

Experiment:7

Study and Implementation of Dynamic Routing Protocols (OSPF, EIGRP, BGP) using Cisco Packet Tracer

Objective

To study and implement Dynamic Routing Protocols — specifically OSPF (Open Shortest Path First), EIGRP (Enhanced Interior Gateway Routing Protocol), and BGP (Border Gateway Protocol) — in a simulated network using Cisco Packet Tracer.

Routing Overview

Routing is the process of selecting the best path for data packets to travel across a network. Routers use routing tables to determine the next hop for each packet.

Routing protocols are categorized into:

- Static Routing: Manually configured routes.
- Dynamic Routing: Routes learned and updated automatically through routing protocols.

Types of Dynamic Routing Protocols

Type	Example	Description
Distance Vector	RIP, EIGRP	Determines the best path based on hop count or composite metrics.
Link State	OSPF, IS-IS	Builds a complete map of the network topology and computes best paths.
Path Vector	BGP	Used between autonomous systems; maintains path information.

Protocol Overview

OSPF (Open Shortest Path First)

- Type: Link State Routing Protocol
- Administrative Distance: 110
- Metric: Cost (based on bandwidth)
- Works within a single autonomous system (AS).
- Supports hierarchical design using areas (Backbone Area 0).

EIGRP (Enhanced Interior Gateway Routing Protocol)

- Type: Hybrid (Distance Vector + Link State features)
- Administrative Distance: 90 (internal), 170 (external)
- Metric: Composite metric (bandwidth, delay, reliability, load).
- Uses DUAL (Diffusing Update Algorithm) to find the shortest loop-free path.
- Cisco proprietary protocol (up to IOS 15.x).

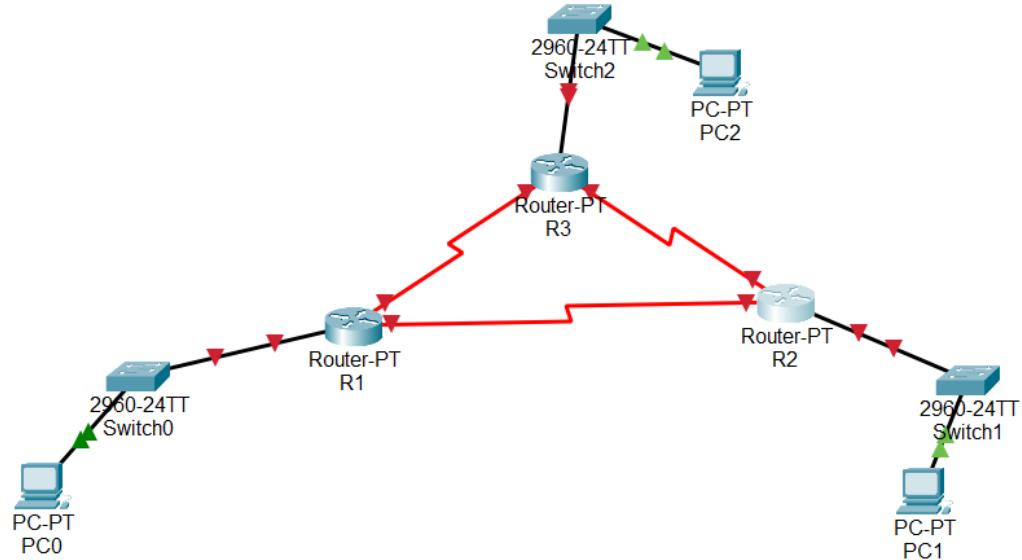
BGP (Border Gateway Protocol)

- Type: Path Vector Protocol
- Administrative Distance: 20 (external), 200 (internal)
- Used between autonomous systems (inter-domain routing).
- Basis of global Internet routing.
- Relies on AS numbers (Autonomous System Numbers) to make routing decisions.

5. Network Topologies

5.1. OSPF Topology

- Three routers connected in a triangle (R1, R2, R3).
- Each router connected to its own LAN.



Addressing (all from 172.16.1.0/24)

LANs (each /27 = up to 30 hosts)

- R1 LAN: 172.16.1.0/27 → gateway 172.16.1.1
- R2 LAN: 172.16.1.32/27 → gateway 172.16.1.33
- R3 LAN: 172.16.1.64/27 → gateway 172.16.1.65

(These consume 172.16.1.0–95. Next free block starts at 172.16.1.96.)

Router↔Router links (start after LANs)

- R1–R2: 172.16.1.96/30 → R1 172.16.1.97, R2 172.16.1.98
- R2–R3: 172.16.1.100/30 → R2 172.16.1.101, R3 172.16.1.102
- R1–R3: 172.16.1.104/30 → R1 172.16.1.105, R3 172.16.1.106

PC examples:

PC0 = 172.16.1.10/27, GW 172.16.1.1
 PC1 = 172.16.1.40/27, GW 172.16.1.33
 PC2 = 172.16.1.70/27, GW 172.16.1.65

6. Commands and Configuration Steps

6.2. OSPF Configuration Example

Router-1

```
Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1
```

```
R1(config)#interface fa0/0
R1(config-if)#ip address 172.16.1.1 255.255.255.224
R1(config-if)#no shutdown
R1(config-if)#exit
```

```
R1(config)#interface se2/0
R1(config-if)#ip address 172.16.1.105 255.255.255.252
R1(config-if)#clock rate 64000
R1(config-if)#no shutdown
R1(config-if)#exit
```

```
R1(config)#interface se3/0
R1(config-if)#ip address 172.16.1.97 255.255.255.252
R1(config-if)#clock rate 64000
R1(config-if)#no shutdown
```

```
R1(config-if)#exit
```

```
R1(config)#router ospf 1
R1(config-router)#router-id 1.1.1.1
R1(config-router)#network 172.16.1.0 0.0.0.31 area 0
R1(config-router)#network 172.16.1.96 0.0.0.3 area 0
R1(config-router)#network 172.16.1.104 0.0.0.3 area 0
R1(config-router)#end
R1#
%SYS-5-CONFIG_I: Configured from console by console
wr
Building configuration...
[OK]
```

Router-2:

```
Router>enable
Router#config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fa0/0
Router(config-if)#ip address 172.16.1.33 255.255.255.224
Router(config-if)#no shutdown
Router(config-if)#exit
Router(config)#
Router(config)#interface se3/0
Router(config-if)#ip address 172.16.1.98 255.255.255.252
Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#exit
```

```
Router(config)#interface se2/0
Router(config-if)#ip address 172.16.1.101 255.255.255.252
Router(config-if)#clock rate 64000
This command applies only to DCE interfaces
Router(config-if)#no shutdown
Router(config-if)#exit
```

```
Router(config)#router ospf 1
Router(config-router)#router-id 2.2.2.2
Router(config-router)#network 172.16.1.32 0.0.0.31 area 0
Router(config-router)#network 172.16.1.96 0.0.0.3 area 0
Router(config-router)#network 172.16.1.100 0.0.0.3 area 0
Router(config-router)#end
Router#wr
Building configuration...
[OK]
```

Router 3

```
Router>enable  
Router#config terminal  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface fa0/0  
Router(config-if)#ip address 172.16.1.65 255.255.255.224  
Router(config-if)#no shutdown  
Router(config-if)#exit
```

```
Router(config)#interface se2/0  
Router(config-if)#ip address 172.16.1.106 255.255.255.252  
Router(config-if)#clock rate 64000  
This command applies only to DCE interfaces  
Router(config-if)#no shutdown  
Router(config-if)#exit
```

```
Router(config)#interface se3/0  
Router(config-if)#ip address 172.16.1.102 255.255.255.252  
Router(config-if)#clock rate 64000  
Router(config-if)#no shutdown
```

```
Router(config-if)#exit  
Router(config)#router ospf 1  
Router(config-router)#router-id 3.3.3.3  
Router(config-router)#network 172.16.1.64 0.0.0.31 area 0  
Router(config-router)#network 172.16.1.100 0.0.0.3 area 0  
.  
Router(config-router)#network 172.16.1.104 0.0.0.3 area 0  
Router(config-router)#end
```

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

EIGRP

```
router eigrp 100  
network 172.16.1.0 0.0.0.31  
network 172.16.1.96 0.0.0.3  
network 172.16.1.104 0.0.0.3  
no auto-summary  
end
```

wr

BGP Configuration

Let's assume:

- R1 and R2 are in AS 100
- R3 is in AS 200
- The BGP peering is between R2 and R3 (using 172.16.1.100/30 link)

R1 (AS 100)

```
router bgp 100
network 172.16.1.0 mask 255.255.255.224
neighbor 172.16.1.98 remote-as 100
end
wr
```

R2 (AS 100)

```
router bgp 100
network 172.16.1.32 mask 255.255.255.224
neighbor 172.16.1.97 remote-as 100
neighbor 172.16.1.102 remote-as 200
end
wr
```

R3 (AS 200)

```
router bgp 200
network 172.16.1.64 mask 255.255.255.224
neighbor 172.16.1.101 remote-as 100
end
wr
```

Home task

Implement the following network in Cisco packet tracer:

