



# Lecture 13- Dynamic Routing & RIP



## What is Dynamic Routing?

Dynamic routing is a method where **routers automatically learn routes** and update their routing tables by exchanging information with other routers.

Instead of manually adding routes (like in static routing), routers talk to each other using **routing protocols**.



## How Dynamic Routing Works?

Routers use routing protocols like:

- RIP
- EIGRP
- OSPF
- IS-IS
- BGP



These protocols help routers decide:

- ✓ Which path is best
- ✓ How far the destination is
- ✓ How fast the link is
- ✓ What to do if a link fails



## Why Dynamic Routing is Used?

- Automatic route updates
- No need to configure routes manually
- Best for medium & large networks
- Automatically adjusts when link goes down

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## Real-Life Example

Think about **Google Maps** 

- It automatically finds the best route
- If road is blocked → it changes route

Same way, routers automatically find the best path.

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## Types of Dynamic Routing Protocols

### 1 Interior Gateway Protocol (IGP)

Used inside the same organization.

Examples:

- RIP
- EIGRP
- OSPF
- IS-IS



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### 2 Exterior Gateway Protocol (EGP)

Used between different organizations (like ISPs).

Example:

- BGP
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# Routing Algorithms Explained

## 1 Distance Vector

Used in:

- RIP
- EIGRP

### What is Distance Vector?

- Router only knows:
  - Distance (how far)
  - Direction (which neighbor)

It does NOT know full network map.

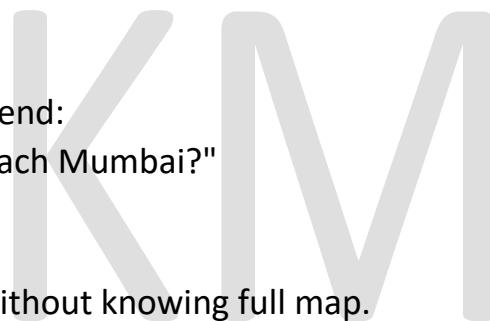
#### Real-Life Example

Imagine asking your friend:  
"How many cities to reach Mumbai?"

Friend says: 3 cities.

You trust your friend without knowing full map.

That is Distance Vector.



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## 2 Link State

Used in:

- OSPF
- IS-IS

### What is Link State?

- Router builds complete network map
- Knows every link and cost

#### Real-Life Example

You open Google Maps and see entire city map.

That is Link State.

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### Path Vector (EGP)

Used in:

- BGP

It keeps full path information of Autonomous Systems.

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## RIP (Routing Information Protocol)

### Type:

Distance Vector

### Metric:

Hop Count

### Maximum Hop:

15

16 = Unreachable 



### Administrative Distance:

120

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## RIP Versions

### ◆ RIP v1

- Classful
- No subnet mask support
- Broadcast updates

### ◆ RIP v2

- Classless
- Supports VLSM
- Supports Authentication
- Uses Multicast 224.0.0.9



## Administrative Distance (AD Value)

AD = Trust Level of Routing Protocol

Lower value = More trusted

Protocol	AD
----------	----

Directly Connected	0
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Static	1
--------	---

BGP External	20
--------------	----

EIGRP	90
-------	----

OSPF	110
------	-----

RIP	120
-----	-----

EIGRP External	170
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BGP Internal	200
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## RIP Timers (Very Important)

Timer	Value	Purpose
Update	30 sec	Sends routing updates
Invalid	180 sec	Mark route invalid
Hold-down	180 sec	Wait before accepting changes
Flush	240 sec	Delete route



## How RIP Works (Full Flow)

- 1 Router sends routing table every 30 seconds
- 2 Neighbor receives update
- 3 Router calculates hop count
- 4 Routing table updates

More hops = less preferred 

Less hops = best route 



## RIP LAB

- PC1 → 192.168.1.2
  - PC2 → 192.168.4.2
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### Router Configuration (Step-by-Step)

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#### ◆ Router 1 Configuration

##### Step 1: Enter Privileged Mode

```
Router> en
```

 Enables administrative mode.

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##### Step 2: Enter Global Configuration

```
Router# conf t
```

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##### Step 3: Set Hostname

```
hostname R1
```

 Makes identification easy.

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##### Step 4: Configure Interfaces

```
int g0/0
```

```
ip add 192.168.10.1 255.255.255.0
```

```
no shut
```

 Connects to R2

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```
int g0/1  
ip add 192.168.20.1 255.255.255.0  
no shut
```

👉 Connects to R3

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```
int g0/2  
ip add 192.168.1.1 255.255.255.0  
no shut
```

👉 Connects to PC1 network

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#### ◆ Router 2 Configuration

```
hostname R2
```

```
int g0/0  
ip add 192.168.10.2 255.255.255.0  
no shut
```

👉 Connects to R1

```
int g0/1  
ip add 192.168.40.1 255.255.255.0  
no shut
```

👉 Connects to R4

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#### ◆ Router 3 Configuration

```
hostname R3  
int g0/0  
ip add 192.168.30.1 255.255.255.0  
no shut
```

```
int g0/1  
ip add 192.168.20.2 255.255.255.0  
no shut
```

---

#### ◆ Router 4 Configuration

```
hostname R4  
  
int g0/0  
ip add 192.168.40.2 255.255.255.0  
no shut  
  
int g0/1  
ip add 192.168.30.2 255.255.255.0  
no shut  
  
int g0/2  
ip add 192.168.4.1 255.255.255.0  
no shut
```

👉 Connects to PC2

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#### PC Configuration

PC1:

- IP: 192.168.1.2
- Subnet Mask: 255.255.255.0
- Gateway: 192.168.1.1

PC2:

- IP: 192.168.4.2
- Subnet Mask: 255.255.255.0
- Gateway: 192.168.4.1



## Enable RIP on All Routers

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### ◆ R1

```
router rip  
version 2  
network 192.168.10.0  
network 192.168.20.0  
network 192.168.1.0  
passive-interface g0/2
```

### Why passive-interface g0/2?

- g0/2 connects to PC1
- PC is not a router
- No need to send RIP updates there
- Improves security
- Reduces unnecessary traffic

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### ◆ R2

```
router rip  
version 2  
network 192.168.10.0  
network 192.168.40.0
```

---

◆ R3

router rip

version 2

network 192.168.20.0

network 192.168.30.0

---

◆ R4

router rip

version 2

network 192.168.30.0

network 192.168.40.0

network 192.168.4.0

passive-interface g0/2

**Why passive-interface on R4?**

Same reason:

- g0/2 connects to PC2
  - No RIP updates needed toward PC
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## Verification Commands

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### ✓ Check Routing Table

show ip route

- R = RIP route
- C = Connected
- L = Local

Example:

R 192.168.4.0 [120/2]

120 = AD

2 = Hop count

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### ✓ Check Protocol Running

show ip protocols

Shows:

- RIP version
- Timers
- Networks added
- Passive interfaces

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### ✓ Check RIP Database

show ip rip database

Shows:

- All learned routes

## 💡 Final Testing

From PC1:

ping 192.168.4.2

If reply comes ✅

RIP is working perfectly 🎉

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## 🎯 Important Points

- RIP is Distance Vector
  - Metric = Hop count
  - Max hop = 15
  - AD = 120
  - RIP v2 supports VLSM
  - Uses multicast 224.0.0.9
  - Timers: 30 / 180 / 180 / 240
- 

## 🏆 Final Understanding

Dynamic Routing = Automatic path selection 🚀

RIP = Simple protocol for small networks

Passive Interface = Security + Less traffic

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## 1 COMPLETE SUMMARY

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### 🌐 What is Dynamic Routing?

Dynamic Routing is a routing method where:

- ✓ Routers automatically learn routes
- ✓ Routers exchange information with neighbors
- ✓ Routing tables update automatically
- ✓ No need to manually configure every route

👉 Unlike Static Routing, admin does NOT manually add all routes.

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### 🧠 How Dynamic Routing Works?

Routers use **Routing Protocols** like:

- RIP
- EIGRP
- OSPF
- IS-IS
- BGP



These protocols help routers decide:

- ✓ Best path
- ✓ Distance to destination
- ✓ Link speed
- ✓ What to do if link fails

📦 Example: Like Google Maps automatically changing route when traffic appears 🚦

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## ⌚ Why Dynamic Routing is Used?

- Automatic route updates
  - Best for medium & large networks
  - Adapts to failures
  - Saves administrator time
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## 🔥 Types of Dynamic Routing Protocols

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### 1 IGP (Interior Gateway Protocol)

Used **inside same organization**

Examples:

- RIP
- EIGRP
- OSPF
- IS-IS



### 2 EGP (Exterior Gateway Protocol)

Used **between organizations (ISPs)**

Example:

- BGP
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## Routing Algorithms

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### 1 Distance Vector

Used in:

- RIP
- EIGRP

Router knows:

- Distance (Hop count)
- Direction (Next hop)

 Does NOT know full network map

 Example: Trusting friend's information without seeing full map

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### 2 Link State

Used in:

- OSPF
- IS-IS

✓ Router builds full network topology

✓ Knows all links and costs

 Example: Seeing full Google Map

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### 3 Path Vector

Used in:

- BGP
- ✓ Maintains full AS path information
-

## ● RIP (Routing Information Protocol)

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### 📌 Basic Details

- Type: Distance Vector
  - Metric: Hop Count
  - Max Hop: 15
  - 16 = Unreachable ✗
  - Administrative Distance (AD): 120
- 

### ✳️ RIP Versions

#### ◆ RIP v1

- Classful
  - No VLSM
  - Broadcast updates
- 
- 

#### ◆ RIP v2

- Classless
  - Supports VLSM
  - Supports Authentication
  - Uses Multicast 224.0.0.9
-

## Administrative Distance (AD)

👉 AD = Trust level of routing source

Lower AD = More trusted

### Protocol      AD

Connected      0

Static      1

BGP External      20

EIGRP      90

OSPF      110

RIP      120

EIGRP External      170

BGP Internal      200

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## ⌚ RIP Timers (Very Important 🔥 )

### Timer      Value      Purpose

Update      30 sec      Send updates

Invalid      180 sec      Mark route invalid

Hold-down      180 sec      Prevent quick changes

Flush      240 sec      Delete route

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## How RIP Works (Step-by-Step Flow)

- 1 Sends full routing table every 30 sec
  - 2 Neighbor receives update
  - 3 Adds +1 hop
  - 4 Updates routing table
  - 5 Best route = Least hop count
- 

## Passive Interface

Used when:

- ✓ Interface connects to PC
- ✓ No need to send routing updates
- ✓ Improves security
- ✓ Reduces traffic

Command:

`passive-interface g0/2`

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## Verification Commands

Command	Purpose
<code>show ip route</code>	View routing table
<code>show ip protocols</code>	Check RIP status
<code>show ip rip database</code>	View RIP routes

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## MIND MAP (Detailed Structure)

### Dynamic Routing

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#### |— Definition

| |— Automatic learning

| |— Routing protocols

| |— No manual routes

|

#### |— Why Used

| |— Automatic updates

| |— Failure handling

| |— Scalable

|

#### |— Types

| |— IGP

| | |— RIP

| | |— EIGRP

| | |— OSPF

| | |— IS-IS

| |

| |— EGP

| |— BGP

|

#### |— Algorithms

| |— Distance Vector

| |— Link State



```
|   └─ Path Vector  
|  
└─ RIP  
    ├─ Distance Vector  
    ├─ Hop Count  
    ├─ Max Hop 15  
    ├─ AD 120  
    ├─ Timers  
    |   ├─ 30  
    |   ├─ 180  
    |   ├─ 180  
    |   └─ 240  
    ├─ RIP v1  
    └─ RIP v2
```

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## Q & A

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### Q 1 What is Dynamic Routing?

**Answer:**

Dynamic routing is a routing method where routers automatically exchange routing information and update routing tables using routing protocols.

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### Q 2 Why use Dynamic Routing instead of Static?

**Answer:**

Because it:

- Automatically updates routes
- Handles link failures
- Scales well
- Requires less manual configuration

### Q 3 What are IGP and EGP?

**Answer:**

IGP is used inside one organization (RIP, OSPF, EIGRP).

EGP is used between organizations (BGP).

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### Q 4 What is Distance Vector algorithm?

**Answer:**

It is a routing algorithm where router knows only:

- Distance
- Direction

It does not know full network map.

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## **Q 5 What is Link State algorithm?**

**Answer:**

In Link State, router builds full network topology and calculates shortest path.

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## **Q 6 What is Path Vector?**

**Answer:**

Used in BGP, it maintains full AS path information.

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## **Q 7 What is RIP?**

**Answer:**

RIP is a Distance Vector routing protocol that uses hop count as metric.

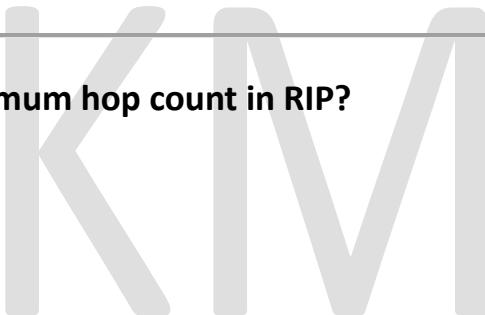
---

## **Q 8 What is the maximum hop count in RIP?**

**Answer:**

15 hops.

16 means unreachable.



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## **Q 9 What is Administrative Distance?**

**Answer:**

Administrative Distance is the trust level of routing protocol.

Lower AD = More trusted.

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## **Q 10 What is RIP AD value?**

**Answer:**

RIP has AD = 120.

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## **Q 1 1 Difference between RIP v1 and RIP v2?**

RIP v1	RIP v2
Classful	Classless
No VLSM	Supports VLSM
Broadcast	Multicast
No Authentication	Supports Authentication

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## **Q 1 2 What multicast address does RIP v2 use?**

**Answer:**

224.0.0.9

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## **Q 1 3 Explain RIP Timers.**

**Answer:**

- Update → 30 sec
  - Invalid → 180 sec
  - Hold-down → 180 sec
  - Flush → 240 sec
- 

## **Q 1 4 What is Passive Interface?**

**Answer:**

It disables routing updates on specific interface but still advertises network.

Used for security and to reduce traffic.

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## **Q 1 5 How to verify RIP?**

**Answer:**

- show ip route
  - show ip protocols
  - show ip rip database
- 

## **Q 1 6 What does R 192.168.4.0 [120/2] mean?**

**Answer:**

R → RIP

120 → AD

2 → Hop count

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### **FINAL CONCLUSION**

- 🔥 Dynamic Routing is essential for scalable networks.
  - 🔥 RIP is simple but limited (max 15 hops).
  - 🔥 RIP v2 is better than v1.
  - 🔥 Understanding AD, timers, and algorithms is very important for interviews.
  - 🔥 Passive interface improves security and efficiency.
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