ROUTING INFORMATION PROTOCOL

Remzi BULUTLU - 309182

Telecommunication Networks and Systems

AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

ROUTING INFORMATION PROTOCOL

SCOPE:

- WHAT IS RIP?
- HOW DOES RIP WORK?
- VERSIONS OF RIP
- CONFIGURATION OF RIP
- ADVANTAGES OF RIP
- DISADVANTAGES OF RIP
- LIMITATIONS OF RIP
- SOURCE

WHAT IS RIP?

- Routing Information Protocol (RIP) is a dynamic routing protocol which uses **hop count** as a routing metric to find the best path between the source and the destination network.

- It is a **distance-vector routing protocol** which has **AD**(Administrative Distance) value 120;
  and works on the application layer of OSI model(Open Systems Interconnection).

- RIP uses transport protocol from port number 520 of UDP (User Datagram Protocol).

Distance-Vector Routing:

The term distance-vector refers to the fact that the protocol manipulates vectors (arrays) of distances to other **nodes**(modem, hub, bridge, switch etc.) in the network.

- In data networks, Distance-Vector Routing Protocol **determines the best route** for data packets based on distance.
- Distance-vector routing protocols **measure the distance by the number of routers a packet has to pass**, one router counts as one **hop**.
- Some distance-vector protocols also take into account network latency and other factors that influence traffic on a given route.
- Distance-vector routing protocols use the **Bellman–Ford algorithm** and **Ford–Fulkerson algorithm** to calculate the best route.

The Bellman–Ford algorithm: an algorithm that computes shortest paths from a single source vertex to all of the other vertices in a weighted digraph.

Ford–Fulkerson algorithm (FFA): a greedy algorithm that computes the maximum flow in a flow network. It is sometimes called a "method" instead of an "algorithm" as the approach to finding augmenting paths in a residual graph.

Hop Count :

Hop count is the number of routers occurring in between the source and destination network.

The path with the lowest hop count is considered as the best route to reach a network and therefore placed in the routing table.

RIP prevents routing loops by limiting the number of hopes allowed in a path from source and destination. The maximum hop count allowed for RIP is 15 and hop count of 16 is considered as **network unreachable**.

- **Routing Information Protocol** was originally designed for Xerox PARC Universal Protocol and was called GWINFO in the Xerox Network Systems (XNS) protocol suite in 1981.

- RIP, which was defined in RFC 1058 in 1988, is known for being **easy to configure and easy to use in small networks.**

HOW DOES RIP WORK?

- RIP uses a distance vector algorithm to decide which path to put a packet on to get to its destination.
- Each RIP router maintains a **routing table**, which is a list of all the destinations the router knows how to reach.
- Each router broadcasts its entire routing table to its closest neighbors **every 30 seconds.**
- In this context, neighbors are the other routers to which a router is connected directly -- that is, the other routers **on the same network segments as the selected router.**
- The neighbors, in turn, pass the information on to their nearest neighbors, and so on, **until all RIP hosts within the network have the same knowledge** of routing paths.
- This shared knowledge is known as "**convergence"**

- If a router **receives an update on a router** and the new path is shorter**;** it will update its table entry with the length and next-hop address of the shorter path.

  If the new path is longer, it will wait through a "hold-down" period to see if later updates reflect the higher value as well.

  It will only update the table entry if the new, longer path has been determined to be stable.

- If a router **crashes or a network connection is severed;** the network discovers this because that router stops sending updates to its neighbors, or stops sending and receiving updates along the severed connection.

If a given route in the routing table **isn't updated across six successive update cycles** (that is, for 180 seconds)**;** a **RIP router will drop that route** and let the rest of the network know about the problem through its own periodic updates.

VERSIONS OF RIP

There are three versions of the Routing Information Protocol:
RIPv1, **RIPv2** and **RIPng**.

RIPv1(standardized in 1988):

- It is an open standard protocol means **it works on the various vendors routers**.
- It works on most of the router, it is **classful routing protocol**.
- Updates are broadcasted.
- Its administrative distance value is 120, it means it is not reliable;

The lesser the administrative distance value the reliability is much more.

- Its metric is hop count and max hop count is 15. There will be total 16 router in the network.
- When there will be the same number of hop to reach destination, Rip starts to perform **load balancing**.
- Load balancing means if there are three ways to reach the destination and each way has same number of routers **then packets will be sent to each path to reach the destination**.
- This reduces traffic and also the load is balanced.
- It is used in small companies, in this protocol **routing tables are updated in each 30 sec**. whenever link breaks rip trace out another path to reach the destination.
- It is **one of the slowest protocol.**

Advantages of RIPv1 :

- Easy to configure, static router are complex.
- Less overhead
- No complexity.

Disadvantage of RIPv1 :

- Bandwidth utilization is very high as broadcast for every 30 seconds.
- It works only on hop count.
- It is not scalable as hop count is only 15, If there will be requirement of more routers in the network it would be a problem .
- Convergence is very slow, wastes a lot of time in finding alternate path.

RIPv2(standardized in 1993):

- Due to some deficiencies in the original RIP specification, RIP version 2 was developed in 1993.
- It supports **classless Inter-Domain Routing** (CIDR) and has ability to carry subnet information, its metric is also hop count and max hop count 15 is same as rip version 1.
- It supports **authentication** and does **subnetting and multicasting**.
- Auto summary can be done on every router.
- In RIPv2 Subnet masks are included in the routing update.
- RIPv2 multicasts the entire routing table to all adjacent routers at the address 224.0.0.9, as opposed to RIPv1 which uses broadcast (255.255.255.255).

Advantages of RIP ver2 :

- It’s a standardized protocol.
- It’s VLSM compliant.
- Provides fast convergence.
- It sends triggered updates when the network changes.
- Works with snapshot routing – making it ideal for dial networks.

Disadvantages of RIPv2 :

- Max hopcount of 15, due to the ‘count-to-infinity’ vulnerability.
- No concept of neighbours.
- Exchanges entire table with all neighbours every 30 seconds (except in the case of a triggered update).

RIPng:

- Works basically in the same manner as RIPv2 with one notable exception: **RIPng can only run on IPv6 networks**.

- Additionally, it uses different IP address lengths.
- Compared to RIPv2's 32-bit addresses; RIPng uses 128-bit IP addresses (to accommodate IPv6 128 bit addressing).
- While a RIPv2 message carries up to 25 route entries; the maximum number of route entries in a RIPng packet depends on the IPv6 MTU (Maximum Transmission Unit) of the sending interface.
- Lastly RIPng has a different packet format than its RIPv2 cousin.

Advantages of RIPng :

The biggest advantage of using RIPng is that it is relatively simple to understand and to implement,and it has been the actual routing standard for many years.

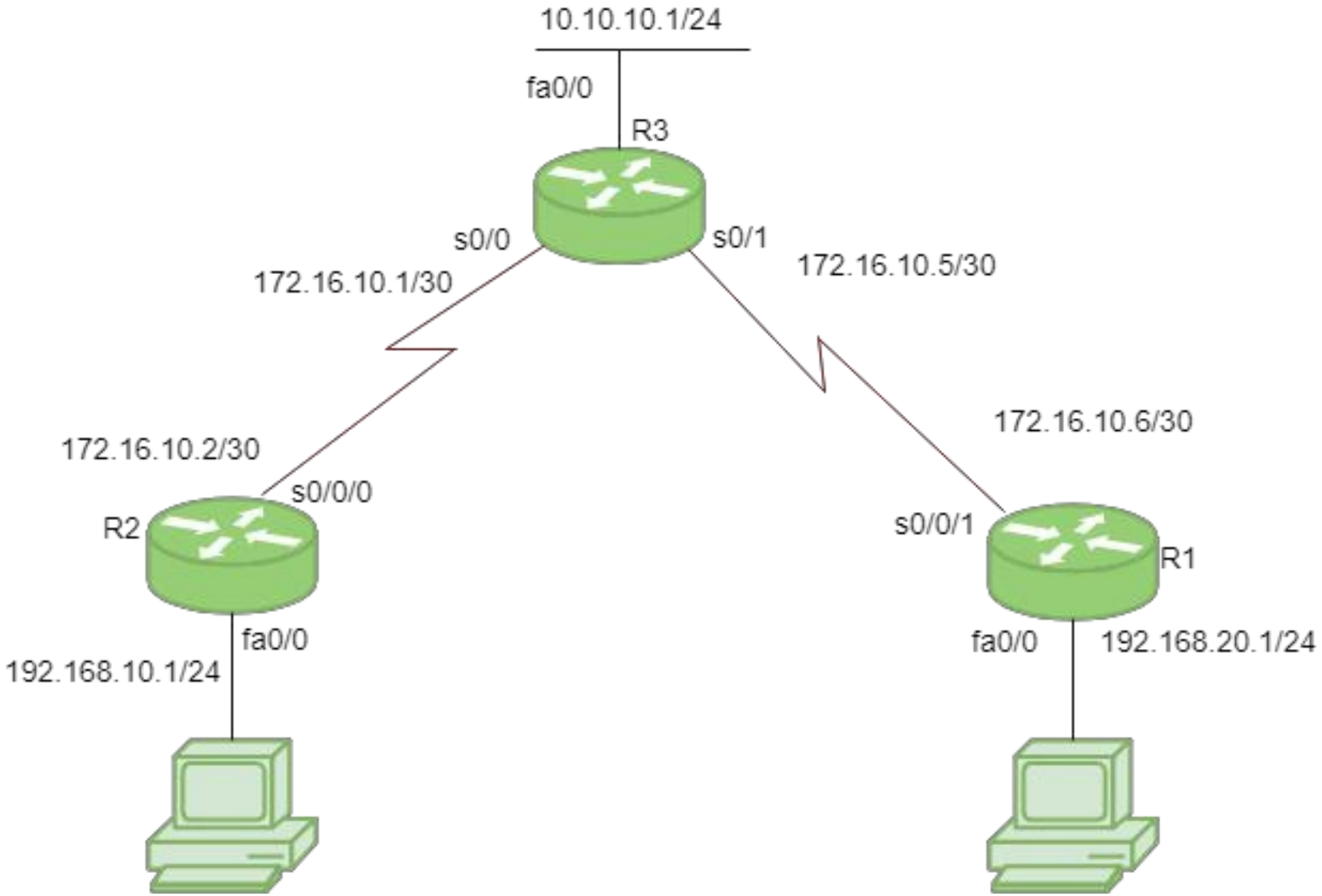
Advantages of RIPng :

- RIPng has a number of limitations that can cause problems in large networks, including the following:
- A limit of 15 hops between the source and destination networks.
- A large amount of bandwidth taken up by periodic broadcasts of the entire routing table.
- Slow convergence.
- Routing decisions based on hop count; no concept of link costs or delay.
- Flat networks; no concept of areas or boundaries.

RIP VER1	RIP VER2
RIP v1 uses what is known as classful routing	RIP v2 is a classless protocol and it supports variable-length subnet masking (VLSM), CIDR, and route summarization
RIPv1 routing updates are broadcasted	RIP v2 routing updates are multicasted
RIPv1 has no authentication	RIP v2 supports authentication
RIP v1 does not carry mask in updates	RIP v2 does carry mask in updates, so it supports for VLSM
RIP v1 is an older, no longer much used routing protocol	IP v2 can be useful in small, flat networks or at the edge of larger networks because of its simplicity in configuration and usage

RIP V1	RIP V2	RIPNG
Sends update as broadcast	Sends update as multicast	Sends update as multicast
Broadcast at 255.255.255.255	Multicast at 224.0.0.9	Multicast at FF02::9 (RIPng can only run on IPv6 networks)
Doesn't support authentication of update messages	Supports authentication of RIPv2 update messages	–
Classful routing protocol	Classless protocol, supports classful	Classless updates are sent

CONFIGURATION OF RIP



Consider the above given topology which has 3-routers R1, R2, R3:

R1 has IP address **172.16.10.6/30** on **s0/0/1**, **192.168.20.1/24** on **fa0/0**.

R2 has IP address **172.16.10.2/30** on **s0/0/0**, **192.168.10.1/24** on **fa0/0**.

R3 has IP address **172.16.10.5/30** on **s0/1**, **172.16.10.1/30** on **s0/0**, **10.10.10.1/24** on **fa0/0**.

Configure RIP for R1 :

R1(config)# router rip

R1(config-router)# network 192.168.20.0

R1(config-router)# network 172.16.10.4

R1(config-router)# version 2

R1(config-router)# no auto-summary

Note : no auto-summary command disables the auto-summarisation. If we don’t select no auto-summary, then subnet mask will be considered as classful in Version 1

Configureg RIP for R2 :

- **R2(config)#** router rip
- **R2(config-router)#** network 192.168.10.0
- **R2(config-router)#** network 172.16.10.0
- **R2(config-router)#** version 2
- **R2(config-router)#** no auto-summary

Configure RIP for R3 :

- **R3(config)#** router rip
- **R3(config-router)#** network 10.10.10.0
- **R3(config-router)#** network 172.16.10.4
- **R3(config-router)#** network 172.16.10.0
- **R3(config-router)#** version 2
- **R3(config-router)#** no auto-summary

RIP timers :

Timers in RIP help regulate performance. They include:

- **Update timer :** The default timing for routing information being exchanged by the routers operating RIP is 30 seconds.

  Using Update timer, the routers exchange their routing table periodically.

- **Invalid timer:** If no update comes until 180 seconds, then the destination router consider it as invalid.

  In this scenario, the destination router mark hop count as 16 for that router.

- **Hold down timer :** This is the time for which the router waits for neighbour router to respond.

  If the router isn't able to respond within a given time then it is declared dead.

  It is 180 seconds by default.

- **Flush time :** It is the time after which the entry of the route will be flushed if it doesn't respond within the flush time.

  It is 60 seconds by default. This timer starts after the route has been declared invalid and after 60 seconds i.e time will be 180 + 60 = 240 seconds.

ADVANTAGES OF RIP

Advantages of RIP include:

- Feasible configuration
- Easy to understand
- Predominantly loop free
- Guaranteed to support almost all routers
- Promotes load balancing
- Additionally, RIP is preferred over static routes due to its simple configuration and the fact that it does not require an update every time the topology changes.

DISADVANTAGES OF RIP

Disadvantages of RIP include:

- Not always loop free
- Only equal-cost load balancing is supported
- Pinhole congestion can occur
- Bandwidth intensive and inefficient
- Large networks lead to slow convergence
- Increased network and processing overhead of RIP when compared to static routing.

LIMITATIONS OF RIP

- The Routing Information Protocol results in increased network traffic due to the checks and updates that it performs on neighboring routers every 30 seconds.
- Furthermore, since RIP only updates neighboring routers, updates for non-neighboring routers can be forgotten since the information is not immediately accessible.

- The enforcement of a maximum hop count of 15.
- As a result, remote routers in large networks may not be able to be accessed or reached.
- Furthermore, the closest path may not be the shortest path. This is because RIP does not take various factors into consideration when calculating the shortest path.

SOURCE

- https://bidb.itu.edu.tr/seyir-defteri/blog/2013/09/07/rip-(routing-information-protocol--y%C3%B6nlendirme-bilgisi-protokol%C3%BC)
- Routing Information Protocol,C.L. HedricK, June 1988
- RIP Version 2 Protocol AnalysiS, G. Malkin, January 1993
- RIP Version 2 Carrying Additional Information, G. Malkin, January 1993
- RIP Version 2 Protocol Analysis, G. Malkin, November 1994
- RIPng for IPv6, G. Malkin, R. Minnear, January 1997
- RIPv1 Applicability Statement for Historic Status, J. Halpern, S. Bradner, March 1996
- https://en.wikipedia.org/wiki/Routing_Information_Protocol