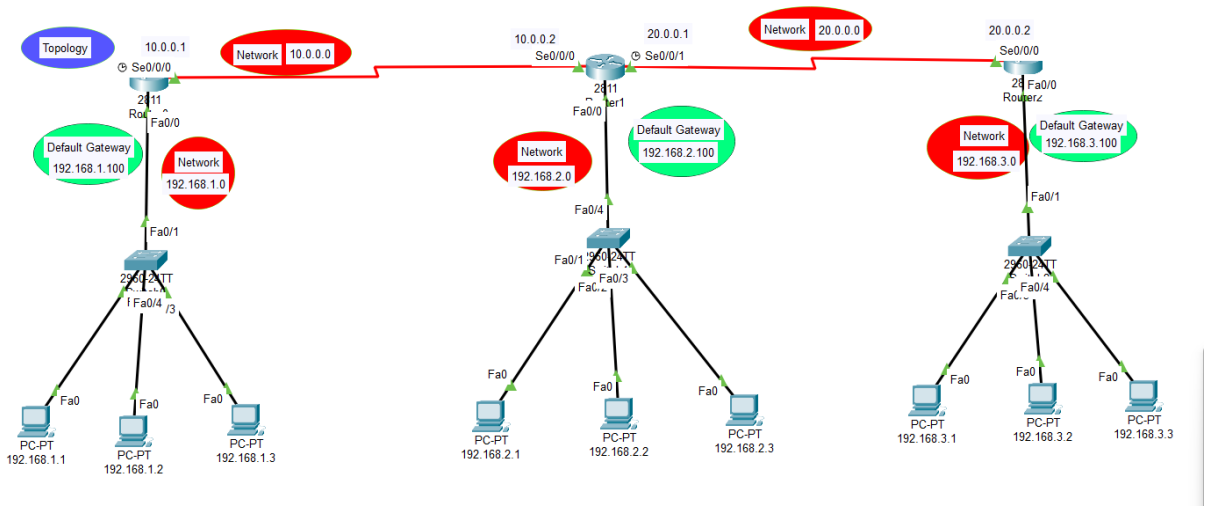
What is Routing?



Routing is the process of forwarding data packets between different networks based on their destination IP addresses. Devices that perform routing are called **routers**.

Routers maintain a **routing table**, which contains information about different networks and how to reach them. They use this table to make forwarding decisions for incoming packets.

Types of Routing

Routing can be classified into **three main types**:

1. Static Routing

Definition:
Static routing is when the network administrator manually configures routes in the routing table. These routes don't change unless manually modified.

Best Used For:

- Small, simple networks
- Networks with stable topology
- Lab/testing environments

Advantages:

- Simple to configure
- No routing protocol overhead

- More secure (no advertisement of routes)

Disadvantages:

- Not scalable
- Doesn't adapt to network changes automatically

Example **Scenario:**
You have two routers (R1 and R2) directly connected:

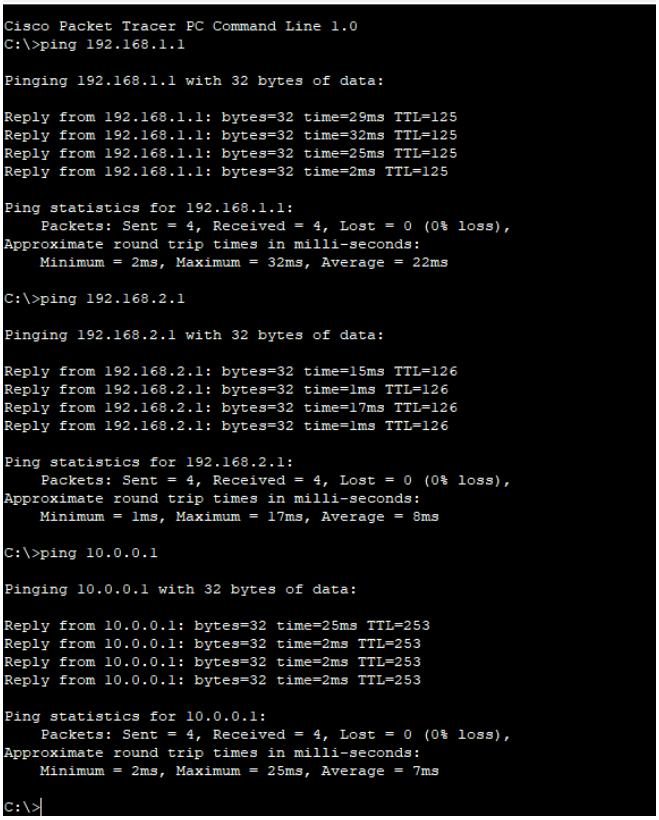
```
R1 ——— R2
```

R1 IP: 192.168.1.1/24
R2 IP: 192.168.2.1/24

Command on R1 to reach R2's network:

```
R1(config)# ip route 192.168.2.0 255.255.255.0 192.168.1.2
```

```
Router>en
Router#
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#
Router(config)#int s0/0/0
Router(config-if)#ip address 10.0.0.2 255.0.0.0
Router(config-if)#no shutdown

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

Router(config-if)#ex
Router(config)#int f0/0
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/0, changed state to up

Router(config-if)#ip address 192.168.2.100 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

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

Router(config-if)#ex
Router(config)#int s0/0/1
Router(config-if)#ip address 20.0.0.1 255.0.0.0
Router(config-if)#no shutdown

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0/1, changed state to up

Router(config)#
Router(config)#
Router(config)#ip route 192.168.1.0 255.255.255.0 10.0.0.1
Router(config)#ip route 192.168.3.0 255.255.255.0 20.0.0.2
Router(config)#
```



2. Dynamic Routing

Definition:
Dynamic routing uses **routing protocols** that allow routers to communicate with each other and automatically update routing tables based on network changes.

Best Used For:

- Large, scalable networks
- Networks where topology can change frequently

Advantages:

- Automatically updates routes
- Scalable and efficient
- Adjusts to link failures

Disadvantages:

- More CPU/RAM usage
- More complex to configure
- Can be less secure if not managed properly

Common Dynamic Routing Protocols:

- **RIP** (Routing Information Protocol) – Uses hop count
- **EIGRP** (Cisco proprietary, fast and efficient)
- **OSPF** (Open standard, uses cost as metric)
- **BGP** (Used for internet routing between ISPs)

Example using RIP:

Routers R1 and R2 are connected.

On both routers:

```
Router(config)# router rip
Router(config-router)# version 2
Router(config-router)# network 192.168.1.0
Router(config-router)# network 192.168.2.0
```

This allows both routers to share routes dynamically.

3. Default Routing

Definition:
A default route is a "catch-all" path used when the router doesn't have a specific route in its table for the destination IP.

Best Used For:

- Edge routers connecting to the internet
- Small networks with one path to the outside world

Advantages:

- Saves routing table space
- Easy to configure

Disadvantages:

- All unknown traffic is sent to one place
- Not suitable for complex environments

Example **Scenario:**
Router connects internal network to the Internet.

```
Router(config)# ip route 0.0.0.0 0.0.0.0 192.168.1.1
```

This sends all unknown traffic to the next-hop router (192.168.1.1), usually your ISP.

Summary Table

Routing Type	Manual/Auto	Best For	Example Protocols	Scalability	Self-Healing
Static Routing	Manual	Small networks	N/A	❌	❌
Dynamic Routing	Automatic	Large networks	RIP, EIGRP, OSPF	✅	✅
Default Routing	Manual	Gateway to Internet	N/A	✅ (simple)	❌