**Department of Computer Science and Engineering**
**Islamic University of Technology (IUT)**
A subsidiary organ of OIC

# Laboratory Report

CSE 4412 : Data Communication and Networking Lab

| | | |
|---|---|---|
| **Name** | **:** | **Syed Samin Sadaf** |
| **Student ID** | **:** | **200042163** |
| **Section** | **:** | **1** |
| **Semester** | **:** | **4** |
| **Academic Year** | **:** | **2021-2022** |
| **Date of Submission** | **:** | **8 March 2023** |

**Title:** Configuration of RIP in a network topology.

## **Objective**:

1. Understand distance vector routing
2. Understand RIP
3. Understand the necessity of dynamic routing

## **Devices/ software Used**:

1. Cisco Packet Tracer (Software)

## **Theory:**

### **Distance Vector (DV) Routing:**

A distance-vector routing (DVR) protocol dictates that a router periodically update its neighbors on topological changes. Traditionally referred to as the old ARPANET routing formula (or known as Bellman-Ford algorithm).

Data stored by the DV router -
1. Every router has a unique ID
2. There is a link cost associated with each link connected to a router (static or dynamic).
3. Intermediate hops

Initialization of the distance vector table:

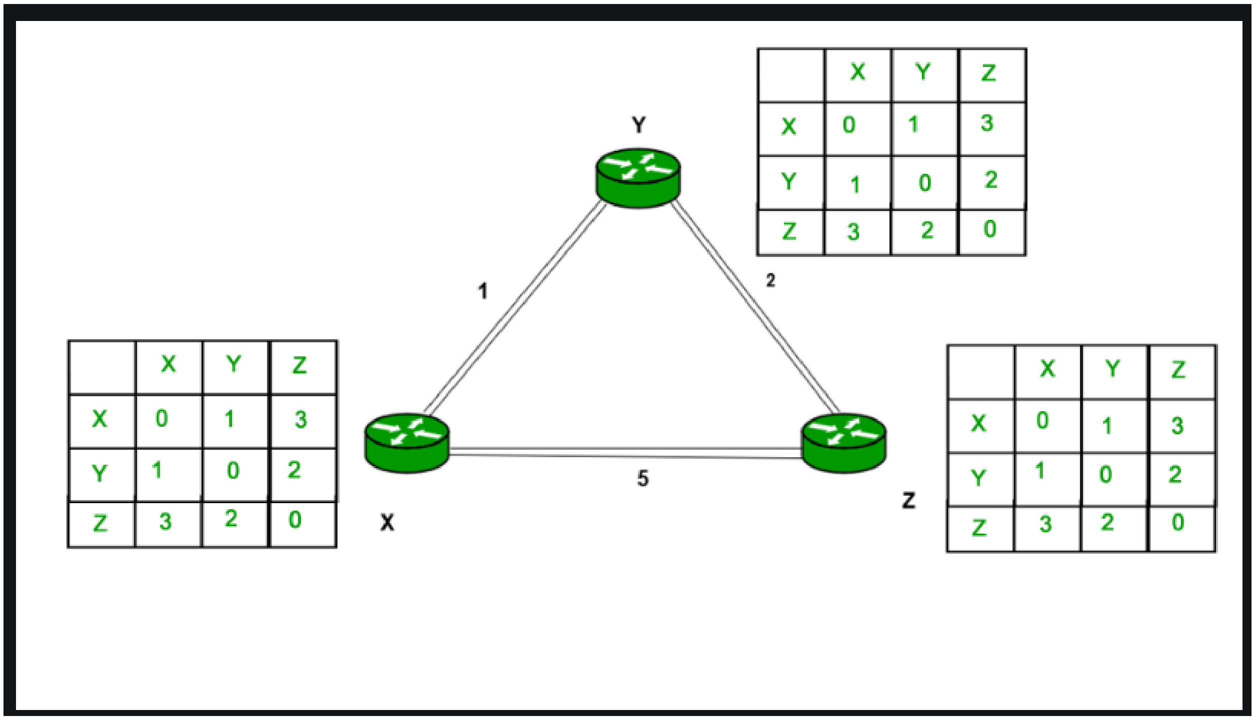
- distance to itself is zero
- distance to ALL other routers is an infinite value.

Algorithm for Distance Vectors:

1. In a routing packet, a router sends its distance vector to each of its neighbors.
2. Every router collects and stores the most recent distance vector it has received from each of its neighbors.
3. When a router receives a distance vector from a neighbor that contains new information, it recalculates its distance vector.It learns that a connection to a neighbor has broken.

Based on minimizing the cost to each destination, the DV calculation is performed.

Dx(y) = Cost estimate from x to y
C(x,v) = Node x knows cost to each neighbor v
Dx = [Dx(y): y $\in$N]. = Node x keeps the distance vector
Node x also keeps track of its neighbors' distance vectors - for each neighbor v, x keeps
Dv = [Dv(y): y $\in$ N]
Dx(y) = min { C(x,v) + Dv(y), Dx(y) } for each node y $\in$ N




| | X | Y | Z |
|---|---|---|---|
| X | 0 | 1 | 3 |
| Y | 1 | 0 | 2 |
| Z | 3 | 2 | 0 |

| | X | Y | Z |
|---|---|---|---|
| X | 0 | 1 | 3 |
| Y | 1 | 0 | 2 |
| Z | 3 | 2 | 0 |

| | X | Y | Z |
|---|---|---|---|
| X | 0 | 1 | 3 |
| Y | 1 | 0 | 2 |
| Z | 3 | 2 | 0 |

Figure : Distance Vector Routing
Source : https://www.geeksforgeeks.org/distance-vector-routing-dvr-protocol/

**Count to Infinity problem in DV routing:**

Each router in DV routing keeps a routing table with information on the network topology and the optimum path to each destination network. The routers exchange information with their neighbors on a regular basis in order to update their routing tables. Each router publishes its routing table to its neighbors, who then update their own tables based on the information received.

The count to infinity problem occurs when a network topology change, such as a link failure, leads a router to feel that reaching a destination network requires a longer path than previously thought. When this occurs, the router raises the metric (i.e., the cost) associated with the destination network and informs its neighbors about the revised routing table.

If the affected router is part of a loop of routers that rely on one another to deliver packets to the destination network, each router in the loop will receive the updated metric and increase it further before broadcasting the new routing table to its neighbors. This method can be repeated indefinitely, increasing the target network metric to infinity.

**Two node Loop problem in DV routing:**

The Two Node Loop Problem can happen in DV routing systems like RIP or EIGRP. It happens when only two routers are linked together and have equal-cost paths to a destination network. In this situation, one router sells its way to the other, who promotes it back to the first. This results in a loop in which the routers continue to exchange packets without making any progress towards the destination network. To address this issue, DV routing protocols include strategies such as split horizon.

**Split Horizon (one solution to instability):**

Split horizon is a method utilized for avoiding routing loops in distance vector (DV) routing protocols. It prevents a router from broadcasting a route back to the same interface from which it was learned. If a router receives a route update for a specific network on interface A, it will not broadcast that route back out on that interface. This prevents a routing loop from occurring if a router broadcasts a route back to the same router from which it received it. Split horizon can be improved further by employing techniques such as poisoned reverse or route poisoning to promptly notify other routers of any topology changes.

**Poison Reverse :**

Poison reverse is a routing loop prevention strategy used in distance vector (DV) routing systems. It works by placing an infinity metric (i.e., unreachable) for a failed route back to the router from where it was learned. For example, if Router A learns a route to Network X from Router B and later finds that the route is no longer viable, Router A advertises the route back to Router B with a metric of infinite. This notifies Router B that the route has failed and prohibits it from advertising it to other routers. Poison reverse can be used in conjunction with split horizon to improve routing loop prevention in DV routing systems.

**Routing Information Protocol (RIP):**

Routing Information Protocol (RIP) is a distance-vector routing protocol used in IP networks. It uses hop count as the primary metric for path selection and employs a maximum hop count limit of 15. RIP works by periodically exchanging routing updates with neighboring routers, allowing them to maintain a consistent view of the network topology. RIP sends its complete routing table to its neighbors every 30 seconds, which can result in significant network overhead. RIP also has a slow convergence time, which can lead to routing loops and other problems. To address these issues, RIP includes mechanisms such as split horizon, triggered updates, and route poisoning. RIP can be used in small to medium-sized networks, but is not recommended for large or complex networks. Its limitations have led to the development of other routing protocols, such as OSPF and BGP, which are more suited to larger and more complex network topologies.

## Diagram of the experiment:

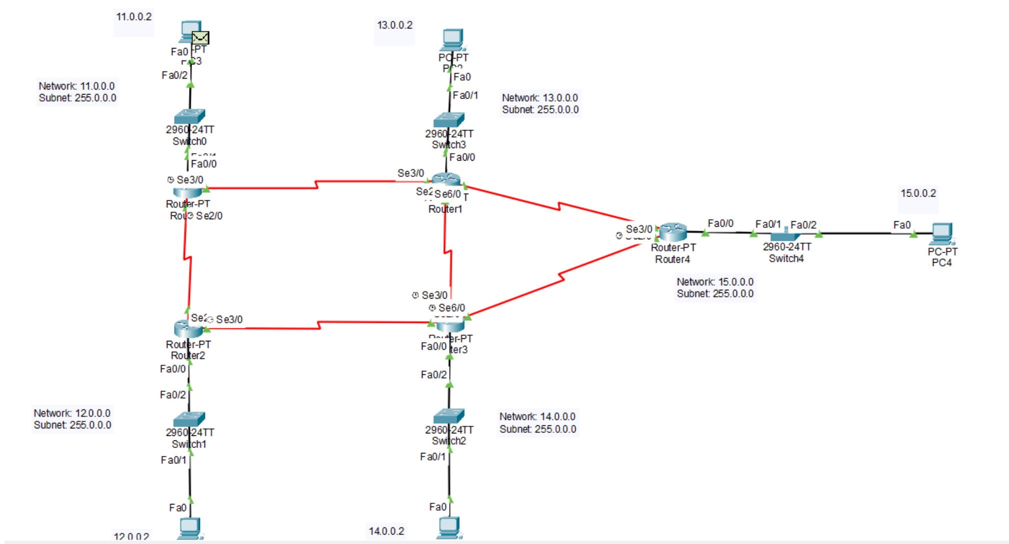



Diagram : Configuration of Router Information Protocol (RIP) for Dynamic Routing

## Configuration of Routers:

Commands for configuring RIP:
router-> en
router# config
router(config)# router rip
router(config-router)# network 11.0.0.0
router(config-router)# network 30.0.0.0
router(config-router)# network 16.0.0.0

**Observation**:
**After setting up the RIP routing algorithm if Serial port Se3/0 of Router 4 is switched off then what are the changes occurring in Routing information of the routers.**

If Serial port Se3/0 of Router 4 is switched off, it will result in a network topology change, which will trigger the RIP routers to update their routing information accordingly.
When the port goes down, Router 4 will no longer be able to reach the networks connected to that port, and it will inform its neighbors by sending out a triggered update with the affected routes removed and a metric of 16 (unreachable).
Router 3 will receive the update from Router 4 and remove the route to Router 4's networks from its routing table. It will then send out an update to its neighbors (Router 2 and Router 1) with the affected routes removed and a metric of 16.
Router 1 will receive the update from Router 3 and remove the route to Router 4's networks from its routing table. It will then send out an update to its neighbors (Router 0) with the affected routes removed and a metric of 16.

Router 0 will receive the update from Router 1 and remove the route to Router 4's networks from its routing table. It will then send out an update to its neighbors (Router 2) with the affected routes removed and a metric of 16.

Router 2 will receive the update from Router 0 and remove the route to Router 4's networks from its routing table. The routing updates will continue until all routers converge to a stable state and have consistent routing information.

## Challenges:

Firstly, Configuring RIP on the routers requires attention to detail and accuracy. A small configuration error can cause the entire network to fail or create routing loops. Secondly, due to time constraints of Distance Vector routing, simulations of Cisco Packet Tracer reach buffer overflow while message delivering to a distant router.