

**Data Communication**

**and**

**Computers Lab**

Experiment-8

Submitted by: Submitted to:  
Aaradhya Bhatiya Alok Jhaldiyal Sir  
500108359  
R2142221035  
Batch - B2(Graphics & Gaming)

## Distance Vector Routing protocol

**Aim:** Configure a Network using Distance Vector Routing protocol.

• RIP

**Apparatus (Software)**: Cisco Packet Tracer

**Theory:** In computer communication theory, packet-switched networks utilize two primary classes of routing protocols: distance-vector protocols and link-state protocols. Distance-vector routing protocols determine optimal paths through algorithms such as the Bellman-Ford algorithm, the Ford-Fulkerson algorithm, or Cisco Systems' DUAL Finite State Machine (DUAL FSM). A fundamental characteristic of distance-vector protocols is that each router periodically communicates topology updates only to its neighbouring routers, contrasting with link-state protocols, where updates are disseminated across all nodes within the network. This approach results in reduced computational demands and lower message overhead compared to link-state protocols.

The Routing Information Protocol (RIP) stands as one of the earliest distance-vector protocols and relies on hop count as its primary metric. To prevent routing loops, RIP enforces a hop limit; paths exceeding 15 hops are considered unreachable. Consequently, this limit restricts the size of networks that RIP can support, as any hop count of 16 or more represents an infinite distance and renders the route inaccessible.

**Procedure:**

1. Develop a Topology shown in figure given below.
2. Configure all Routers
3. Implement RIP protocols in Router to configure Network.

# Network Setup and Configuration

### Assigning IP Addresses:

I assigned IP addresses to each router interface using the ip address command. Since this network uses class C IP addresses (192.168.0.0 to 201.168.0.0), I have assigned unique IPs from these ranges to each interface of the routers.

Example command:

ip address 192.168.0.1 255.255.255.0.

### Enabling Interfaces:

Each interface was enabled using the no shutdown command to bring it up and allow communication. By default, interfaces are administratively down, so you need to use no shutdown to activate them.

### Setting Clock Rate:

For Serial connections between routers, the clock rate is necessary on the DCE (Data Communications Equipment) side to set the speed of the link. This is done with the clock rate command.

Example command:

clock rate 64000.

# Configuring RIP:

RIP was enabled using the router rip command. This command initiates RIP as the routing protocol on each router.

RIP uses hop count as its metric, with a maximum of 15 hops allowed. Since RIP is a distance-vector routing protocol, it updates neighboring routers about topology changes periodically.

Command: router rip

# Adding Network Addresses:

The network command under RIP configuration mode was used to add each directly connected network. This informs the RIP protocol to advertise these networks to other routers.

Example command: network 192.168.0.0.

# Structured example of the commands for each router:

* enable
* configure terminal
* interface Gig0/0
* ip address 192.168.1.1 255.255.255.0
* no shutdown
* interface Serial0/1/0
* ip address 192.168.2.1 255.255.255.0
* clock rate 64000
* no shutdown
* exit
* router rip
* network 192.168.1.0
* network 192.168.2.0
* exit

# Explanation of RIP Concepts and Benefits

* Distance Vector Routing: RIP is a distance-vector protocol, meaning each router only knows the distance to reach neighboring routers, and they share this distance information to calculate paths.
* Periodic Updates: RIP routers broadcast updates every 30 seconds to inform neighbors of any network changes.
* Hop Limit: RIP’s maximum hop count is 15, making it suitable for smaller networks to avoid routing loops.
* Simplicity: RIP has a low computational requirement, making it easier to set up in basic configurations and suitable for small networks.

# Practical Use of RIP in the Lab

In this lab, RIP helps simplify the configuration by automatically sharing routes between routers, eliminating the need for static routes. The lab showcases how RIP’s hop limit can work effectively in smaller networks while maintaining a straightforward setup.

### 1. Devices Used

For this network, we used the following types of devices:

* PCs: Four PC devices were used to represent endpoints on each side of the network. These PCs allow for end-to-end communication testing.
* Switches: Two switches were placed, each connecting two PCs to a central router on both the left and right side of the network. Switches help create local area networks (LANs) and connect multiple devices within the same network.
* Routers: Six Cisco ISR 4331 routers were used to establish connections between different networks. Routers are critical for routing packets across networks and handling the routing protocol (RIP) configuration.

### 2. Connections (Cabling)

Different types of cables were used based on the type of connections:

* Copper Straight-Through Cable:
  + This cable type was used to connect PCs to switches and switches to routers on the Gigabit Ethernet interfaces (e.g., Gig0/0/1, Gig0/0).
  + Example setup:
    - PC Fa0 → Switch Fa0/0
    - Switch0 Gig0/1 → Router Gig0/0
* Serial Cable:
  + Serial cables were used to connect the routers on their serial interfaces (e.g., Se0/1/0, Se0/1/1). Since routers don't have Ethernet connectivity by default between each other, serial cables allow point-to-point WAN connections.
  + Example setup:
    - Router0 Se0/1/0 → Router8 (Router1) Se0/1/1
    - Router8 (Router1) Se0/1/0 → Router8 (Router3) Se0/1/1

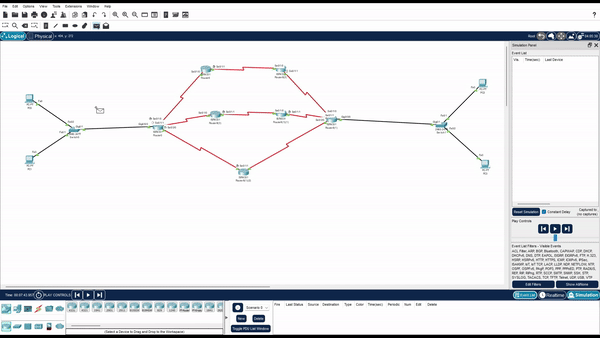
# Case 1:

### Lower Path with Least Hop Count

**Scenario:** When all router ports have the same clock rate.

Path Selection: The lower path with the least number of hops is selected by RIP, as it prioritizes the shortest hop count to the destination.

Explanation: Since all interfaces have equal clock rates, RIP chooses the path with the lowest hop count for efficiency, as the lower path has fewer hops compared to the upper and middle paths.



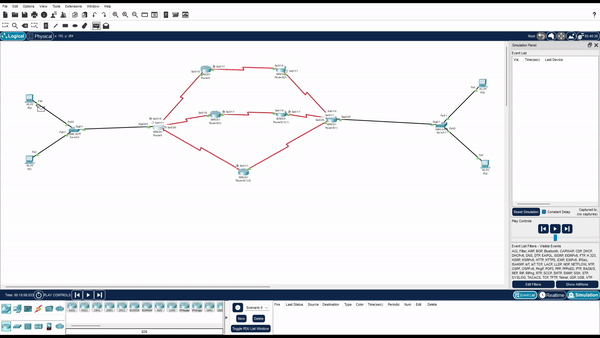
# Case 2:

### Upper Path with Higher Clock Rate Than Middle Path

**Scenario:** The lower path port is shutdown, and the upper path has a higher clock rate than the middle path.

Path Selection: RIP selects the upper path due to its higher clock rate.

Explanation: In RIP, clock rate typically does not impact routing decisions as it prioritizes hop count. However, in this setup, with the lower path disabled and a higher clock rate on the upper path, the configuration prefers the upper path for data transmission.



# Case 3:

### UPPER AND MIDDLE PATHS WITH SAME CLOCK RATE, LOWER PATH SHUTDOWN

**Scenario:** Both upper and middle paths have the same clock rate, while the lower path port is disabled.

Path Selection: Packet Tracer randomly selects between the upper and middle paths since they have the same hop count and clock rate.

Explanation: When both paths have identical metrics (hop count and clock rate), RIP has no preference between them, so Packet Tracer may choose either path at random. This simulates equal-cost load balancing behavior.

