



## Assignment 2

Aim - Simulation of WAN Network (minimum 3 networks) using Cisco Packet Tracer ~~the~~ Tool (Dynamic Routing)

### RIP

Routing Information Protocol - is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance vector routing protocol that works on the application layer of the OSI model.

RIP prevents routing loops by implementing a limit on the <sup>number of</sup> hops allowed in a path from the source to destination. The largest number of hops allowed for RIP is 15, which limits the size of networks that RIP can support.

RIP uses the User Datagram Protocol (UDP) as its transport protocol and is assigned the reserved port number 520.

Distance Vector Routing - Distance Vector Routing protocol requires that a router inform its neighbours of topology changes periodically. Historically known as old ARPANET routing algorithm or Bellman Ford algorithm.

Each ~~routing~~ router maintains a Distance Vector Table containing the distance between itself and all possible destination nodes.



Distances based on a chosen metric are computed using information from the neighbour's distance vectors.

Count to Infinity Problem - It is also called as routing loop.

A problem with distance vector routing is that any decrease in cost (good news) propagates quickly but any increase in cost (bad news) will propagate slowly. Whenever a link is broken, it should be communicated immediately but other routers unknowingly give information that they know how to reach a disconnected node. This false information is propagated to all the routers and it takes a very long time before the cost for the broken link is recorded as infinity by all the routers.

RIP Working - In RIP, full routing tables are sent in updates. The updates (routing information) are always broadcast. Routers always trust the routing information received from the neighbour routers. This is also called as routing on rumour. Each router broadcasts the entire routing table to its closest neighbours every 30s.





## Steps for Configuration -

Take 4 end devices of generic type

Take 2 switches of type PT and connect 1 pair of end devices to switch 0 & another pair of end devices to switch 1, through cables.

Take 2 routers of type 'Router PT' & connect one with switch 0 & the other with switch 1 using copper cables.

Connect the 2 routers also using cable.

Allocate the IP addresses to the end devices & the ports of both the routers.

Assign the default gateway field of the end device with the IP address of the nearest router.

Configure the routers.

### Configuration Commands

→ for router 0:

#enable

#config t

#router rip

#network 10.0.0.0

#network 172.16.0.0

→ for router 1

#enable

#config t

#router rip

#network 192.168.30.0

#network 172.16.0.0

After configuring the rip on each router, execute these commands on any 1 router.

# show ip route

# show ip protocol

# hostname

# show running



OSPF (Open Shortest Path First) - It is a widely used & a supported routing protocol. It is an intradomain protocol. It is based on link state routing algorithm in which each router contains the information of every domain and based on this information, it determines the shortest path. OSPF achieves routing by learning about every router and subnet within the entire network. Every router contains information about the entire network.

Link State Routing - link state routing uses link state routers to exchange messages that allow each router to learn about the entire network topology. Based on this learned topology, each router is able to compute its routing table by using the shortest path computation. For calculating the shortest path Dijkstra's algorithm is used.

OSPF uses 5 different types of messages -

- 1) Hello message - Used by routers to introduce themselves to other routers
- 2) Database Description message - It is normally sent in response to Hello message.





- 3) Link-state request message - used by routers that need information about specific link state ~~packag~~ packets.
- 4) link-state update message - Main message for building the link state database
- 5) link-state acknowledgement message - Used to create reliability in OSPF protocol.

OSPF Working - A router finds its neighbours by using HELLO packet. Link costs are ~~calculated~~ set by using echo packet. link state packet based on gathered information is created.

Each router distributes these packets & receives packets from others. The shortest path is now calculated.

Configuration Steps - Take 4 end devices of generic type, 2 switches of type 'switch-PT' & connects 1 pair of ~~switches~~ to devices to switch 0 & the other pair to switch 1, through cables. Take 2 routers & connect them with each other & with the switches.

Allocate the IP addresses to the end devices & ports of both the routers.

Assign default gateway field of end device with the nearest router. Configure the routers.

For each router, alter the physical configuration to add 1-port serial WAN interface card (WIC-1T). Switch the router off before adding then switch it back on. This is required as we connect the 2 routers using serial DCE cable to form the third network. Make sure to keep all interfaces on. Now use the following commands for OSPF -

for router 1

#enable

#config t

#router ospf 10

#network 10.0.0.0  
255.0.0.0 area 0

#network 172.16.0.0  
255.255.0.0 area 0

router 2

#enable

#config t

#router ospf 10

#network 192.168.30.0 255.255.  
255.0 area 0

#network 172.16.0.0 255.255.0.0  
area 0

Use exit till you return to router# (root console)

Use these commands on any 1 router -

#show ip route

#show ip protocol

#hostname

#show running

## OUTPUT FOR RIP

Press RETURN to get started!

%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router>enable

Router#config

Configuring from terminal, memory, or network [terminal]? t

Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router rip

Router(config-router)#network 192.168.30.0

Router(config-router)#network 172.16.0.0

Router(config-router)#exit

Router(config)#exit

Router#

%SYS-5-CONFIG\_I: Configured from console by console

Router>enable

Router#show ip route

Codes: C - connected, S - static, I - IGRP, 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

C 10.0.0.0/8 is directly connected, FastEthernet0/0

C 172.16.0.0/16 is directly connected, Serial2/0

R 192.168.30.0/24 [120/1] via 172.16.0.2, 00:00:06, Serial2/0

Router#show ip protocol

Routing Protocol is "rip"

Sending updates every 30 seconds, next due in 4 seconds

Invalid after 180 seconds, hold down 180, flushed after 240

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Redistributing: rip

Default version control: send version 1, receive any version

Interface Send Recv Triggered RIP Key-chain

FastEthernet0/0 1 2 1



```
Serial2/0 1 2 1
Automatic network summarization is in effect
Maximum path: 4
Routing for Networks:
10.0.0.0
172.16.0.0
Passive Interface(s):
Routing Information Sources:
Gateway Distance Last Update
172.16.0.2 120 00:00:13
Distance: (default is 120)
Router#hostname
Translating "hostname"...domain server (255.255.255.255)
% Unknown command or computer name, or unable to find computer address
```

```
Router#show running
Building configuration...
```

```
Current configuration : 790 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
```

```

!
!
!
!
interface FastEthernet0/0
ip address 10.0.0.10 255.0.0.0
duplex auto
speed auto
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 172.16.0.1 255.255.0.0
clock rate 64000
!
interface Serial3/0
no ip address
clock rate 2000000
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
router rip
network 10.0.0.0
network 172.16.0.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!

```

```
line vty 0 4
login
!
!
!
end
```

Router#

## OUTPUT FOR OSPF

LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

%LINK-5-CHANGED: Interface Serial2/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

00:00:10: %OSPF-5-ADJCHG: Process 10, Nbr 192.168.30.5 on Serial2/0 from LOADING to FULL, Loading Done

Router>enable

Router#show ip route

Codes: C - connected, S - static, I - IGRP, 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

C 10.0.0.0/8 is directly connected, FastEthernet0/0

C 172.16.0.0/16 is directly connected, Serial2/0

O 192.168.30.0/24 [110/65] via 172.16.0.2, 00:08:11, Serial2/0

Router#show ip protocol

Routing Protocol is "rip"

Sending updates every 30 seconds, next due in 3 seconds

Invalid after 180 seconds, hold down 180, flushed after 240

Outgoing update filter list for all interfaces is not set

Incoming update filter list for all interfaces is not set

Redistributing: rip

Default version control: send version 1, receive any version

Interface Send Recv Triggered RIP Key-chain

FastEthernet0/0 1 2 1

Serial2/0 1 2 1

Automatic network summarization is in effect

Maximum path: 4

Routing for Networks:



10.0.0.0  
172.16.0.0  
Passive Interface(s):  
Routing Information Sources:  
Gateway Distance Last Update  
172.16.0.2 120 00:00:03  
Distance: (default is 120)

Routing Protocol is "ospf 10"  
Outgoing update filter list for all interfaces is not set  
Incoming update filter list for all interfaces is not set  
Router ID 172.16.0.1  
Number of areas in this router is 1. 1 normal 0 stub 0 nssa  
Maximum path: 4  
Routing for Networks:  
10.0.0.0 0.255.255.255 area 0  
172.16.0.0 0.0.255.255 area 0  
Routing Information Sources:  
Gateway Distance Last Update  
172.16.0.1 110 00:11:48  
192.168.30.5 110 00:11:48  
Distance: (default is 110)

Router#  
Router#hostname  
Translating "hostname"...domain server (255.255.255.255)  
% Unknown command or computer name, or unable to find computer address

Router#show running  
Building configuration...

Current configuration : 908 bytes  
!  
version 12.2  
no service timestamps log datetime msec  
no service timestamps debug datetime msec  
no service password-encryption  
!  
hostname Router  
!  
!  
!  
!  
!  
!  
!  
!  
ip cef  
no ipv6 cef  
!

```
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
!  
interface FastEthernet0/0  
ip address 10.0.0.10 255.0.0.0  
duplex auto  
speed auto  
!  
interface FastEthernet1/0  
no ip address  
duplex auto  
speed auto  
shutdown  
!  
interface Serial2/0  
ip address 172.16.0.1 255.255.0.0  
clock rate 64000  
!  
interface Serial3/0  
no ip address  
clock rate 2000000  
shutdown  
!  
interface FastEthernet4/0  
no ip address  
shutdown  
!  
interface FastEthernet5/0  
no ip address  
shutdown  
!  
router ospf 10  
log-adjacency-changes  
network 10.0.0.0 0.255.255.255 area 0  
network 172.16.0.0 0.0.255.255 area 0  
!
```

```
router rip
network 10.0.0.0
network 172.16.0.0
!
ip classless
!
ip flow-export version 9
!
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
End
Router#
```