end device is turned off.

✦   Administratively down :- Interface is disabled by using shutdown command.

Possible values for data link layer status

✦   Up :- The data link layer is operational.

✦ Down :- The data link layer is not operational. Possible reasons could be a disabled physical layer, missed keep alives on a serial link, no clocking or an incorrect encapsulation type.

show ip interface brief is a extremely useful command to get quick overview of all interfaces on switch. It lists their status including IP address and protocol.

```
Switch>enable
Switch#show ip interface brief
Interface            IP-Address      OK? Method Status    Protocol
FastEthernet0/1      unassigned      YES manual up        up
FastEthernet0/2      unassigned      YES manual up        up
FastEthernet0/3      unassigned      YES manual down      down
FastEthernet0/4      unassigned      YES manual down      down
--More--
```

STEP 5: Saving the configuration

Saving the configuration on a modern Cisco Catalyst switch running IOS software works the same as on Cisco routers. This means you have to copy the running configuration (in RAM) to the startup configuration (in NVRAM) by using the following command in Privileged EXEC mode:

SWR-2024#copy running-config startup-config

If you run the show startup-config command, you should get the same output as the show running-config command. The dir nvram: command should show the startup-config file with a size greater than zero. The configuration is also stored in the config.text file in flash, which content you can see by using the show flash command.STEP 6: Display switch hardware and firmware information

The show version command allows you to display information about the switch's hardware and IOS. The first half shows information about the IOS in flash, the boot loader on ROM, the uptime, what caused the switched to reboot, and the IOS edition it runs. The second half shows information about the hardware, including the interfaces, the memory and serial numbers.

SWR-2024#show version

```
Cisco Internetwork Operating System Software
IOS (tm) C2950 Software (C2950-I6Q4L2-M), Version 12.1(9)EA1
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Wed 24-Apr-02 06:57 by antonino
Image text-base: 0x80010000, data-base: 0x804E8000

ROM: Bootstrap program is CALHOUN boot loader

Switch uptime is 2 hours, 40 minutes
System returned to ROM by power-on
System restarted at 06:43:48 UTC Tue Aug 8 2006
System image file is "flash:/c2950-i6q412-mz.121-9.EA1.bin"

cisco WS-C2950-12 (RC32300) processor (revision F0) with 20815K bytes of memory.
Processor board ID FHK0637X0AV
Last reset from system-reset
Running Standard Image
12 FastEthernet/IEEE 802.3 interface(s)

32K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address: 00:0A:F4:67:C1:80
Motherboard assembly number: 73-5782-11
Power supply part number: 34-0965-01
Motherboard serial number: FOC06360ZK2
Power supply serial number: PHI063403L1
Model revision number: F0
Motherboard revision number: A0
Model number: WS-C2950-12
System serial number: FHK0637X0AV
Configuration register is 0xF
```

a. Enter the **show version** command. The Switch will return information about the IOS that is running in RAM.

b. Write the name of the IOS version? _____

c. What is the name of the system image (IOS) file?

_____ d.
Where was the switch IOS image booted from?

_____

e. How many Ethernet interfaces does this switch have? _____

Lab Exercise:

1. Submit a lab with performing a simple task connect a pc with switch using console connection and configure telnet connection. Using Telnet configure switch with all basic configuration we learnt in this Lab.

   Change the switch's host name-&- Configure passwords

```
Terminal

state to up


Switch>
Switch>
Switch>
Switch>en
Switch#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#hostname 19ES48Sw
19ES48Sw(config)#line consol 0
19ES48Sw(config-line)#password 19es48
19ES48Sw(config-line)#login
19ES48Sw(config-line)#exit
19ES48Sw(config)#exit
19ES48Sw#
%SYS-5-CONFIG_I: Configured from console by console

19ES48Sw#exit







19ES48Sw con0 is now available
```

Configuring the password on the Telnet.

```
Press RETURN to get started!



User Access Verification

Password:

19ES48Sw>en
19ES48Sw#config t\
                   ^
% Invalid input detected at '^' marker.

19ES48Sw#
19ES48Sw#config t
Enter configuration commands, one per line.  End with CNTL/Z.
19ES48Sw(config)#line vty 0 15
19ES48Sw(config-line)#password 19es48
19ES48Sw(config-line)#login
19ES48Sw(config-line)#exit
19ES48Sw(config)#exit
19ES48Sw#
%SYS-5-CONFIG_I: Configured from console by console

19ES48Sw#
```

```
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1
 no ip address
 shutdown
!
!
!
line con 0
 password 19es48
 login
!
line vty 0 4
 password 19es48
 login
line vty 5 15
 password 19es48
 login
!
!
!
end

19ES48Sw#
```

Enabling Service Password Encryption:

```
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1
 no ip address
 shutdown
!
!
!
!
line con 0
 password 7 0870154B1A4D5D
 login
!
line vty 0 4
 password 7 0870154B1A4D5D
 login
line vty 5 15
 --More--
```

Configure Banner on switch

```
19ES48Sw#config t
Enter configuration commands, one per line.  End with CNTL/Z.
19ES48Sw(config)#banner motd#This device is not allowed to carry at home#
                             ^
% Invalid input detected at '^' marker.

19ES48Sw(config)#banner motd #This device is not allowed to carry at home#
19ES48Sw(config)#exit
19ES48Sw#
%SYS-5-CONFIG_I: Configured from console by console

19ES48Sw#exit
```

```
This device is not allowed to carry at home

User Access Verification

Password:
% Password:   timeout expired!













 Press RETURN to get started!

```

show mac-address-table

```
19es48Sw(config)#exit
19es48Sw#
%SYS-5-CONFIG_I: Configured from console by console

19es48Sw#sh mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type        Ports
----    -----------       --------    -----

19es48Sw#
```

show ip interface brief

```
19es48Sw#sh mac address-table
          Mac Address Table
-------------------------------------------

Vlan    Mac Address       Type         Ports
----    -----------       --------     -----

19es48Sw#sh ip int br
Interface               IP-Address      OK? Method Status
Protocol
FastEthernet0/1         unassigned      YES manual up                up
FastEthernet0/2         unassigned      YES manual down              down
FastEthernet0/3         unassigned      YES manual down              down
FastEthernet0/4         unassigned      YES manual down              down
FastEthernet0/5         unassigned      YES manual down              down
FastEthernet0/6         unassigned      YES manual down              down
FastEthernet0/7         unassigned      YES manual down              down
FastEthernet0/8         unassigned      YES manual down              down
FastEthernet0/9         unassigned      YES manual down              down
FastEthernet0/10        unassigned      YES manual down              down
FastEthernet0/11        unassigned      YES manual down              down
FastEthernet0/12        unassigned      YES manual down              down
FastEthernet0/13        unassigned      YES manual down              down
FastEthernet0/14        unassigned      YES manual down              down
FastEthernet0/15        unassigned      YES manual down              down
FastEthernet0/16        unassigned      YES manual down              down
FastEthernet0/17        unassigned      YES manual down              down
FastEthernet0/18        unassigned      YES manual down              down
FastEthernet0/19        unassigned      YES manual down              down
FastEthernet0/20        unassigned      YES manual down              down
FastEthernet0/21        unassigned      YES manual down              down
 --More--
```

Saving the configuration

```
19es48Sw#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
19es48Sw#
```

FINAL CHECK LIST
1. Return all equipment and materials to their proper storage area.
2. Submit your answers to question, before the next laboratory.

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MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY, JAMSHORO
COMPUTER COMMUNICATION & NETWORKING
(2nd Semester, 3rd Year) LAB HANDOUT # 4