CIT 223: Data Communication and Computer Network Lab
Assignment #07
Routing Protocols: Static Routing, RIP, OSPF and BGP

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1 Introduction

Routing Protocols are the set of defined rules used by the routers to communicate between source & destination. They do not move the information to the source to a destination, but only update the routing table that contains the information.

1.1 Configuring the Router

Step 1

Configure the LAN interface

Command Line

```
interface interface_id
ip address ip_address subnet_mask
no shutdown
```

Command Line

```
Configuring the Serial Connection

interface serial <interface_number>
encapsulation hdlc
```

Replace interface_id with the LAN interface ID (e.g., FastEthernet0/0, GigabitEthernet0/0), ip_address with the IP address for the LAN interface, and subnet_mask with the appropriate subnet mask.

Step 2

Configure the Static Routing

Command Line

```
ip route network_address subnet_mask next_hop_ip_address
```

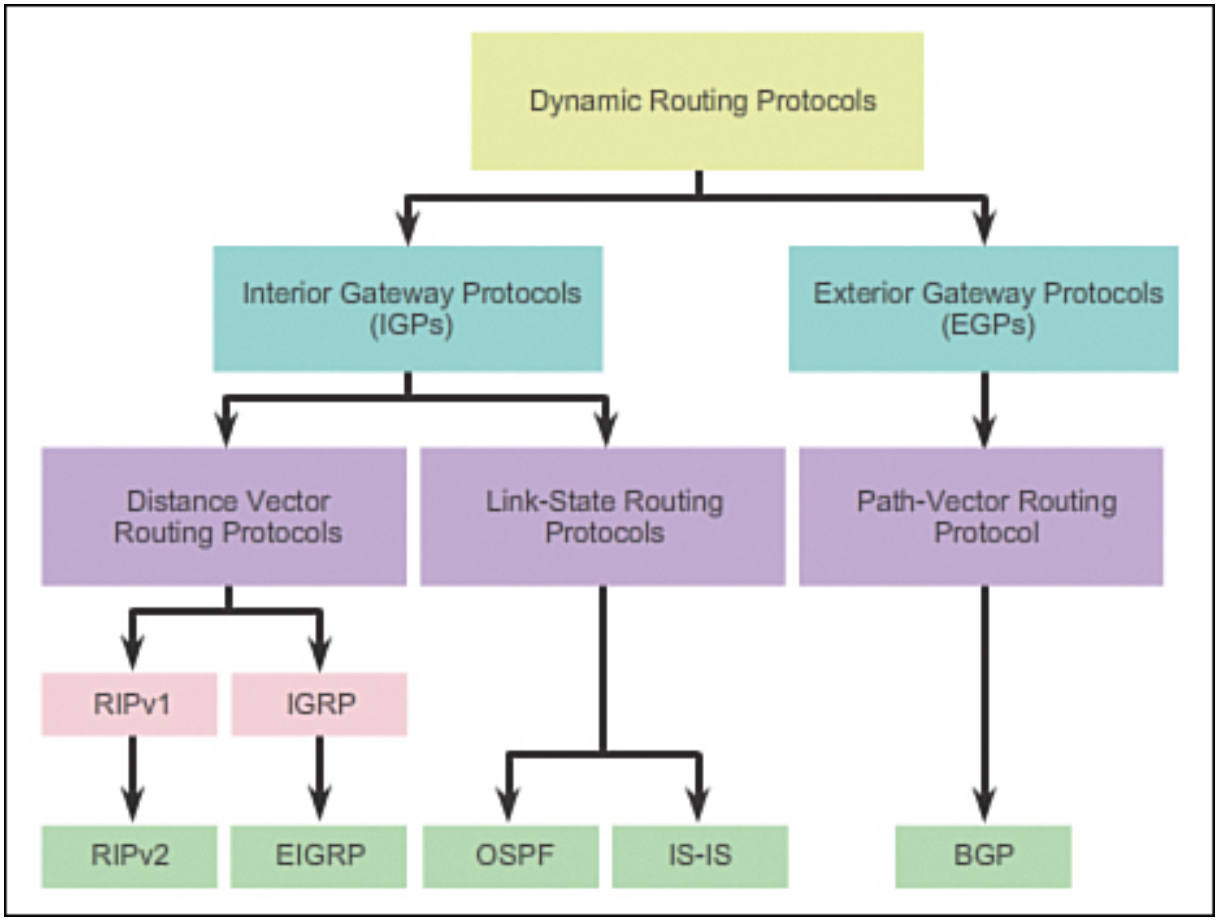


Figure 1: Dynamic Routing Protocols

1.2 Interior Gateway Protocols (IGP)

Interior gateways are gateways that belong to the same autonomous system.

1.2.1 Routing Information Protocol (RIP)

RIP is used in both LAN and WAN Networks. It also runs on the Application layer of the OSI model. Two versions of RIP are RIPv1 and RIPv2.

1.2.2 Open Shortest Path First (OSPF)

Open Shortest Path First (OSPF) protocol is a link- state IGP tailor-made for IP networks using the Shortest Path First (SPF) method. OSPF routing allows us to maintain

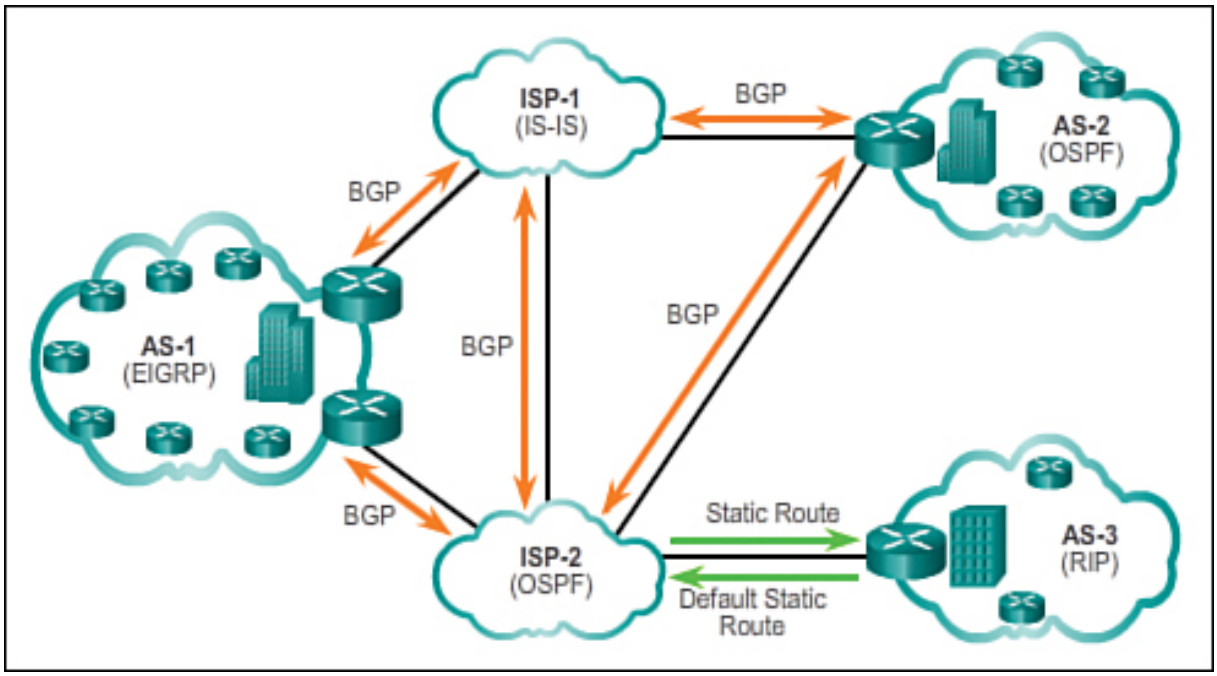


Figure 2: Dynamic Routing Protocols - The Picture

databases detailing information about the surrounding topology of the network. It also uses the Dijkstra algorithm (Shortest path algorithm) to recalculate network paths when its topology changes. It is secure, as it can authenticate protocol changes to keep data secure.

1.2.3 Enhanced Interior Gateway Routing Protocol (EIGRP)

EIGRP is a hybrid routing protocol that provides routing protocols, distance vector, and link-state routing protocols. It can route the same protocols that IGRP routes using the same composite metrics as IGRP, which helps the network select the best path destination.

1.3 Exterior Gateway Protocol (EGP)

EGP is a protocol used to exchange data between gateway hosts that are neighbors with each other within autonomous systems. This routing protocol offers a forum for routers to share information across different domains. The full form for EGP is the Exterior Gateway Protocol. EGP protocol includes known routers, network addresses, route costs, or neighboring devices.

1.3.1 Border Gateway Protocol (BGP)

BGP is the latest routing protocol of the Internet, which is classified as a Distance path Vector Protocol (DPVP). It sends updated router table data when changes are made. Therefore, there is no auto-discovery of topology changes, which means that the user needs to configure BGP manually.

2 Lab Objectives

The objectives of the lab are:

1. To Understand the Basic Operation(s) of RIP, EIGRP, OSPF and BGP

3 Configuration

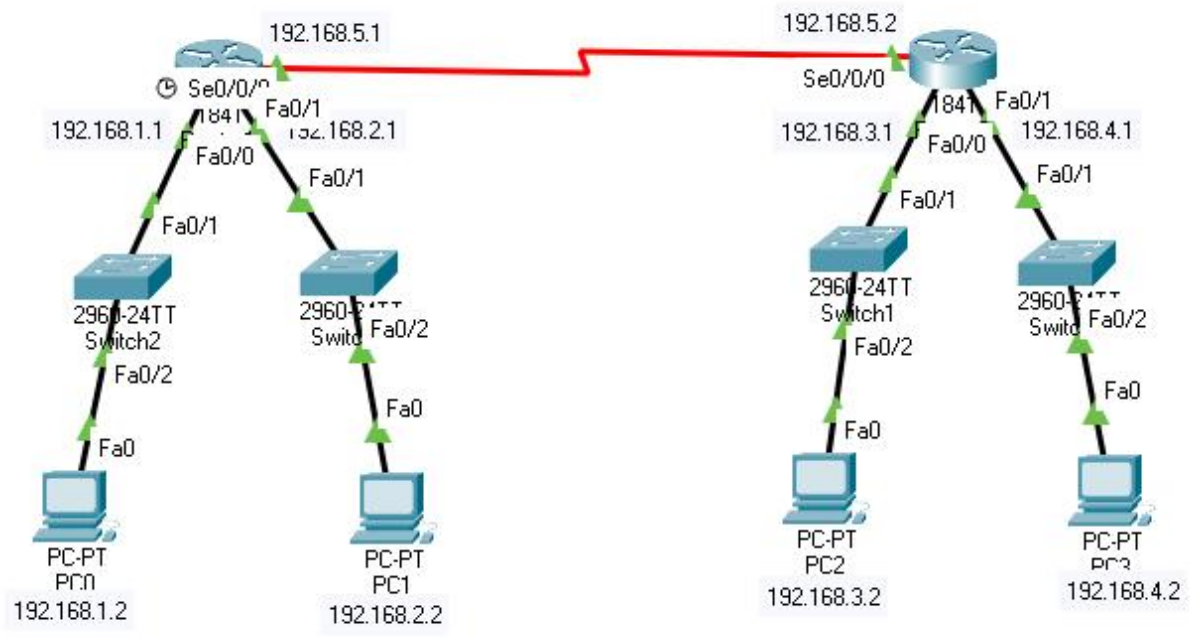


Figure 3: Configuration Set

Step 3

Serial Link Configuration

1. Router 1 Configuration
2. Router 2 Configuration

Command Line

```
Router(config)#hostname R1
R1(config)#interface s0/0/0
R1(config-if)#ip address 192.168.5.1 255.255.255.0
R1(config-if)#clock rate 64000
R1(config-if)#bandwidth 1024
R1(config-if)#no shutdown
```

Command Line

```
Router(config)#hostname R2
R2(config)# interface serial 0/0/0
R2(config-if)#ip address 192.168.5.2 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
```

Step 4

Other Interfaces Configuration

Command Line

```
R1(config)#interface fastethernet 0/0
R1(config-if)#ip address 192.168.1.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#interface fastethernet 0/1
R1(config-if)#ip address 192.168.2.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#exit
R1(config)#exit
R1#show interface brief
```

Command Line

```
R2(config)#interface fastethernet 0/0
R2(config-if)#ip address 192.168.3.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#interface fastethernet 0/1
R2(config-if)#ip address 192.168.4.1 255.255.255.0
R2(config-if)#no shutdown
R2(config-if)#exit
R2(config)#exit
R2#show interface brief
```

Step 5

Routing Information Protocol (RIP) Implementation

Command Line

```
R1(config)#router rip
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.2.0
R1(config-router)#network 192.168.3.0
R1(config-router)#network 192.168.4.0
R1(config-router)#network 192.168.5.0
R1(config-router)#exit
R1(config)#exit
R1#show run
```

Step 6

Verify the connections

1. Try ICMP requests over different systems.

Step 7

Enhanced Interior Gateway Routing Protocol (EIGRP) Implementation

1. Process ID of AS Number: It is a number which must be same for networks which are desired to connect to each other. The value can very between 100 to 400 though available options can be 1- 65535
2. The configuration of the interface /basic configurations remain the same.
3. Remove the RIP configuration and configure EIGRP instead.
4. Then Verify the Connection.

Command Line

```
R1(config)#no router rip
R1(config)#router eigrp 343
R1(config-router)#network 192.168.1.0
R1(config-router)#network 192.168.2.0
R1(config-router)#network 192.168.3.0
R1(config-router)#network 192.168.4.0
R1(config-router)#network 192.168.5.0
R1(config-router)#exit
```

Step 8

Open Shortest Path First (OSPF) Implementation

1. Process ID: It is any number that must be same for all networks in AS.
2. Wild Card Mask (0.0.0.255): It will represent host bits in 192.168.1.0/24
3. The configuration of the interface and other basic configurations remain the same.
4. Remove the EIGRP configuration and configure OSPF instead.
5. Then Verify the Connection.

Command Line

```
R1(config)#no router eigrp 343
R1(config)#router ospf 343
R1(config-router)#network 192.168.1.0 0.0.0.255 area 0
R1(config-router)#network 192.168.2.0 0.0.0.255 area 0
R1(config-router)#network 192.168.3.0 0.0.0.255 area 0
R1(config-router)#network 192.168.4.0 0.0.0.255 area 0
R1(config-router)#network 192.168.5.0 0.0.0.255 area 0
R1(config-router)#exit
```

Step 9

Border Gateway Protocol (BGP) Implementation

Step 10

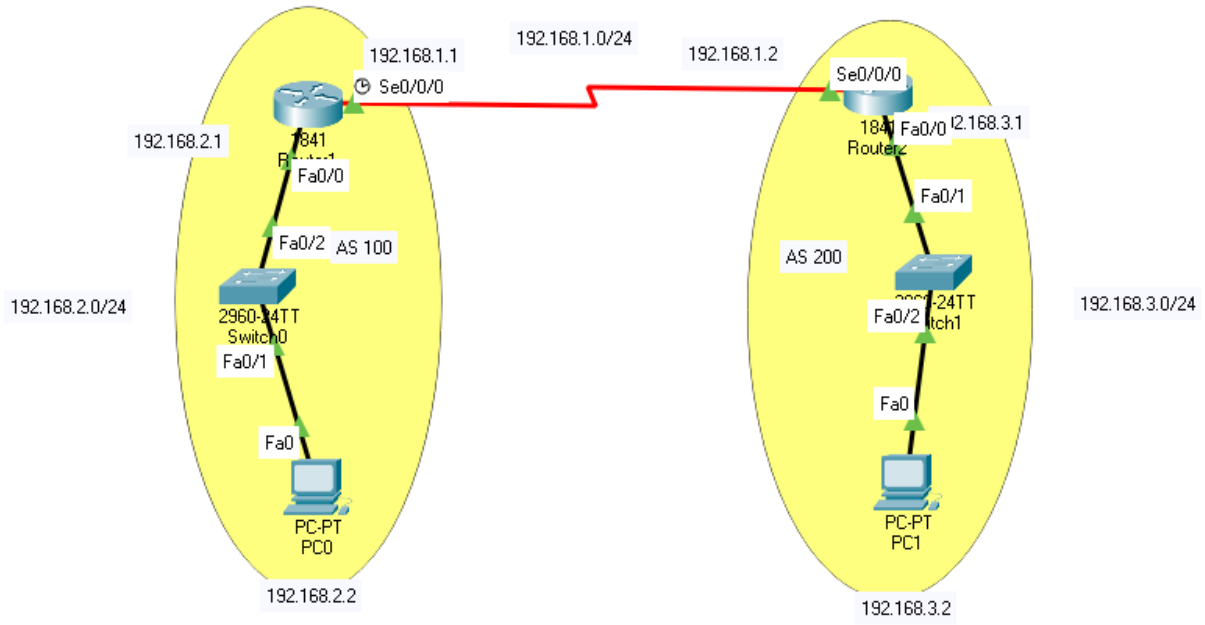
Router Configuration

1. Router 1
2. Router 2

Command Line

Router 1 Configuration

```
Router(config)#router bgp 100
Router(config-router)#network 192.168.1.0
Router(config-router)#network 192.168.2.0
Router(config-router)#neighbor 192.168.1.2 remote-as 200
Router(config-router)#neighbor 192.168.3.2 remote-as 200
Router(config-router)#
```



Command Line

Router 2 Configuration

```
Router(config)#router bgp 200
Router(config-router)#network 192.168.1.0
Router(config-router)#network 192.168.3.0
Router(config-router)#neighbor 192.168.1.1 remote-as 100
Router(config-router)#
%BGP-5-ADJCHANGE: neighbor 192.168.1.1 Up
Router(config-router)#neighbor 192.168.2.3 remote-as 100
Router(config-router)#
```

Step 11

Verify Connectivity

4 Lab Questions

Question 1

Configure a network as that of Figure 4

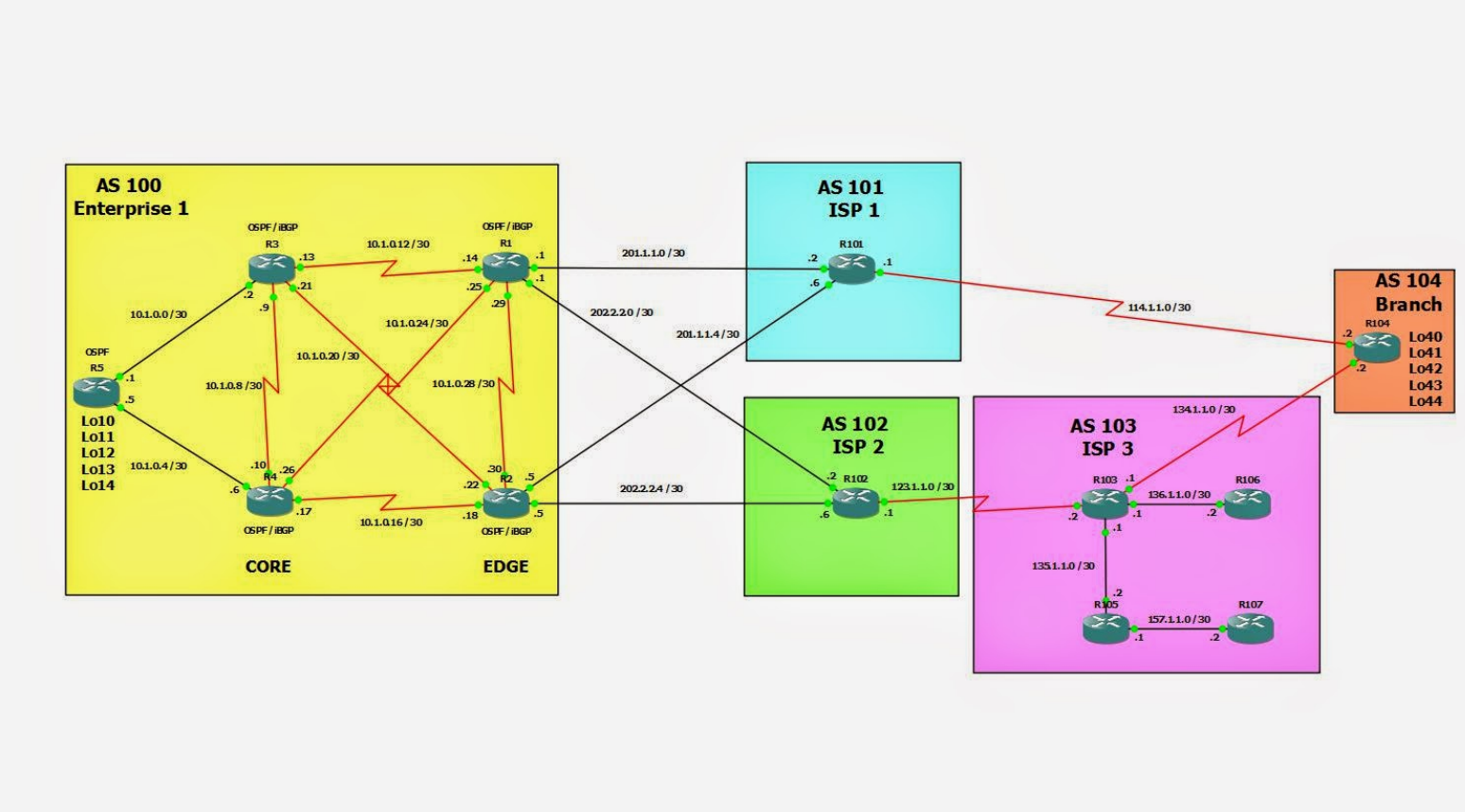


Figure 4: BGP Exercise