



**Computer Networks Laboratory Manual #9**  
**Router Basic IOS**

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## 1. Introduction:

In this laboratory exercise, you shall learn about the Cisco Router IOs.

## 2. Objective:

After completing this lab, the student will be able to

- Understand the Cisco router IOS
- Use commands to configure the Cisco routers

## 3. Methodology:

To achieve this objective, we will use Cisco Packet Tracer.

## 4. Background:

Cisco IOS (Internetwork Operating System) is a proprietary operating system that runs on Cisco Systems routers. IOS is CLI based and it provide a set of commads to work with.

Before using a Cisco router we need to configure it. The configuration of the router can be done using IOS commands. You can configure the device by using the console port or a remote access method, such as Telnet or Secure Shell (SSH), to access the CLI.

### Understanding Command Modes

The CLI command mode structure is hierarchical, and each mode supports a set of specific commands. This section describes the most common of the many modes that exist.

Table given below lists common command modes with associated CLI prompts, access and exit methods, and a brief description of how each mode is used.

**Table 1 Command Modes**

Command Mode	Access Method	Prompt	Exit Method	Mode Usage
User EXEC	Log in.	Router>	Issue the <b>logout</b> or <b>exit</b> command.	<ul style="list-style-type: none"> <li>• Change terminal settings.</li> <li>• Perform basic tests.</li> <li>• Display device status.</li> </ul>
Privileged EXEC	From user EXEC mode, issue the <b>enable</b> command.	Router#	Issue the <b>disable</b> command or the <b>exit</b> command to return to user EXEC mode.	<ul style="list-style-type: none"> <li>• Issue <b>show</b> and <b>debug</b> commands.</li> <li>• Manage device configuration files.</li> <li>• Manage device file systems.</li> </ul>
Global configuration	From privileged EXEC mode, issue the <b>configure terminal</b> command.	Router(config)#	Issue the <b>exit</b> command or the <b>end</b> command to return to privileged EXEC mode.	Configure the device.
Interface configuration	From global configuration mode, issue the <b>interface</b> command.	Router(config-if)#	Issue the <b>exit</b> command to return to global configuration mode or the <b>end</b> command to return to privileged EXEC mode.	Configure individual interfaces.

EXEC commands are not saved when the software reboots. Commands that you issue in a configuration mode can be saved to the startup configuration. If you save the running configuration to the startup configuration, these commands will execute when the software is rebooted. Global configuration mode is the highest level of configuration mode. From global configuration mode, you can enter a variety of other configuration modes, including protocol-specific modes.

The following example shows how the command prompt changes to indicate a different command mode:

```
Router> enable
Router# configure terminal
Router(config)# interface ethernet 1/1
Router(config-if)# ethernet
Router(config-line)# exit
Router(config)# end
```

The CLI includes an interactive Help feature. Table 2 describes the purpose of the CLI interactive Help commands.

Table 2

Command	Purpose
<b>Help</b>	Provides a brief description of the Help feature in any command mode.
<b>?</b>	Lists all commands available for a particular command mode.
<i>partial command?</i>	Provides a list of commands that begin with the character string (no space between the command and the question mark).
<i>partial command</i> <Tab>	Completes a partial command name (no space between the command and <Tab>).
<i>command ?</i>	Lists the keywords, arguments, or both associated with the command f(space between the command and the question mark).
<i>command keyword ?</i>	Lists the arguments that are associated with the keyword (space between the keyword and the question mark).

### Understanding Enable and Enable Secret Passwords

Some privileged EXEC commands are used for actions that impact the system, and it is recommended that you set a password for these commands to prevent unauthorized use. Two types of passwords, enable (not encrypted) and enable secret (encrypted), can be set. The following commands set these passwords and are issued in global configuration mode:

- **enable password**
- **enable secret password**

Using an enable secret password is recommended because it is encrypted and more secure than the enable password. When you use an enable secret password, text is encrypted (unreadable) before it is written to the config.text file. When you use an enable password, the text is written as entered (readable) to the config.text file.

Each type of password is case sensitive, can contain from 1 to 25 uppercase and lowercase alphanumeric characters, and can start with a numeral. Spaces are also valid password characters; for example, “two words” is a valid password. Leading spaces are ignored, but trailing spaces are recognized.

To remove a password, use the no form of the commands: **no enable password** or **no enable secret password**.

To recall commands from the history buffer, use the following methods:

- Press Ctrl-P or the Up Arrow key—Recalls commands beginning with the most recent command. Repeat the key sequence to recall successively older commands.

Most configuration commands have a **no** form that is used to reset a command to its default value or to disable a feature or function. For example, the **ip routing** command is enabled by default. To disable this command, you would issue the **no ip routing** command. To re-enable IP routing, you would issue the **ip routing** command.

## Understanding CLI Error Messages

Table 3 shows the common error messages that you will encounter if you make a mistake during the use of CLI

*Table 3*

Error Message	Meaning	How to Get Help
% Ambiguous command: "show con"	You did not enter enough characters for the command to be recognized.	Reenter the command followed by a space and a question mark (?). The keywords that you are allowed to enter for the command appear.
% Incomplete command.	You did not enter all the keywords or values required by the command.	Reenter the command followed by a space and a question mark (?). The keywords that you are allowed to enter for the command appear.
% Invalid input detected at "^" marker.	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all the commands that are available in this command mode. The keywords that you are allowed to enter for the command appear.

## Saving Changes to a Configuration

To save changes that you made to the configuration of a device, you must issue the **copy running-config startup-config** command or the **copy system:running-config nvram:startup-config** command.

When you issue these commands, the configuration changes that you made are saved to the startup configuration and saved when the software reloads or power to the device is turned off or interrupted. The following example shows the syntax of the **copy running-config startup-config** command:

```
Router# copy running-config startup-config Destination
filename [startup-config]?
```

You press Enter to accept the startup-config filename (the default), or type a new filename and then press Enter to accept that name. The following output is displayed indicating that the configuration was saved.

```
Building configuration...
[OK]
Router#
```

## 5. Lab Exercise:

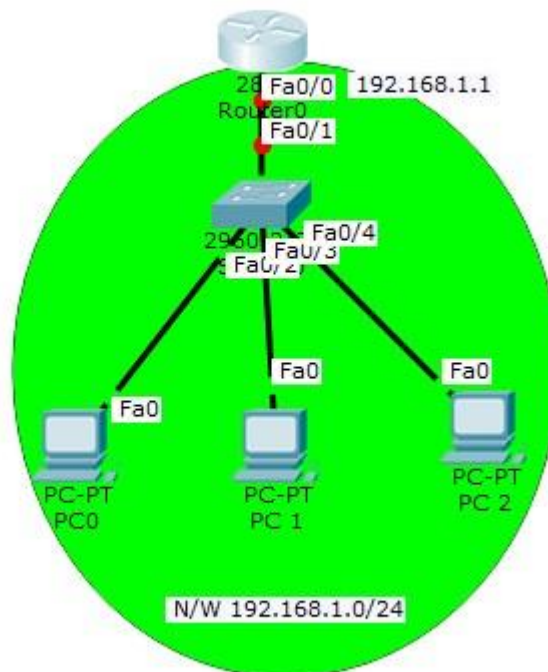
### 5.1. Fill the given table with the required information

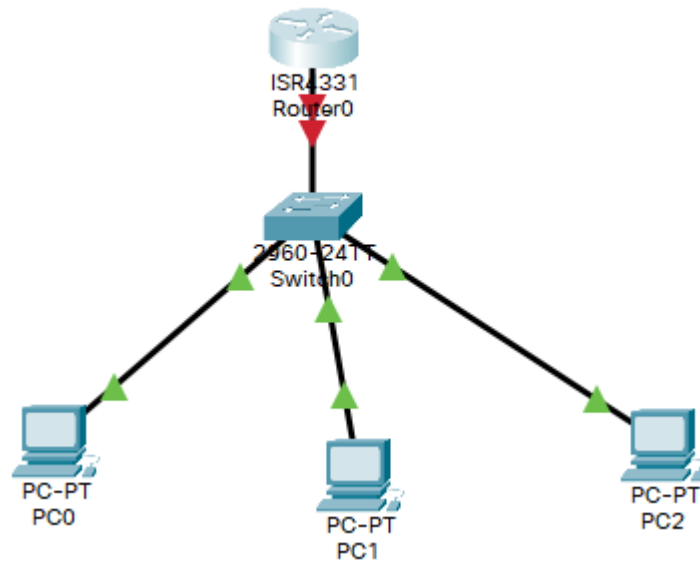
Comm and	Purpose	Screenshot of Output
Show version	To display the configuration of the system hardware, the software version, the names and sources of configuration files, and the boot images.	<pre> Router#show version Cisco IOS Software [Everest], ISR Software (X86_64_LINUX_IOS) 16.6.4,RELEASE SOFTWARE (fc3) Technical Support: http://www.cisco.com/techsupport Copyright (c) 1986-2018 by Cisco Systems, Inc. Compiled Sun 08-Jul-18 04:33 by mcpres  Cisco IOS-XE software, Copyright (c) 2005-2018 by cisco Systems, Inc. All rights reserved. Certain components of Cisco IOS-XE software are licensed under the GNU General Public License ("GPL") Version 2.0. Cisco IOS-XE software code licensed under GPL Version 2.0 is free software with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify it under the terms of GPL Version 2.0. For more details, see the documentation or "License Notice" file accompanying the IOS-XE software, or the applicable URL provided on the flyer accompanying the software.  ROM: IOS-XE ROMMON  Router uptime is 4 minutes, 8 seconds Uptime for this control processor is 4 minutes, 8 seconds System returned to ROM by power-on System image file is "bootflash:isr4300-universalk9.16.06.04" Last reload reason: PowerOn  This product contains cryptographic features and is subject to U.S. and local country laws governing import, export, and transmission. Delivery of Cisco cryptographic products does not imply a security evaluation.  --More-- </pre>
Show mac address-table	It is used for displaying information about the MAC address table.	<pre> Router#show mac-address-table           Mac Address Table ----- Vlan    Mac Address      Type      Ports ----    - </pre>

Show ip route	It is used for showing the IPv4 routing table.	<pre>Router#show ip route Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2,        E1 - OSPF external type 1, E2 - OSPF external type 2,        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area        * - candidate default, U - per-user static route, o - OGP        P - periodic downloaded static route  Gateway of last resort is not set</pre>
Show ip interface brief	It is used for viewing a summary of the router interface.	<pre>Router#show ip interface brief Interface                IP-Address      OK? Method Status GigabitEthernet0/0/0     unassigned      YES unset  administratively down GigabitEthernet0/0/1     unassigned      YES unset  administratively down GigabitEthernet0/0/2     unassigned      YES unset  administratively down Vlan1                    unassigned      YES unset  administratively down Router#</pre>

## 5.2 Configure a Router to act as a DHCP:

### 1. Build the network topology as shown in the given figure.





**Figure 1: Router to act as DHCP**

2. On the router, configure *interface fastethernet0/0* to act as the default gateway for our LAN. Use the CLI tab (command line interface) and enter the following commands:

```
Router>enable
```

```
Router>enable
Router#
```

```
Router#config terminal
```

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

```
Router(config)#int fa0/0      (FastEthernet0/)
```

```
Router(config)#interface gigabitEthernet0/0/0
Router(config-if)#
```

```
Router(config-if)#ip add 192.168.1.1 255.255.255.0
```

```
Router(config-if)#ip address 192.168.1.4 255.255.255.0
Router(config-if)#
```

```
Router(config-if)#no shutdown
```

```
Router(config-if)#no shutdown
```

```
Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0/0, changed state to up
```

```
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0/0, changed state to up
```

```
Router(config-if)#exit
```

```
Router(config-if)#exit
Router(config)#
```

**3. Configure DHCP server on the Router. In the server we will define a DHCP pool of IP addresses to be assigned to hosts, a Default gateway for the LAN and a DNS Server.**

```
Router(config)#
```

```
Router(config)#ip dhcp pool MY_LAN
```

```
Router(config)#ip dhcp pool MY_LAN
```

```
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
```

```
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
```

```
Router(dhcp-config)#default-router 192.168.1.1
```

```
Router(dhcp-config)#default-router 192.168.1.4
```

```
Router(dhcp-config)#dns-server 192.168.1.10
```

```
| Router(dhcp-config)#dns-server 192.168.1.10
```

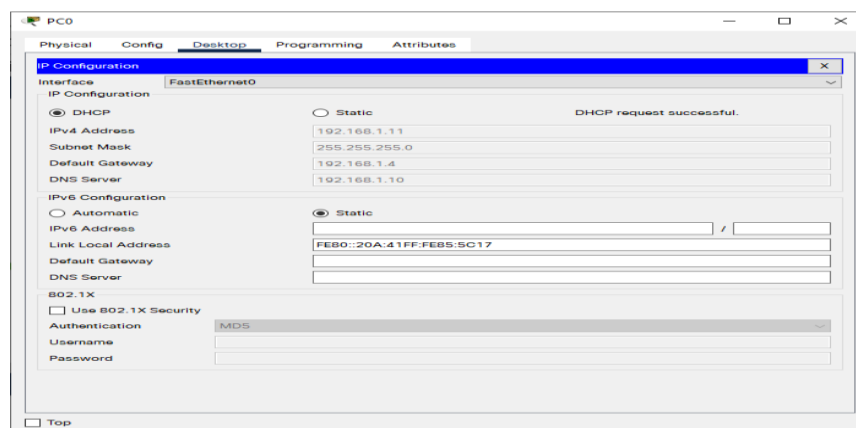
We can add ip dhcp excluded-address command to our configuration so as to configure the router to exclude addresses 192.168.1.1 through 192.168.1.10 when assigning addresses to clients. The ip dhcp excluded-address command may be used to reserve addresses that are statically assigned to key hosts.

So add the above command under the global configuration mode.

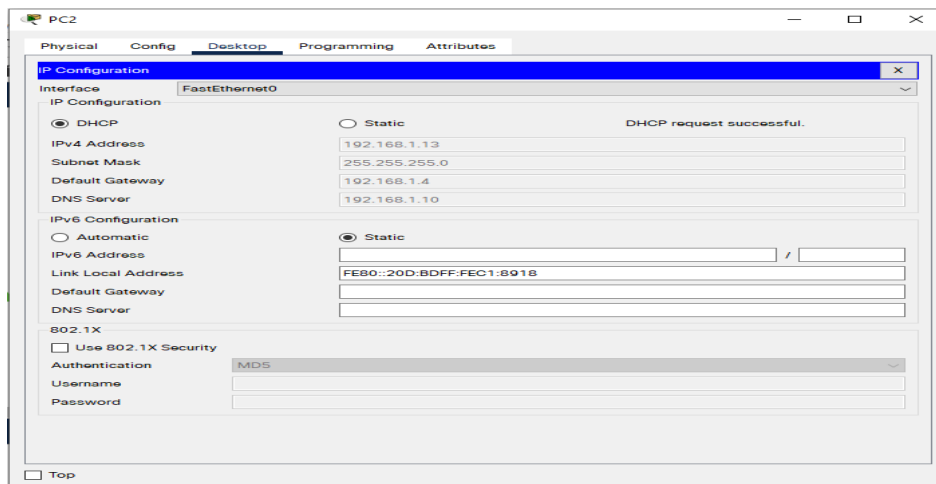
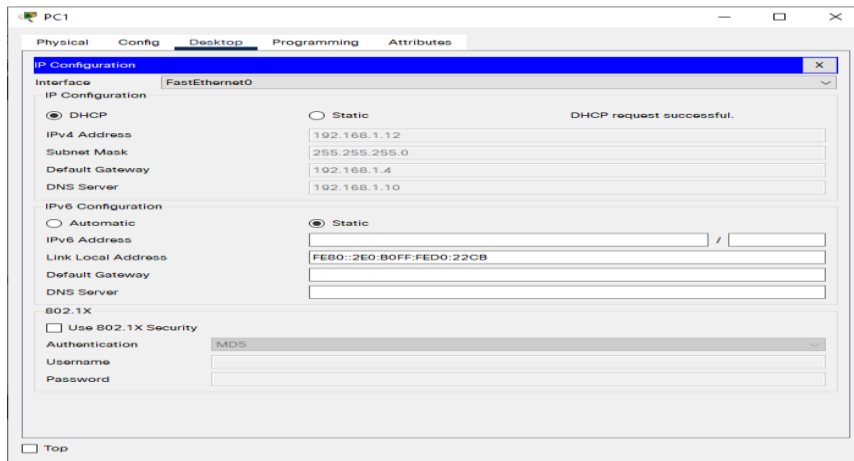
**Router(config)#ip dhcp excluded-address 192.168.1.1 192.168.1.10**

```
Router(dhcp-config)#ip dhcp excluded-address 192.168.1.1 192.168.1.10
```

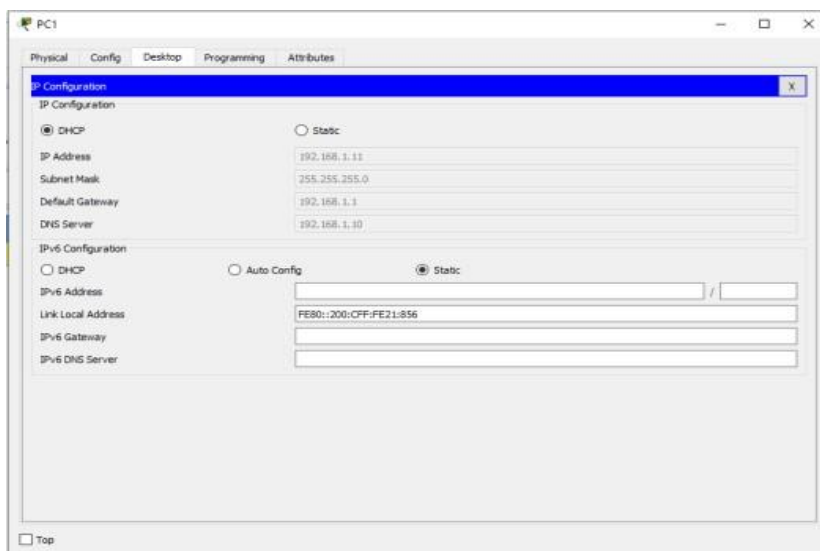
**5. Now go to every PC and on their IP configuration tabs, enable DHCP. Every PC should be able to obtain an IP address, default gateway and DNS server, as defined in step 2.**







For example, to enable DHCP on PC1: Click PC1->Desktop->IP configuration. Then enable DHCP:



6. Do this for the other PCs.

You can test the configuration by pinging PC2 from PC1. Ping should succeed.

```

C:\>ping 192.168.1.13

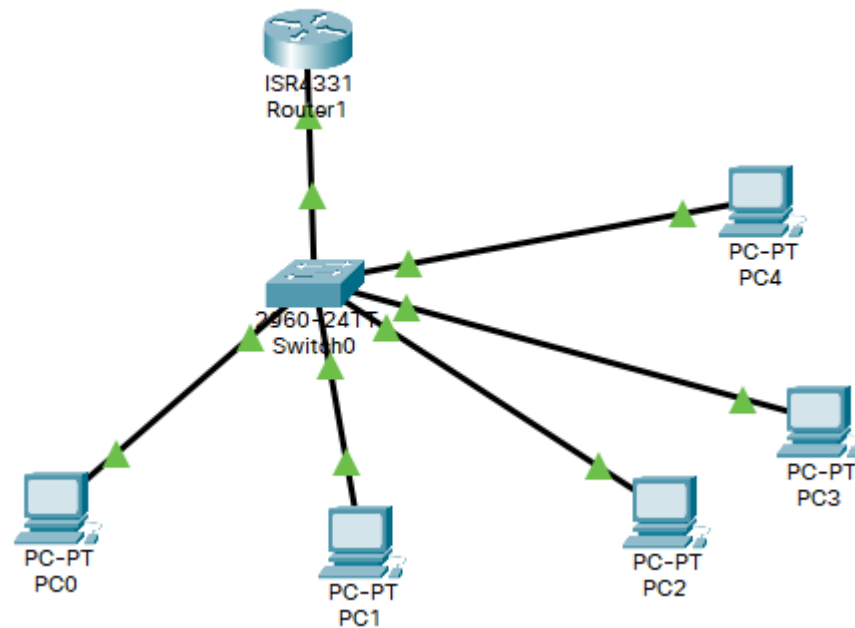
Pinging 192.168.1.13 with 32 bytes of data:

Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time=1ms TTL=128
Reply from 192.168.1.13: bytes=32 time<1ms TTL=128
Reply from 192.168.1.13: bytes=32 time=10ms TTL=128

Ping statistics for 192.168.1.13:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 2ms

```

7. Now add two more PCs via a switch, do they receive the IP addresses.



8. Note down the IP addresses being allocated.

PC-0: 192.168.1.11

PC-1: 192.168.1.12

PC-2: 192.168.1.13

PC-3: 192.168.1.15

PC-4: 192.168.1.14

9. Save the topology, and restart it again, to see if the same addresses are allocated to the same PCs, why not?

The same addresses are not allocated to the same pc, because when the server is in DHCP mode it assigns the random IP from the given address range. Therefore, when we check the IP again it can be changed.

The purpose of the DHCP server is to assign addresses dynamically from the pools of the IPS.

**== End of Lab ==**

## **Rubrics Sheet**

<b>Activities</b>	<b>Description</b>	<b>Marks</b>
<b>Task 1</b>	Student has filled the table with correct information	1
<b>Task 2</b>	Student has performed the given task without any errors	4

<b>Viva Voce</b>	Student can answer the questions regarding subnetting and the performed tasks.	5
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