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The Effect of Immigration from IPv4 to IPv6 Over RIP and RIPng

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Abstract

This paper describes the future routing protocol called the Routing Information Protocol Next Generation (RIPng), the term Next Generation(NG), is used to describe protocols that support the Internet Protocol Version 6 (IPv6), Comparing it with RIP Routing Information Protocol, that was used with Internet Protocol version 4 to study the impact of immigration from IPv4 to IPv6, and explained the bandwidth, Router's hardware improvement needed to implement , as a result of these study internal router interface have to use IPv6 rather global router interface to reduce the cost of offering high bandwidth and High specification routers.

Keywords: *RIP , RIPng , Routing Protocols, IPv4 and IPv6.*

1. Introduction

Distance vector protocol is also known as Distributed Bellman-Ford or Routing Information Protocol (RIP). Every node maintains a routing table and it contains all available destinations details, the next node to reach to destination, the number of hops to reach the destination. To maintain topology in a network nodes periodically send table to all neighbors. By using the distance vector protocols, each router over the internetwork send the neighboring routers, the information about destination that it knows how to reach. Moreover to say the routers sends two pieces of information first, the router tells, how far it thinks the destination is and secondly, it tells in what direction (vector) to use to get to the destination. When the router receives the information from the others, it could then develop a table of destination addresses, distances and associated neighboring routers, and from this table then select the shortest route to the destination. Using a distance vector protocol, the router simply forwards the packet to the neighboring host (or destination) with the available shortest path in the routing table and assumes that the receiving router will know how to forward the packet beyond that point. The best example for this is the routing information protocol (RIP)[1].

2. Routing Information Protocol RIP

Routing Information Protocol is a distance vector routing protocol, and its algorithm is simple and easy to implement, widely used on the network[2] . RIP is a dynamic, distance vector routing which RIP uses UDP port 520 for route updates. Like all distance vector routing protocols, RIP takes some time to converge. RIP calculates the best route to a destination based solely on how many hops it is to the destination network, RIP tends to be inefficient in network using more than one LAN protocol. This is because RIP prefers paths with the shortest hop count. The path with the shortest hop count might be over the slowest link in the network [3]. This protocol sends broadcast its routing table every 30 seconds. A packet can contain up to 25 destinations, and the unit measure uses hop count (number of jumps), maximum is 15 routers [4].

2.1 RIP characteristics

1. Distance vector routing protocol.
2. It metric is the number of jumps.
3. The maximum number of jumps is 15
4. One updates every 30 seconds
5. Not always it selects the fastest route for the packages.
6. It generates great amount of traffic of network with updates.

[5]

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2.2 RIP Operation

RIP uses two message types the first one is the Request message, which is sent out on startup by each RIP enabled interface and Requests all RIP enabled neighbours to send routing table. The second message is the Response message, which is sent to requesting router containing routing table.

2.3 RIPv2 Message Format [6]

The RIP message format is shown in Figure 1. All the extensions to the original protocol are carried within what were unused fields. RIP updates can contain entries for up to 25 routes. RIP operates from UDP port 520 and has a maximum datagram size (with an eight-byte UDP header) of 512 octets.

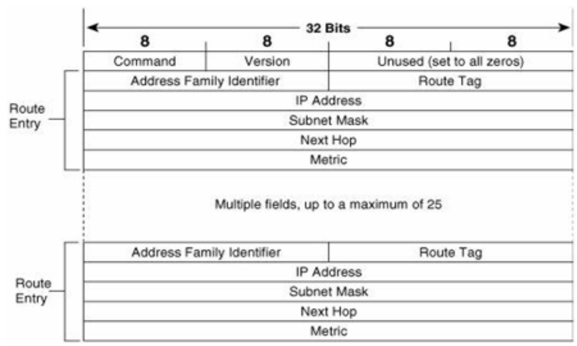

Figure 1 - The RIP message format

- Command will always be set to either one, signifying a request message, or two, signifying a response message.
- Version will be set to two for RIPv2. If it is set to zero, or if it is set to one but the message is not a valid RIPv1 format, the message will be discarded. RIPv2 will process valid RIPv1 messages.
- Address Family Identifier is set to two for IPv4. The only exception is a request for a router's (or host's) full routing table, in which case it will be set to zero.
- Route Tag provides a field for tagging external routes or routes that have been redistributed into the RIPv2 process. One suggested use of this 16-bit field is to carry the autonomous system number of routes that have been imported from an external routing protocol. Although RIP itself does not use this field, external routing protocols connected to a RIP domain in multiple locations may use the route tag field to exchange information across the RIP domain. The field may also be used to group certain external routes for easier control within the RIP domain.
- IP Address is the IPv4 address of the destination of the route. It may be a major network address, a subnet, or a host route.
- Subnet Mask is 32-bit mask that identifies the network and subnet portion of the IPv4 address.
- Next Hop identifies a better next-hop address, if one exists, than the address of the advertising router. That is, it indicates a next-hop address, on the same subnet, that is metrically closer to the destination than the advertising router is. If the field is set to all zeros (0.0.0.0), the address of the advertising router is the best next-hop address.
- Metric is a hop count between 1 and 16.

3. Routing information protocol next generation (Ripng)

With IPv4 almost completely depleted, IPv6 is fast becoming the emerging standard for device addressing. Unfortunately IPv6 uses an architecture that is completely different form that in the IPv4, thus devices and every other thing that works with IP addresses must change to function under IPv6, routing protocols inclusive. With dynamic routing serving as almost the defacto standard for IP routing, routing protocols must be changed/upgraded to support IPv6. This is what led to the development of RIPv6 or RIPng. RIPng works essentially like its predecessor (RIPv2), but incorporates a few changes, prominent amongst which is the change from a 32-bit to a 128-bit addressing as used in IPv6[7].

3.1 Operation of RIPng

RIPng for IPv6 is based on RIPv2, but it is not an extension of RIPv2; it is an entirely separate protocol. RIPng does not support IPv4, so to use RIP to route both IPv4 and IPv6, you must run RIPv1 or v2 for IPv4 and RIPng for IPv6. RIPng uses the same timers, procedures, and message types as RIPv2. For example, like RIPv2 it uses a 30-second update timer jittered to prevent message synchronization, a 180-second timeout period, a 120-second garbage-collection timer, and a 180-second holddown timer. It uses the same hop-count metric, with 16 indicating an unreachable value. And, it uses Request and Response messages in the same way that RIPv2 does. And, like RIPv2, Request and Response messages are multicast with the same few unicast exceptions that RIPv1 and v2 use. The IPv6 multicast address used by RIPng is FF02::9. An exception to these parallel functions is authentication. RIPng does not have an authentication mechanism of its own, but instead relies on the authentication features built into IPv6.

Figure 2 shows the RIPng message format. Unlike RIPv1 and v2, which run at UDP port 520, RIPng sends and receives its messages at UDP port 521. Also unlike RIPv1 and v2, there is no set message size. The message size is dependent only on the MTU of the link on which it is being sent.

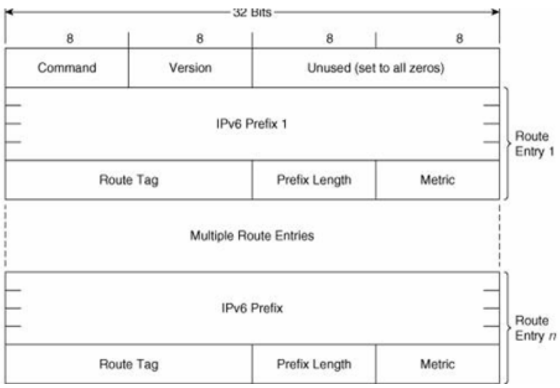

Figure 2 The RIPng message format.

- Command is always set to 1, indicating a Request message, or to 2, indicating a Response message.
- Version is always set to 1, that is, the current version of RIPng in RIPngv1.
- IPv6 Prefix is the 128-bit IPv6 destination prefix of the route entry.
- Route Tag is used in the same way the 16-bit RIPv2 Route Tag field is used: for transporting external route attributes across the RIP domain.
- Prefix Length is an 8-bit field specifying, in bits, the significant part of the address in the IPv6 Prefix field. For example, if the advertised prefix is 3ffe:2100:1201::/48, the value in the Prefix Length field is 48 (0x30). If the advertised route entry is a default route, the IPv6 prefix is 0:0:0:0:0:0:0:0 and the Prefix Length is 0.
- Metric is the same hop count metric used by RIPv1 and v2. But as the maximum possible value is 16, the field is reduced to 8 bits from the unnecessarily large 16 bits of RIP.

4. Simulation Methodology

Network is simulated using OPNET® Modeler. OPNET® is extensive and powerful simulation software tool with wide variety of capabilities. It enables the possibility to simulate entire heterogeneous networks with various protocols[8]. The simulated communication network designed for RIP and RIPng as shown in the figure 3, consists of 9 routers and 20 PCs and three different application servers.

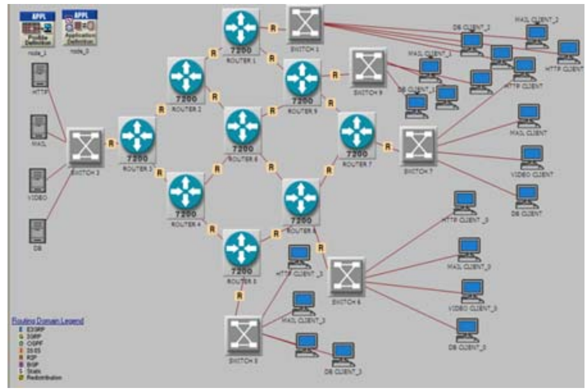

figure 3 the network diagram

5. Results

As shown in figure 4 the total number of updates of RIP approximately half of total number of updates of RIPng , that means the traffic will increase over the transmission media.

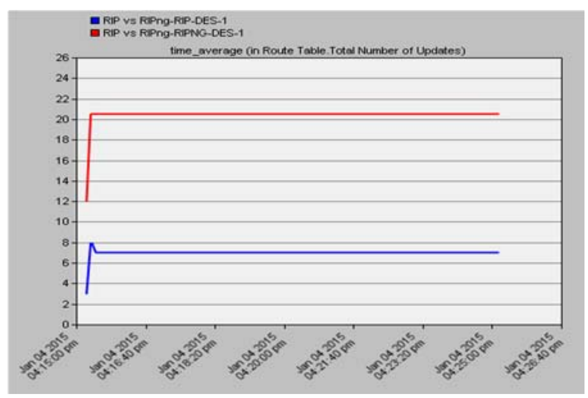

figure 4 total number of updates

As illustrated in figure 5 when RIPng is used there is overload over Router1 CPU comparing with RIP, that means if RIPng is needed to be implemented rather than RIP Router's CPU must upgrade.

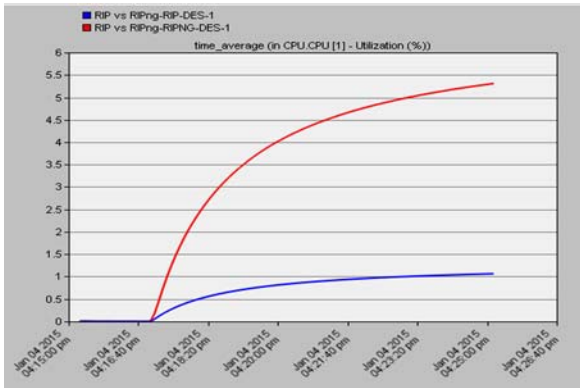

figure 5 Router1 CPU Utilization

As shown in figure 6 when is used RIPng, the forwarding memory queuing delay will increase, and depending on this delay the packets transfering have affect , and the network throughput, so the Routers memories have to upgrade to solve this problem.

6. Conclusions

- In the use RIPng rather than RIP, the network hardware must be upgraded to meet the packet size increase from IPv4 to IPv6, the hardware include the Routers CPU and Memories and the transmission media.
- The study shows the important of use IPv6 over internal router interface rather global router interface to reduce the cost of offering high bandwidth and High specification routers.

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