Routing Information Protocol (RIP)

- RIP is an interior gateway protocol for use within a *small* autonomous system (RFC 1058)
- It supports two types of packets
  - Request: Instructs neighbouring devices for their distance vector table
  - Response: Sends the local distance vector table
    - Sent every 30 seconds
    - Sent in response to a request packet
    - Sent in cases of triggered update support when there is a change in the local distance vector table

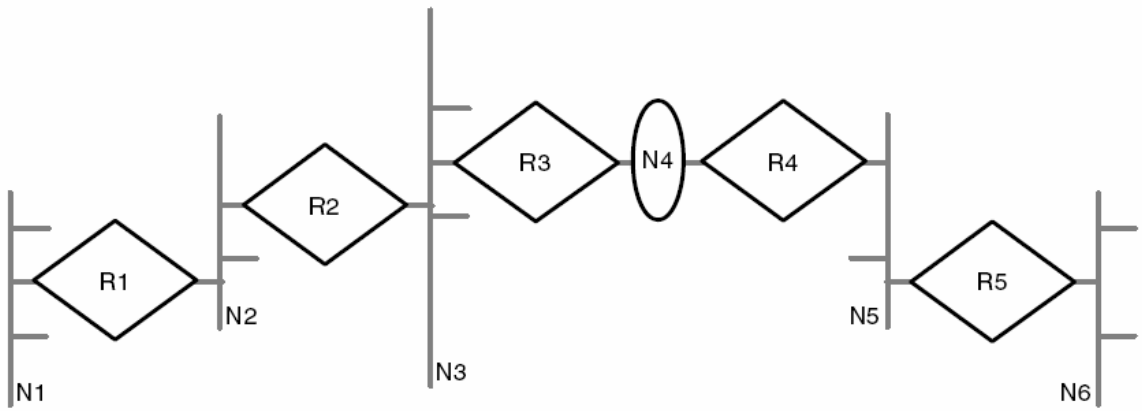
RIP (cont.)

- When a device receives a distance vector table, it is compared to the local one
  - If there is a lower cost route to a destination, the new route is used
- In LAN environments, RIP datagrams are sent using the MAC broadcast address and an IP network broadcast address
- In point-to-point networks, directed transmission is used
- RIP devices may be
  - Active: Advertise and Receive routing updates
  - Passive: They just receive routing updates.

RIP Distance Vector Tables

- Each entry in the vector table contains
  - Destination Network
  - Cost (Distance) to reach this destination. This is usually in number of hops
  - IP address of next hop to reach destination
- At router initialisation, the vector table contains entries to directly connected networks with cost 1. Also any static routes are included.
- When a table is received
  - Each path's cost is added to the cost of the link to the neighbouring router
  - Path of least cost is stored in local vector table

RIP Distance Vector Example



Router R2 Distance Vector Table

Net	Next Hop	Metric
N1	R1	2
N2	Direct	1
N3	Direct	1
N4	R3	2
N5	R3	3
N6	R3	4

Router R3 Distance Vector Table

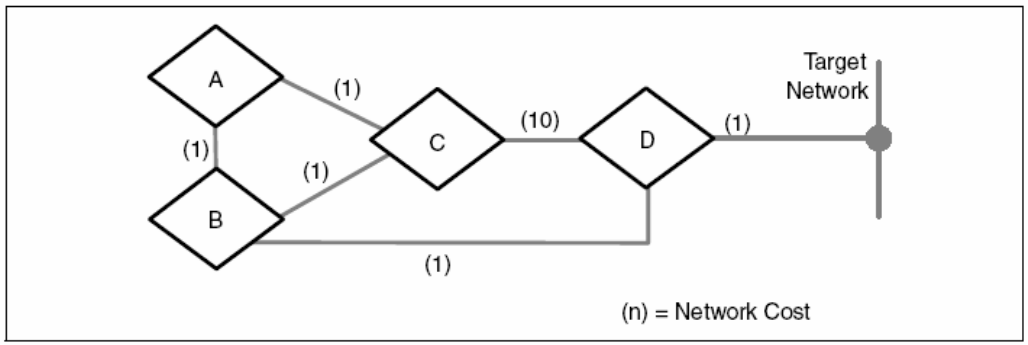
Net	Next Hop	Metric
N1	R2	3
N2	R2	2
N3	Direct	1
N4	Direct	1
N5	R4	2
N6	R4	3

Router R4 Distance Vector Table

Net	Next Hop	Metric
N1	R3	4
N2	R3	3
N3	R3	2
N4	Direct	1
N5	Direct	1
N6	R5	2

Counting to Infinity

- With enough time, the distance vector table will contain information about all networks
- Yet during convergence, erroneous results might propagate through the networks
- Consider the example below when link between router B and D fails.



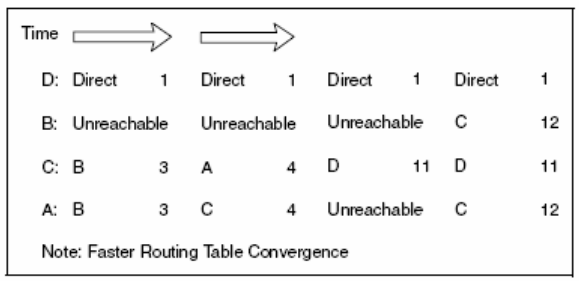
Time													
D:	Direct	1	Direct	1	Direct	1	Direct	1	....	Direct	1	Direct	1
B:	Unreachable		C	4	C	5	C	6		C	11	C	12
C:	B	3	A	4	A	5	A	6		A	11	D	11
A:	B	3	C	4	C	5	C	6	....	C	11	C	12

Counting to Infinity (cont)

- Router A and C continue increasing their metric up to infinity.
  - Each claims to be able to reach destination network through the partner
- To avoid this, in RIP no metric can be larger than 16 hops
  - Disadvantage is that more than 15 hops to reach a destination network is considered invalid
- To avoid long convergence on topology changes two modifications to the RIP algorithm are
  - Split horizon
  - Triggered updates

Split Horizon

- This dictates that one should never send information on an interface through which the information was learnt in the first place.
- The limitation is that each node must wait for the erroneous route to timeout (which is usually 3 minutes)
  - During this time, wrong information will be sent to other routers.



Split Horizon with Poison Reverse

- This is an enhancement on Split Horizon, where all networks are advertised yet those which have been learnt through the specific interface will be advertised as unreachable on that interface.
- When a router learns a route which becomes unreachable, this route is immediately deleted from the local table.
  - This avoids propagation of erroneous routes
- Poison Reverse is useless when the network has no redundant links
- Major disadvantage is that the size of routing announcements are larger than split horizon advertisements.

Triggered Updates

- This also aims to reduce convergence time
- Whenever a router changes the cost of a path, it immediately sends the new distance vector table to its neighbours
- Ensures that updates are propagated quickly

RIP Limitations

- The following disadvantages apply to RIP
  - Path cost limit due to the counting to infinity problem
  - Network-intensive table updates
  - Slow convergence unless triggered updates are used
  - No support for variable length subnet masking
- To tackle some of these limitations RIP-2 exists which supports the following:
  - CIDR and VLSM
  - MultiCasting
  - Authentication
  - Back-Compatible to RIP-1
- RIP-2 still has path-cost limit and slow convergence. In addition authentication is not very secure.

RIP Packet Format

- RIP packets are transmitted using UDP
- RIP datagrams have a maximum size of 512 bytes