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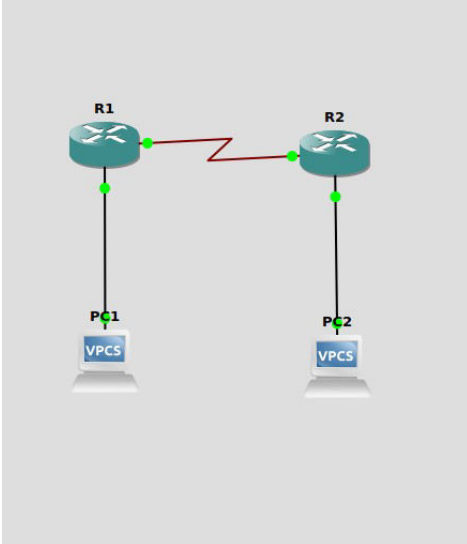
Computer Networks Lab 6:Computer Network Design using SWITCH and ROUTERS in GNS3

II.
LAB EXERCISES
1. Switching Cisco IOS Command Modes
This exercise demonstrates how to log into a router and how to work with the different Cisco IOS command modes. It is important to understand the different modes so you know where you are and what commands are accepted at any time.
i. Connect the Ethernet interfaces of the Linux PCs and the Cisco router as shown in Figure 6.7. Do not turn on the Linux PCs yet.
ii. Right-click on Router1 and choose Start.
iii. Right-click on Router1 and choose Console. Wait a few seconds until the router is initialized. If everything is fine, you should see the prompt shown below. This is the User EXEC mode. If the prompt does not appear, try to restart GNS3 and repeat the setup again.
Router1>
iv. To see which commands are available in this mode, type ?:
Router1>?
v. To view and change system parameters of a Cisco router, you must enter the Privileged EXEC mode by typing:
Router1>enable
Router1#
vi. Type the following command to disable the Privileged EXEC mode
Router1# disable
NOTE: The Cisco routers in GNS3 sometimes start up in Privileged instead of the User EXEC mode.
PAGE: 6 0vii. To modify system wide configuration parameters, you must enter the global configuration mode. This mode is entered by typing:
Router1#configure terminal
Router1(config)#
or
Router1#conf t
Router1(config)#
viii. To make changes to a network interface, enter the interface configuration mode, with the command:
Router1(config)#interface FastEthernet0/0
Router1(config-if)#
The name of the interface is provided as an argument. Here, the network interface that is configured is FastEthernet0/0.
ix. To return from the interface configuration to the global configuration mode, or from the global configuration mode to the Privileged EXEC mode, use the exit command:
Router1(config-if)#exit
Router1(config)#exit
Router1#
The exit command takes you one step up in the command hierarchy. To directly return to the Privileged EXEC mode from any configuration mode, use the end command:
Router1(config-if)#end
Router1#
x. To terminate the console session from the User EXEC mode, type logout or exit:
Router1>logout
Router con0 is now available
Press RETURN to get started

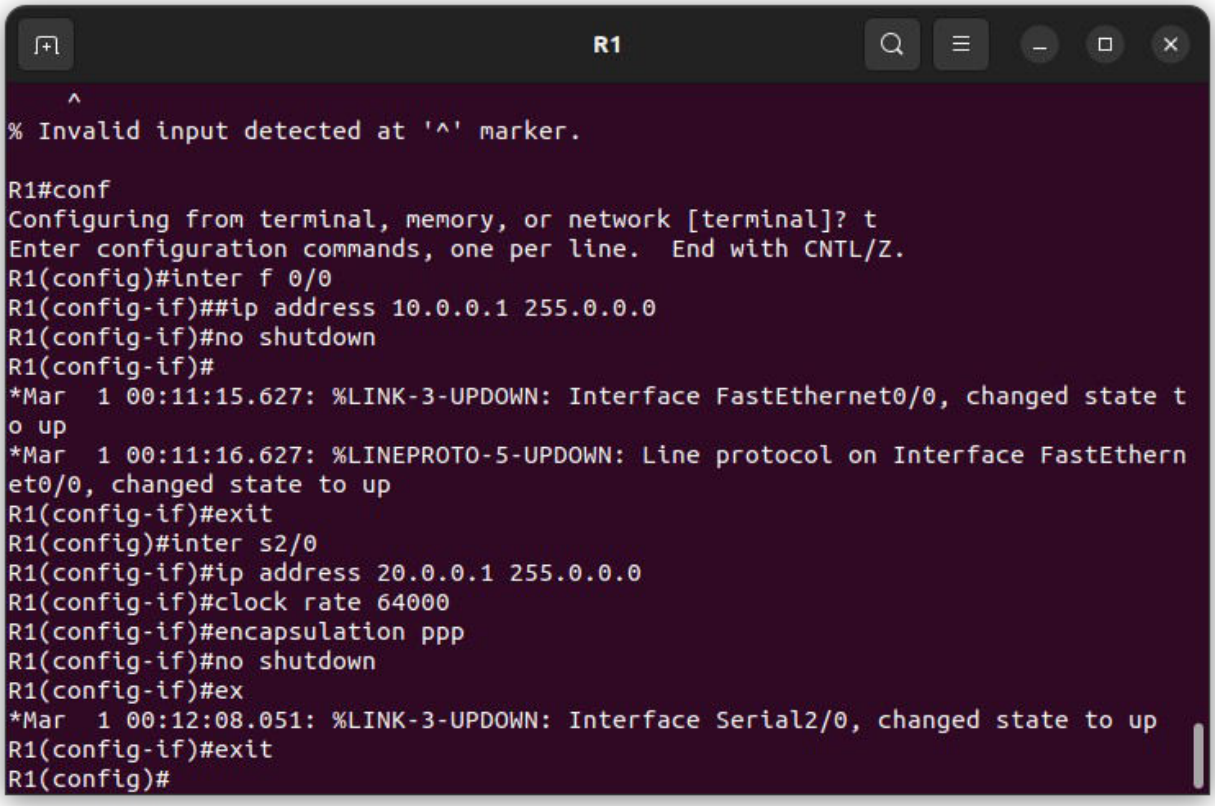


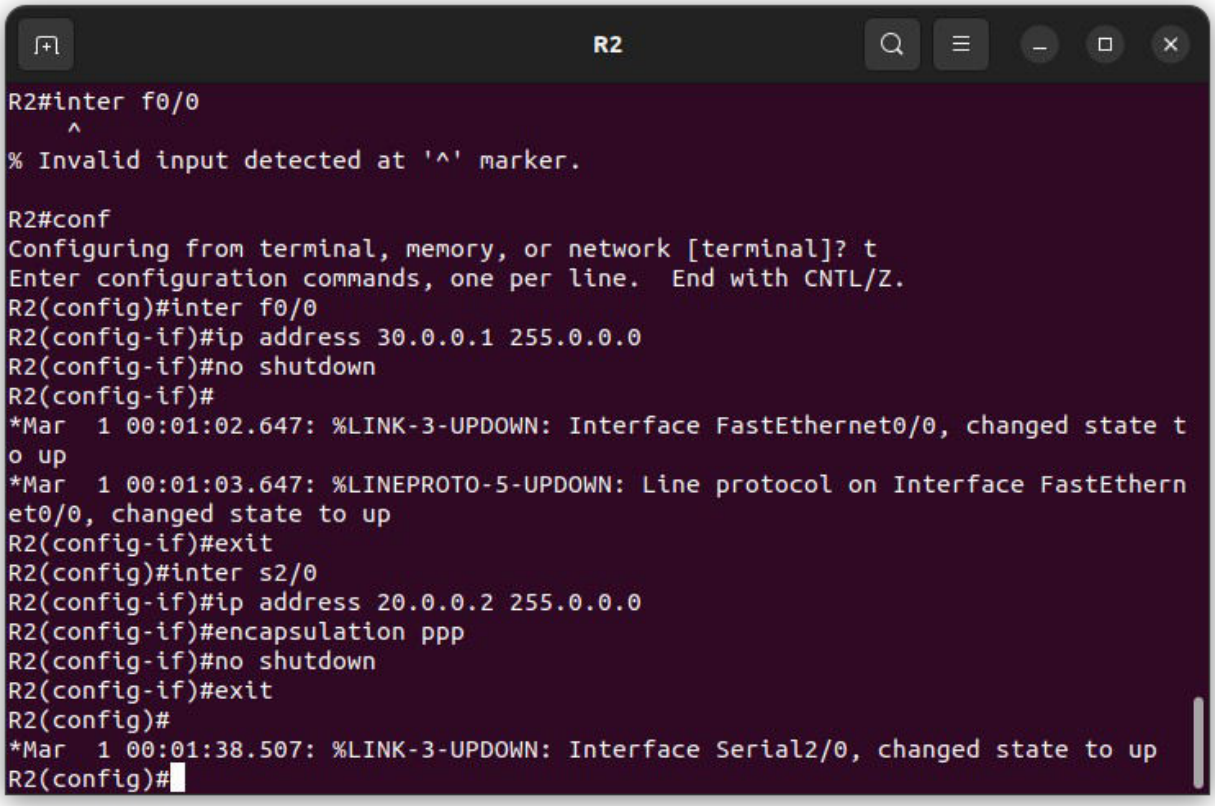
R1

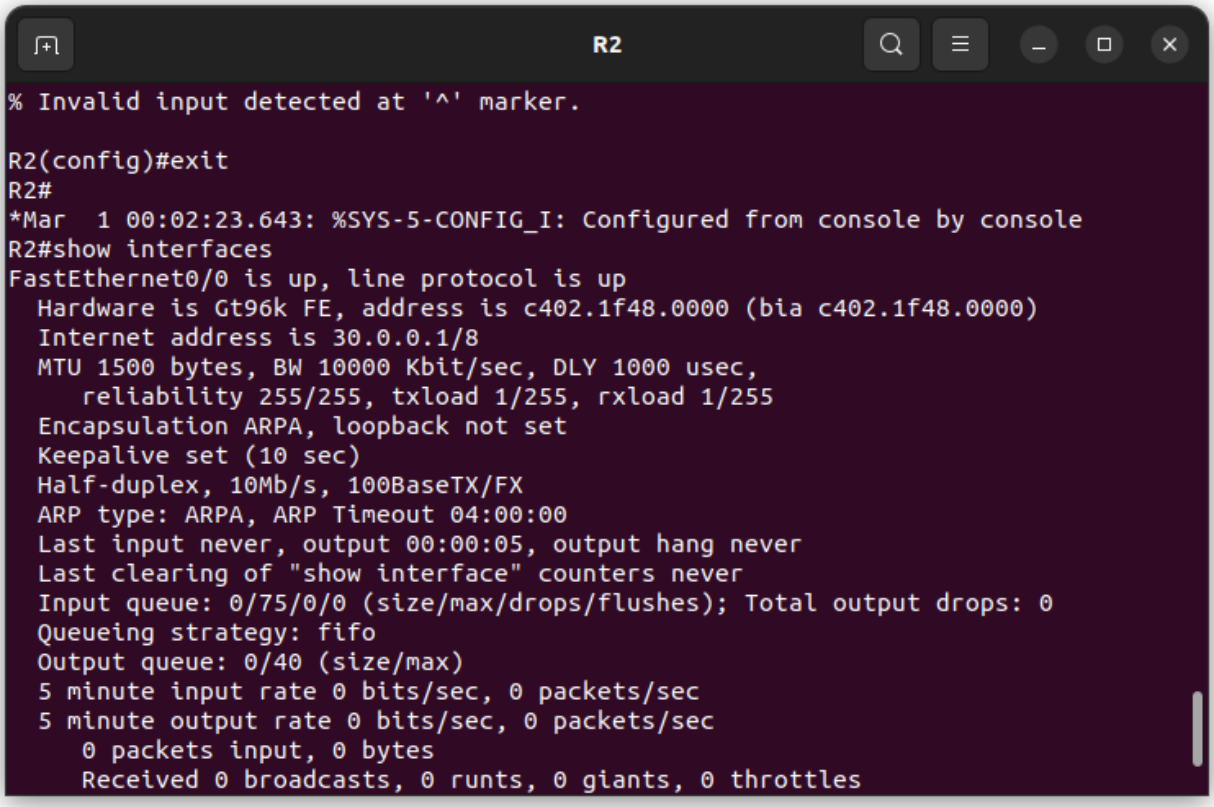
```
  disable          Turn off privileged commands
  disconnect       Disconnect an existing network connection
  dot1x            Dot1x Exec Commands

R1#enable
R1#disable
R1>enable
R1#conf
Configuring from terminal, memory, or network [terminal]? t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 20.0.0.0 255.0.0.0 10.0.0.2
R1(config)#interface FastEthernet0/0
R1(config-if)#
R1(config-if)#exit
R1(config)#exit
R1#
*Mar  1 00:08:07.679: %SYS-5-CONFIG_I: Configured from console by console
R1#logout
```

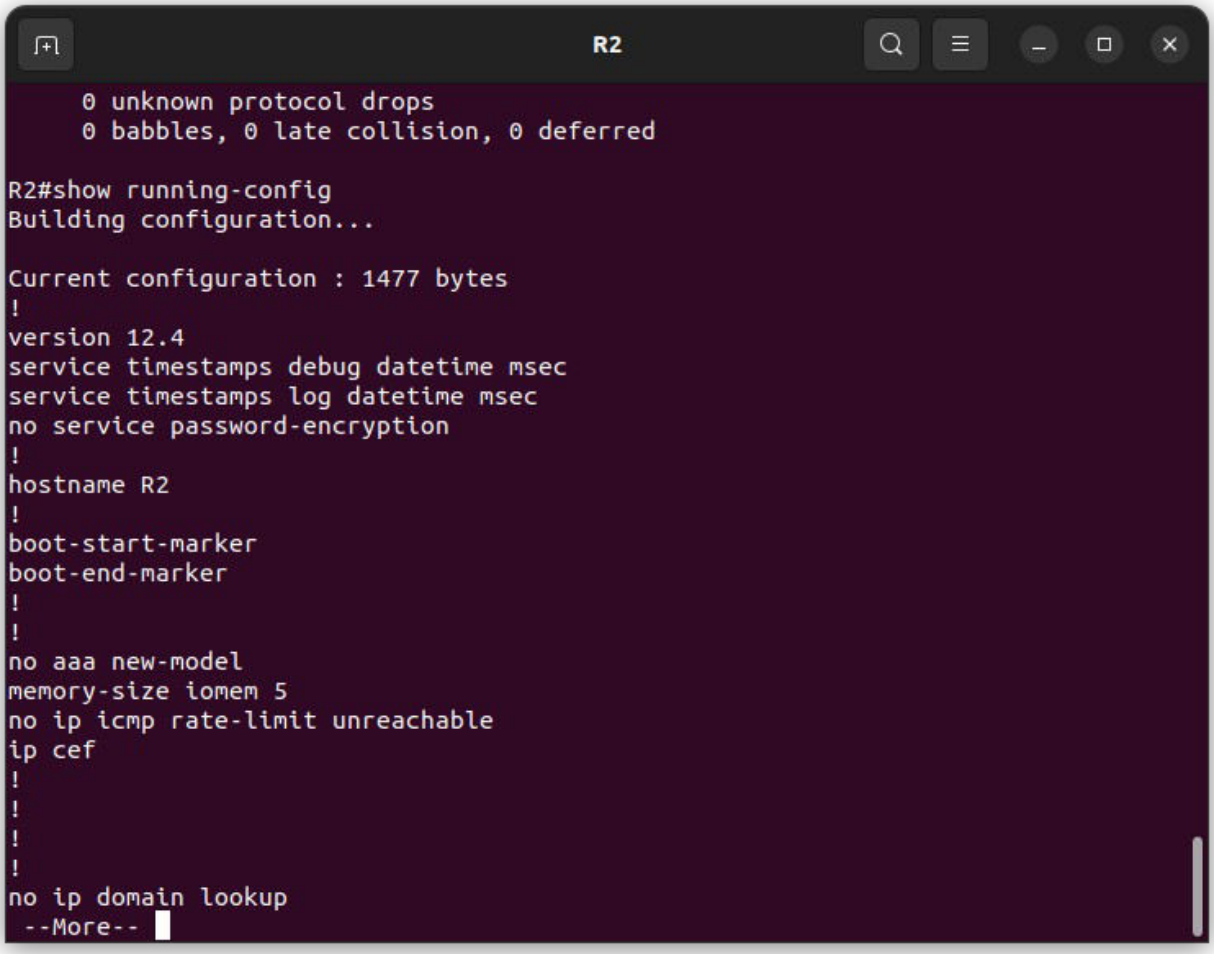
```
R1 con0 is now available



Press RETURN to get started.
```

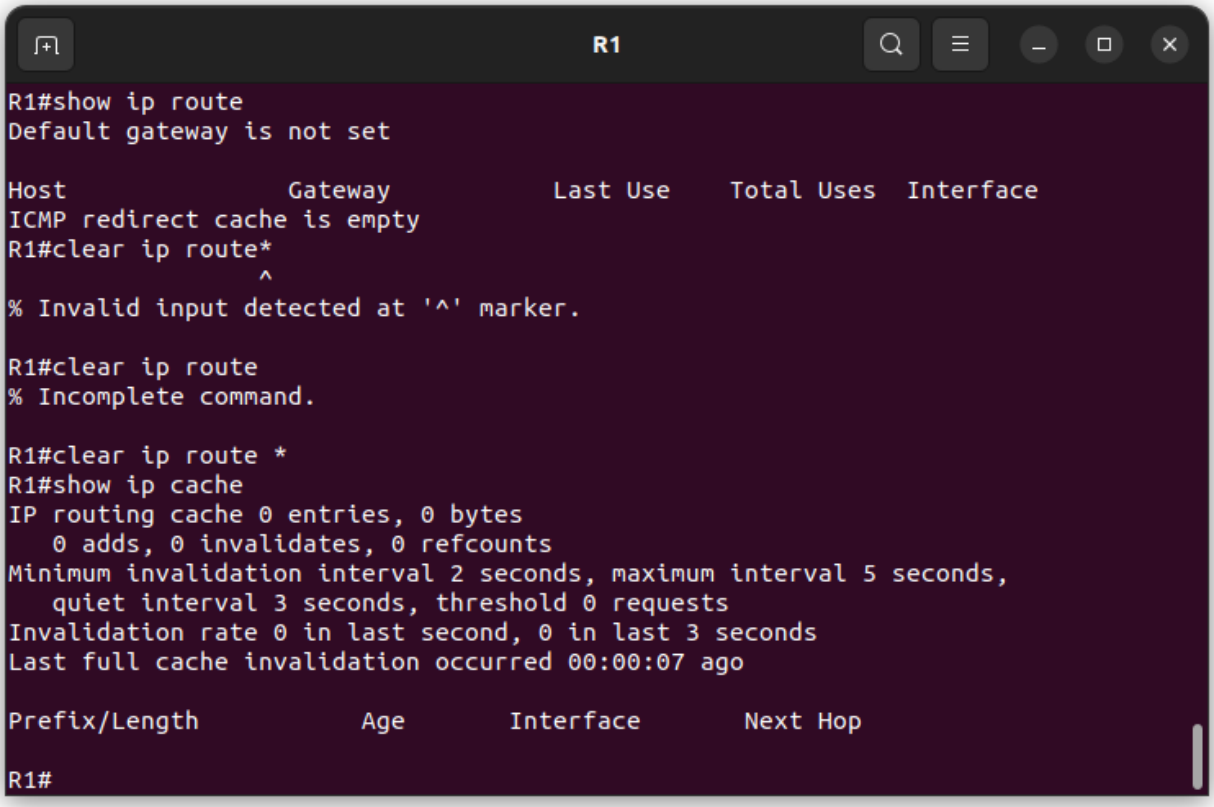
2. Configuring a Cisco Router via the console
The following exercises use basic commands from the Cisco IOS that are needed to configure a Cisco router.
PAGE: 61i. Right-click on Router1 and choose Start.
ii. Right-click on Router1 and choose Console. Wait some seconds until the initial console window is set up. When the router is ready to receive commands, proceed to the next step.
iii. Configure Router1 and Router 2 with the IP addresses given in Figure 6.7.
Note: In IOS Mode under Global Configuration,we can enable or disable IP Forwarding. When it is disabled it also deletes the contents of the routing table.
Router1(config)#ip routing
Router1(config)#no ip routing
In IOS Mode under Interface Configuration,we can enable or disable a network interface
Router1(config-if)#no shutdown
Router1(config-if)#shutdown
Tip: “no ip routing” is used to guarantee that the routing cache is empty, not routing table.
In Router 1
Interface Fastethernet0/0 in global configuration mode
R1(config)#inter f 0/0
R1(config-if)#ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown
R1(config-if)#exit
Interface Serial 2/0
R1(config)#inter s2/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#clock rate 64000
R1(config-if)#encapsulation ppp
R1(config-if)#no shutdown
R1(config-if)#exit
In Router 2
Interface Fastethernet 0/0
R2(config)#inter f0/0
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#no shutdown
R2(config-if)#exit
Interface Serial 2/0
R2(config)#inter s2/0
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#no shutdown
PAGE: 62R2(config-if)#exit
Tip to save Time: It will be tiring to manually type in the configuration data for a router, everytime you set a lab, you can save time by saving all this configurations in an excel file and simply copying and pasting in the router console window.
iv. When you are done, use the following command to check the changes you made to the router configuration, and save the outputs:
R1# show interfaces
R1#show running-config
v. Assign ip addresses for both PC's as mentioned in Figure 6.7 with appropriate ip and subnet maskand default gateway.


R1
^
% Invalid input detected at '^' marker.
R1#conf
Configuring from terminal, memory, or network [terminal]? t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#inter f 0/0
R1(config-if)##ip address 10.0.0.1 255.0.0.0
R1(config-if)#no shutdown
R1(config-if)#
*Mar 1 00:11:15.627: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar 1 00:11:16.627: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R1(config-if)#exit
R1(config)#inter s2/0
R1(config-if)#ip address 20.0.0.1 255.0.0.0
R1(config-if)#clock rate 64000
R1(config-if)#encapsulation ppp
R1(config-if)#no shutdown
R1(config-if)#ex
*Mar 1 00:12:08.051: %LINK-3-UPDOWN: Interface Serial2/0, changed state to up
R1(config-if)#exit
R1(config)#

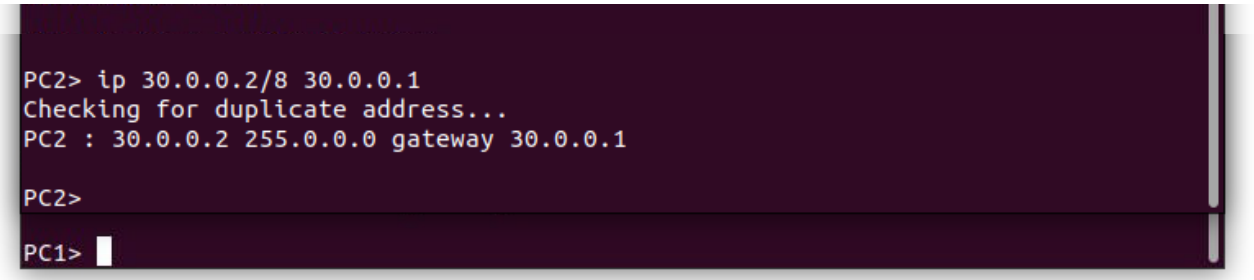

R2
R2#inter f0/0
^
% Invalid input detected at '^' marker.
R2#conf
Configuring from terminal, memory, or network [terminal]? t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#inter f0/0
R2(config-if)#ip address 30.0.0.1 255.0.0.0
R2(config-if)#no shutdown
R2(config-if)#
*Mar 1 00:01:02.647: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
*Mar 1 00:01:03.647: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
R2(config-if)#exit
R2(config)#inter s2/0
R2(config-if)#ip address 20.0.0.2 255.0.0.0
R2(config-if)#encapsulation ppp
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#
*Mar 1 00:01:38.507: %LINK-3-UPDOWN: Interface Serial2/0, changed state to up
R2(config)#


R2
% Invalid input detected at '^' marker.
R2(config)#exit
R2#
*Mar 1 00:02:23.643: %SYS-5-CONFIG_I: Configured from console by console
R2#show interfaces
FastEthernet0/0 is up, line protocol is up
  Hardware is Gt96k FE, address is c402.1f48.0000 (bia c402.1f48.0000)
  Internet address is 30.0.0.1/8
  MTU 1500 bytes, BW 10000 Kbit/sec, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half-duplex, 10Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:05, 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
     0 packets input, 0 bytes
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles


R2
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
R2#show running-config
Building configuration...
Current configuration : 1477 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname R2
!
boot-start-marker
boot-end-marker
!
!
no aaa new-model
memory-size iomem 5
no ip icmp rate-limit unreachable
ip cef
!
!
!
!
no ip domain lookup
 --More--



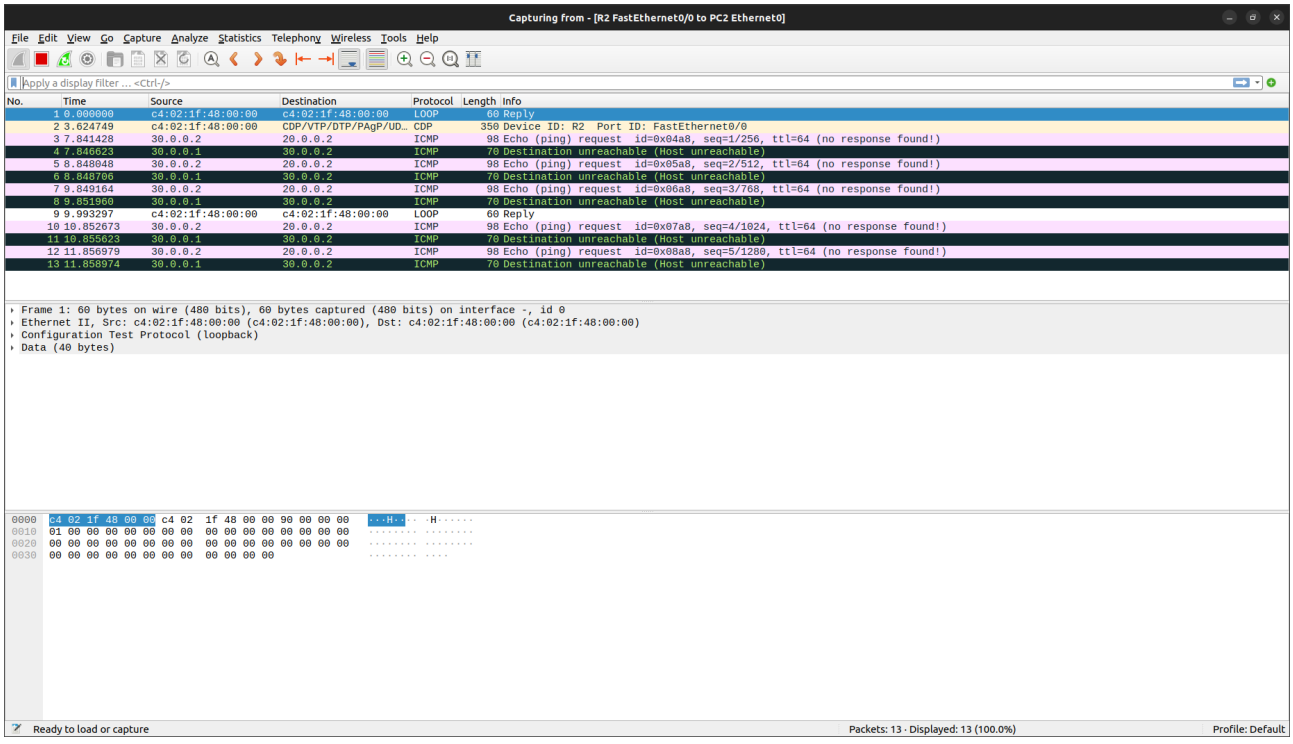
3. Setting static routing table entries on a Cisco router
In this exercise, you will add static routes to the routing table of Router1. The routing table must be configured so that it conforms to the network topology shown in Figure 6.7. The routes are configured manually, which is also referred to as static routing.
The IOS command to configure static routing is ip route. The command can be used to show, clear, add, or delete entries in the routing table. The commands are summarized in the list below.
Note: Whenever an IP address is configured for a network interface on a router, routing table entries for the directly connected network are added automatically.
PAGE: 63By default, Routers know only directed connected networks here Router 1 know only 10.0.0.0 and 20.0.0.0 it doesn't know the 30.0.0.0 like this R2 doesn't know about 10.0.0.0.So we are going to add Static route to this both router.
R1(config)#ip route Destination Network| Destination N/W Subnet Mask |Next Hop Address
In Router R1, just give this command, in this case Destination is 30.0.0.0 and its subnet mask is 255.0.0.0 next hop address is 20.0.0.2
R1(config)#ip route 30.0.0.0 255.0.0.0 20.0.0.2
In Router R2
R2(config)#ip route 10.0.0.0 255.0.0.0 20.0.0.1



Now both routers know all the networks.
i. Issue a ping command from PC1 to PC2, Router1 and PC4, respectively
ii. Save the captured Wireshark output.
iii. Use the saved data to answer the following questions:
• What is the output on PC1 when the ping commands are issued?

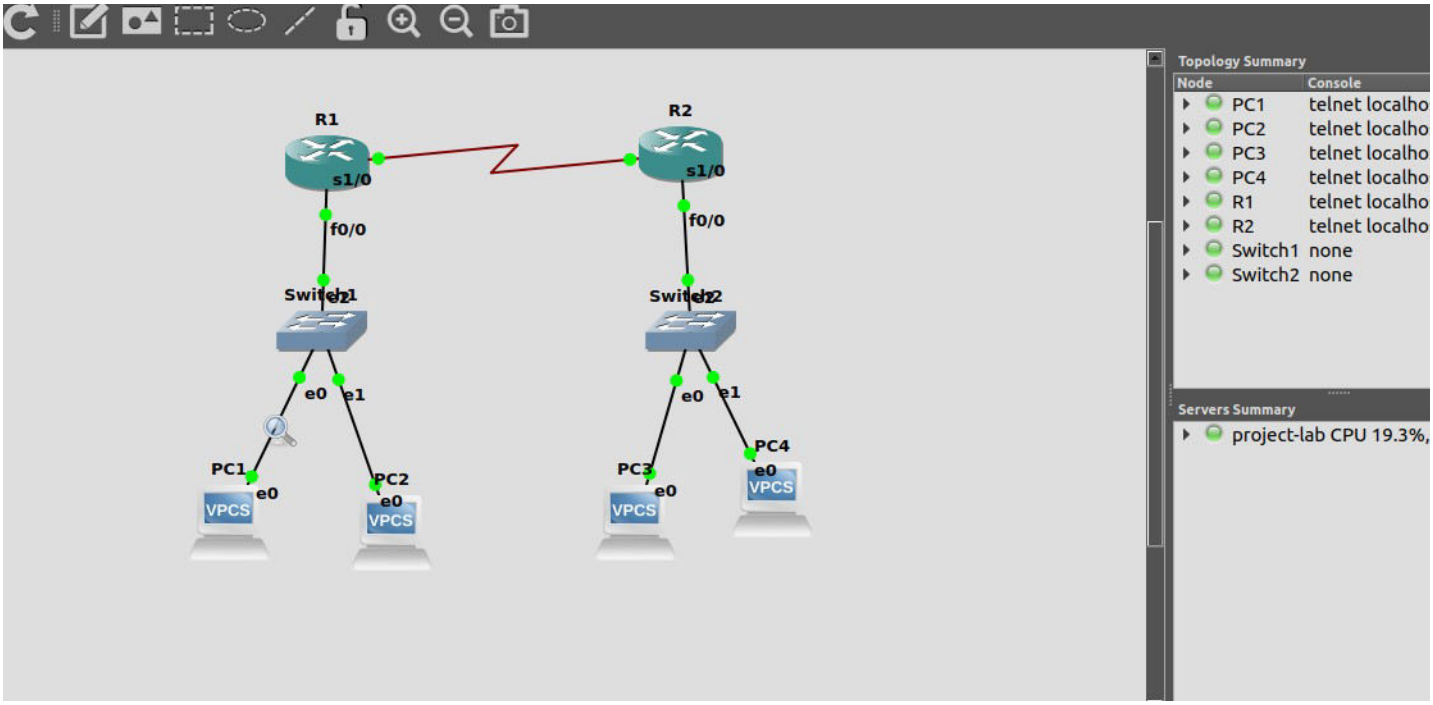
```
PC2> ping 20.0.0.2

*30.0.0.1 icmp_seq=1 ttl=255 time=5.576 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*30.0.0.1 icmp_seq=2 ttl=255 time=1.055 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*30.0.0.1 icmp_seq=3 ttl=255 time=3.107 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*30.0.0.1 icmp_seq=4 ttl=255 time=3.339 ms (ICMP type:3, code:1, Destination hos
t unreachable)
*30.0.0.1 icmp_seq=5 ttl=255 time=2.356 ms (ICMP type:3, code:1, Destination hos
t unreachable)

PC2>
```

• Which packets, if any, are captured by Wireshark?



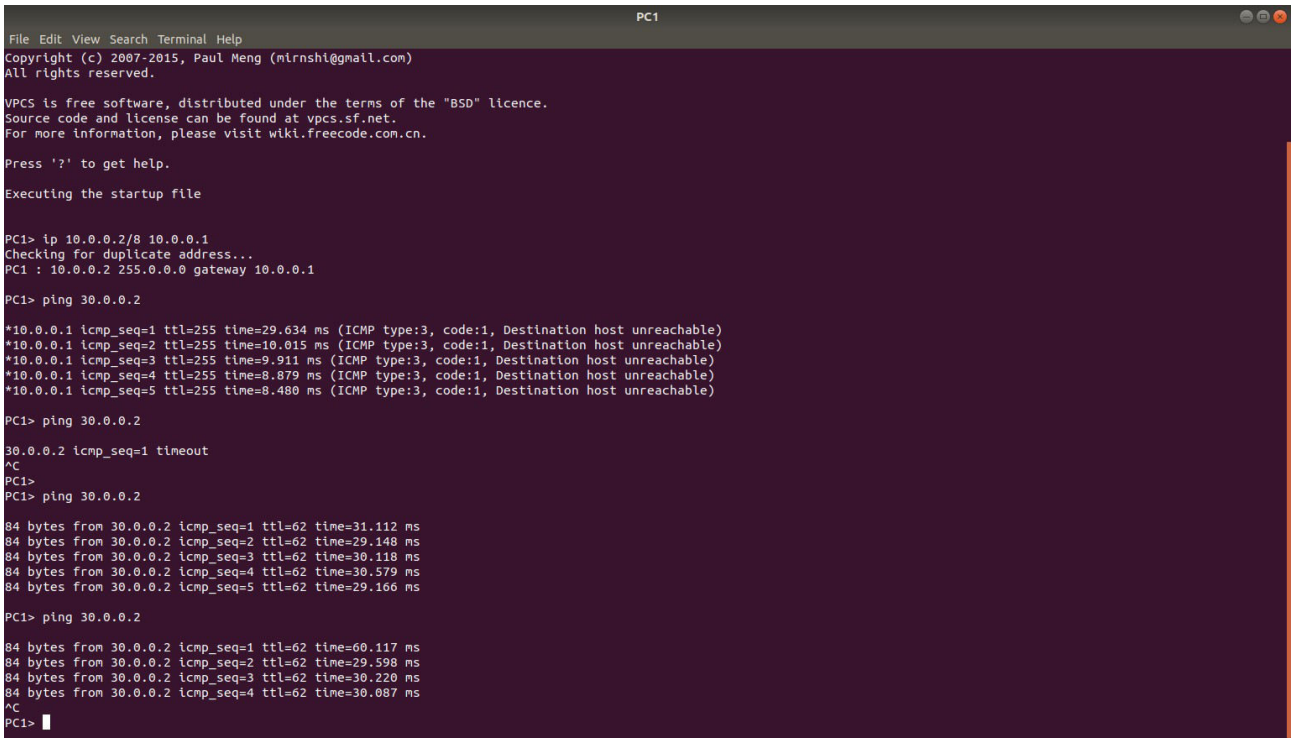
• Do you observe any ARP packets? If so, what do they indicate?
=> No it doesn't contain any ARP packets.

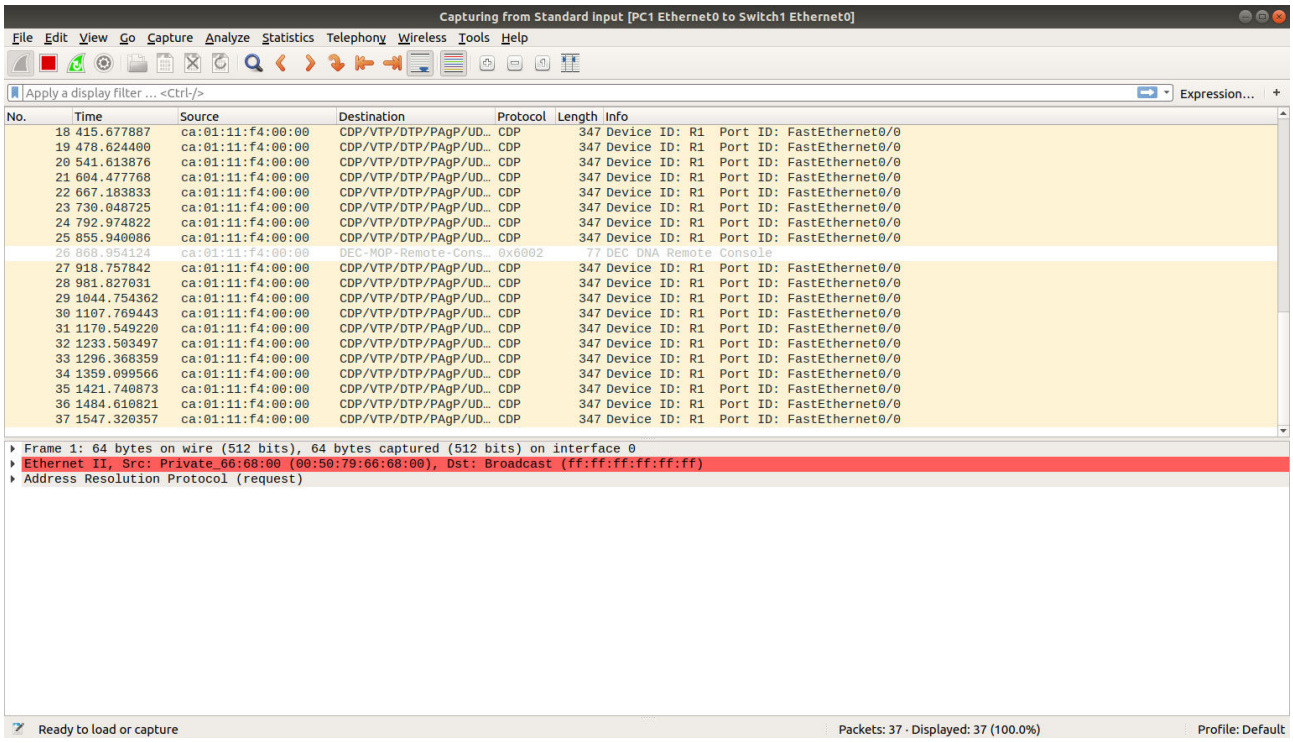
II. In the CSE department, two students sitting in two different labs want to establish a connection and send the data. So, configure the below network topology as shown in Figure. 6.8 and check the connectivity by pinging from PC0 to PC2.




```
PC2> ip 10.0.0.3/8 10.0.0.1
Checking for duplicate address...
PC2 : 10.0.0.3 255.0.0.0 gateway 10.0.0.1

PC2> ping 10.0.0.2

84 bytes from 10.0.0.2 icmp_seq=1 ttl=64 time=0.508 ms
84 bytes from 10.0.0.2 icmp_seq=2 ttl=64 time=0.826 ms
84 bytes from 10.0.0.2 icmp_seq=3 ttl=64 time=0.834 ms
^C
PC2>
```

```
PC3> ip 30.0.0.2/8 30.0.0.1
Checking for duplicate address...
PC3 : 30.0.0.2 255.0.0.0 gateway 30.0.0.1
```


PC1
File Edit View Search Terminal Help
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
PC1> ip 10.0.0.2/8 10.0.0.1
Checking for duplicate address...
PC1 : 10.0.0.2 255.0.0.0 gateway 10.0.0.1
PC1> ping 30.0.0.2
*10.0.0.1 icmp_seq=1 ttl=255 time=29.634 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.0.1 icmp_seq=2 ttl=255 time=10.015 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.0.1 icmp_seq=3 ttl=255 time=9.911 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.0.1 icmp_seq=4 ttl=255 time=8.879 ms (ICMP type:3, code:1, Destination host unreachable)
*10.0.0.1 icmp_seq=5 ttl=255 time=8.480 ms (ICMP type:3, code:1, Destination host unreachable)
PC1> ping 30.0.0.2
30.0.0.2 icmp_seq=1 timeout
^C
PC1>
PC1> ping 30.0.0.2
84 bytes from 30.0.0.2 icmp_seq=1 ttl=62 time=31.112 ms
84 bytes from 30.0.0.2 icmp_seq=2 ttl=62 time=29.148 ms
84 bytes from 30.0.0.2 icmp_seq=3 ttl=62 time=30.118 ms
84 bytes from 30.0.0.2 icmp_seq=4 ttl=62 time=30.579 ms
84 bytes from 30.0.0.2 icmp_seq=5 ttl=62 time=29.166 ms
PC1> ping 30.0.0.2
84 bytes from 30.0.0.2 icmp_seq=1 ttl=62 time=60.117 ms
84 bytes from 30.0.0.2 icmp_seq=2 ttl=62 time=29.598 ms
84 bytes from 30.0.0.2 icmp_seq=3 ttl=62 time=30.220 ms
84 bytes from 30.0.0.2 icmp_seq=4 ttl=62 time=30.087 ms
^C
PC1>


Capturing from Standard input [PC1 Ethernet0 to Switch1 Ethernet0]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
Expression...
No. Time Source Destination Protocol Length Info
18 415.677887 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
19 478.624400 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
20 541.613876 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
21 604.477768 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
22 667.183833 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
23 730.048725 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
24 792.974822 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
25 855.940086 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
26 868.954124 ca:01:11:f4:00:00 DEC-MOP-Remote-Cons… 0x6002 77 DEC DNA Remote Console
27 918.757842 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
28 981.827031 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
29 1044.754362 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
30 1107.769443 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
31 1170.549220 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
32 1233.503497 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
33 1296.368359 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
34 1359.099566 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
35 1421.740873 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
36 1484.610821 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
37 1547.320357 ca:01:11:f4:00:00 CDP/VTP/DTP/PAgP/UD… CDP 347 Device ID: R1 Port ID: FastEthernet0/0
Frame 1: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface 0
Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Address Resolution Protocol (request)
Ready to load or capture
Packets: 37 · Displayed: 37 (100.0%)
Profile: Default