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Routing Information Protocol (RIP) for Wired Network

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Abstract. As we can see today, the new technology provides many facilities and fast communication, such as the Internet. We must think about how this information transfers from the source to the destination. Due to the fact that a device called a router does managing the transfer operation, this device explores the path from the source to the destination at a low cost. Furthermore, in this paper, we present one of the most popular algorithms used in routing, is the Distance Vector (DV) algorithm, which is the basis of the well-known Routing Information Protocol (RIP). Therefore, we will explain how this protocol works and what is the problem when implementing it in the weird network and shows how can this protocol manage this problem and solve it. Besides, show where this protocol is used. As a result, the discussion part will explain the purpose of using this protocol and make a comparison with other routing protocols to see the efficiency of this protocol. Thus, during this paper, we will find the accuracy of this algorithm.

INTRODUCTION

Traffic is one of the most problems in the networks, and to avoid the congestion in it and deliver the data from the source to the destination with a short path we need an algorithm that implements to get the optimal path. Therefore, now we know what route is not necessary to get the best path, it is depending on the algorithm that applied. Furthermore, when the data is transferred from one network to another one, there is a router that manages and decides which is the best path the packet will take[1]. Besides, the router at least will be connected with two networks. The router will take any place in the network and his works to create and enhance the routing table. Furthermore, there are conditions, which decide the route, the distance measurement and cost algorithm determine the best route to any given packet. The packet will cross many routers from one network to another to reach the destination[2].

However, each algorithm has a measure that will be the metric. The length is one of the most metrics used to determine the best path and optimal route and this can help the algorithm to establish and enhance the routing table[3]. Routing algorithms fill routing tables with a list of networks and their corresponding "next hop" on the way to their destination. When a router receives an incoming packet, it checks the destination address and attempts to associate this address with a next-hop[4].

THE PROPOSED METHOD

In this section the new and modern routing algorithm uses many metrics, combing it to make a hybrid. All the metrics in the following have been used:

1. *Path length*: it is one of the most common routing metrics used to measure protocol efficiency. Some protocol put a cost on each link and this will happen by allowing the administrator network to assign this cost. In another hand, other routing protocol use hop- count, this metric will explain the number of passes that the packet will go through it to the destination[5].

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2. *Reliability*: It means the bit rate error for each link in the network. For example, if the network links down after the networks fail and this link has damage will repeat itself faster than the other link. The reliability vector value will be an assignment by the network administrator.
3. *Routing delay:* It is a more important metric to evaluate the protocol works because it works with time; this is mean the time the packet will take to reach the destination from the source. In any router, the delay depends on many vectors like ("bandwidth network link, port queue for each router, network congestion and the physical link that the packet on it.
4. *Bandwidth:* This term indicates the amount of traffic capacity that is available of the link, for example, the bandwidth of 20 Mbps. However, any route in the link with greater bandwidth does not necessarily to get a better way or route rather than the link has slower bandwidth.
5. *Load*: this will refer to the network resources that will be not available or busy.
6. *Communication cost*: it will be a more important metric because many companies will focus on the performance rather than the operating spend.

The Distance-Vector Algorithm

The Distance-Vector (DV) algorithm pseudo code[11]. For each router sets Dx[y] is equal to the weight, x and y are two-router, w(x;y) of the link from x to y, if there is such a link. If there is no such link, then x sets Dx[y] = +1, (each router notifies neighbours only when it is DV changes like adding one or more).
For each loop, the router x send the distance vector to each neighbour[6]. Then the router x will make the update to the distance vector by applying the following steps:

```
For each router y adjacent to x do

 For each other router w do

  If Dx[w] > w(x; y) / Dy[w] then

      f It is faster to _rst go to y on the way to w, g

      Set Dx[w] = w(x; y) + Dy[w]

      Set Cx[w] =y

  End if

End for
```

Routing Information Protocol

The router works is to get the best and optimal path, as written early this will happen by consulting a forwarding table. The router has to construct routing and forwarding tables. However, the basic routing problem is how the lowest path cost between two nodes is achieved. Besides that, the protocol will have a variety of ways to tackle the cost of the lost route. Figure (1). shown us the router connects with two networks[7].

However, the RIP protocol is implemented to Distance Vector Algorithm. This protocol uses hop and counts as a metric and this parameter will be discussed in the next part. The RIP protocol is used in networks of a local and wide area. To manage the network size, the RIP protocol designed and uses a network that is logically homogeneous. Further, has evolved for networks based on smaller IP.

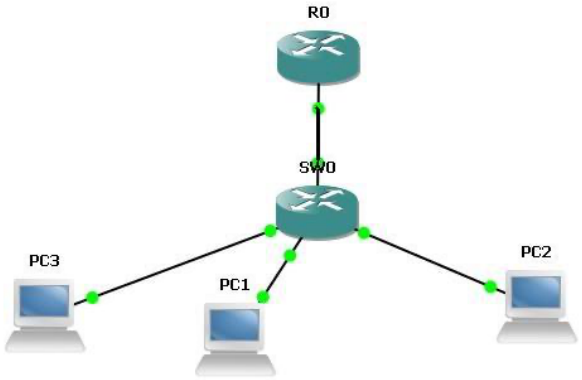

FIGURE 1. Router connection

Besides, the works of this protocol are by building a table which includes all the information about the neighbor it means the distance from each node to all the neighbours and each node explore a new path it will up data the table and exchange this table with the neighbours to show them the best path. In route update, RIP uses UDP port 520. Table1. shows us the RIP table content and how can the information insides this table helps the router to decide the best route depending to the information provides by exploring the neighbors. The up data in this table exchange between the neighbors every period 30 seconds. Basically, this information defines as the destination, the next hop to the distention and a metric.

TABLE 1. an example to RIP Routing

Destination	Next hop	distance	Timer	Flag
Network A	Router 1	3	t1, t2,t3	X, Y
Network B	Router 2	5	t1,t2,t3	X, Y
Network C	Router 3	2	t1,t2,t3	X, Y

Furthermore, RIP will make improvements and maintain to the best route goes to the distention. When the new information present the best route to the distention, then the new information will be replaced with the old route information in Table 1.

In contrast, when the failure happens in the router or the router detect a failure link, the router send a message that informs all the router there is an up data in the route to the distention and propagates the change.

Problems of RIP Protocol in Wired Network and the Solutions

As other protocol, the RIP protocol has problems in the network when it tries to find the best path

1. Slow convergence.
2. Count to infinity problem.
3. Routing loops.

The solution for the first problem can be the triggered updates that minimize the problem of slow convergence by making instant propagation for the information of changed route.

Hop-Count Limit solved the count to infinity by put 15 hope to the destination if more than will consider unreachable.

Split Horizon: It is, in fact, never helpful in sending information about any update in the route by returning back to the direction where it comes. The benefits of the split horizon rule and poison reveres are to prevent two-node routing loops.

But, with more than two node the split horizon rule and poison reveres are not efficient, so to solve this problem must the metrics reach to infinity then the network announce this path unreachable, this will come by triggered updates to speed up convergence of network.

The Metric of RIP

The RIP protocol uses one kind of routing parameter as a measure of the distance to the destination from the source. This parameter called (hop- count)[8].
An example, when a router sends information about routing updates to the current router telling it that there is a new destination for the new network, the router will insert this new information into the routing table and will use the IP address for the next hop. On the other hand, since the RIP protocol has a finite number of hops, an infinite loop cannot occur between two nodes. RIP protocol has a number of hops equal to 15 and unfortunately, any increase in the metric value will cause the network to enter into an infinite loop and it will be inaccessible to it.

Routing Information Protocol Packet Format

Table 2. showed us the packet format that belongs to RIP protocol and the explanation about each part[9]

TABLE 2. packet format [23]

A	B	C	D	C	E	C	C	F

A = Command (request or response)

B = Version number

C = Zero

D = Address family identifier

E = Address

F = Metric

1. Command: this will refer to the packet whether response or request. In case request this will asked the router to send all or partition of the router table. In contrast, if it is response means reply to request and it has the routing entries[10].
2. Version number: this is referring to the RIP protocol version used.
3. Zero: This field name comes from the value that has it “Zero". Furthermore, this part of the packet not really used from RFC 1058 RIP. It just put it in the format to get backward compatibility with different standard of RIP[11].
4. Address-family identifier (AFI): this part defines the family address used. However, RIP protocol work to carry the whole information from variety protocol.
5. Address: identify the IP address for the entry.
6. Metric: refer to the number of hop the router take in its travel from the source to the destination, it will be from 1 to 15, but if it reaches to 16 or above, this hop will be unreachable[12].

The Updating Routing in the RIP Protocol

Table 3. involved the routing timer such as routing-update timer, route timeout timer, route flush timer, hold down.

TABLE 3. routing information protocol timer[13].

Timer	Default	Controls
Update	30 sec	The time between the route update advertisement.
Timeout	90 sec	Period a route withdrawn from the table to prevent a routing loop.
Flush	180 sec	Interval a rout should stay ‘live’ in the routing table. This counter resets every time the router hears an update for this route.
Flush	120 sec	How long to wait to delete a route after it has timed out.

Implementation of RIP Protocol

For more information, RIP protocol has been implementing in many areas such as:

1.Route included in most BSD Unix systems[14].

2. Routing and Remote Access, a windows serves feature contains RIP support.

3. Quagga, it is a network routing software suite, which implement many types of routing algorithms, one of them, is RIP protocol.

4. OpenBSD, this includes RIP implementation.

5. Cisco IOS, the router software used in Cisco, which support to both types RIPv1, RIPv2, and RIPng.

6. Cisco NX-OS software used in Cisco Nexus data center switches (supports RIPv1 and RIPv2)[15].

RESULTS AND DISCUSSION

This paper aims to explain the RIP protocol work in general and discuss the major feature of this protocol and the problem which occur when implementing the RIP protocol in the wired network. Besides, the reason by chosen RIP protocol with the wired network is related to the features, which provide by this protocol, there are many reasons that will make this protocol commonly popular to use:

RIP protocol has many features such as mature, stable, widely supported and easy to configure.

In fact, RIP protocol is a simple protocol; this means an expensive and low computation. Besides, it is simple to implement, widely support, most popular to use with the protocol of TCP/IP and it is one of the most commonly use with small networks.

In contrast, as with other protocol, the RIP protocol has some disadvantages and limitation when implemented such as slow convergences, generates additional protocol traffic, not suitable for large network, count to infinity problem, and slow when adjust the failure link and the weakness in security.

After this briefly describe we show why we chose this protocol. Lastly, by making a comparative between RIP protocol and OSPF protocol to see the majority features of these two protocols. Table 4. Show the comparison between two protocols RIP and OSPF

TABLE 4. RIP and OSPF Comparativation

FEATURE	RIP	OSPF
Algorithm	Distance Vector	Link state
Max hop	15 hope and the 16 consider unreachable.	Limit by the size of the routing table in the router
Subsystem segmentation	Treat the announcement system as a subsystem	Break the announcement system into one or two with two level of routing algorithm
Metrics	Distention/hop.	Distention/hop/link identifier/cost
integrity	No authentication in RIP-1, its added to the RIP-2	Several authentication algorithms run on it.
Complexity	Simple for each router	More complex because Several more PDUs and exchanges are defined in the protocol and more information are represented in the routing table.
Acceptance	Widely used, BSD support RIP.	It's published in RFCs so it's newer.
Number of route	A single route to the distention	Support multi route to one distention also has load-balancing traffic.
Routes type	Have host, network and the RIP-2 add the ability to transmit the sub-network entity.	Have host, network and sub-network routes.

CONCLUSION

In this paper, we present a brief overview about the routing protocol, in specific the routing information protocol (RIP) and shows the weakness, the problems that accrue with the wired network and how RIP handle with it and the robustness of this protocol. However, relating to the age of RIP protocol and many types of routing protocols that

appear, this protocol is still used. Lastly, this protocol is suitable to use in the stub network and with a small system that does not have frequently paths.

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