LAB No 12 **Date:**

Study of Dynamic Routing Protocols using GNS3

Objectives:

- To study the routing information protocol.
- To study the open shortest path first.

1. Routing Information Protocol - RIP:

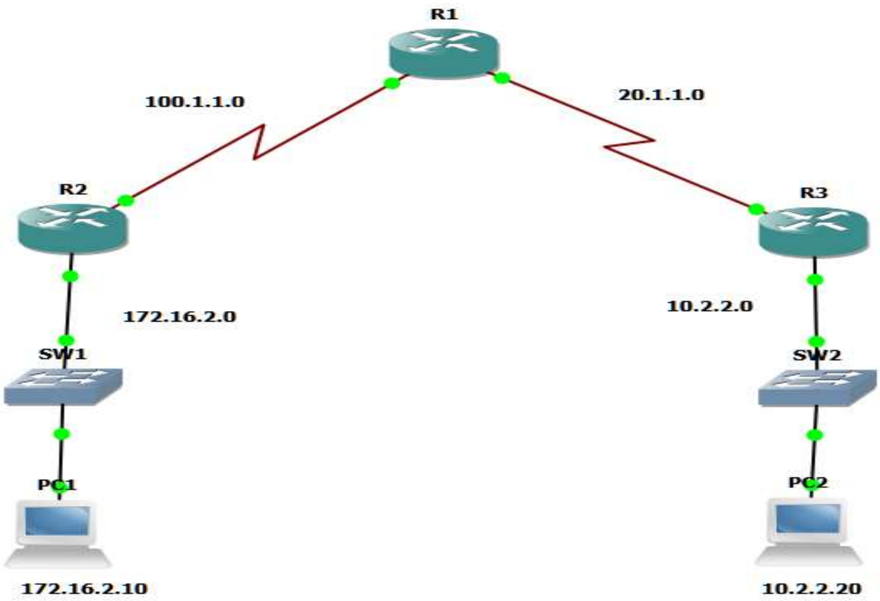
Routing Information Protocol (RIP) is a dynamic routing protocol which uses hop count as a routing metric to find the best path between the source and the destination network. It is a distance vector routing protocol.

Hop Count: Hop count is the number of routers occurring in between the source and destination network. The path with the lowest hop count is considered as the best route to reach a network and therefore placed in the routing table. RIP prevents routing loops by limiting the number of hopes allowed in a path from source and destination. The maximum hop count allowed for RIP is 15 and hop count of 16 is considered as network unreachable.

Features of RIP:
1. Updates of the network are exchanged periodically.
2. Updates (routing information) are always broadcast.
3. Full routing tables are sent in updates.
4. Routers always trust on routing information received from neighbour routers. This is also known as Routing on rumours.

RIP versions:
There are three versions of routing information protocol – RIP Version1, RIP Version2 and RIPng. **RIP v1** is known as *Classful* Routing Protocol because it doesn't send information of subnet mask in its routing update.
RIP v2 is known as *Classless* Routing Protocol because it sends information of subnet mask in its routing update.
RIPng (RIP next generation) is an extension of RIPv2 for support of IPv6, the next generation Internet Protocol.

The RIPv2 routing protocol uses the following command syntax:



Router(config)#router rip

Router(config-router)#version 2

Router(config-router)#network <network-IP>

Router(config-router)#network <network-IP>

LAB EXERCISE:

Configure the below topology to setup connectivity using RIPv2. R1, R2, and R3 will use dynamic routing protocol (RIPv2).

Configuration for R1

R1#conf t

R1(config)#int s1/0

R1(config-if)#ip add 100.1.1.2 255.255.255.0

R1(config-if)#no shut

R1(config-if)#int s1/1

R1(config-if)#ip address 20.1.1.1 255.255.255.0

R1(config-if)#no shut

R1(config-if)#exit

R1(config)#router rip

R1(config-router)#version 2

R1(config-router)#network 20.1.1.0

R1(config-router)#network 100.1.1.0

Configuration for R2

R2#config t

R2(config)#int f1/0

R2(config-if)#ip address 172.16.2.1 255.255.0.0

R2(config-if)#no shut

R2(config-if)#int s2/0

R2(config-if)#ip address 100.1.1.1 255.255.255.0

R2(config-if)#no shut

R2(config-if)#exit

R2(config)#router rip

R2(config-router)#version 2

R2(config-router)#network 172.16.0.0

R2(config-router)#network 100.1.1.0

Configuration for R3

R3#config t

R3(config)#int s2/0

R3(config-if)#ip add 20.1.1.2 255.255.255.0

R3(config-if)#no shut

R3(config-if)#int f1/0

R3(config-if)#ip add 10.2.2.1 255.255.255.0

R3(config-if)#no shut

R3(config-if)#exit

R3(config)#router rip

R3(config-router)#ver 2

R3(config-router)#network 10.2.2.0

R3(config-router)#network 20.1.1.0

RIP Verification:

show ip route command should display all RIP networks and end to end ping should be successful.
show ip protocol command should display if necessary, ports are active.
show ip rip database command should displays the contents of RIP database inside the router.
debug ip rip command shows RIP updates occurring in the system undebug all Once you turn on *debug ip rip* router will keep showing RIP updates. The command undebug all will stop such RIP updates.
show running-config command is used to get the current configuration from the Router.

2. Open Shortest Path First - OSPF:

BASIC OSPF - Enable OSPF

Open Shortest Path First (OSPF) is an IGP developed by the OSPF working group of the Internet Engineering Task Force (IETF). Designed expressly for IP networks, OSPF supports IP subnettingand tagging of externally derived routing information. OSPF also allows packet authentication and uses IP multicast when sending/receiving packets.

As with other routing protocols, enabling OSPF requires that you create an OSPF routing process, specify the range of IP addresses to be associated with the routing process, and assign area IDs to be associated with that range of IP addresses.

Configuration

With OSPF, every router has its own unique "picture" (topology map) of the network. Routers use "HELLO" packets to periodically check with routers to ensure they are still there. Every router in OSPF is identified with a "router ID". The router ID can be manually entered or OSPF will automatically choose the IP address with the highest number. It supports variable length

subnet masks (VLSM), making it a classless routing protocol.

OSPF works well in point to point and point to multipoint, broadcast or non-broadcast configurations. OSPF also offers a number of OSPF-specific features such as stub areas, virtual links, and OSPF on demand circuits. In OSPF route redistribution is supported between different routing protocols.

An OSPF point-to-multipoint interface is defined as a numbered point-to-point interface having one or more neighbours. It creates multiple host routes. An OSPF point-to-multipoint network has the following benefits compared to nonbroadcast multiaccess and point-to-point networks.

The OSPF routing protocol uses the following command syntax:

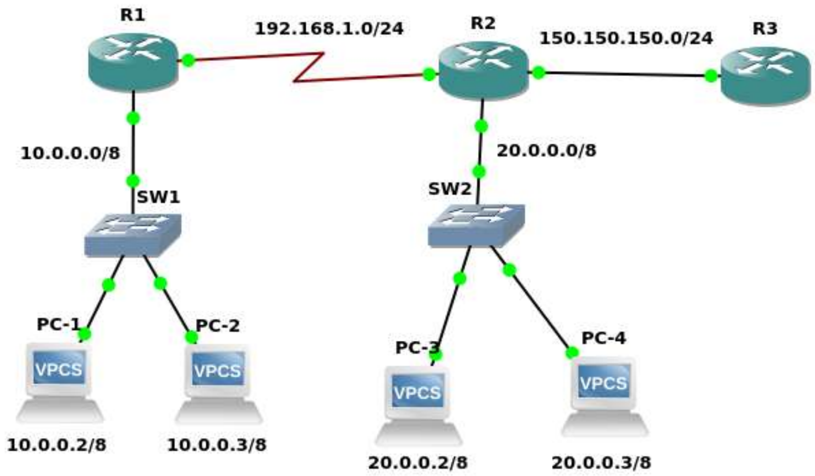
Router(config)#router ospf <process id 1-65535>

Router(config-router)network <network address> <wild card mask> area <0-4294967295>

Area id number can always be zero (0) for small networks, but for larger networks, the area IDs need to be properly planned as all routing updates must traverse area 0.

LAB EXERCISE:

Configure the below topology to setup connectivity using RIPv2. R1, R2, and R3 will use dynamic routing protocol (OSPF).



Configuration for R1

R1(config)#router ospf 200
R1(config-router)#network 10.0.0.0 0.255.255.255 area 0
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0.0.0.0
R1(config-router)#exit

Configuration for R2

R2(config)#router ospf 200
R2(config-router)#network 20.0.0.0 0.255.255.255 area 0
R2(config-router)#network 192.168.1.0 0.0.0.255 area 0
R2(config-router)#network 150.150.150.0 0.0.0.255 area 1
R2(config-router)#exit
R2(config)#exit

Configuration for R3

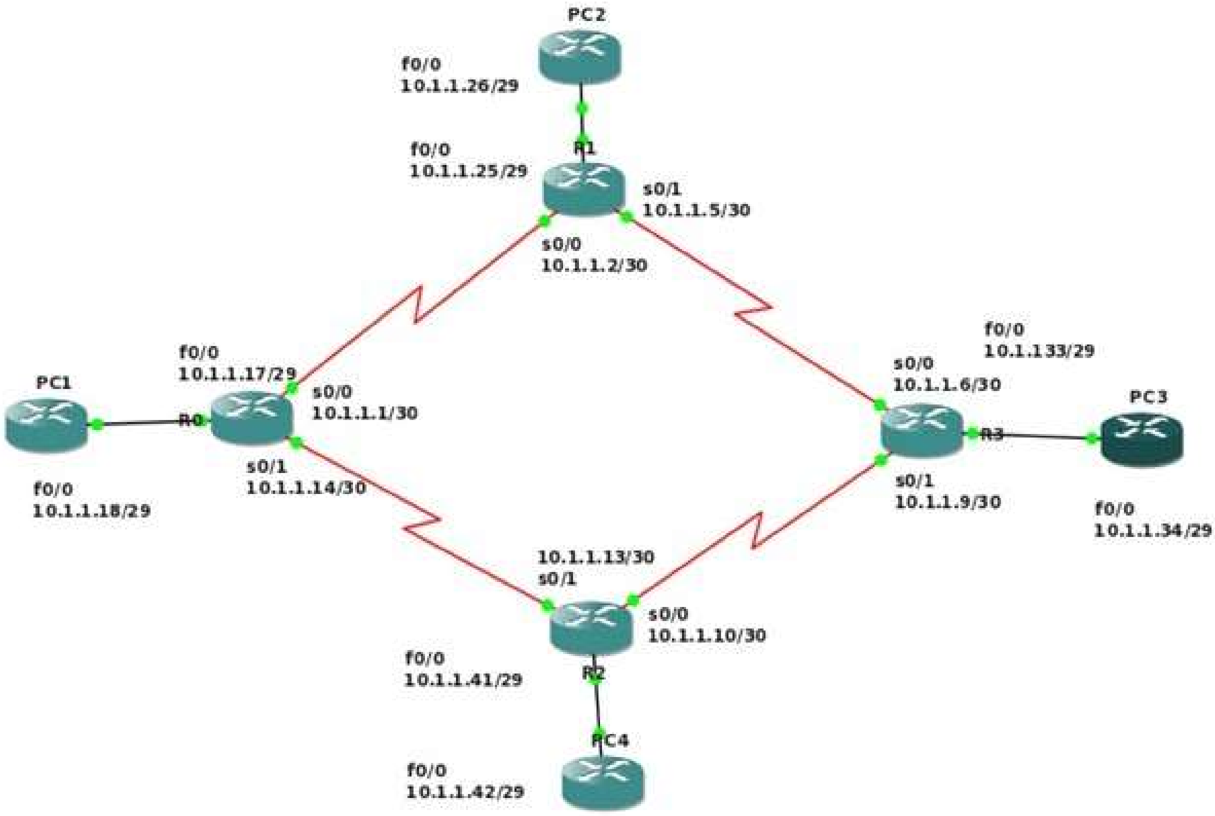
R3(config)#router ospf 200
R3(config-router)#network 150.150.150.0 0.0.0.255 area 1
R3(config-router)#exit
R3(config)#exit

OSPF Verification:

show ip route
show ip ospf neighbor
show ip ospf database

ADDITIONAL EXERCISE:

Configure the below network topology using RIP and OSPF as shown in Figure and check the connectivity by pinging from PC1 to PC2, PC3, PC4.


PC2
f0/0
10.1.1.26/29
f0/0
10.1.1.25/29
R1
s0/1
10.1.1.5/30
s0/0
10.1.1.2/30
f0/0
10.1.133/29
f0/0
10.1.1.17/29
PC1
s0/0
10.1.1.1/30
R0
s0/0
10.1.1.6/30
PC3
R3
s0/1
10.1.1.14/30
s0/1
10.1.1.9/30
f0/0
10.1.1.18/29
f0/0
10.1.1.34/29
10.1.1.13/30
s0/1
s0/0
10.1.1.10/30
f0/0
10.1.1.41/29
R2
PC4
f0/0
10.1.1.42/29