Engineering Journal

CIT 167

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Basic Commands 2020

Packet Tracer Labs **CIT 167**
Spring 2020 Chaz Davis

Basic Router Commands

```
Router> ---User EXEC mode exit
Router> ?
Router> enable
---------------
Router# ---Privileged EXEC mode disable, exit
Router# ?
-----------------
Router# configure terminal
Router(config)# ---Global Config mode exit, end, Ctrl+c, Ctrl+z
Router(config)# ?
-----------------
Router(config)# line vty 0 15
Router(config)# line console 0
Router(config-line)# ---Line configuration mode exit, end, Ctrl+c, Ctrl+z
Router(config-line)# ?
----------------------------
Router(config)# interface gigabitEthernet 0/0/0
Router(config-if)# ---Interface configuration mode exit, end, Ctrl+c, Ctrl+z
Router(config-if)# ?
```

Router Config Commands

```
Router#
Router# configure terminal
Router# show ?
Router# show running-config
Router# copy running-config startup-config
Router# ping 192.168.1.100
Router# traceroute 192.168.1.100
Router# ssh 192.168.1.100
Router# telnet 192.168.1.100
Router# debug ?
Router# clock set 07:14:00 October 15 2019
Router# reload
---------------------------------
Router(conf)#
Router(conf)# hostname R1
Router(conf)# banner motd "No unauthorized access allowed!"
Router(conf)# enable password class
Router(conf)# enable secret class
Router(conf)# service password-encryption
Router(config)# line vty 0 15
Router(config)# line console 0
Router(config)# interface gigabitEthernet 0/0/0
----------------------------------------------------
Router(config-line)#
Router(config-line)# password cisco
Router(config-line)# login
Router(config-line)# transport input all (line vty)
----------------------------------------------------
Router(config-if)#
Router(config-if)# interface gigabitEthernet 0/0/0
Router(config-if)# int g0/0 //command abbreviation
Router(config-if)# ip address 192.168.1.1 255.255.255.0
Router(config-if)# no shutdown
```

Basic Switch Commands

```
Switch> ---User EXEC mode exit
Switch> enable
---------------
Switch# ---Privileged EXEC mode disable, exit
-----------------
Switch# configure terminal
Switch(config)# ---Global Config mode exit, end, Ctrl+c, Ctrl+z
-----------------
Switch(config)# line vty 0 15
Switch(config)# line console 0
Switch(config-line)# ---Line configuration mode exit, end, Ctrl+c, Ctrl+z
----------------------------
Switch(config)# interface vlan 1
Switch(config-if)# ---Interface configuration mode exit, end, Ctrl+c, Ctrl+z
----------------------------
Switch#
Switch# configure terminal
Switch# show ?
Switch# show running-config
Switch# copy running-config startup-config
Switch# ping 192.168.1.100
Switch# traceroute 192.168.1.100
Switch# ssh 192.168.1.100
Switch# telnet 192.168.1.100
Switch# debug ?
Switch# clock set 07:14:00 October 15 2019
Switch# reload
---------------------------------
Switch(conf)#
Switch(conf)# hostname R1
Switch(conf)# banner motd "No unauthorized access allowed!"
Switch(conf)# enable password class
Switch(conf)# enable secret class
Switch(conf)# service password-encryption
Switch(config)# line vty 0 15
Switch(config)# line console 0
Switch(config)# interface vlan 1
----------------------------------------------------
Switch(config-line)#
Switch(config-line)# password cisco
Switch(config-line)# login
Switch(config-line)# transport input all (line vty)
----------------------------------------------------
Switch(config-if)#
Switch(config-if)# interface vlan 1
Switch(config-if)# ip address 192.168.1.2 255.255.255.0
Switch(config-if)# no shutdown
Switch(config-if)# exit
Switch(config)# ip default-gateway 192.168.1.1
```

Extra helpful commands:

```
Router(conf)# no ip domain-lookup //prevents miss-typed commands from being "translated..."
Router(conf-line)# logging synchronous //prevents logging output from interrupting your command input
```

Useful Bits: Basics

2020

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```
User can interact with a shell with a CLI or a GUI.

Cisco IOS is used for cisco devices

The most common way to configure a HOME router is with a web broswer

Methods to access the CLI environment:
-Console : Physical management port that provides out of band access,
  works even without connectivity
-SSH : Secure CLI connection, requires active networking services
-Telnet: Like SSH but insecure because everything is sent in cleartext

Some devices also support a legacy AUX port used to establish remote CLI session using a modem.
It works similarly to console connection.

Some useful terminal emulators via SSH/Telnet:
-PuTTY
-Tera term
-OS X terminal
-SecureCRT

For security Cisco IOS separates management access into two modes:
-User EXEC mode: Limited capabilities but useful for basic operations and monitoring,
 Doesn't allow change to configurations
 CLI prompt ends with a >
 referred as 'view-only' mode

-Privileged EXEC mode: Higher configuration modes can only be accessed this mode
       CLI prompt ends with a #


To configure the device the user must enter Global configuration mode:
- it is identified by a command prompt that ends with (config)#
- changes here affect the device as a whole
- from here you can access more specifi sub-configuration mode for specific function of the IOS device:
Two common subs are:
-Line configuration Mode: (config-line)#
-Interface configuration Mode: (config-if)#


If you type 'enable' on command line you go from user EXEC to privileged EXEC mode
If you type 'disable' on command line you return to the user EXEC mode

From privileged EXEC mode if i type 'configure terminal' i go to Global configuration mode
To return to privileged EXEC mode type 'exit'
```

```
From Global configuration mode if i type 'interface <interface-name> <interface-number'
  i get to the specific interface configuration
for the specified interface, the same for line 'line <line-name> <line-number>'.
You don't need to return to global configuration mode to switch between sub-configurations.
To return to Global Configuration mode (from sub-configuration) type 'exit'.
To return directly to Privileged exec mode type 'end' or press 'Ctrl+Z'

The general command syntax is the command followed by keywords and arguments:
-Keyword : a specific parameter defined in the operating system
-Argument: not predefined, a variable or value user-defined.

Convention:
boldface: commands and literals that you enter as shown
italics: arguments for which you suplly values
[x] : Optional element
{x} : Required element
[x {y | z}]: Required choice within an optional argument

IOS helps:
-Context-sensitive help:
Helps you find quickly which command are available in each command mode
To access it type '?' at the CLI
It can even be used to check what parameters a particular command accept
or to finish the name of a command.
Command syntax check:
If a command is entered wrong, the CLI provides the user a feedback about what is wrong.
```

Cisco IOS shortcuts

```
IMPORTANT SHORTCUTS : Ctrl-Shift-6 To abort a command mid-stream
  (Useful for mistyped commands and cisco IOS attempting translate it with DNS)
      Ctrl+R refresh last command (example if an output of a interface down/up
    shows in the middle of typing a command)

Hostnames:
-Case sensitive
-to change hostname use the command 'hostname <hostname>' in Global Config Mode
-to reset default hostname use the command 'no hostname' in Global Config Mode

Passwords:
-use 'enable secret <password>' in Global Config Mode to set password for Privileged Exec Mode
-to set a password in user EXEC mode, type 'password <password>' in line console configuration mode
('line console 0' global config command)

 next enable user login with the 'login' command
-to set a password for VTY (Virtual terminal) lines used for SSH and Telnet enter line VTY config mode
with 'line vty 0 15' (if 16 vty lines)
 next set password with 'password <password>' and enable login with 'login'
-To encrypt passwords:
Use command 'service password-encryption', this applies only to configuration files

To check the config for encryption run 'show running-config'

To add a banner message of the day use 'banner motd # the message of the day # '

There are two types of config:
-startup config ,stored in NVRAM, to view it use 'show startup-config'
-running config ,stored in RAM
To save changes made to the running config in the startup config do 'copy running-config startup-config'
To restore the startup config run in privileged EXEC mode 'reload'
If unwanted changes were made to the startup config file it is
      possible to remove it by using 'erase startup-config'
```

```
Types of network media include twisted-pair copper cables,
      fiber-optic cables,
      coaxial cables,
      or wireless as shown in the figure.

Difference between them:

    Distance the media can successfully carry a signal

    Environment in which the media is to be installed

    Amount of data and the speed at which it must be transmitted

    Cost of the media and installation
```

```
Cisco IOS Layer 2 switches have physical ports for devices to connect.
These ports do not support Layer 3 IP addresses.
Therefore, switches have one or more switch virtual interfaces (SVIs)

IP address information can be added:
-manually
-using DHCP

To configure SVI use 'interface vlan 1' in global config mode.
Assign an ip address using 'ip address <ip-address> <subnet-mask>'
Enable the inteface using 'no shutdown'

To see a brief interface ip screen : 'show ip inteface brief'

To test the connectivity of a device on a network
or of a website use the command 'ping <ip-address>'
```

Lab 1

Configuring Basic Router Settings Jan 23, 2020

Packet Tracer Lab 1 **CIT 167**
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- Important Commands for the Lab

- no ip domain lookup suppresses all DNS-lookups from the router to the configured DNS seves
  allows for sloppy typing keeps from doing a lookup everytime
  better practice configure ip name-server
  then disable automatic telnetting to "hostnames""
  transport prefferred none and set that for con, aux, and vty
- exec-timeout 5 0
  configure the inactive session timeout on console port
  parameter passed in is minutes
  if two nubers passed the second is seconds
- logging synchronous
  for when long commands are interrupted by console message
  tells the router to hold messages until it detects no input from the keyboard
- service password-encryption
  normally all passwords, except enable secret, are stored in clear-text
  stores all passwords in an encrypted form
  stores them using an MD5 hashing algorithm
- ? allows you to look up help from commandline
  similar to –help on linux
  if no help available, returns <CR>

- Important Concepts

- Understand the process of setting up new schemes
- Logging in over ssh and telnet from the commandline
- Finding info through the long lines of output

Part 1:Set Up the Topology

i) Cable the Network I started off by placing the the router(1941), the switch(2960), and 2 windows 7 pcs on the the canvas.

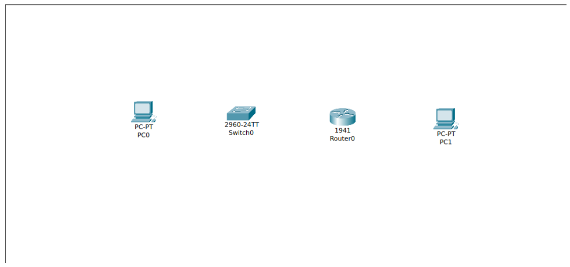
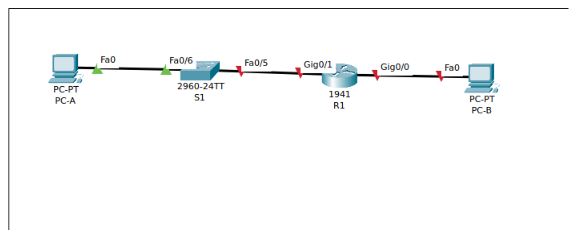


Figure 1.1: View of the Network Topology

ii) Wiring up the routers
Next I used straight copper wiring to connect the router the switch and the two pcs and renamed the accordingly. See Fig 1.2.

Device	connected on	connected to
PC-A	FA0	S1 Fa0/6
S1	Fa0/6	PC-A Fa0/6
R1	gig 0/1	S1 Fa0/5
PC-B	FA0	R1 gig0/0

(a) IP table



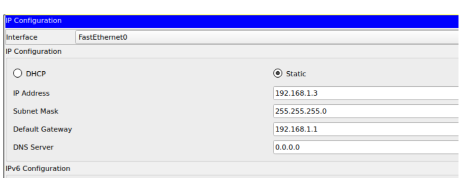
(b) Showing the Network

Figure 1.2: Configuring the Network

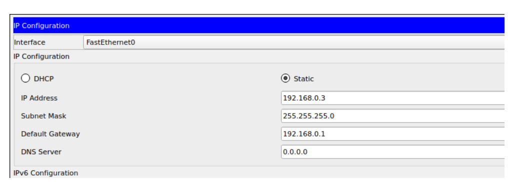
Part 2: Configure Devices and Verify connectivity

I started off by configuring the ipaddress, subnet mask, and default gateways on PC-A and PC-B

i) Configuring the PCs I started off by configuring the IPs for the PC's. See Fig 1.3.



(a) IP Config PC-A



(b) IP Config PC-B

Figure 1.3: Configuring the IPs

ii) Configuring the router

Next I logged into the router went to the commandline, and escalated to priveledged exec mode.

1

Name and passwords

```
Router>ena
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname R1
R1(config)#no ip domain lookup
R1(config)#no ip domain-lookup
R1(config)#security passwords min-length 10
R1(config)#enable secret cisco12345
R1(config)#line con 0
R1(config-line)#password coscoconpass
R1(config-line)#exec-timeout 5 0
R1(config-line)#login
R1(config-line)#logging synchronous
R1(config-line)#exit
R1(config)#line vty 0 4
R1(config-line)#password ciscovtypass
R1(config-line)#exec-timeout 5 0
R1(config-line)#login
R1(config-line)#logging synchronous
R1(config-line)# exit
R1(config)#service password-encryption
R1(config)#banner motd #Unauthorized access prohibited!#
```

2

Connections

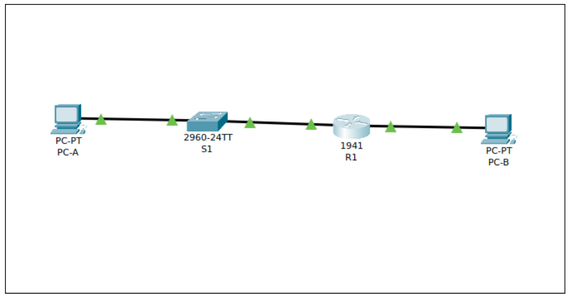
```
R1(config)#int g0/0
R1(config-if)#description Connection to PC-B
R1(config-if)#ip address 192.168.0.1 255.255.255.0
R1(config-if)#no shut

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0,
changed state to up

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

R1(config-if)#exit
R1(config)#exit
R1#
%SYS-5-CONFIG_I: Configured from console by console

R1#clock set 10:00:00 28 Jan 2020
R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#
```

I then did the same for PC-A

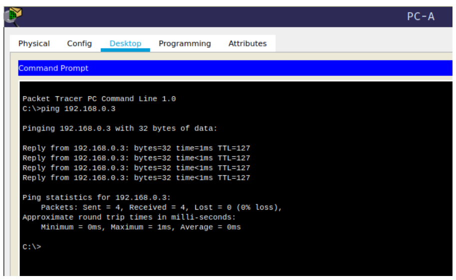
```
R1(config)#int g 0/1
R1(config-if)#description Connection to S1
R1(config-if)#ip address 192.168..1.1 255.255.255.0
                         ^
% Invalid input detected at '^' marker.

R1(config-if)#ip address 192.168.
                         ^
% Invalid input detected at '^' marker.

R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shut

R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1,
changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/1, changed state to up

R1(config-if)#
```

3

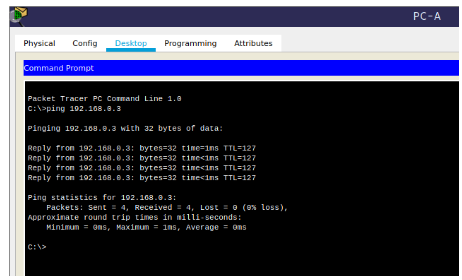
Verifying network connectivity



(a) R1 Enable



(b) Pingin PC-B from PC-A



(c) Telnet PC-A to R1

Figure 1.4: Verifying the Network Connectivity

Part 3: Display Router Information

i) important hardware and software info

While logged in with telnet I ran the following commands

```
R1>show version
Cisco IOS Software, C1900 Software (C1900-UNIVERSALK9-M),
Version 15.1(4)M4, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2007 by Cisco Systems, Inc.
Compiled Wed 23-Feb-11 14:19 by pt_team

ROM: System Bootstrap, Version 15.1(4)M4, RELEASE SOFTWARE (fc1)
cisco1941 uptime is 1 hours, 19 minutes, 11 seconds
System returned to ROM by power-on
System image file is "flash0:c1900-universalk9-mz.SPA.151-1.M4.bin"
Last reload type: Normal Reload

This product contains cryptographic features
and is subject to United States and local country
laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export,
distribute or use encryption. Importers, exporters,
distributors and users are responsible for
compliance with U.S. and local country laws.
By using this product you agree to comply with
applicable laws and regulations. If you are unable to
comply with U.S. and local laws,
return this product immediately.

A summary of U.S. laws governing Cisco
cryptographic products may be found at:
```

```
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
```

We can see that the IOS image on the router is Cisco IOS Software,

```
C1900 Software (C1900-UNIVERSALK9-M), Version 15.1(4)M4, RELEASE SOFTWARE (fc2)
```

We can also see that the NVRAM by using show flash:

```
R1#show flash

System flash directory:
File  Length   Name/status
  3   33591768 c1900-universalk9-mz.SPA.151-4.M4.bin
  2   28282    sigdef-category.xml
  1   227537   sigdef-default.xml
[33847587 bytes used, 221896413 available, 255744000 total]
249856K bytes of processor board System flash (Read/Write)
```

ii) Display Startup Info

```
R1#show startup-config
Using 959 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
service password-encryption
security passwords min-length 10
!
hostname R1
!
enable secret 5 $1$mERr$WvpW0n5HghRrqnrwXCUUl.
!
ip cef
no ipv6 cef
!
license udi pid CISCO1941/K9 sn FTX1524C630-
no ip domain-lookup
spanning-tree mode pvst
!
interface GigabitEthernet0/0
 description Connection to PC-B
 ip address 192.168.0.1 255.255.255.0
 duplex auto
 speed auto
!
interface GigabitEthernet0/1
 no ip address
 duplex auto
 speed auto
 shutdown
!
interface Vlan1
 no ip address
 shutdown
!
ip classless
ip flow-export version 9
banner motd ^CUnauthorized access prohibited!^C
!
line con 0
 exec-timeout 5 0
 password 7 0822435D0A1606181C1B0D1739
 logging synchronous
 login
!
line aux 0
!
line vty 0 4
 exec-timeout 5 0
 password 7 0822455D0A1613030B1B0D1739
 logging synchronous
 login
```

```
!
end
```

From this we can see that the passwords are encrypted

I used show startup-config | begin vty

It did not like that command wouldnt show any info

iii) Display the routing table on the router

i ran show ip route

```
R1#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, E - EGP
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 - ODR
P - periodic downloaded static route

Gateway of last resort is not set

  192.168.0.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.0.0/24 is directly connected, GigabitEthernet0/0
L 192.168.0.1/32 is directly connected, GigabitEthernet0/0
  192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C 192.168.1.0/24 is directly connected, GigabitEthernet0/1
L 192.168.1.1/32 is directly connected, GigabitEthernet0/1

R1#
```

There are two entries with a C encoding

iv) Display a summary list Display a summary list of the interfaces on the router

I ran the show ip interface brief command:

```
show ip interface brief
Interface           IP-Address  OK? Method Status           Protocol
GigabitEthernet0/0  192.168.0.1 YES manual up                    up
GigabitEthernet0/1  192.168.1.1 YES manual up                    up
Vlan1               unassigned  YES unset  administratively down down
```

when we gave the command ‘no shut‘ that changed the gig ethernet ports from down to up.

Lab 2

Documenting The Network Jan 26, 2020

Packet Tracer Lab 2 **CIT 167**
Spring 2020 Chaz Davis

- Important Commands for the Lab

- show interface displays the status of the router's interfaces
  interface status up/down
  Protocol status on the device
  Utilization
  Errors
  MTU
  MTU
- show ip interface (brief) tons of useful info:
  IP protocol status
  all its services
  all of its interfaces and their protocols and status'
  Ip address
  Layer 2 status
  layer 3 status
  it is the config thats in the routers memory.
  sh run this is not updated upon changes. but upon running the command copy running-configuration startup-configuration
- show ip route
  lists all networks that the router can reach
  their metric - the routers preference for them and how to get there
- show version gives the routers config register (firmware settings)
  the last time it was booted
  the version of the IOS
  the model of router
  the amount of ram and Flash

Part 1: filling in the table

i) R2 I logged into R2 and ran the following commands i ran show ip config

```
Interface              IP-Address      OK? Method Status Protocol
GigabitEthernet0/0     10.255.255.245  YES manual up       up
GigabitEthernet0/1     10.255.255.249  YES manual up        up
GigabitEthernet0/2     10.10.10.1      YES manual up        up
Serial0/0/0            64.100.100.1    YES manual up        up
Serial0/0/1            unassigned      YES unset  up        up
Serial0/0/1.1          64.100.200.2    YES manual up        up
Vlan1                  unassigned      YES unset
administratively down down
```

I then ran show interfaces

```
GigabitEthernet0/0 is up, line protocol is up (connected)
Hardware is CN Gigabit Ethernet, address is
0001.969a.1d01 (bia 0001.969a.1d01)
Internet address is 10.255.255.245/30
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 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 RJ45
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 63 bits/sec, 0 packets/sec
5 minute output rate 65 bits/sec, 0 packets/sec
241 packets input, 16664 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 watchdog, 1017 multicast, 0 pause input
0 input packets with dribble condition detected
```

I then ran show running-config

```
Building configuration...

Current configuration : 2258 bytes
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
hostname R2
enable secret 5 $1$mERr$9cTjUIEqNGurQiFU.ZeCi1
ip cef
no ipv6 cef
username Tier3a password 0 cisco
username administrator password 0 cisco
license udi pid CISCO2911/K9 sn FTX15249169
ip ssh version 2
ip domain-name Central
ip host R1 10.255.255.254 10.255.255.246 10.2.0.1
ip host R3 10.255.255.253 10.255.255.250 10.3.0.1
spanning-tree mode pvst
interface GigabitEthernet0/0
 ip address 10.255.255.245 255.255.255.252
 ip ospf priority 255
 duplex auto
 speed auto
interface GigabitEthernet0/1
 ip address 10.255.255.249 255.255.255.252
 ip ospf priority 255
 duplex auto
 speed auto
interface GigabitEthernet0/2
 ip address 10.10.10.1 255.255.255.0
```

```
  duplex auto
  speed auto
 interface Serial0/0/0
  ip address 64.100.100.1 255.255.255.252
  encapsulation ppp
  ppp authentication pap
  ppp pap sent-username R2 password 0 cisco
 interface Serial0/0/1
  no ip address
  encapsulation frame-relay
  clock rate 2000000
 interface Serial0/0/1.1 point-to-point
  ip address 64.100.200.2 255.255.255.252
  frame-relay interface-dlci 202
  clock rate 2000000
 interface Vlan1
  no ip address
  shutdown
 router ospf 1
  log-adjacency-changes
  passive-interface Serial0/0/0
  passive-interface Serial0/0/1
  network 10.255.255.244 0.0.0.3 area 0
  network 10.255.255.248 0.0.0.3 area 0
  network 10.10.10.0 0.0.0.255 area 0
  network 64.100.100.0 0.0.0.3 area 0
  default-information originate
 ip classless
 ip route 0.0.0.0 0.0.0.0 64.100.100.2
 ip route 0.0.0.0 0.0.0.0 64.100.200.1 200
 ip flow-export version 9
 ip access-list extended PERMIT_LOCAL
  permit udp any any eq domain
  permit tcp any any eq domain
  permit ip 64.100.200.0 0.0.0.3 any
  permit ip 64.104.223.0 0.0.0.3 any
  permit icmp 64.100.200.0 0.0.0.3 any
  permit icmp 64.104.223.0 0.0.0.3 any
  permit icmp any any echo-reply
  deny ip any any
 banner login Username: administrator
 Password: cisco Enable: class
 banner motd Username:administrator
 Password:cisco Enable:class
 line con 0
 line aux 0
 line vty 0
  login local
  transport input ssh
 line vty 1 4
  no login
 end
```

ii) Filling in part of the table

we now have enough information to fill in pieces of the table

R2			connecting device	
interface	address	subnetmask	name	interface
G0/0	10.255.255.245	255.255.255.252	D1	Gi 0/1
G0/1	10.255.255.249	255.255.255.252	D2	G 0/1
G0/2	10.10.10.1	255.255.255.0	S3	G 0/1

Part 2: S3

i) Gathering data I continued to do the same for the rest of the switches and interfaces
ii) full table
here is the completed table

R2			connecting	device
interface	address	subnetmask	name	interface
G0/0	10.255.255.245	255.255.255.252	D1	Gi 0/1
G0/1	10.255.255.249	255.255.255.252	D2	G 0/1
G0/2	10.10.10.1	255.255.255.0	S3	G 0/1
S0/0/0	64.100.100.1	255.255.255.252	Internet	N/A
s0/0/1.1	64.100.200.2	255.255.255.252	Intranet	N/A
S3				
VLAN 1	10.10.10.254	255.255.255.0	N/A	N/A
F0/1	N/A	N/A	Cent. Srvr	NIC
G0/1	N/A	N/A	R2	G0/2
c. srvr				
NIC	10.10.10.2	255.255.255.0	S3	F0/1
D1				
VLAN2	10.2.0.1	255.255.255.0	N/A	N/A
G0/1	10.255.255.246	255.255.255.252	R2	G0/0
G0/2	10.255.255.254	255.255.255.252	D2	G0/2
F0/23	N/A	N/A	S2	F0/23
F0/24	N/A	N/A	S1	G0/1
S1				
VLAN2	10.2.0.2	255.255.255.0	N/A	N/A
F0/23	N/A	N/A	D2	F0/23
G0/1	N/A	N/A	D1	F0/24
D2				
F0/23	N/A	N/A	S1	F0/23
F0/24	10.3.0.1	255.255.255.0	S3	G0/1
G0/1	10.255.255.250	255.255.255.252	R2	G0/1
G0/2	10.255.255.253	255.255.255.252	D1	G0/2
S2				
VLAN1	10.3.0.1	255.255.255.0	N/A	N/A
F0/23	N/A	N/A	D1	F0/23
G0/1	N/A	N/A	D2	F0/24

Lab 3

Configuring IPv4 and IPv6 — Jan 28, 2020

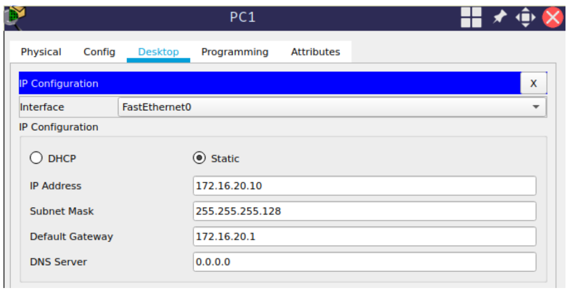
Packet Tracer Lab 3 — **CIT 167**
Spring 2020 — Chaz Davis

- Important Commands for the Lab

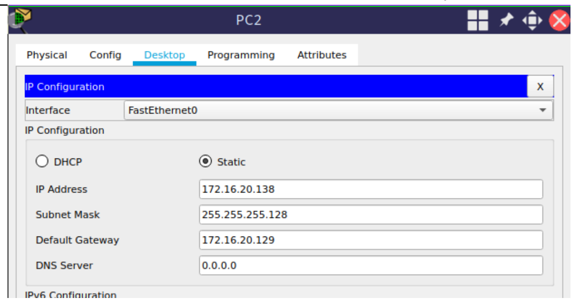
- config start off in user mode
  - enable moves you from user to priveledged mode
  - config terminal you can change the global parameters
  - interface router
  - router from global you can go into router settings instead of interface routerprotocol
- ip address... followed by the ip address and the subnet mask of the pc to be cofigured
- no shutdown this enables the interface or 'brings it up' must be in interface configuration mode
- interface... Followed by the name of the interface to be configured ie.
  - GigabitEthernet0/0
  - FastEthernet0...
  - can be shortened to int g 0/0 or int Fa 0

- Important Concepts

- Difference between IPv6 and IPv4
- How to ping from the commandline



(a) PC1 assign



(b) PC2 assign

Figure 3.1: Assigning IPv4 addressing

Part 1: Configuring IPv4

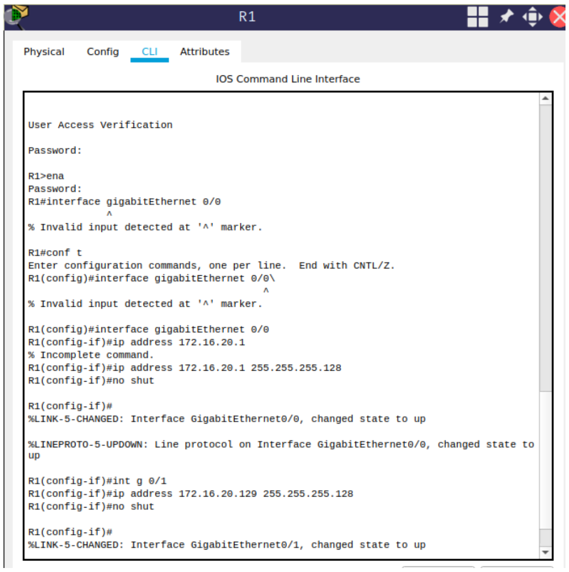
i) Assign IPv4 addressing

I opened up PC1 and clicked on the desktop. I then opened the IPconfiguration box and entered the Information from the table. See Fig 3.1a.

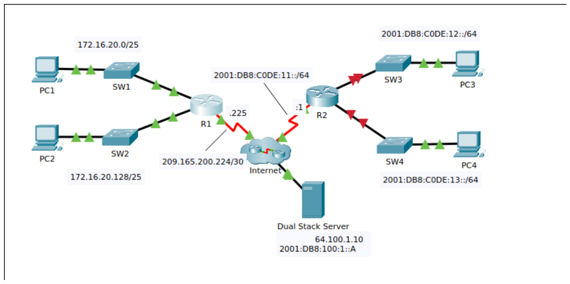
I opened up PC2 and clicked on desktop and opened the ipconfiguration box and entered the information from the table. See Fig 3.1b.

I opened up R1 and and used the commandline tool to enter the information according to the chart. See Fig 3.2a.

We can now see that PC1 PC2 and R1 are all connected to each other. See Fig 3.2b.



(a) R1 assign



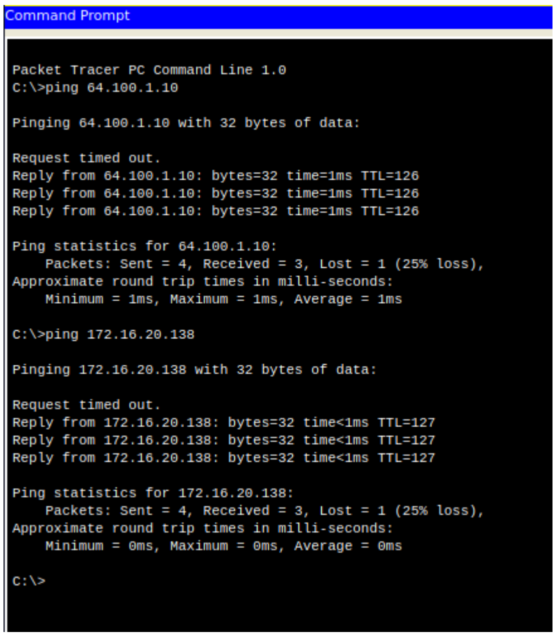
(b) Connected Network Layout

Figure 3.2: Network Connectivity

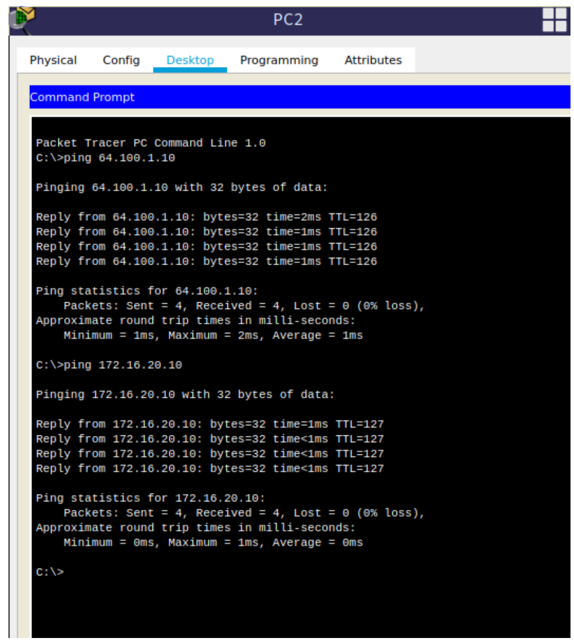
ii) Verify connectivity

I opened PC1 went the command line and successfully pinged the Dual stack server and then successfully pinged PC2. See Fig 3.3a

I opened PC2 went the command line and successfully pinged the Dual stack server and then successfully pinged PC1 See Fig 3.3b



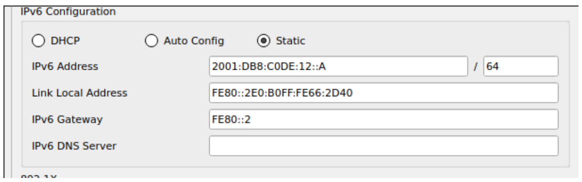
(a) PC1 Successfully pinging the server and PC2



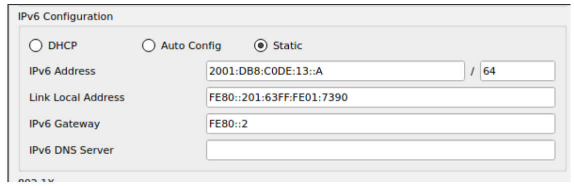
(b) PC2 successfully pinging the server and PC1

Figure 3.3: Network Verification

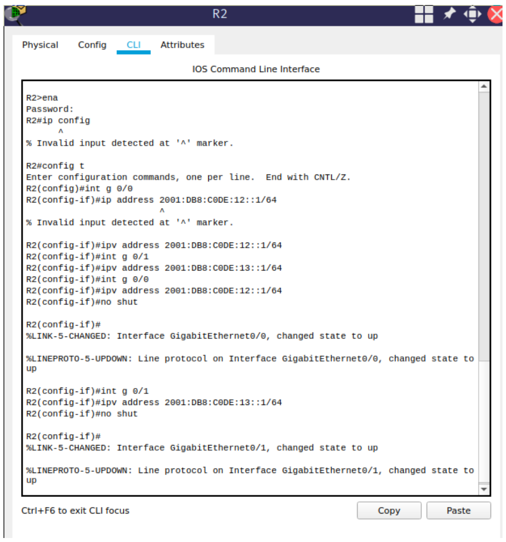
Part 2: configuring IPv6



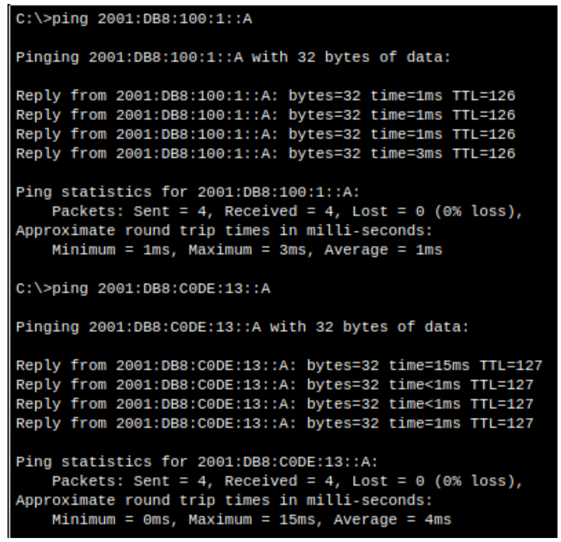
(a) IPv6 Configuration for PC3



(b) IPv6 Configuration for PC4



(c) Configuring R2 Interface



(d) PC3 PC4 and R2 Connections

Figure 3.4: IPv6 Configuration

i) Assign IPv6 addressing and verify connectivity

I opened up PC3 and clicked on desktop and opened the ipconfiguration box and entered the information from the table. See Fig 3.4a.

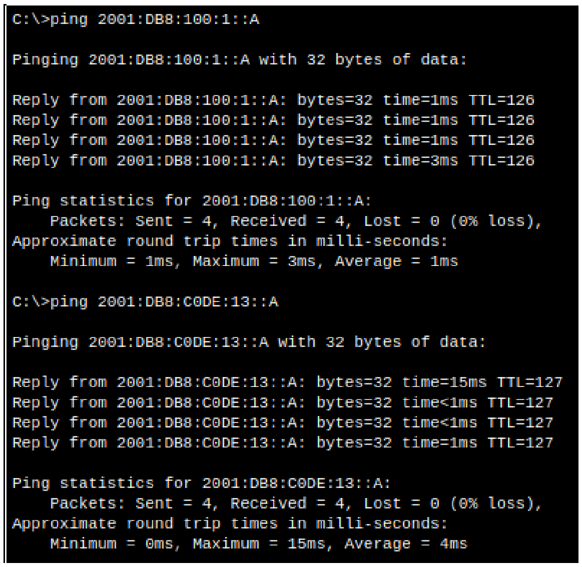
I opened up PC4 and clicked on desktop and opened the ipconfiguration box and entered the information from the table. See Fig 3.4b

I opened up R2 and and used the commandline tool to enter the information according to the chart. See Fig 3.4c.

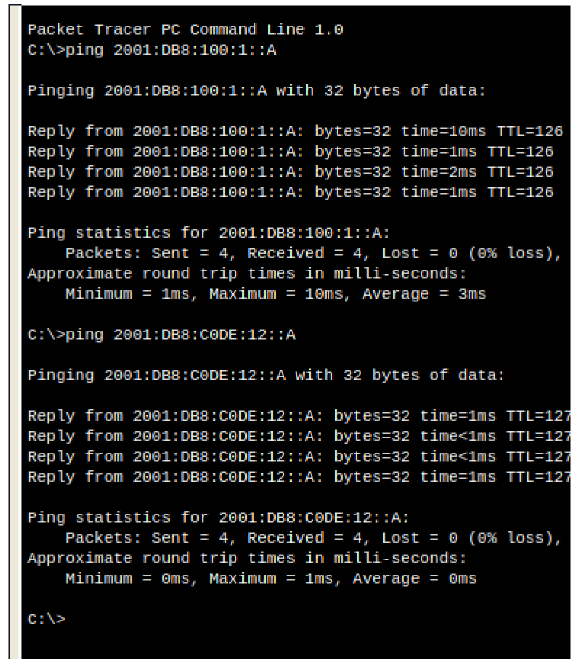
We can now see in Fig 3.4d that PC3 PC4 and R2 are all connected to each other.

ii) Verify connectivity

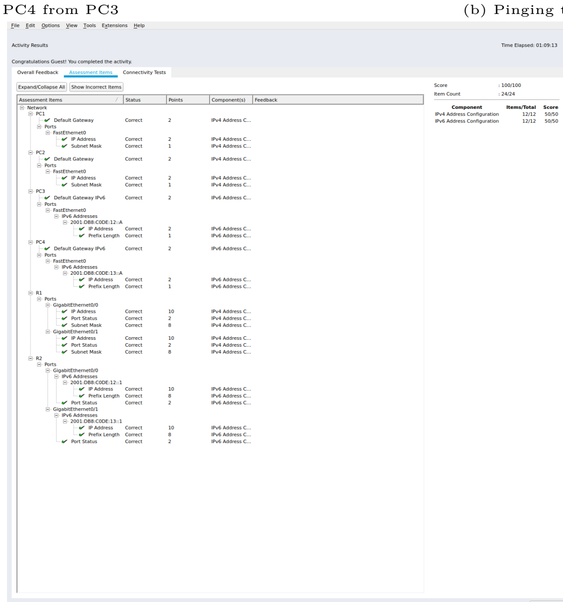
I opened PC3 went the command line and successfully pinged the Dual stack server and then successfully pinged PC4



(a) Pinging the Server and PC4 from PC3



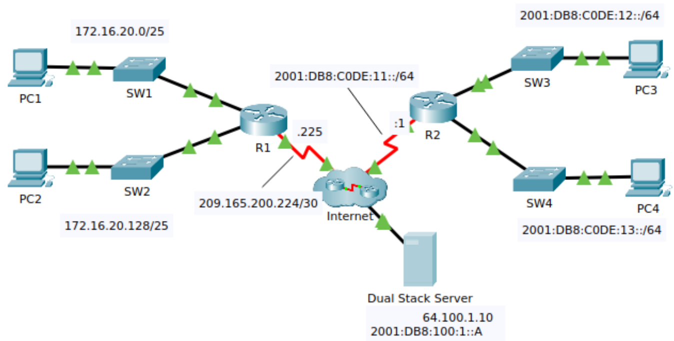
(b) Pinging the Server and PC3 from PC4



(c) Topology of the Completed Network

Figure 3.5: Verifying Connectivity of the Network

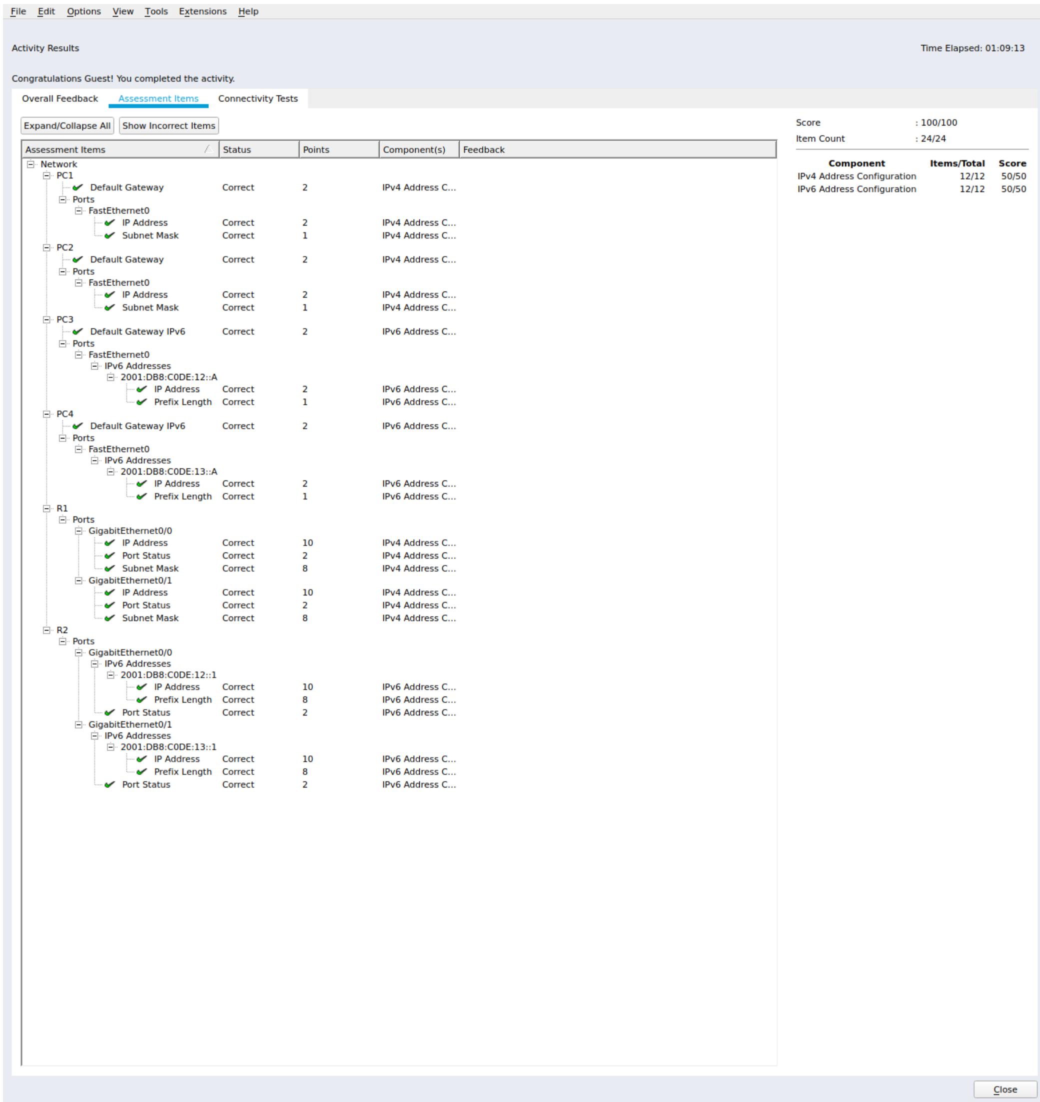
I opened PC4 went the command line and successfully pinged the Dual stack server and then successfully pinged PC3


172.16.20.0/25
PC1
SW1
2001:DB8:C0DE:11::/64
.225
:1
R1
R2
PC2
SW2
172.16.20.128/25
209.165.200.224/30
Internet
2001:DB8:C0DE:12::/64
SW3
PC3
SW4
PC4
2001:DB8:C0DE:13::/64
Dual Stack Server
64.100.1.10
2001:DB8:100:1::A

Part 3: Wrap Up

i) Success

Clicked the Check results button 100% success



Configuring Static Routes 2020

Packet Tracer Labs **CIT 167**
Spring 2020 Chaz Davis

Configuring Static Routes

- There are two common types of static routes in the routing table:
  - Static route to a specific network
  - Default static route

IPv4 Routing

```
ip route <network-address> <subnet-mask> { next-hop-ip | exit-intf }

- Next-hop-ip: IP-address of the connecting router to use for forwarding.
- Exit-intf: the outgoing interface to use to forward the packet to the next hop.
```

Configure a IPv4 Default Static Route

```
ip route 0.0.0.0 0.0.0.0 { exit-intf | next-hop-ip }
```

The distance parameter is used to create a floating static route by setting an administrative distance that is higher than a dynamically learned route.

Configure an IPv4 Floating Static Route

- Given an example where R1 is attached to R2 (172.16.2.2) and R3 (10.10.10.2), the following would create a default static route to R2, and a floating static route to R3:

```
ip route 0.0.0.0 0.0.0.0 172.16.2.2     # Default route to R2
ip route 0.0.0.0 0.0.0.0 10.10.10.2 5   # Floating default route to R3
```

- Default route to R2 has no administrative distance specified, so would default to 1. This is the preferred route..
- Floating default route to R3 has administrative distance 5. Since this value is greater that of the default route, this route ”floats” - it is not present in the routing table unless the preferred route fails.

Default Administrative Distances

```
Connected                   0
Static                      1
EIGRP summary route         5
External BGP                20
Internal EIGRP              90
IGRP                        100
OSPF                        110
IS-IS                       115
RIP                         120
External EIGRP              170
Internal BGP                200
```

Verify a Static Route

```
show ip route
show ip route static                  # Displays contents of static routes
show ip route static | begin Gateway
show ip route <network>


show running-config | section ip route

# displays the routes that packets will actually take when traveling to their
destination
traceroute <ip-address>
trace <destination>

#displays detailed info about neighboring devices descovered using Cisco Discovery
Protocol
show cdp neighbors
show cdp neighbors detail
```

Command Sequence

```
enable
configure terminal

ip route 192.168.3.0 255.255.255.0 192.168.2.2
exit

show ip route
ping 192.168.3.1
trace 192.168.3.1

exit
```

IPv6 Routing

```
ipv6 route <ipv6-prefix>/<prefixlength> {ipv6-address | exit-intf}
```

Displaying and Testing IPv6 Routes

```
show ipv6 route
show ipv6 route static
show ipv6 route <network>
show running-config | section ipv6 route

ping ipv6 <ipv6-address>
traceroute
```

Configure a Directly Connected Static IPv6 Route

```
ipv6 route <ipv6-address>/<network-prefix> <interface>
ipv6 route 2001:db8:acad:2::/64 s0/0/0
```

Configure a Fully Specified Static IPv6 Route

```
ipv6 route <ipv6-address>/<network-prefix> <interface> <next-hop ipv6-address>
ipv6 route 2001:db8:acad:2::/64 s0/0/0 fe80::2
```

Configure a Default IPv6 Static Route

```
ipv6 route ::/0 {ipv6-address | exit-intf}
ipv6 route ::/ 2001:db8:acad:4::2
```

Configure an IPv6 Floating Static Route

```
ipv6 route ::/0 <ipv6-address> <administrative-distance>
ipv6 route ::/0 2001:db8:aad:4::2
ipv6 route ::/0 2001:db8:aad:6::2 5
```

Common IOS Troubleshooting Commands

```
ping
ping <ip-address> source <source_ip>
traceroute <ip-address>
show ip route | begin Gateway
show ip interface brief
show cdp neighbors detail
```

Static Routing 2020

Packet Tracer Labs **CIT 167**
Spring 2020 Chaz Davis

Important Concepts for Static Routing

- Routing is the process of selecting paths in a network along which to send network traffic
- Static routing involves manual updating of routing tables with fixed paths to destination networks.
- Static routing uses include:
  - Defining an exit point from a router when no other routes are available or necessary.
  - Small networks that require only one or two routes.
  - To provide a failsafe backup in the event that a dynamic route is unavailable.
  - To help transfer routing information from one routing protocol to another.
- Static routing disadvantages include:
  - Potential for human error
  - Lack of fault tolerance
  - Default prioritization over dynamic routing
  - Administrative overhead
- To display the current state of the routing table use the show ip route command in user EXEC or privileged EXEC mode.
- To display the entries in the Address Resolution Protocol (ARP) table use the show arp command in user EXEC or privileged EXEC mode.
- To establish static routes use the ip route command in global configuration mode. To remove static routes, use the no form of this command.
- To discover the routes that packets will actually take when traveling to their destination, use the trace / traceroute privileged EXEC command.
- To display detailed information about neighboring devices discovered using Cisco Discovery Protocol (CDP), use the show cdp neighbors privileged EXEC command.

Important Terms to know

- ARP table

  A table of IP and hardware addresses resolved using the Address Resolution Protocol.

- Cisco Express Forwarding (CEF)

  An advanced layer 3 switching technology used mainly in large core networks or the Internet to enhance the overall network performance.

- Internet Control Message Protocol (ICMP)

  Used by network devices to send error messages on an IP network.

- Layer 3 switch

  A device capable of both routing and switching operations using dedicated application-specific integrated circuit (ASIC) hardware.

- next-hop router

  The next router in the path between source and destination.[20]

- outgoing interface

  The local network interface used to connect to a next-hop router.

- routing table

  A data table stored in a router or a networked computer that lists the routes to particular network destinations, and in some cases, metrics (distances) associated with those routes.

- static route

  A manually-configured routing entry.

- summary route

  A route containing the highest-order bits that match all addresses for a given collection of destination networks.

- traceroute

  A computer network diagnostic tool for displaying the route (path) and measuring transit delays of packets across an Internet Protocol (IP) network.

Lab 4

Troubleshooting Static Routes

Feb 4, 2020

Packet Tracer Lab 4 **CIT 167**
Spring 2020 Chaz Davis

- Important Commands for the Lab

- show ip route [ip-address] to display the current state of the routing table
  command can be used in EXEC or privileged EXEC mode
- no ip route To remove static routes, use this command in global configuration
  ```
  no ip route prefix mask <ip address | interface-type interface-number> [permanent]
  ```
- ip route To establish static routes, use this command in global configuration
  ```
  ip route prefix mask <ip address | interface-type interface-number> [permanent]
  ip route 192.168.3.0 255.255.255.0 192.168.2.2
  ```

Part 1: Locate The Problem

Based on the output of the commands I've run, from PC1 and from R1 and R2 and R3.
It appears that R2 is incorrectly configured and it has R1 as the wrong ip adresses in its routing table. See Fig.
It also appears that R3 is incorrectly configured and has no route for pc1 in its tables.

```
R2#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, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     172.31.0.0/16 is variably subnetted, 8 subnets, 5 masks
C       172.31.0.0/24 is directly connected, GigabitEthernet0/0
L       172.31.0.1/32 is directly connected, GigabitEthernet0/0
S       172.31.1.0/25 [1/0] via 172.31.1.198
S       172.31.1.128/26 [1/0] via 172.31.1.194
C       172.31.1.192/30 is directly connected, Serial0/0/0
L       172.31.1.193/32 is directly connected, Serial0/0/0
C       172.31.1.196/30 is directly connected, Serial0/0/1
L       172.31.1.197/32 is directly connected, Serial0/0/1
```

(a) R2 misconfiguration of static Route

Figure 4.1: Network Misconfigured:
R2 - not set up for R1

Part 2: Determine the solution

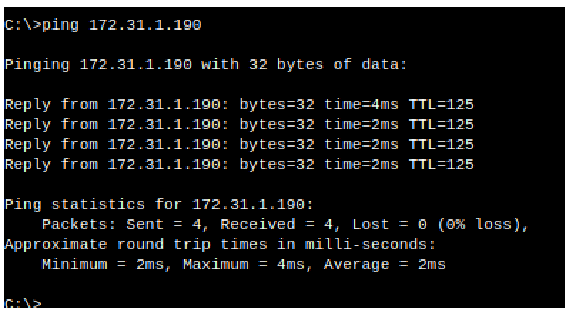
I believe the solution is going to be statically configuring the routes for router 2 and 3, making sure that all are connected.

Part 3: Implement the solution

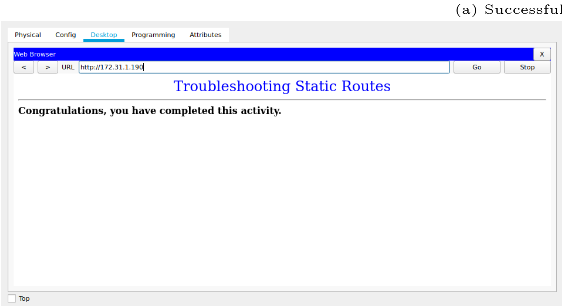
I went to R2 first, and configured the network settings. First, by removing the incorrect routing tables by running the
commands `no ip route 172.31.1.0 255.255.255.128 172.31.1.198` and `no ip route 172.31.1.128 255.255.255.192 172.31.1.194` Then, I repopulated the table by running the
commands `ip route 172.31.1.0 255.255.255.128 172.31.1.194` and `ip route 172.31.1.128 255.255.255.192 172.31.1.198`.
I then went to R3 and cofigured it for PC1 by running `ip route 172.31.1.0 255.255.255.128 serial 0/0/1`

Part 4: Verify that the issue is resolved

Finally I verified that the network is now working properly. Table on Pg. 33
As you can see in FIg. 4.2a I was successfully able to ping the server from PC1.
I then opened the web browser on PC1 Fig. 4.2b and PC2 Fig. 4.2c and entered the servers address and got the congratulations message.



(a) Successful Ping of the server from PC1



(b) Successful Webpage Login PC1

(c) Successful Webpage Login from PC2

Figure 4.2: Successful Verification

Lab 5

Configuring IPv6 Static Routes

Feb 6, 2020

Packet Tracer Lab 5 | **CIT 167**
Spring 2020 | Chaz Davis

- Important Commands for the Lab

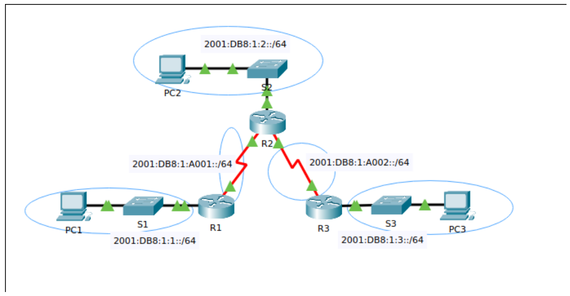
- ipv6 unicast-routing
- ipv6 route
- show ipv6 interface brief

- Important notes about IPv6

IPv6 uses a new mechanism for mapping IP addresses to link layer addresses (MAC addresses), because it does not support the broadcast addressing method, on which the functionality of the Address Resolution Protocol (ARP) in IPv4 is based. IPv6 implements the Neighbor Discovery Protocol (NDP, ND) in the link layer, which relies on ICMPv6 and multicast transmission. IPv6 hosts verify the uniqueness of their IPv6 addresses in a local area network (LAN) by sending a neighbor solicitation message asking for the link layer address of the IP address. If any other host in the LAN is using that address, it responds.

Part 1:Examine the Network

i) a There are 5 networks connected in the current topology



(a) Topology

Figure 5.1: Topology of the Network

ii) b

In Fig 5.1 we can see the R1 and R3 each have two connected networks, and that R2 has three connected networks.

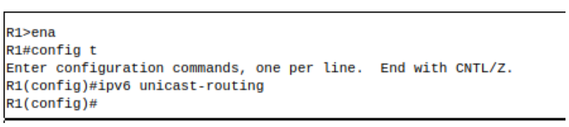
iii) c

ipv6 route then we specify [the network, and prefix] then we specify either [next hop address or exit interface]

Part 2: Configure IPv6 static and default routes

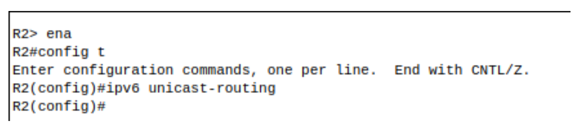
i) Enabling the Routers

I logged into Each of the routers ena, conf t, and then typed in `ipv6 unicast-routing` into each terminal as seen in Fig 5.2.



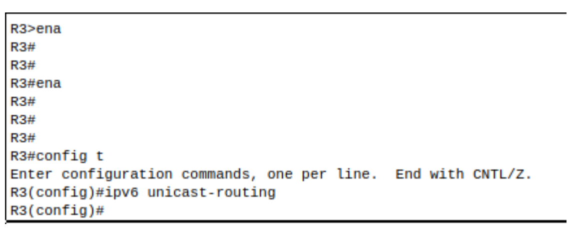
```
R1>ena
R1#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ipv6 unicast-routing
R1(config)#
```

(a) R1 Enable



```
R2> ena
R2#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ipv6 unicast-routing
R2(config)#
```

(b) R2 Enable



```
R3>ena
R3#
R3#
R3#ena
R3#
R3#
R3#
R3#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#ipv6 unicast-routing
R3(config)#
```

(c) R3 Enable

Figure 5.2: Enabling IPv6

ii) Configuring the routers

Next I went to the three routers and manually entered the info for the network configuring each destination and each hop on the network. See Fig 5.3.

```
R1>ena
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ipv6 route 2001:DB8:1:2::/64
% Incomplete command.
R1(config)#ipv6 route 2001:DB8:1:2::/64 2001:DB8:1:A001::2
R1(config)#ipv6 route 2001:DB8:1:A002::/64 2001:DB8:1:A001::2
R1(config)#ipv6 route 2001:DB8:1:3::/64
% Incomplete command.
R1(config)#ipv6 route 2001:DB8:1:3::/64
% Incomplete command.
R1(config)#ipv6 route 2001:DB8:1:3::/64 2001:DB8:1:2::1/64
                                        ^
% Invalid input detected at '^' marker.

R1(config)#ipv6 route 2001:DB8:1:3::/64 2001:DB8:1:A001::2
R1(config)#
```

(a) Manually entering the network info on R1

```
R2>ena
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ipv6 route 2001:DB8:1:1::1/64 0/0/0
                                         ^
% Invalid input detected at '^' marker.

R2(config)#ipv6 route 2001:DB8:1:1::1/64 serial 0/0/0
R2(config)#ipv6 route 2001:DB8:1:3::1/64 serial 0/0/1
R2(config)#ipv6 route 2001:DB8:1:3::1/64 serial 0/0/1 2001:DB8:1:A002::2/64
                                                      ^
% Invalid input detected at '^' marker.

R2(config)#
R2(config)#ipv6 route 2001:DB8:1:3::1/64 serial 0/0/1 2001:DB8:1:A002/64
                                                      ^
% Invalid input detected at '^' marker.

R2(config)#ipv6 route 2001:DB8:1:3::1/64 serial 0/0/1 2001:DB8:1:A002::2
R2(config)#
```

(b) Manually entering the network info on R2

```
R3>ena
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#ipv6 route ::/0
% Incomplete command.
R3(config)#ipv6 route ::/0 2001:DB8:1:A002::1
R3(config)#
```

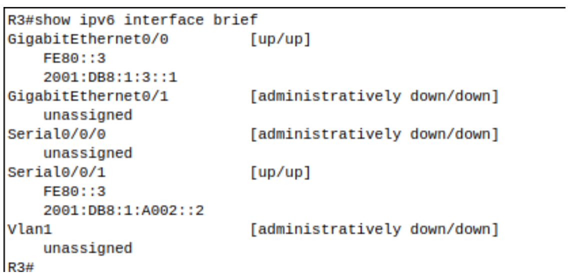
(c) Manually entering the network info on R3

Figure 5.3: Manually Configuring the Destination IPv6 address, as well as the next hop address and Exit address

iii) Verifying Static Route Configurations

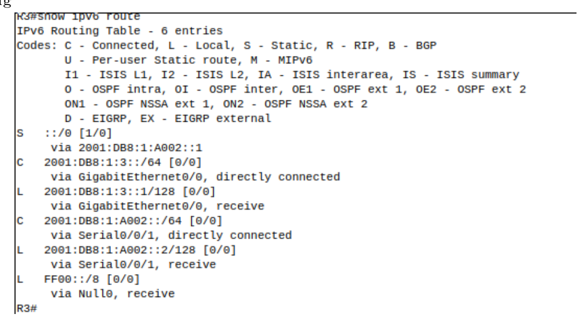
```
C:\>ipv6config

FastEthernet0 Connection:(default port)

   Link-local IPv6 Address.........: FE80::20A:F3FF:FE15:580C
   IPv6 Address....................: 2001:DB8:1:1::F/64
   Default Gateway.................: FE80::1
   DHCPv6 Client DUID..............: 00-01-00-01-99-2B-D5-EC-00-0A-F3-15-58-0C

Bluetooth Connection:

   Link-local IPv6 Address.........: ::
   IPv6 Address....................: ::/0
   Default Gateway.................: ::
   DHCPv6 Client DUID..............: 00-01-00-01-99-2B-D5-EC-00-0A-F3-15-58-0C

C:\>
```

(a) IPv6Config



```
R3#show ipv6 interface brief
GigabitEthernet0/0         [up/up]
    FE80::3
    2001:DB8:1:3::1
GigabitEthernet0/1         [administratively down/down]
    unassigned
Serial0/0/0                [administratively down/down]
    unassigned
Serial0/0/1                [up/up]
    FE80::3
    2001:DB8:1:A002::2
Vlan1                      [administratively down/down]
    unassigned
R3#
```

(b) IPv6 Interface brief



```
R3#show ipv6 route
IPv6 Routing Table - 6 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route, M - MIPv6
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
       ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
       D - EIGRP, EX - EIGRP external
S   ::/0 [1/0]
     via 2001:DB8:1:A002::1
C   2001:DB8:1:3::/64 [0/0]
     via GigabitEthernet0/0, directly connected
L   2001:DB8:1:3::1/128 [0/0]
     via GigabitEthernet0/0, receive
C   2001:DB8:1:A002::/64 [0/0]
     via Serial0/0/1, directly connected
L   2001:DB8:1:A002::2/128 [0/0]
     via Serial0/0/1, receive
L   FF00::/8 [0/0]
     via Null0, receive
R3#
```

(c) show ipv6 route

Figure 5.4: Verifying the Network

1

PC command
From the command prompt in the PC terminals, I entered
the command `ipv6 config` for information on the network See Fig 5.4a

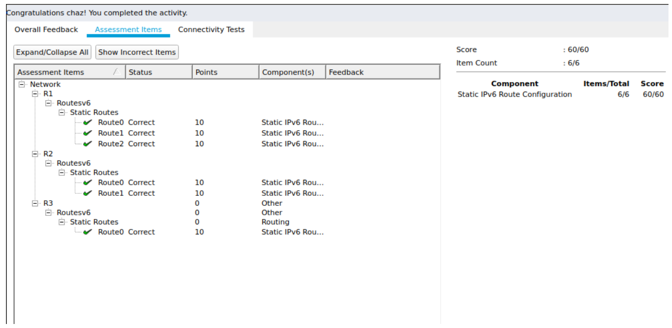
2

routing address
From the routers terminals
I entered `show ipv6 interface brief` to display the configured addresses. See Fig 5.4b

3

Routing Table
Finally, I entered `Show ipv6 route` into each of the prompts to display the routing tables. See Fig 5.4c

Part 3: Success



Lab 6

Configuring IPv4 Static Routes

Feb 8, 2020

Packet Tracer Lab 6 **CIT 167**
Spring 2020 Chaz Davis

- Important Concepts for the Lab

- Recursive static route

  a route whose next hop and destination network are covered by another learned route in the Routing Information Database (RIB).

  Such static routes cannot be installed in the RIB because they are considered redundant routes.

- Directly Connected Static Route

  A directly connected static route is one that uses the exit interface to forward traffic to the intended destination.

  This is in contrast to the recursive static route which used the next hop IP address of the router along the path to the destination

- Loopback

  A loopback interface is a logical, virtual interface in a cisco router.

  A loopback interface is not a physical interface like Fast Ethernet or Gigabit Ethernet interface.

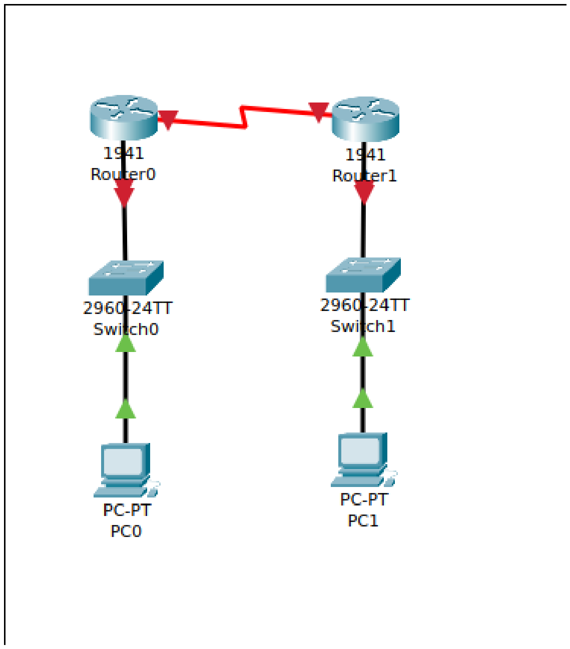
- A loopback interface has many uses

  Loopback interface's IP Address determines a routers OSPF Router ID.

  A loopback interface is always up and allows Border Gateway Protocol (BGP) neighborship between two routers to stay up even if one of the outbound physical interfaces is down.

Part 1: Setting up the topology

i) Cabling the Network I've configured the network with two routers, 2 switches, and 2 pcs as seen in Fig. 6.1a.

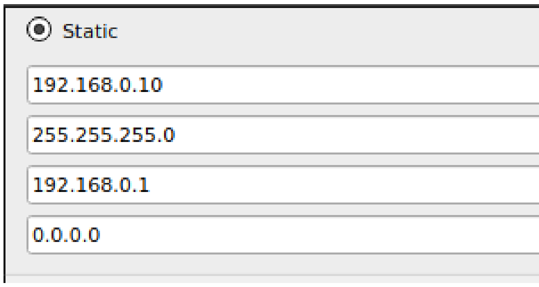


(a) Cabling the topology

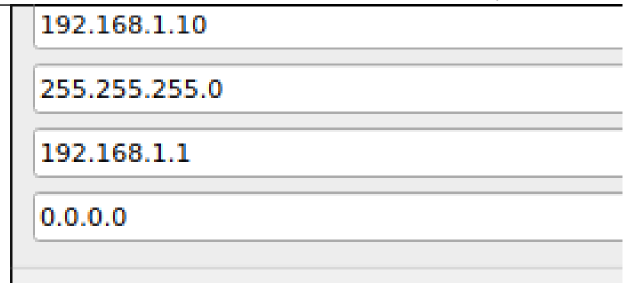
ii) Initialization
I flipped the switches and restarted the routers and switches.

Part 2: Configuring Basic Device Settings

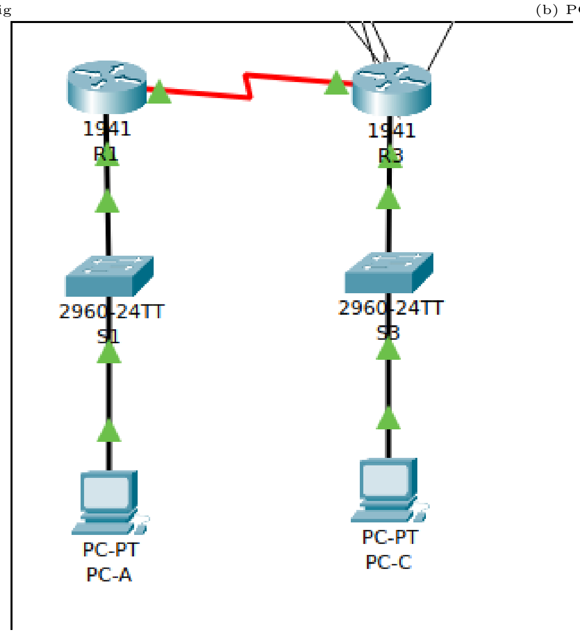
i) Configuring the PC Interfaces I configured the PCs according to the table. As you can see in Fig. 6.2a and Fig. 6.2b on Pg. 41.
ii) Verify the LANs
Next, I ran commands on the routers to configure the device names, setup DNS lookup, added passwords, and then ran the configuration and startup styles.
iii) Configuring IP settings on the routers
Finally i configured the ip addresses on the routers and set up the static routing tables fir the addresses. See Fig. 6.2d and Fig. 6.2e on Pg. 41.



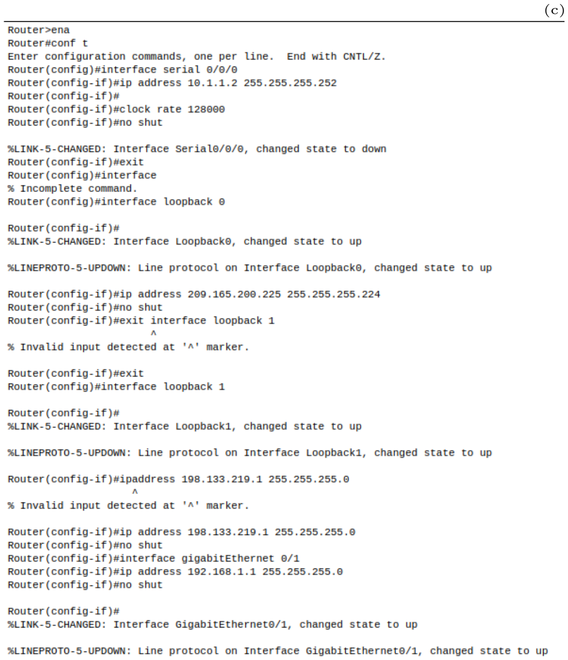
(a) PC-A IP config



(b) PC-B IPConfig

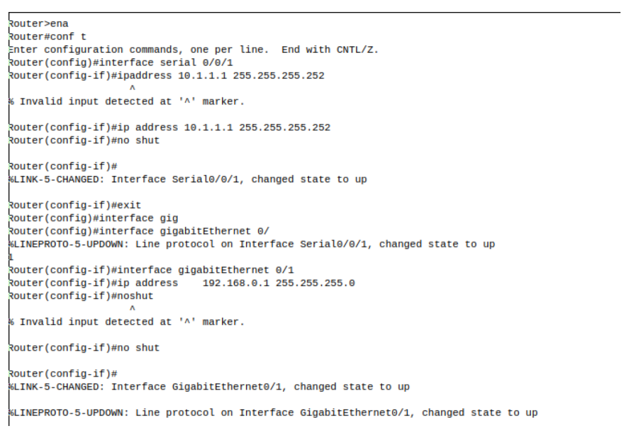


(c) The network now



```
Router>ena
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial 0/0/0
Router(config-if)#ip address 10.1.1.2 255.255.255.252
Router(config-if)#
Router(config-if)#clock rate 128000
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/0/0, changed state to down
Router(config-if)#exit
Router(config)#interface
% Incomplete command.
Router(config)#interface loopback 0

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

Router(config-if)#ip address 209.165.200.225 255.255.255.224
Router(config-if)#no shut
Router(config-if)#exit interface loopback 1
                       ^
% Invalid input detected at '^' marker.

Router(config-if)#exit
Router(config)#interface loopback 1

Router(config-if)#
%LINK-5-CHANGED: Interface Loopback1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback1, changed state to up

Router(config-if)#ipaddress 198.133.219.1 255.255.255.0
                    ^
% Invalid input detected at '^' marker.

Router(config-if)#ip address 198.133.219.1 255.255.255.0
Router(config-if)#no shut
Router(config-if)#interface gigabitEthernet 0/1
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
```

(d) Router 3 config



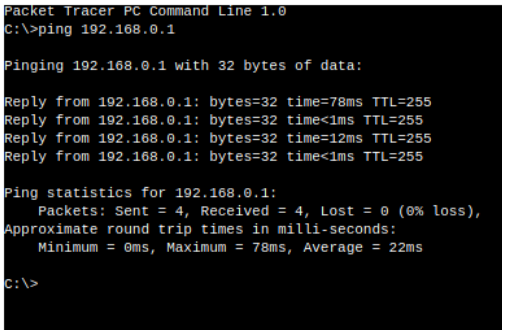
```
Router>ena
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface serial 0/0/1
Router(config-if)#ipaddress 10.1.1.1 255.255.255.252
                    ^
% Invalid input detected at '^' marker.

Router(config-if)#ip address 10.1.1.1 255.255.255.252
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/0/1, changed state to up

Router(config-if)#exit
Router(config)#interface gig
Router(config)#interface gigabitEthernet 0/
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up
1
Router(config-if)#interface gigabitEthernet 0/1
Router(config-if)#ip address    192.168.0.1 255.255.255.0
Router(config-if)#noshut
                    ^
% Invalid input detected at '^' marker.

Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
```

(e) router 1 config

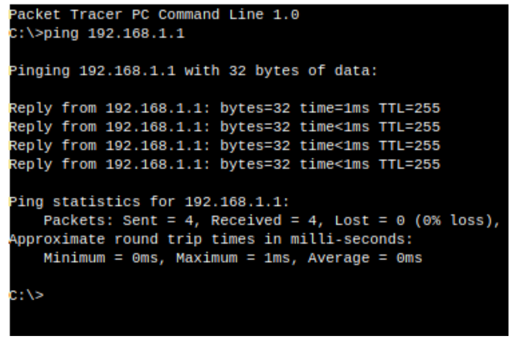
Figure 6.2: Configuring the network interfaces

iv) Verify Connectivity of LANs

I tested conectivity by pinging from each PC. I was able to ping from PC to router but from PC-A I was ubnable to reach PC-C or either loopback. See Fig. 6.3a. and Fig. 6.3b on Pg. 42.

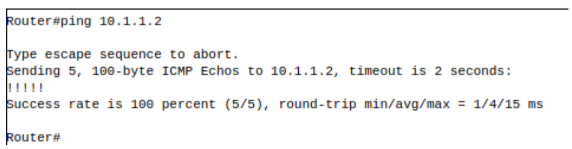


(a) Pinging the default gateway from PC-A



(b) Pinging the default gateway from PC-C

Pinging PC-C, Lo0, and Lo1 from PC-A



(c) Pinging S0/0/0 and R3 from R1

Figure 6.3: Verifying Connections between devices on the network

Part 3: Configure Static Routes

i) Configure recursive static route I went to R1 and entered the command `ip route 192.168.1.0 255.255.255.0 10.1.1.2` in to the command line.
The new `show ip route` shows us the static routing configuration.
In the last line we see `S 192.168.1.0/24 [1/0] via 10.1.1.2 .`

ii) Configure directly connected static route
I went to R3 and entered `ip route 192.168.0.0 255.255.255.0 serial 0/0/0`.
When I run the `show ip route` command from R3 we can now see the static exit interface in the line `S 192.168.0.0/24 is directly conn`

iii) Configure Static Route
I went to R1 and ran `ip route 198.133.219.0 255.255.255.0 serial 0/0/1`.

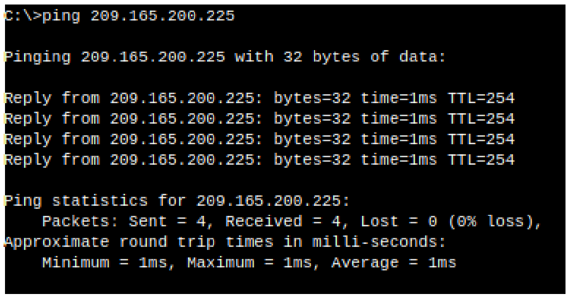
iv) Remove static Routes for Loopback
I went to R1 and
ran `ip route 209.165.200.224 255.255.255.224 10.1.1.2`
and now we can see with the lines:

```
S    198.133.219.0/24 is directly connected, Serial0/0/1
     209.165.200.0/27 is subnetted, 1 subnets
S       209.165.200.224/27 [1/0] via 10.1.1.2
```

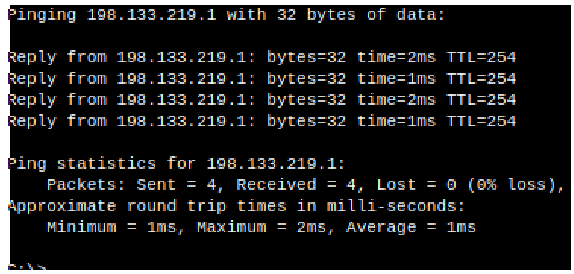
That we are correctly configured.

Part 4: Configure and verify the default route

I went to R1 and entered `ip route 0.0.0.0 0.0.0.0`.
I the went to PC-A and Pinged 209.165.200.225 see Fig. 6.4a
Lastly, I pinged 198.133.219.1 from PC-A. See Fig. 6.4b



(a) Pinging PC-C from PC- A



(b) Pinging R1 from PC-A

Figure 6.4: Verifying the default routes

Reflection

If we added a new network we could run `ip route 192.168.3.0 255.255.255.0 s0/0/0` `ip route 192.168.3.0 255.255.255.0 10.1.1.1` from R3
With a recursive static route perform lookups in the routing table before forwarding the packets. With a directly connected static route, the exit-interface parameter is specified, which allows the route to resolve a forwarding decision in one lookup.
A default gateway tells the device to contact the next hop of the default route if they don't have a more specific route. Without a default route, a router will drop a request for a network that is not in its routing table and send ICMP Destination unreachable.

Configuring
Dynamic Routing 2020

Packet Tracer Labs **CIT 167**
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Access RIP configuration mode

router rip

- Prompt will show up as `Router(config-router)#`
- When enabling RIP, the default version is RIPv1.
- To disable and eliminate RIP, use the ‘no router rip‘ global configuration command. This command stops the RIP process and erases all existing RIP configurations.
- Upon enabling, need to advertise networks with ‘network <network-address>‘

Enable and Verify RIPv2

By *default, when a RIP process is configured on a Cisco router, it is running RIPv1*, as shown in Figure 1. However, even though the router only sends RIPv1 messages, it can interpret both RIPv1 and RIPv2 messages. A *RIPv1 router ignores the RIPv2 fields in the route entry.*
Use the ‘version 2‘ router configuration mode command to enable RIPv2, as shown in Figure 2. Notice how the ‘show ip protocols‘ command verifies that R2 is now configured to send and receive version 2 messages only. The RIP process now includes the subnet mask in all updates, making *RIPv2 a classless routing protocol.*
Note: Configuring ‘version 1‘ enables RIPv1 only, while configuring ‘no version‘ returns the router to the default setting of sending version 1 updates but listening for version 1 and version 2 updates.

Propogate a Default Route

```
The `default-information originate` router configuration command.
This instructs R1 to originate default information,
by propagating the static default route in RIP updates.
```

RIP Routing Configuration Mode Commands

```
network <network-address>       # Enables RIP on all interfaces on that network.
version 2                       # Enables RIPv2
version 1                       # Enables RIPv1 only
no version                      # Returns to default setting: send v1, listen v1+v2
no auto-summary                 # Disables default automatic summarization (RIPv2)

passive-interface <interface>   # Prevent transmission of routing updates out interface
# However, still allows network to be advertised
passive-interface g0/0
passive-interface default       # Makes all interfaces passive
no passive-interface <intf>     # Re-enables passive transmission of routing updates
```

Verify RIP Routing

```
show ip protocols
show ip route
```

Propogate a Default Route

To propagate a default route in RIP,
the edge router must be configured with a default static route
using the `ip route 0.0.0.0 0.0.0.0` command:

```
ip route 0.0.0.0 0.0.0.0 <exit-interface> <next-hop IP>
```

Next configure router to propogate the static default route in RIP updates:

```
router rip
default-information originate
```

Useful Bits
Dynamic Routing 2020

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RIP Overview

The Routing Information Protocol (RIP) uses broadcast UDP data packets to exchange routing information. Cisco software sends routing information updates every 30 seconds, which is termed advertising. If a device does not receive an update from another device for 180 seconds or more, the receiving device marks the routes served by the nonupdating device as unusable. If there is still no update after 240 seconds, the device removes all routing table entries for the nonupdating device.

A device that is running RIP can receive a default network via an update from another device that is running RIP, or the device can source the default network using RIP. In both cases, the default network is advertised through RIP to other RIP neighbors.

The Cisco implementation of RIP Version 2 (RIPv2) supports plain text and message digest algorithm 5 (MD5) authentication, route summarization, classless interdomain routing (CIDR), and variable-length subnet masks (VLSMs).

RIP Routing Updates

The Routing Information Protocol (RIP) sends routing-update messages at regular intervals and when the network topology changes. When a device receives a RIP routing update that includes changes to an entry, the device updates its routing table to reflect the new route. The metric value for the path is increased by 1, and the sender is indicated as the next hop. RIP devices maintain only the best route (the route with the lowest metric value) to a destination. After updating its routing table, the device immediately begins transmitting RIP routing updates to inform other network devices of the change. These updates are sent independently of the regularly scheduled updates that RIP devices send.

RIP Routing Metric

The Routing Information Protocol (RIP) uses a single routing metric to measure the distance between the source and the destination network. Each hop in a path from the source to the destination is assigned a hop-count value, which is typically 1. When a device receives a routing update that contains a new or changed destination network entry, the device adds 1 to the metric value indicated in the update and enters the network in the routing table. The IP address of the sender is used as the next hop. If an interface network is not specified in the routing table, it will not be advertised in any RIP update.

Authentication in RIP

The Cisco implementation of the Routing Information Protocol (RIP) Version 2 (RIPv2) supports authentication, key management, route summarization, classless interdomain routing (CIDR), and variable-length subnet masks (VLSMs).

By default, the software receives RIP Version 1 (RIPv1) and RIPv2 packets, but sends only RIPv1 packets. You can configure the software to receive and send only RIPv1 packets. Alternatively, you can configure the software to receive and send only RIPv2 packets. To override the default behavior, you can configure the RIP version that an interface sends. Similarly, you can also control how packets received from an interface are processed.

RIPv1 does not support authentication. If you are sending and receiving RIP v2 packets, you can enable RIP authentication on an interface.

The key chain determines the set of keys that can be used on the interface. Authentication, including default authentication, is performed on that interface only if a key chain is configured. For more information on key chains and their configuration, see the "Managing Authentication Keys" section in the "Configuring IP Routing Protocol-Independent Features" chapter in the Cisco IOS IP Routing: Protocol-Independent Configuration Guide.

Cisco supports two modes of authentication on an interface on which RIP is enabled: plain-text authentication and message digest algorithm 5 (MD5) authentication. Plain-text authentication is the default authentication in every RIPv2 packet.

Note

Do not use plain text authentication in RIP packets for security purposes, because the unencrypted authentication key is sent in every RIPv2 packet. Use plain-text authentication when security is not an issue; for example, you can use plain-text authentication to ensure that misconfigured hosts do not participate in routing.

Exchange of Routing Information

Routing Information Protocol (RIP) is normally a broadcast protocol, and for RIP routing updates to reach nonbroadcast networks, you must configure the Cisco software to permit this exchange of routing information.
To control the set of interfaces with which you want to exchange routing updates, you can disable the sending of routing updates on specified interfaces by configuring the passive-interface router configuration command.

You can use an offset list to increase increasing incoming and outgoing metrics to routes learned via RIP. Optionally, you can limit the offset list with either an access list or an interface.
Routing protocols use several timers that determine variables such as the frequency of routing updates, the length of time before a route becomes invalid, and other parameters. You can adjust these timers to tune routing protocol performance to better suit your internetwork needs. You can make the following timer adjustments:

The rate (time, in seconds, between updates) at which routing updates are sent The interval of time, in seconds, after which a route is declared invalid The interval, in seconds, during which routing information about better paths is suppressed The amount of time, in seconds, that must pass before a route is removed from the routing table The amount of time for which routing updates will be postponed You can adjust the IP routing support in the Cisco software to enable faster convergence of various IP routing algorithms, and hence, cause quicker fallback to redundant devices. The total effect is to minimize disruptions to end users of the network in situations where quick recovery is essential

In addition, an address family can have timers that explicitly apply to that address family (or Virtual Routing and Forwarding [VRF]) instance). The timers-basic command must be specified for an address family or the system defaults for the timers-basic command are used regardless of the timer that is configured for RIP routing. The VRF does not inherit the timer values from the base RIP configuration. The VRF will always use the system default timers unless the timers are explicitly changed using the timers-basic command.

RIP Route Summarization

Summarizing routes in RIP Version 2 improves scalability and efficiency in large networks. Summarizing IP addresses means that there is no entry for child routes (routes that are created for any combination of the individual IP addresses contained within a summary address) in the RIP routing table, reducing the size of the table and allowing the router to handle more routes.
Summary IP address functions more efficiently than multiple individually advertised IP routes for the following reasons: The summarized routes in the RIP database are processed first. Any associated child routes that are included in a summarized route are skipped as RIP looks through the routing database, reducing the processing time required. Cisco routers can summarize routes in two ways: Automatically, by summarizing subprefixes to the classful network boundary when crossing classful network boundaries (automatic summary).

Note

Automatic summary is enabled by default.

As specifically configured, advertising a summarized local IP address pool on the specified interface (on a network access server) so that the address pool can be provided to dialup clients. When RIP determines that a summary address is required in the RIP database, a summary entry is created in the RIP routing database. As long as there are child routes for a summary address, the address remains in the routing database. When the last child route is removed, the summary entry also is removed from the database. This method of handling database entries reduces the number of entries in the database because each child route is not listed in an entry, and the aggregate entry itself is removed when there are no longer any valid child routes for it.
RIP Version 2 route summarization requires that the lowest metric of the ”best route” of an aggregated entry, or the lowest metric of all current child routes, be advertised. The best metric for aggregated summarized routes is calculated at route initialization or when there are metric modifications of specific routes at advertisement time, and not at the time the aggregated routes are advertised.
The ip summary-address rip routerconfiguration command causes the router to summarize a given set of routes learned via RIP Version 2 or redistributed into RIP Version 2. Host routes are especially applicable for summarization.

See the ”Route Summarization Example” section at the end of this chapter for examples of using split horizon.

You can verify which routes are summarized for an interface using the show ip protocols EXEC command. You can check summary address entries in the RIP database. These entries will appear in the database only if relevant child routes are being summarized. To display summary address entries in the RIP routing database entries if there are relevant routes being summarized based upon a summary address, use the show ip rip database command in EXEC mode. When the last child route for a summary address becomes invalid, the summary address is also removed from the routing table.

Lab 7

Configuring RIPv2 Jan 31, 2020

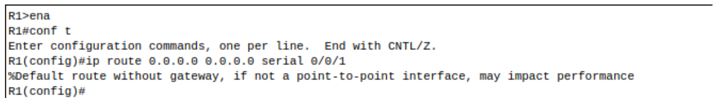
Packet Tracer Lab 7 **CIT 167**
Spring 2020 Chaz Davis

- Important Commands for the Lab

- router rip
  - version 2
- no auto-summary
- network
  - for when long commands are interrupted by console message
- passive-interface

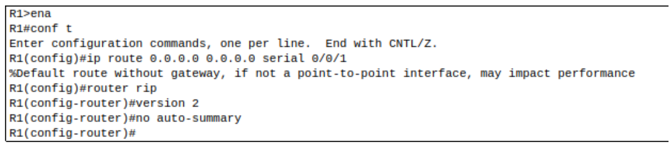
Part 1: Configure RIPv2

i) Configure RIPv2 on R1 I configured the Router for default rute all internet traffic through serial 0/0/1



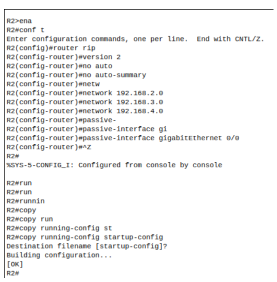
```
R1>ena
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 0.0.0.0 0.0.0.0 serial 0/0/1
%Default route without gateway, if not a point-to-point interface, may impact performance
R1(config)#
```

Next I, configured the router to use rip protocol, then to use version 2, and then passed it the no auto-summary command



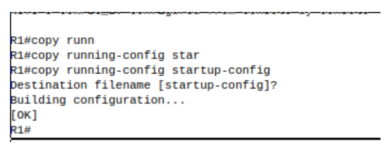
```
R1>ena
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#ip route 0.0.0.0 0.0.0.0 serial 0/0/1
%Default route without gateway, if not a point-to-point interface, may impact performance
R1(config)#router rip
R1(config-router)#version 2
R1(config-router)#no auto-summary
R1(config-router)#
```

I set the networks on R1, and then Used the passive interface command to setup the LAN port, and then default-information originate to advertise the routes that I've configured see: 7.1a.
Lastly, I stepped out of config router mode and ran the command: copy-running config startup-config to save my work see:7.1b



```
R2>ena
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#no auto
R2(config-router)#no auto-summary
R2(config-router)#netw
R2(config-router)#network 192.168.2.0
R2(config-router)#network 192.168.3.0
R2(config-router)#network 192.168.4.0
R2(config-router)#passive-
R2(config-router)#passive-interface gi
R2(config-router)#passive-interface gigabitEthernet 0/0
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#run
R2#run
R2#runnin
R2#copy
R2#copy run
R2#copy running-config st
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#
```

(a) setting networks R1



```
R1#copy runn
R1#copy running-config star
R1#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R1#
```

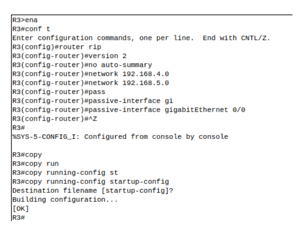
(b) Finishing up R1

Figure 7.1: Configuring R1 for RIPv2

ii) Configure RIPv2 on R2 and R3 Next I configured R2 and R3 for their networks

```
R2>ena
R2#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#router rip
R2(config-router)#version 2
R2(config-router)#no auto
R2(config-router)#no auto-summary
R2(config-router)#netw
R2(config-router)#network 192.168.2.0
R2(config-router)#network 192.168.3.0
R2(config-router)#network 192.168.4.0
R2(config-router)#passive-
R2(config-router)#passive-interface gi
R2(config-router)#passive-interface gigabitEthernet 0/0
R2(config-router)#^Z
R2#
%SYS-5-CONFIG_I: Configured from console by console

R2#run
R2#run
R2#runnin
R2#copy
R2#copy run
R2#copy running-config st
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#
```

(a) Configuring R2



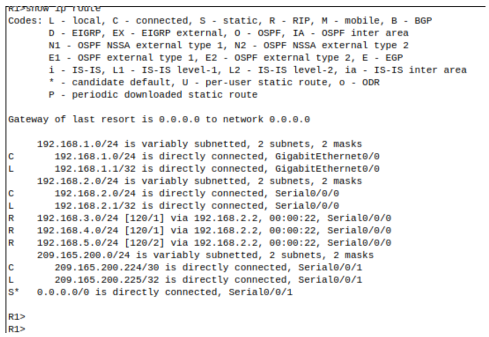
```
R3>ena
R3#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R3(config)#router rip
R3(config-router)#version 2
R3(config-router)#no auto-summary
R3(config-router)#network 192.168.4.0
R3(config-router)#network 192.168.5.0
R3(config-router)#pass
R3(config-router)#passive-interface gi
R3(config-router)#passive-interface gigabitEthernet 0/0
R3(config-router)#^Z
R3#
%SYS-5-CONFIG_I: Configured from console by console

R3#copy
R3#copy run
R3#copy running-config st
R3#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R3#
```

(b) Configuring R3

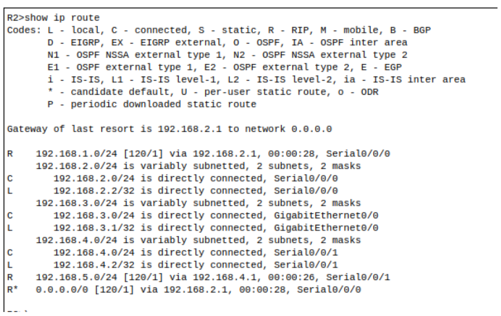
Figure 7.2: Configuring the Routers for RIPv2

Part 2: Verify Configurations

i) View Routing Tables of R1, R2, and R3

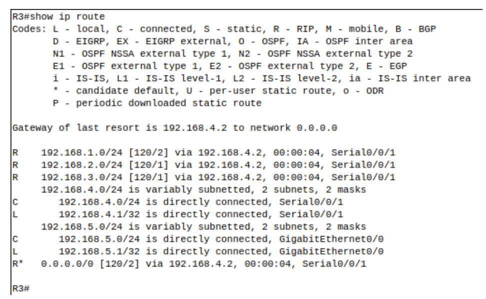


```
R1>show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is 0.0.0.0 to network 0.0.0.0

     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, Serial0/0/0
L       192.168.2.1/32 is directly connected, Serial0/0/0
R    192.168.3.0/24 [120/1] via 192.168.2.2, 00:00:22, Serial0/0/0
R    192.168.4.0/24 [120/1] via 192.168.2.2, 00:00:22, Serial0/0/0
R    192.168.5.0/24 [120/2] via 192.168.2.2, 00:00:22, Serial0/0/0
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
C       209.165.200.224/30 is directly connected, Serial0/0/1
L       209.165.200.225/32 is directly connected, Serial0/0/1
S*   0.0.0.0/0 is directly connected, Serial0/0/1

R1>
R1>
```



```
R2>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, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is 192.168.2.1 to network 0.0.0.0

R    192.168.1.0/24 [120/1] via 192.168.2.1, 00:00:28, Serial0/0/0
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, Serial0/0/0
L       192.168.2.2/32 is directly connected, Serial0/0/0
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/0
L       192.168.3.1/32 is directly connected, GigabitEthernet0/0
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/24 is directly connected, Serial0/0/1
L       192.168.4.2/32 is directly connected, Serial0/0/1
R    192.168.5.0/24 [120/1] via 192.168.4.1, 00:00:26, Serial0/0/1
R*   0.0.0.0/0 [120/1] via 192.168.2.1, 00:00:28, Serial0/0/0
```

(a) Routing Tables for R2

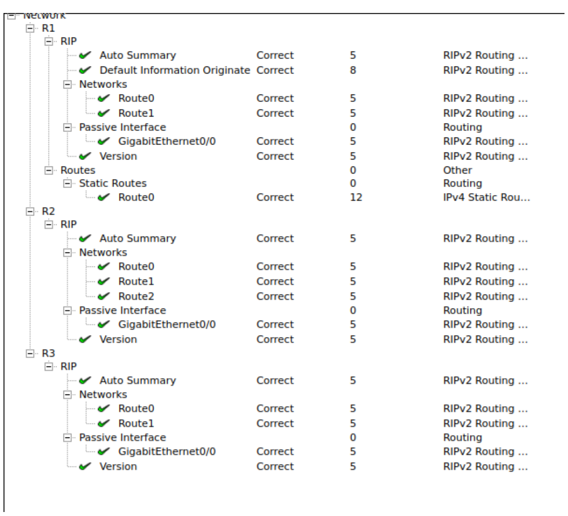


```
R3#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is 192.168.4.2 to network 0.0.0.0

R    192.168.1.0/24 [120/2] via 192.168.4.2, 00:00:04, Serial0/0/1
R    192.168.2.0/24 [120/1] via 192.168.4.2, 00:00:04, Serial0/0/1
R    192.168.3.0/24 [120/1] via 192.168.4.2, 00:00:04, Serial0/0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/24 is directly connected, Serial0/0/1
L       192.168.4.1/32 is directly connected, Serial0/0/1
     192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.5.0/24 is directly connected, GigabitEthernet0/0
L       192.168.5.1/32 is directly connected, GigabitEthernet0/0
R*   0.0.0.0/0 [120/2] via 192.168.4.2, 00:00:04, Serial0/0/1

R3#
```

(b) Routing Tables for R3

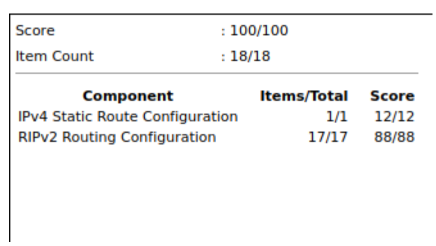
Figure 7.3: IP Routing Tables for the Routers

ii) Success



Network			
R1			
RIP			
Auto Summary	Correct	5	RIPv2 Routing ...
Default Information Originate	Correct	8	RIPv2 Routing ...
Networks			
Route0	Correct	5	RIPv2 Routing ...
Route1	Correct	5	RIPv2 Routing ...
Passive Interface		0	Routing
GigabitEthernet0/0	Correct	5	RIPv2 Routing ...
Version	Correct	5	RIPv2 Routing ...
Routes		0	Other
Static Routes		0	Routing
Route0	Correct	12	IPv4 Static Rou...
R2			
RIP			
Auto Summary	Correct	5	RIPv2 Routing ...
Networks			
Route0	Correct	5	RIPv2 Routing ...
Route1	Correct	5	RIPv2 Routing ...
Route2	Correct	5	RIPv2 Routing ...
Passive Interface		0	Routing
GigabitEthernet0/0	Correct	5	RIPv2 Routing ...
Version	Correct	5	RIPv2 Routing ...
R3			
RIP			
Auto Summary	Correct	5	RIPv2 Routing ...
Networks			
Route0	Correct	5	RIPv2 Routing ...
Route1	Correct	5	RIPv2 Routing ...
Passive Interface		0	Routing
GigabitEthernet0/0	Correct	5	RIPv2 Routing ...
Version	Correct	5	RIPv2 Routing ...

(a) Results



Score : 100/100
Item Count : 18/18

Component	Items/Total	Score
IPv4 Static Route Configuration	1/1	12/12
RIPv2 Routing Configuration	17/17	88/88

(b) All components cleared

Figure 7.4: Successful Completion

Lab 8

Configuring Basic RIPv2 — Jan 31, 2020

Packet Tracer Lab 8 — **CIT 167**
Spring 2020 — Chaz Davis

- Important Commands for the Lab

```
enable
configure terminal

router rip
network 192.168.0.0
version 2
exit
exit

show ip route
ping 192.168.3.1
trace 192.168.3.1

exit
```

- Important Concepts

  - Dynamic or adaptive routing involves automatic updating of the routing tables based on information carried by routing protocols.
  - Link-state protocols require that a router inform all the nodes in a network of topology changes. Each node shares info regarding the nodes it can connect to with the entire network so that each node can build its own network map and determine for itself the least cost path to any given node.
  - RIP is a distance vector routing protocol which employs the hop count as a routing metric. RIP uses UDP as its transport protocol, and is assigned the reserved port number 520.
  - auto summarization a feature which allows RIP to summarize its routes to their classful networks automatically.

Part 1: Build the Network and Configure Basic Device Settings

I did as the Lab specified, I placed three 1941 routers, making sure to turn them off and add on the Serial ports, turning them back on when finished. I then placed two 2960 switches, and then three end user PCs as instructed.

i) Cable The Network I ran the cabling between as shown in the diagram Fig 8.1, connecting the correct ports and interfaces.

ii) Initialize the Router and Switch and Configure basic settings for each I configured each of the routers and then their serial interfaces, i then configured the switches

iii) Configure PC IP Addressing I went to the desktop of each pc and set it up according to the addressing table. See Fig 8.2.

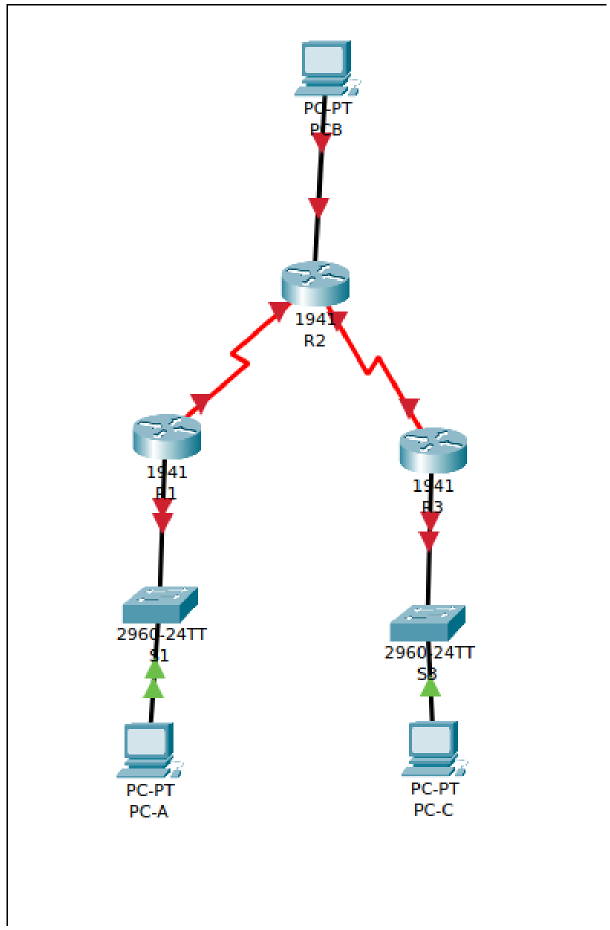
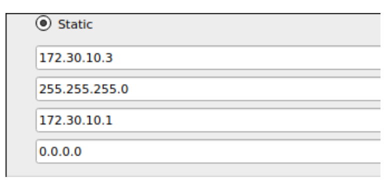
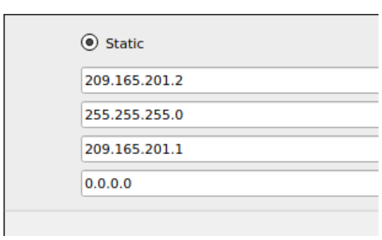


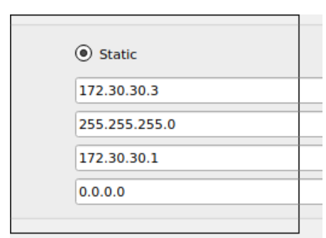
Figure 8.1: Cabling the Network



(a) Configuring PC A



(b) Configuring PC B

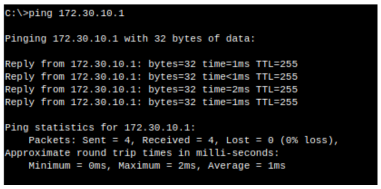


(c) Configuring PC C

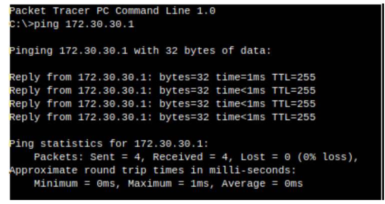
Figure 8.2: Setting up the PC's according to the addressing Table

iv) Test Connectivity

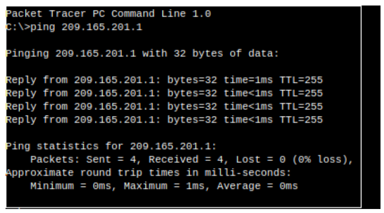
To test connectivity I went to the command prompt on each of the PCs and pinged their routers. See Fig 8.3.



(a)



(b)



(c)

Figure 8.3: Testing Connectivity

Part 2: Configure and Verify RIPv2 Routing

i) Confiugure RIPv2 routing I ran the commands for setting up router rip version two on each router see Fig 8.4a.

ii) Examine the current state of the network
I ran show ip interface brief from router 2. See Fig 8.4b.

iii) Disable automatic summarization
I ran No auto-summary from each of the routers, cleared the ip routing tables

iv) Configure and redistribute a default route for internet access
I went to R2 set the default route and then gave the command to distribute the table amongst the network

v) Verify the routing configuration
I went to R1 and typed show ip route to verify the network configurations as you can see in Fig 8.5a.
I then Pinged PC-B from PC-A's interface. See Fig 8.5b.
Finally, I pinged PC-C from PC-B. Fig 8.5c.

```
R1#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, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
L       10.1.1.1/32 is directly connected, Serial0/0/0
     172.30.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.30.10.0/24 is directly connected, GigabitEthernet0/1
L       172.30.10.1/32 is directly connected, GigabitEthernet0/1

R1#
```

(a) Setting Up RIPv2 on Each Router

```
R2#show ip interface brief
Interface              IP-Address      OK? Method Status                Protocol
GigabitEthernet0/0     209.165.201.1   YES manual up                    up
GigabitEthernet0/1     unassigned      YES unset  administratively down down
Serial0/0/0            10.1.1.2        YES manual up                    up
Serial0/0/1            10.2.2.2        YES manual up                    up
Vlan1                  unassigned      YES unset  administratively down down
R2#
```

(b) show ip interface brief ran from router 2

Figure 8.4: Configuring RIPv2 on the network

```
R1#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, E - EGP
       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 - ODR
       P - periodic downloaded static route

Gateway of last resort is 10.1.1.2 to network 0.0.0.0

     10.0.0.0/8 is variably subnetted, 3 subnets, 2 masks
C       10.1.1.0/30 is directly connected, Serial0/0/0
L       10.1.1.1/32 is directly connected, Serial0/0/0
R       10.2.2.0/30 [120/1] via 10.1.1.2, 00:00:25, Serial0/0/0
     172.30.0.0/16 is variably subnetted, 3 subnets, 2 masks
C       172.30.10.0/24 is directly connected, GigabitEthernet0/1
L       172.30.10.1/32 is directly connected, GigabitEthernet0/1
R       172.30.30.0/24 [120/2] via 10.1.1.2, 00:00:25, Serial0/0/0
R*   0.0.0.0/0 [120/1] via 10.1.1.2, 00:00:25, Serial0/0/0

R1#
```

(a) Running show ip route from R1

```
C:\>ping 209.165.201.2

Pinging 209.165.201.2 with 32 bytes of data:

Reply from 209.165.201.2: bytes=32 time=2ms TTL=126
Reply from 209.165.201.2: bytes=32 time=1ms TTL=126
Reply from 209.165.201.2: bytes=32 time=1ms TTL=126
Reply from 209.165.201.2: bytes=32 time=1ms TTL=126

Ping statistics for 209.165.201.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 2ms, Average = 1ms

C:\>
```

(b) Pinging PC-B from PC-A

```
C:\>ping 172.30.30.3

Pinging 172.30.30.3 with 32 bytes of data:

Reply from 172.30.30.3: bytes=32 time=2ms TTL=125
Reply from 172.30.30.3: bytes=32 time=2ms TTL=125
Reply from 172.30.30.3: bytes=32 time=5ms TTL=125
Reply from 172.30.30.3: bytes=32 time=2ms TTL=125

Ping statistics for 172.30.30.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 5ms, Average = 2ms
```

(c) Pinging PC-C from PC-A

Figure 8.5: Verifying connectivity

Part 3: Reflection

i) Why would you turn off auto-summary? Route summarization reduces the amount of routing information in the routing tables. If you are using RIP Version 2, you can turn off automatic summarization by specifying no auto-summary. Disable automatic summarization if you must perform routing between disconnected subnets. When automatic summarization is off, subnets are advertised.

ii) How did R1 and R3 learn the pathway to the internet? they are using rip routing updates from the router default config. RIPv2 multicasts the entire routing table to all adjacent routers at the address