National University of Sciences and Technology (NUST)
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EE-357 Computer and Communication Networks

Lab 5 - Router Administrative Function and LAN Connections

		CLO5-PLO9		
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EXPERIMENT NO 5

PART – ½

Router Administrative Function

2 OBJECTIVE

This lab exercise is designed for understanding cisco router advanced configurations and Administrative Functions.

3 RESOURCES REQUIRED

- Computer
- Packet Tracer (version 5 or higher)

4 INTRODUCTION

4.1 ROUTER ADMINISTRATIVE FUNCTIONS

Even though this section isn't critical to making a router or switch work on a network, it is really important; in it, you will go through configuring commands that will help you administrate your network.

The administrative functions that you can configure on a router and switch are

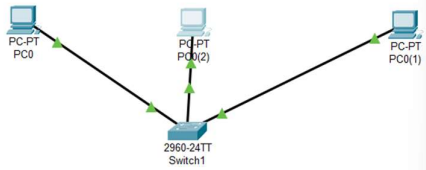
- Hostnames
- Banners
- Setting Passwords
- Interface Descriptions

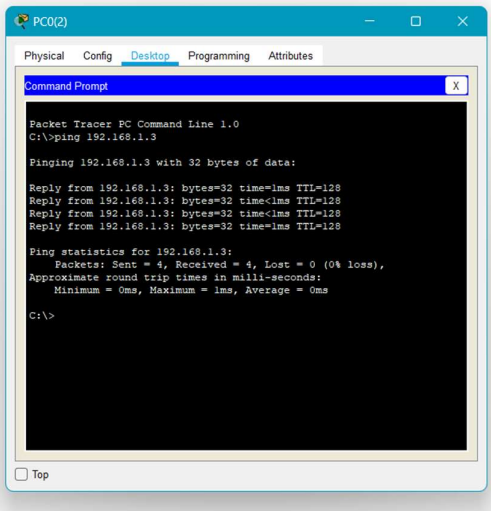
Before proceeding to the administrative functions, perform the following task which serves as a review for Packet Tracer.

5 LAB TASK 1:

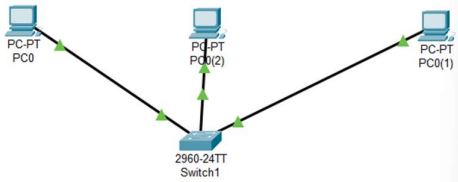
Open CISCO Packet Tracer, place a switch and connect three PCs to it. Then, assign the IP addresses to the PCs and verify the connections by using the ping command. Submit screenshots of packet tracer window as well as the command terminal showing a successful ping and a failed ping.

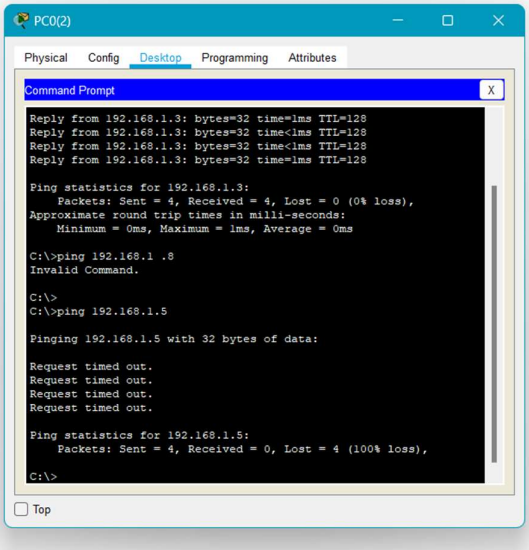
Successful ping:





Failed Ping





6 HOSTNAMES

You can set the identity of the router with the hostname command. This is only locally significant, which means that it has no bearing on how the router performs name lookups or how the router works on the internetwork.

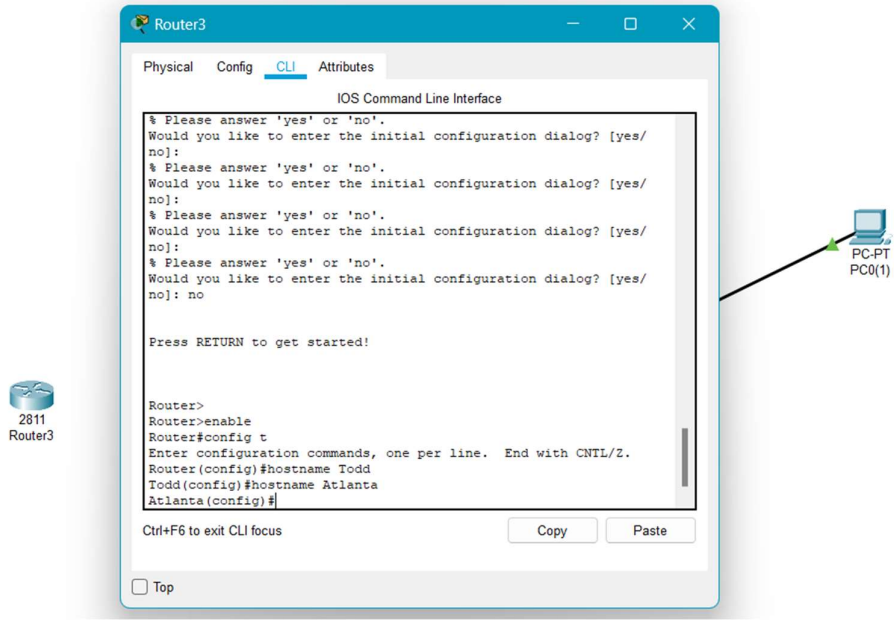
Here's an example:

```
Router>enable
Router#config t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname Todd
Todd(config)#hostname Atlanta
Atlanta(config)#
```

Even though it's pretty tempting to configure the hostname after your own name, it's definitely a better idea to name the router something pertinent to the location. This is because giving it a hostname that's somehow relevant to where the device actually lives will make finding it a whole lot easier. And it also helps you confirm that you are, indeed, configuring the right device.

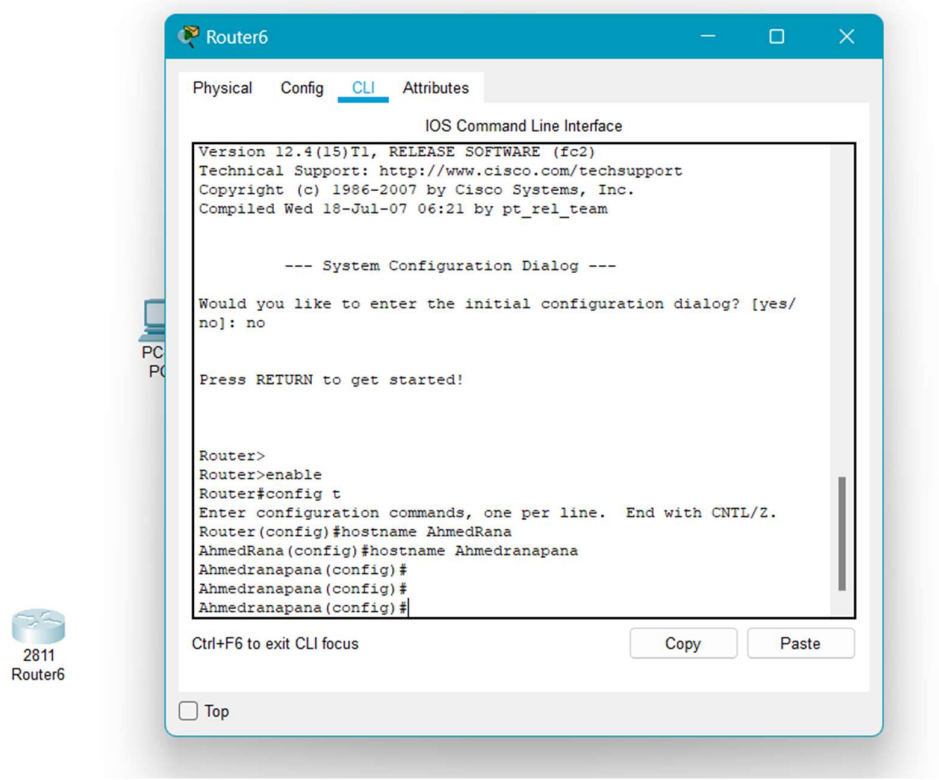
6.1 OUTPUT



Lab Task 2:

For task submission, change the hostname to a name of your choice and take a screenshot of the CLI output.

6.2 Output:



7 Banners

A banner is a warning message given to anyone who attempts to telnet or dial into your internetwork. You can create a banner to give anyone who shows up on the router exactly the information you want them to have. There are four available banner types: exec process creation banner, incoming terminal line banner, login banner, and message of the day banner.

```
Router(config)#banner ?
LINE c banner-text c, where 'c' is a delimiting character
exec Set EXEC process creation banner
incoming Set incoming terminal line banner
login Set login banner
motd Set Message of the Day banner
```

```
Router>
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname AhmedRana
AhmedRana(config)#hostname Ahmedranapana
Ahmedranapana(config)#
Ahmedranapana(config)#
Ahmedranapana(config)#banner ?
  login  Set login banner
  motd   Set Message of the Day banner
Ahmedranapana(config)#banner
```

Ctrl+F6 to exit CLI focus Copy Paste

Message of the day (MOTD) is the most extensively used banner. It gives a message to every person dialling into or connecting to the router via Telnet, auxiliary port or even through a console port as can be seen here:

```
Router(config)#banner motd ?
LINE c banner-text c, where 'c' is a delimiting character
Router(config)#banner motd #
Enter TEXT message. End with the character '#'.
If you are not authorized to be in Acme.com network, then you must
disconnect immediately #
```

7.1 OUTPUT

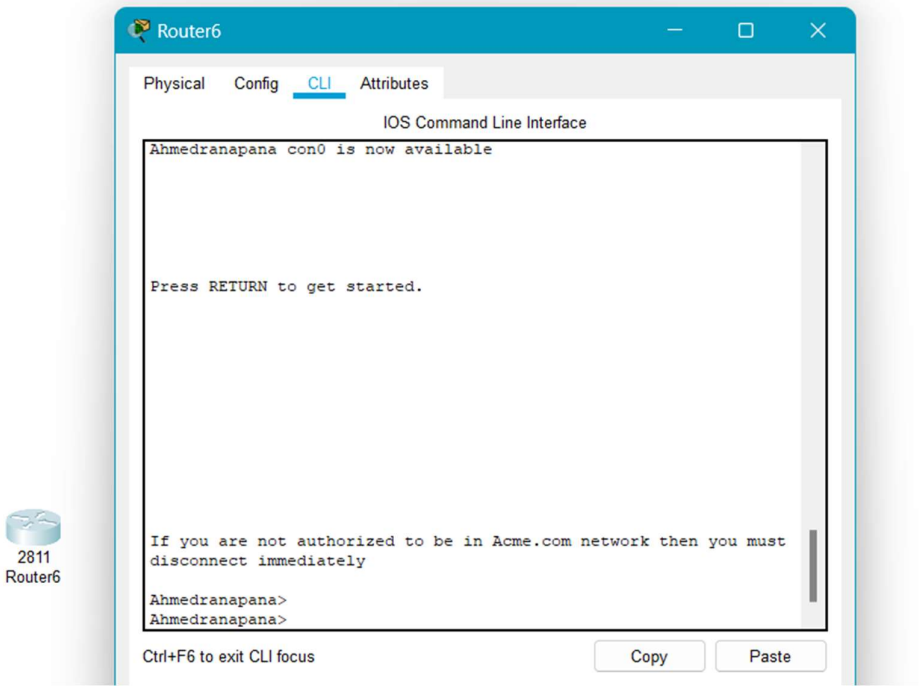
```
  login  Set login banner
  motd   Set Message of the Day banner
Ahmedranapana(config)#banner motd?
motd
Ahmedranapana(config)#banner motd #
Enter TEXT message.  End with the character '#'.
If you are not authorized to be in Acme.com network then you must
disconnect immediately #

Ahmedranapana(config)#
```

Ctrl+F6 to exit CLI focus Copy Paste

In the following line, ^Z means Ctrl + Z and is used to exit the config mode (You may need to press Enter after it)

```
#Router(config)#^Z
Router#00:25:12: %SYS-5-CONFIG_I: Configured from console by console
Router#exit
Router con0 is now available Press RETURN to get started.

If you are not authorized to be in Acme.com network, then you must disconnect
immediately.
Router>
```

7.2 OUTPUT



The preceding MOTD banner essentially tells anyone connecting to the router that if they're not on the guest list, then they should leave. The part to understand is the delimiting character—the thing that's used to tell the router when the message is done. You can use any character you want for it, but you cannot use the delimiting character in the message itself. Also, once the message is complete, press Enter, then the delimiting character, then Enter again. It will still work if you don't do that, but if you have more than one banner, they'll be combined as one message and put on a single line. For example, you can set a banner on one line as shown:

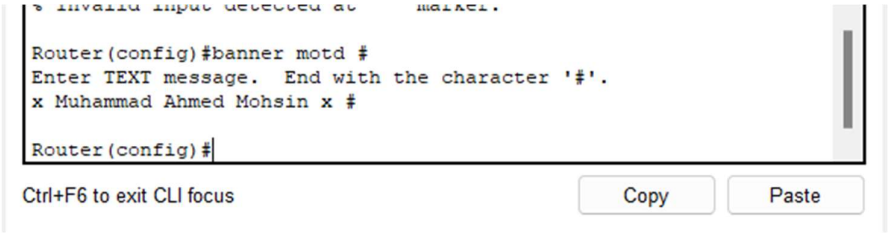
```
Router(config)#banner motd x Unauthorized access prohibited! x
```

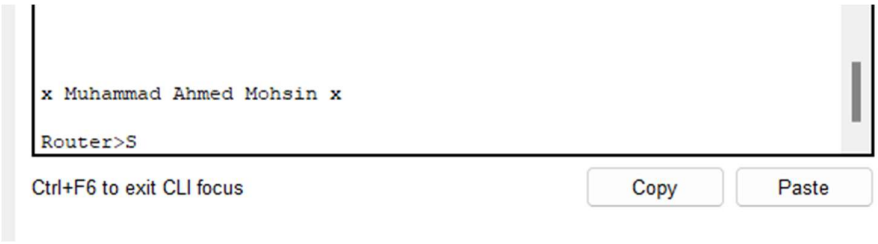
This example will work just fine, but if you add another MOTD banner message they would end up on a single line.

Lab Task 3:

For this task submission, create a banner which shows your name(s) in the message and submit screenshot of your banner's output in the CLI:

Banner Output:





Below are some details of the other banner types:

- **Exec banner:** you can configure a line-activation (exec) banner to be displayed when an EXEC process (such as a line-activation or incoming connection to a VTY line) is created. By simply starting a user exec session through a console port, you'll activate the exec banner.
- **Login banner:** you can configure a login banner to be displayed on all connected terminals. This banner is displayed after the MOTD banner, but before the login prompts. The login banner can't be disabled on a per-line basis, so to globally disable it, you've got to delete it with the no banner login command.

1.1. Setting Passwords:

There are five passwords used to secure your Cisco routers: console, auxiliary (not available in Packet Tracer), telnet (VTY), enable password, and enable secret. Just as you learned in the earlier lab, the last two passwords are used to set your enable passwords that are used to secure privileged mode. This will prompt a user for a password when the enable command is used. The first three password types are used to configure a password when user mode is accessed either through the console port, through the auxiliary port, or via Telnet. In this part, you will develop understanding of setting these passwords and then perform a task at the end.

1.1.1. Enable Password

You set the enable passwords from global configuration mode like this:

```
Router(config)#enable ?
password Assign the privileged level password
secret Assign the privileged level secret
```

The following points describe the enable password parameters:
password: Sets the enable password on older, pre-10.3 systems, and isn't ever used if an enable secret is set.
secret: Is the newer, encrypted password that overrides the enable password if it's set.

Here is an example of setting the enable passwords:

```
Router(config)#enable secret todd
Router(config)#enable password todd
```
The enable password you have chosen is the same as your enable secret. This is not recommended. Re-enter the enable password.

If you try to set the enable secret and enable passwords the same, the router will give you a warning to change the second password. If you don't have older legacy routers, you don't have to use the enable password. User-mode passwords are assigned by using the line command:

7.3 OUTPUT:

```
Router(config)#enable ?
  password  Assign the privileged level password
  secret    Assign the privileged level secret
Router(config)#enable secret todd
Router(config)#enable password todd
The enable password you have chosen is the same as your enable
secret.
This is not recommended.  Re-enter the enable password.
Router(config)#toddl
               ^
% Invalid input detected at '^' marker.

Router(config)#enable password toddl
Router(config)#line ?
  <2-499>  First Line number
  aux      Auxiliary line
  console  Primary terminal line
  tty      Terminal controller
  vty      Virtual terminal
  x/y/z    Slot/Subslot/Port for Modems
Router(config)#line
```

Ctrl+F6 to exit CLI focus Copy Paste

```
Router(config)#line ?
```
<0-70> First Line number
aux Auxiliary line
console Primary terminal line
vty Virtual terminal

Here are the lines to be concerned with:
Console: Sets a console user-mode password.

vty: Sets a Telnet password on the router. If this password isn't set, then Telnet can't be used by default.

To configure the user-mode passwords, you configure the line you want and use either the login or no login command to tell the router to prompt for authentication.

The next section will provide a line-by-line example of each line configuration. Cisco has begun this process of not letting you set the "login" command before a password is set on a line because if you set the login command under a line, and then don't set a password, the line won't be usable. And it will prompt for a password that doesn't exist.

Lab Task 4:

For this task submission, set both the enable and secret passwords to be your registration number and submit screenshot of the CLI ouput

7.4 OUTPUT

```
Router>
Router>
Router>
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#enable?
enable
Router(config)#enable ?
  password  Assign the privileged level password
  secret    Assign the privileged level secret
Router(config)#enable enable secret 333060
                      ^
% Invalid input detected at '^' marker.

Router(config)#enable secret 333060
Router(config)#enable password 333060
```

1.1.2. Console Password

To set the console password, use the line console 0 command (shown below). But look at what happens when **line console 0 ?** is typed. From the aux line configuration, an error occurs.
You can still type line console 0 and it will accept it, but the help screens just don't work from that prompt. Type **exit** to get back one level and you'll find that your help screens now work.

Here is the example:

```
Router(config)#line ?
Router(config-line)#line console ?

% Unrecognized command
Router(config-line)#exit
 Router(config)#line console ?
<0-0> First Line number
Router(config)#line console 0
Router(config-line)# password todd1
Router(config-line)# login
```

Since there's only one console port, the only choice is line console 0. You can set all your line passwords to the same password, but for security reasons, it is recommended that you make them different.

7.5 OUTPUT

```
% Invalid input detected at '^' marker.

Router(config)#enable secret 333060
Router(config)#enable password 333060
The enable password you have chosen is the same as your enable
secret.
This is not recommended.  Re-enter the enable password.
Router(config)#
Router(config)#
Router(config)#line console 0
Router(config-line)#line ?
% Unrecognized command
Router(config-line)#line
                    ^
% Invalid input detected at '^' marker.

Router(config-line)#line console ?
% Unrecognized command
Router(config-line)#exit
Router(config)#line console ?
  <0-0>  First Line number
Router(config)#line console 0
Router(config-line)#password todd1
Router(config-line)#login
Router(config-line)#
```

Ctrl+F6 to exit CLI focus Copy Paste

1.1.3. Telnet Password

To set the user-mode password for Telnet access into the router, use the line vty command.
Routers that aren't running the Enterprise edition of the Cisco IOS default to five VTY lines, 0 through 4. But if you have the Enterprise edition, you'll have significantly more. The best way to find out how many lines you have is to use that question mark:

```
Router(config)#line vty 0 ?
```

```
 <1-15> Last Line Number <cr>
Router(config)#line vty
Router(config)#password todd2
Router(config)# login
```

7.6 OUTPUT

IOS Command Line Interface

```
% Unrecognized command
Router(config-line)#line
                     ^
% Invalid input detected at '^' marker.

Router(config-line)#line console ?
% Unrecognized command
Router(config-line)#exit
Router(config)#line console ?
  <0-0>  First Line number
Router(config)#line console 0
Router(config-line)#password todd1
Router(config-line)#login
Router(config-line)#exit
Router(config)#line vty 0 ?
  <1-15>  Last Line number
  <cr>
Router(config)#line vty
% Incomplete command.
Router(config)#line vty
% Incomplete command.
Router(config)#line vty 0
Router(config-line)#password todd2
Router(config-line)#login
Router(config-line)#
```

Ctrl+F6 to exit CLI focus Copy Paste

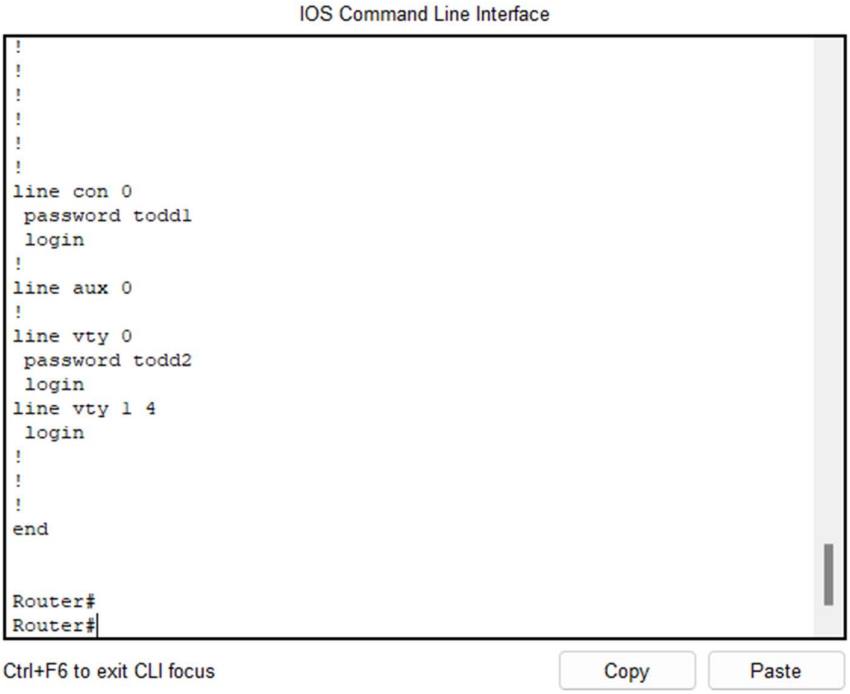
1.1.4. Encrypting Your Passwords

Because only the enable secret password is encrypted by default, you'll need to manually configure the user-mode and enable passwords for encryption.
Notice that you can see all the passwords except the enable secret when performing a show running-config on a router:

```
Router#sh running-config

[output cut]
!
enable secret 5 $1$rFbM$8.aXocHg6yHrM/zzeNkAT. enable password todd1
!
[output cut] line con 0
password todd1
 login
```

```
line aux 0
password todd
login

line vty 0 4
password  todd2
login
!
end
Router#
```

7.7 OUTPUT:



To manually encrypt your passwords, use the service password-encryption command.
Here's an example of how to do it:

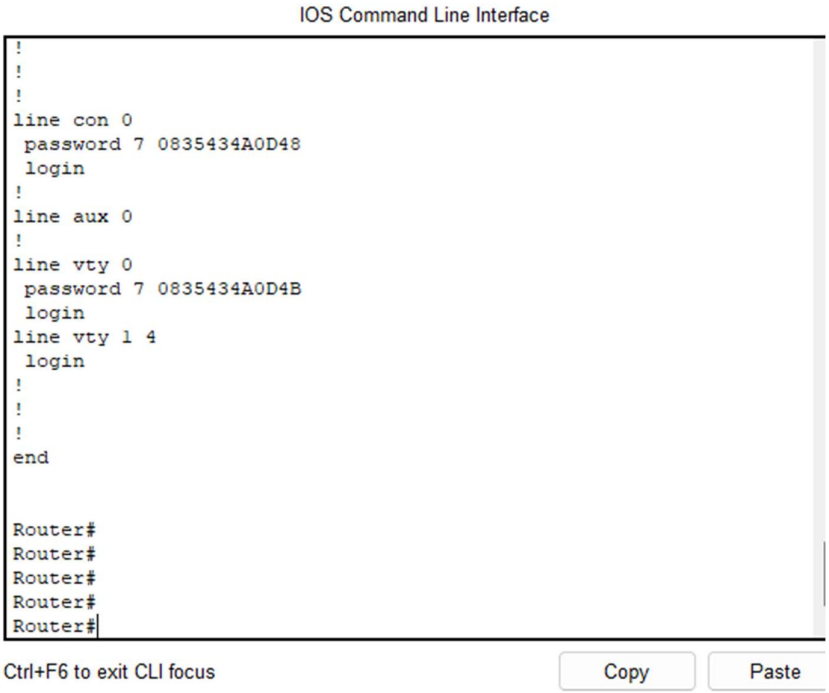
```
Router#config t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#service password-encryption
Router(config)#^Z
Router#sh run

Building configuration...
```

```
[output cut]
!
enable secret 5
$1$rFbM$8.aXocHg6yHrM/zzeNkAT. enable
password 7 0835434A0D
!
[output cut]
```



```
!
line con 0

password 7
111D160113 login
line aux 0

password 7
071B2E484A login
line vty 0 4

password 7
0835434A0D login

line vty 5 197
password 7
09463724B login
!
end
```

7.8 OUTPUT:



Here is an example of how you might set and encrypt your Telnet password:

1. Enter the mode to configure telnet access: **line vty 0 4**
2. Enable Telnet login: **login**
3. Set the password to cisco: **password cisco**
4. Return to global configuration mode: **exit**
5. Encrypt password in show run/start output: **service password-encryption**

This is somewhat different from what is shown in the Telnet and encryption sections earlier, but you should know this way as well. Here are the commands in order:

```
Router(config)#line vty 0 4
Router(config-line)#login
Router(config-line)#password cisco
Router(config)#exit
Router(config)#service password-encryption
```

Lab Task 5:

Based on your understanding of setting passwords, set the passwords to the names of your group members and then showcase your result in the CLI window by

providing its screenshot. You must also highlight/outline the passwords in the screenshots.

Screenshots:

IOS Command Line Interface

```
!
!
!
end


Router#
Router#
Router#
Router#
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#line console 0
Router(config-line)#password Ahmed
Router(config-line)#login
Router(config-line)#line vty 3
Router(config-line)#password Imran
Router(config-line)#login
Router(config-line)#enable secret password Amina
Router(config)# enable password  Bilal
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#sh run
```

Ctrl+F6 to exit CLI focus Copy Paste

1.2. Descriptions

Setting descriptions on an interface is helpful to the administrator and, like the hostname, only locally significant. The description command is a helpful one because you can, for instance, use it to keep track of circuit numbers.
Here is an example:

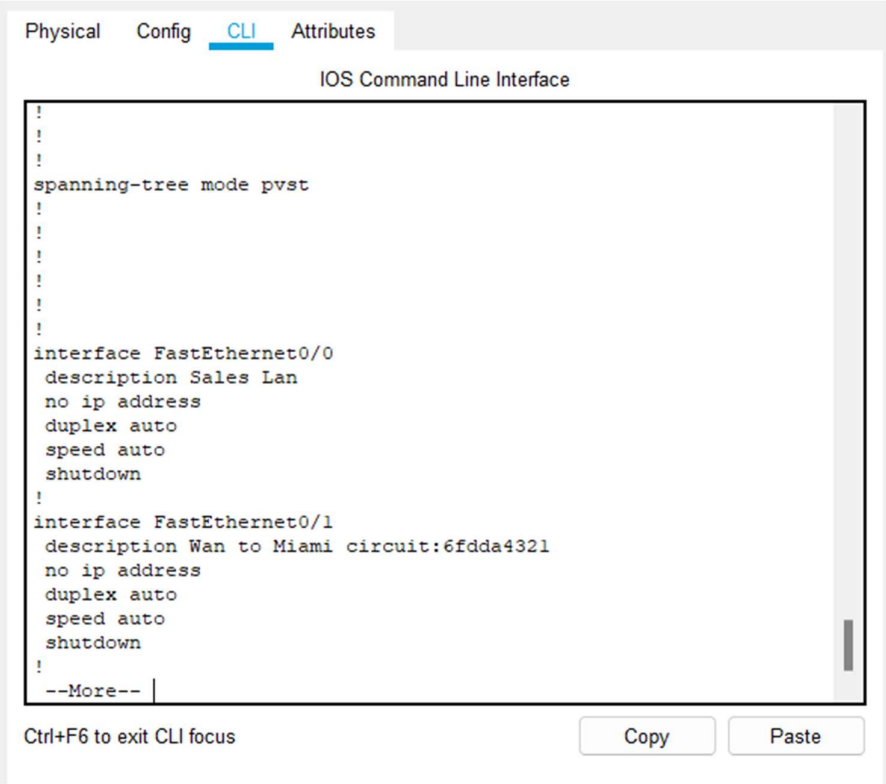
```
Atlanta(config)#int FastEthernet 0/0
Atlanta(config-if)#description Sales Lan

Atlanta(config)#int FastEthernet 0/1
Atlanta(config-if)#desc Wan to Miami circuit:6fdda4321
```

You can view the description of an interface either with the show running-config command or the show interface command:

```
Atlanta#sh run
```

[cut]
interface Ethernet0 description **Sales Lan**
ip address 172.16.10.30 255.255.255.0 no ip directed-broadcast
!
interface Serial0
description **Wan to Miami circuit:6fdda4321** no ip address
no ip directed-broadcast no ip mroute-cache Atlanta**#sh int e0**
Ethernet0 is up, line protocol is up

Hardware is Lance, address is 0010.7be8.25db (bia 0010.7be8.25db)
Description: Sales Lan
[output cut]




```
Atlanta#sh int s0
```

Serial0 is up, line protocol is up
Hardware is HD64570
Description: Wan to Miami circuit:6fdda4321
[Output cut]

(All the outputs shown above are for example only so your outputs may not match!!)

Lab Task 6:

Based on your understanding of setting description, set some descriptions (on both Ethernet ports) and display them in the CLI window which you will submit as screenshot for the task submission. Highlight/outline the descriptions in the screenshots.

7.9 OUTPUT:

IOS Command Line Interface

```
% Invalid input detected at '^' marker.

Router#config
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#int FastEthernet 0/0
Router(config-if)#description Ahmed Mohsin
Router(config-if)#exit
Router(config)#int fastEthernet 0/1
Router(config-if)#description Ahmed not Mohsin
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#sh run
Building configuration...

Current configuration : 822 bytes
!
```

IOS Command Line Interface

```
!
!
spanning-tree mode pvst
!
!
!
!
!
!
interface FastEthernet0/0
 description Ahmed Mohsin
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface FastEthernet0/1
 description Ahmed not Mohsin
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 --More--
```

Ctrl+F6 to exit CLI focus Copy Paste

EXPERIMENT NO 5

PART – 2/2

Connecting Local Area Networks (LANs) using Router

8 OBJECTIVE

This lab exercise is designed for understanding LAN and using Router to communicate two LANS.

9 RESOURCES REQUIRED

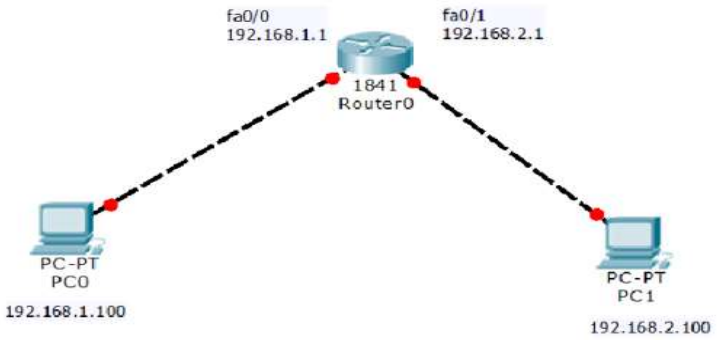
- Computer
- Packet Tracer (version 5 or higher)

10 INTRODUCTION

A local area network (LAN) is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building and has its network equipment and interconnects locally managed.
For example, consider two IP from different networks. First IP is 192.168.1.100 from 192.168.1.0 network and the other IP is 192.168.2.100 from 192.168.2.0 network. Now these IP cannot ping each other using hub or switch because they belong to two different networks. So to make two machines from different network communicate each other we need to use router.

11 PROCEDURE

1. Open Packet Tracer 5 and setup a network similar to the following network. Use Router and PCs



2. Double click on the Router and go to the CLI tab. Follow the steps below to complete the lab. (*Note: You can also do the same using a PC if you use a **console** cable (blue wire in Packet Tracer) for connection. One side of console cable is RS 232 and the other is RJ45. Go to PC's desktop then Terminal (equivalent of HyperTerminal), accept the default settings and then login to the Router*).

Step 1 - Enter Privileged Mode

Privileged mode gives access to all the Router commands. Many of the privileged commands configure operating parameters. Therefore, privileged access should be password-protected to prevent unauthorized use. The privileged command set includes those commands contained in user EXEC mode, as well as the **configure** command through which access to the remaining command modes is gained.

```
Router>enable
Router#
```

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

Step 2 - Examine the current router configuration

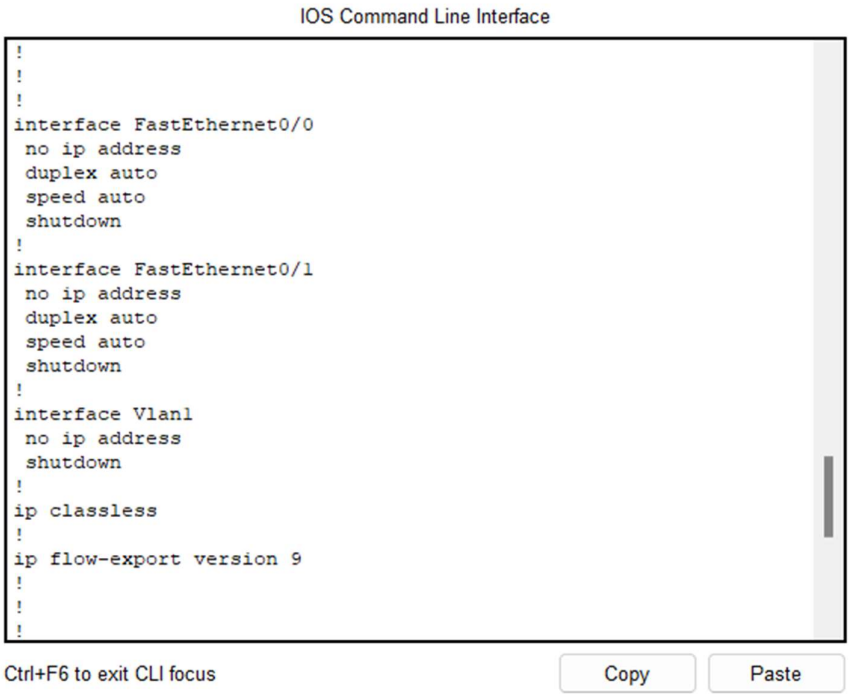
Examine the following current running configuration file:

Router#**show running-config**

Lab Task 7:

How many interfaces does the Router have?

11.1 OUTPUT:



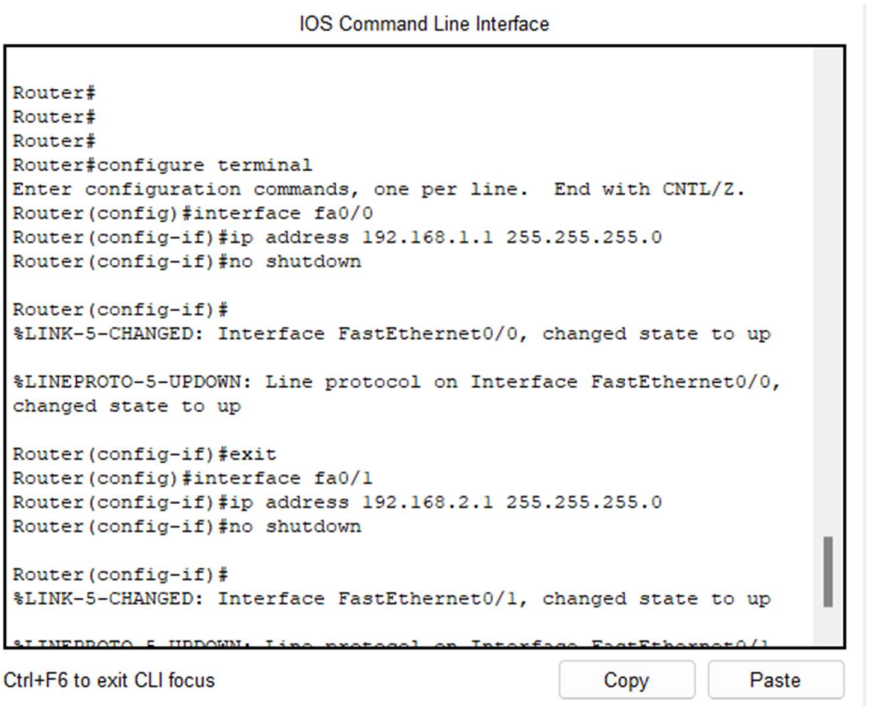
Step 3 - Assign the IP address to the Router Interface

```
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fa0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#interface fa0/1
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shutdown
```

Lab Task 8:

Observe the output in the CLI and briefly explain what the above lines are doing.

11.2 OUTPUT



11.3 EXPLANATION:

The given CLI commands are configuring the IP addresses on the two interfaces (fa0/0 and fa0/1) of the router and enabling them by turning off the "shutdown" state.

The first command "configure terminal" enters the global configuration mode of the router, allowing the user to configure various settings on the router.

The second command "interface fa0/0" selects the FastEthernet 0/0 interface on the router for configuration.

The third command "ip address 192.168.1.1 255.255.255.0" sets the IP address and subnet mask on the selected interface to 192.168.1.1 and 255.255.255.0, respectively.

The fourth command "no shutdown" enables the selected interface to start forwarding traffic.

The fifth command "exit" exits the interface configuration mode and returns to the global configuration mode.

The sixth and seventh commands configure the IP address and subnet mask on the FastEthernet 0/1 interface in a similar way and enable it by turning off the "shutdown" state.

Overall, these commands are configuring the IP addresses and enabling two interfaces on the router, which will allow it to communicate with other devices in the network.

Step 4 - Configure the hosts attached to the Router

Configure the hosts to use the same IP subnet for the address, mask and default-gateway.

Step 5 - Verify connectivity

To verify that the hosts and Router are correctly configured, you need to use ping

Lab Task 9:

Were the pings successful? If the answer is yes, submit screenshot showcasing the ping. If the answer is no, troubleshoot the hosts and router configurations and provide an explanation:

11.4 OUTPUT

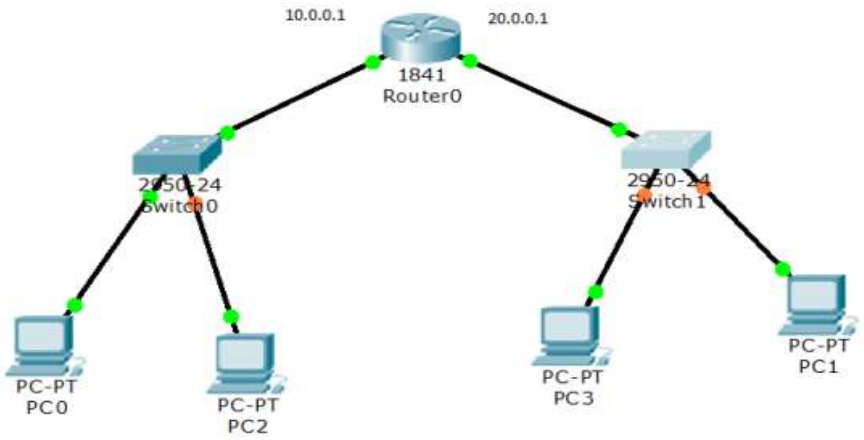
```
PC>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:

Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 192.168.2.100

Pinging 192.168.2.100 with 32 bytes of data:

Request timed out.
Reply from 192.168.2.100: bytes=32 time=0ms TTL=127
Reply from 192.168.2.100: bytes=32 time=0ms TTL=127
Reply from 192.168.2.100: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.2.100:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

11.5 EXPLANATION:

In this lab task we inserted the gateway IP address of the router so that the PC can access the gateway of the router before pinging the second PC. After 2-3 attempts we were successfully able to ping the second PC.

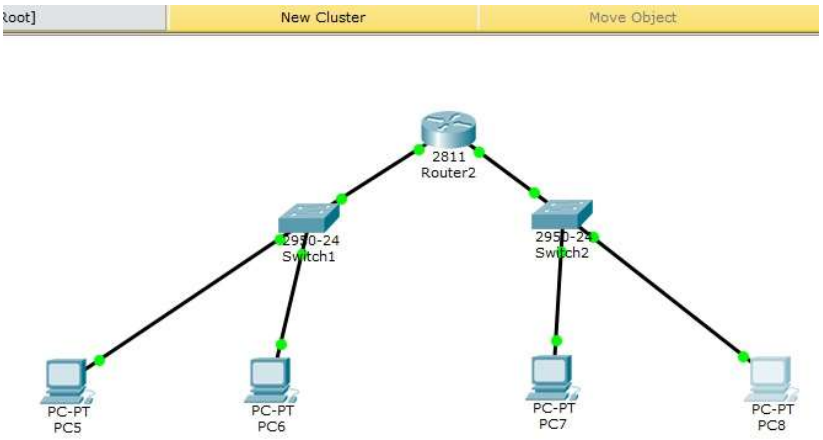
Lab Task 10:

Now using the previously built concepts, solve the question given in the diagram. Take two different networks (LANs) and configure the router to make all the PCs ping each other or communicate with each other. Note that when pinging across the router, you may have to send the packet several times before ping is successful



For the task submission, list the IP addresses of the PCs and the Router. Also, provide screenshots showcasing your work in Packet Tracer.

11.6 SETUP SCREENSHOT



The IP addresses are as follows:

11.6.1 PC 1:
192.168.1.100

11.6.2 PC 2:
192.168.2.100

11.6.3 PC 3:
192.168.2.100

11.6.4 PC 4:
192.168.2.100

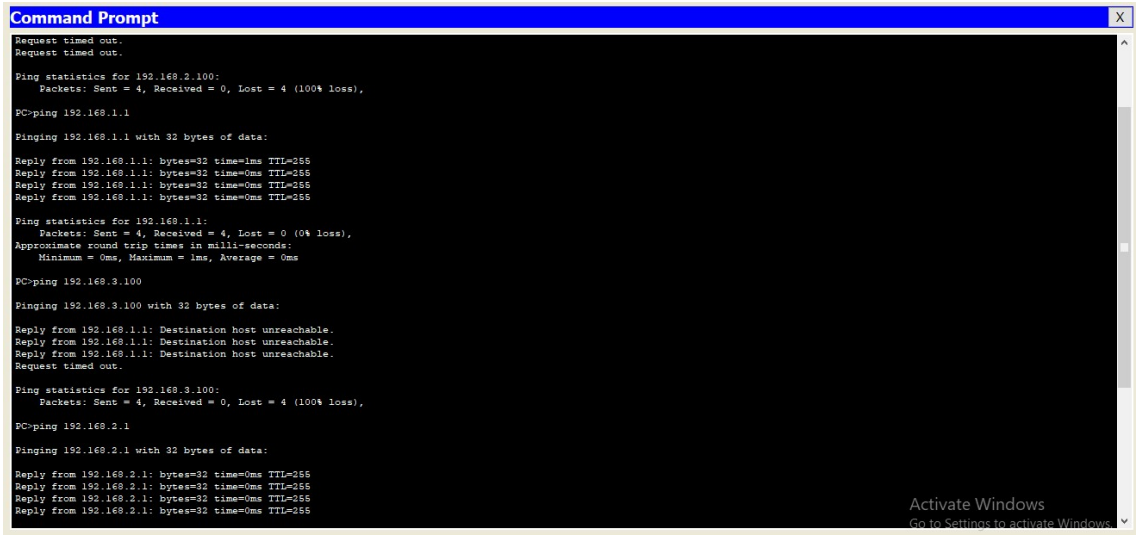
11.6.5 PC 5:
192.168.2.100

11.6.6 PC 6:
192.168.2.100

11.6.7 Router Gateway 1:
192.168.1.1

11.6.8 Router Gateway 2:
192.168.2.1

11.7 ACCESSING GATEWAY 1:



11.8 ACCESSING GATEWAY 2:

```
PC>ping 192.168.3.100

Pinging 192.168.3.100 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Request timed out.

Ping statistics for 192.168.3.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>ping 192.168.2.1

Pinging 192.168.2.1 with 32 bytes of data:

Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255
Reply from 192.168.2.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.2.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 192.168.3.100

Pinging 192.168.3.100 with 32 bytes of data:

Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.
Reply from 192.168.1.1: Destination host unreachable.

Ping statistics for 192.168.3.100:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

12 CONCLUSION

In conclusion, the router gateway access and IP address assigning lab using Cisco Packet Tracer was a valuable learning experience. Through this lab, we were able to gain hands-on experience in configuring and managing network devices, specifically routers. We learned how to assign IP addresses to interfaces and how to access the router's gateway through the command line interface.

Furthermore, we also learned how to set up passwords for the router, which is an important aspect of network security. By setting up passwords, we can control who has access to the router and prevent unauthorized access.

Overall, this lab provided a comprehensive understanding of the basic configuration and management of routers using Cisco Packet Tracer. These skills are crucial for anyone interested in pursuing a career in networking or IT, and the knowledge gained from this lab will undoubtedly prove useful in future networking projects and tasks.