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Comparative Study of RIPng and OSPFV3 with IPV6

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Abstract: ***In the communication network it is mainly depend on the routing protocol and these network are growing very fast. Routing protocol send packets from one end to other end. There is various routing protocol in the internet world but in this paper we evaluated the performance of RIPng and OSPV3 with IPV6. A lot of observation and calculation between various routing protocols has been done in IPV4. GNS-3 simulation is used to evaluate the performance of RIPng and OSPFv3 in enterprise network based on packet delay variation, end to end delay, traffic receives, traffic sent, jitter, response time, convergence for IPv6. This paper will firstly introduce RIPng and OSPFv3 and its metric mechanisms. After discussing the simulation result will be drawn to communicate the finding of this paper and which protocol performance the best upon implementing within an IPv6 enterprise network.***

Keywords: RIPng, OSPFv3, GNS-3, Wire shark, IPv6.

I. INTRODUCTION

Routing refers to the process of determining the best route for the transmission of data packets from one end to other end. A routing protocol shares data first among rapidly neighbours, and then to the network. Routing protocols are a set of rules in which communication network proceed when computers try to communicate with each other across networks and communication between two routing protocols is based on the routing algorithm which is totally based on the metrics to observe the path to transfer the data across two networks [1]. In present day's different routing protocol exist, among these routing protocol most popular are RIP (Routing Information Protocol) and OSPF (Open Shortest Path First). RIP and OSPF are the examples of interior gateway routing protocol. RIP is a distance vector dynamic routing protocol and it uses for hop count and the maximum hop count is15 [2]. IPv6 is a new addressing protocol evolved in 1999 designed to remove the drawbacks of IPv4.IPv4 was developed in 1981; did not get any vital change afterward and also it produces only 32-bit addressing space containing 4.3 billion unique internet protocol addresses. Each internet enabled device involve a unique IP address from this address space. But fast growth of the internet has resulted in these addresses being exhausted. IPv6 has 128 bits address space which is more than IPv4 [3].Moreover, IPv6 brings a number of development over IPv4 to expand addressing space.

II. RIP (ROUTING INFORMATION PROTOCOL)

RIP is a distance vector routing protocol and it is used to determining best route between source and destination and also uses UDP (User Datagram Protocols) port for message encapsulation. RIP allowed the maximum number of hops is 15. This hop limit also limits the size of networks that RIP can support. A hop count of 16 is assumed as an infinite distance, in other words we can that the route is assumed as unreachable. RIP implements the split horizon, route poisoning and hold down mechanisms to prevent incorrect routing information from being propagated. RIP only maintains the routing table for the best path in the networking for every destination. RIP mostly known as routing information protocol is a distance vector algorithm and working structure depends on Bellman-Ford algorithm, and acted less fast than link state protocols. Its configuration is easy. It evaluates the best path between hosts to destination by using hop count methodology. Hop count concerned with router which is directly attached to network is set to 0 and if it is attached directly to router, set to 1 the hop count limit set to from 1 to 15 and if it exceeds the given hop count metric.

Characteristics of Routing Information Protocol (RIP)

RIP is easy and efficient in smaller networks and thus require little management.
RIP is mostly based on hop counts and its matrices.
RIP used a fixed subnet mask length.
RIP supports IP and IPX routing.
RIP routes have an administrative distance is 120.

Advantages of Routing Information Protocol

Easy and efficient in smaller networks.
Easy configuration.
Low resource usage.

Disadvantages of Routing Information protocol

Loop creation.
Slow convergence.
Scalability problem.
Lack of metrics.

2.1 RIPv1:

RIPv1 supports Classful routing in the network. The periodic routing updates do not carry subnet mask, therefore variable length subnet mask (VLSM) cannot be used in the RIPv1. This drawback makes impossible to have different – sized subnets inside the similar network class. The methodology is not concerned with authentication in the RIPv1 routing protocol. It updates for each 30 seconds and hold-down for 180 seconds. It's main operation based on hop count method in the routing protocol. The security level of RIPv1 is low in t. he networking.

RIP version 1 use local broadcast to share routing information in the networking. These updates produce periodic in nature. It uses hop count as a metric which is not always best metric to use in the networking. Example- if you have two route to available other network that are having to hop connection and another case was 128 kbps WAN connection, the RIP would use the slower 128 kbps connection becomes it having less hop count metric in the networking. RIP v1 are now outdated RIP support 15 hops on the packet in the network, then 16 it will drop the packet to avoid packet for the networking. Version of RIP solved the count to infinity problem in a networking. RIP v1 work on the bases of classless protocol in the networking.

2.2 RIPv2:

The routing protocol RIPv2 work on Classless Inter-Domain Routing (CIDR) classes. Thus does include the subnet mask with its routing updates in the networking. The methodology is concerned with its authentication and has authority to close or restrict unauthorized user and it uses variable-length subnet masking (VLSM) classes and also actively participating when any change take place, it automatically "Triggered updates" on the routing table information that is concerned with neighbour router.

2.3 RIPng

RIPng protocol is the new generation of Ripv2, and it is used in IPv6 network. RIPng is based on distance vector algorithm, or also known as Bellman-Ford algorithm. In which the RIP and RIPv2, if the hop count is equal or more than 16, the destination network or host is unable to reach.

RIPng restore time is 30 seconds. If after 30 seconds, no restore data is received from a neighbour and the route will be marked as unworkable. Split horizon and poison reverse technology are used to prevent routing loops and route redistribution in RIPng. RIP is one of the previous version of RIPng. There are three types of the Routing Information Protocol: RIPv1, RIPv2, and RIPng. RIPng uses an easier mechanism than other routing protocols to determine the cost of a route, which is that it just calculate number of hop to the destination. The router count up the distance between the neighbour and itself to the metric of every route received after receiving the RIPng response messages from its neighbours.

However, all IPv6 routes are known by all routers, and they keep sending response messages periodically to prevent authentic routes from expiring. Like preceding version of RIP, RIPng has a diameter limitation, where the distant path to any IPv6 route is limited to a metric of 15 when originate. The protocol allows for enormous costs to be mention to any link, limiting the number of hops, but a metric of 16 or greater are unreachable. Routing loops can also cause high merging time when IPv6 routes that are no longer valid are being propagated in a looped environment, where RIPng will continue to enhance the metric by one. The mechanism reduces the metric of 16 anticipate the routes from being passed around indefinitely, since the routes will circle until they reach the largest metric and are sometime eliminated. A route cannot be chosen based on bandwidth such as measured load, delay, reliability. RIP is the development of RIPv2 for support of IPv6. The main differences between RIPv2 and RIPNG are:

- While RIPv2 supports RIPv1 update evidence, RIPNG does not. IPv6 routers were, at the time, supposed to use IPsec for authentication.
- RIPv2 allows attaching approximate tags to routers but RIPNG not.
- Support of IPv6.
- RIPv2 encryption the next-hop into each route entries.
  RIPNG requires definite encoding.

III. OSPFv3

Open Shortest Path First version 3(OSPFV3) is an interior routing protocol which is used in IPv6 routing protocol. OSPFV3 is a link-state protocol and uses Dijkstra's algorithm to determine best route to all destinations. OSPFv3 is much similar to OSPFv2, and it is developed to support IPv4 and IPv6 but OSPFv2 only supports IPv4 [13]. According to Cisco, there are many significant changes in OSPFv3. In OSPFv2, a routing process is necessary to be configured in "configuration" privilege technique of router. When using a non-broadcast multi-access (NBMA) interface in OSPFv3, the device must be mainly composed with the list of neighbours. Neighbouring devices are determine by their device ID. OSPF automatically choose a loopback interface over any other kind, and it select the highest IP address among all loopback interfaces. If no loopback interfaces are present, the maximum IP address in the device is chosen. OSPFv3

could not be used any particular interface. OSPF was constructed with the specific goal of handling routing tasks within an enterprise network and it requires quick convergence, minimum routing traffic, and better security [14]. The concept of OSPF routing is depend on creating, maintaining and distributing a link –state database, which specify a collection of routers and their operational interfaces, how they are interconnected and cost to use the interfaces[15] . Cost is a metrics used to explain the relative efficiency of many routes to the destination. Each router in the routing domain is responsible for the formation of its local piece of topology by link state advertisements (LSA) [16]**.** In LSAs it contains information describing routers, networks, reachable routes, route prefixes and metrics. As long as every OSPF router has an identical link state database, each router can observe the shortest paths to the advertised destination, using Dijkstra Shortest Path First algorithm [17]. OSPFV3 works on single Autonomous System (AS) .As per previous but existing OSPF for IPv4 has been renew for OSPF for IPv6 but the groundwork of initial things still same [18]. Updates are mostly occurred due to modification in network topology When we talk about difference between OSPF for IPv4 and OSPF for IPv6 is the protocols working for every link and it doesn't consider per-subnet so it is clear that IP subnets may assign to single link means if 2 nodes move on single link, they can talk directly even without having common IP subnet [19]**.**

OSPF Area

There are two levels given by OSPF to cover the accentual areas in networking. An area represents 32 bit having IP address format 0.0.0.0 as it is like 0 and when network used more than one area, the 0 area assign to support network and act as a backbone and total areas in network must be connected to this backbone [20]. If they could not have connected to it, they must be attached through virtual link. OSPF is called for IPv4 routing protocol and OSPFv3 is called for IPv6 routing protocol [21]. The OSPF have two types of area: -first is the normal area and second is the stub area. Normal area is a default area given in OSPF and generally called normal area and it also called regular area. Stub area which do not receive route communication and are external to the AS are known as stub Areas. Following features are associated with Stub Areas.

IV. INTERNET PROTOCOL (IP)

The IP protocol is used to connect different nodes in a network, so now day's Internet progress obsessively require global unique unicast IP addresses. IP considered as the separate denominator to meet various application layers such as audio, voice, video and data. So these all devices demand IP addresses to inter connect all type of IP appliances on the Internet. The Internet Protocol version 4 (IPv4) is calculated by its 32 bit IP address. IPv4 is the fourth revision in the IP development. The finite space of IPv4 forms Inconvenience for long-run progress of Internet. Furthermore, parts of the IPv4 classes such as "Class D" and "Class E" are reserved for notable uses. These classes decreases the Number of globally unique unicast IPv4 addresses. The large blocks of globally unicast addresses were started allot to organizations across the globe in 1980s. The present Internet is originate fast mostly in Asia and Europe. Some of Asian and African countries accepted one "Class C" address for the whole country; because of limitations in IPv4 and late reach to the Internet. The global Internet routing table is wide and still expand in the future. To support these wide routing tables, networks are using despite mechanisms such as Classless Interdomain routing *(CIDR)* and Network Address Translation *(NAT)* in IPv4 address. Many studies predicted the consumption of the present IPv4 address between 2005 and 2011.

The Internet Protocol impose two basic operations; addressing and fragmentation. The Internet modules use the addresses to transmit datagrams towards their destinations. An IP packet or a datagram has two fundamental element; IP header and payload. Transmission control protocol (TCP) and the Internet protocol (IP) are the two protocols started working with IP. The TCP/IP Internet protocol obtain the Network layer in OSI model.

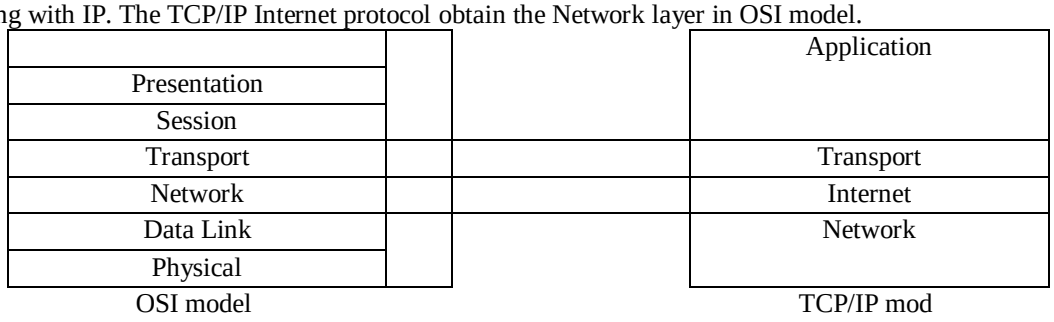

Figure:-OSI – TCP/IP model

The choice of a route for transmitting datagrams is called routing. The Internet modules used in the Internet protocol header to fragment and reassemble datagrams for transmission through networks. For presuming services on the Internet, the Internet protocol uses four basic mechanisms such as Type of Service, Time to Live, Options, and Header checksum from Source to Destination address**.** Present Internet has two well-known Internet protocols in the network. Without these protocols present and the future Internet cannot be exit in the network. Two type of internet routing protocol is given as:-

4.1 Internet Protocol Version 4 (IPv4).

4.2 Internet Protocol Version 6 (IPv6).

4.1 Internet protocol version 4

The IPv4 address is 32 bit numeric address in a network. Internet protocol used the IP addresses to make a communication with a singular node in the network. An IPv4 address support two part of information such as "Network

address" and "Host Address". The network address is used to calculate the location of a network and host address is used to reach at the particular destination within a network. The IPv4 addresses are divided in three classes; class A with network prefix /8 and it is used for the large sized networks. Class B has a network prefix of /16 and used for middle sized networks whiles class C has a network prefix of /24 and used for the small networks. At the current stages of internet, allocation of addresses was not planned. The result of class B addresses giving to small sized companies which led to rapidly depletion of the IPv4 addresses in that class. Later medium sized companies were providing several /24 addresses and this led increase the Internet backbone router's in the routing tables. Numerous methods such as Sub netting, Variable Length Subnet Mask (VLSM), Classless Inter-Domain Routing (CIDR) and Network Address Translation (NAT) have been acquire to delay IP address space exhaustion. Conversely, the use of these techniques came with a number of difficulties. These difficulties form the basis of the IPv6 address scheme, because it propose a permanent solution to these difficulties.

4.2 IPv6

The Internet Engineering Task Force (IETF) intend the IPv6 Address scheme. The IPv6 protocol is used to improve the IPv4 protocol. IPv6 is not intended only to solve the IP addresses shortage difficulties, but it used to enhance the prominent features over IPv4.

IPv6 Addressing

Internet Protocol version 6 (IPv6) is the new version of the Internet Protocol (IP), the communications protocol that produce an identification and location system for computers on networks and routes traffic across the Internet. IPv6 was evolved by the Internet Engineering Task Force to deal with the long-anticipated problem of IPv4 address exhaustion [4]. IPv6 is deliberate to replace IPv4. It clarify the processing of packets in routers by placing the responsibility for packet fragmentation into the end points [5]. The IPv6 subnet size is normalized by fixing the size of the host identifier portion of an address to 64 bits to facilitate an automatic mechanism for forming the host identifier from link layer addressing information. The model of the IPv6 address space implements a very different model philosophy than in IPv4, in which sub netting was used to upgrade the efficiency of utilization of the small address space [6].

Features of IPv6:

It Support source node and destination node addresses that are 128 bits (16 bytes) long.
It requires IPsec support.
In IPV6 the host is used to send packets but not routers.
It is used a link-local scope

a) Static routing

IPv6 static routing protocol is not much different from IPv4 static routing protocol, it is composed manually to define a route between two communication networks[7] In the dynamic routing protocols, static routing protocol does not renew automatically, instead of that, network administrator will need to re-configure if there is some change related to this static route[8].

The benefits of static routing are more secure and uses router's resource effectively. Static routing protocol uses less bandwidth and CPU's resource of router to observe the best route. However, the drawbacks are that it cannot re-configure automatically if it has any change in network topology. Moreover, static routing protocol does not have any algorithm to prevent loop in network. Because of that, it is normally used in a small network which needs only one route to Internet or to help securing a network [9].

b) Dynamic routing protocols

Dynamic routing protocols are used for routing purpose between routers and in which routers belonging to a network can be configured in similar routing protocol or dissimilar routing protocol [10]. For example, three routers in a network that is R1, R2 and R3. All three routers can be configured with routing protocols, such as R1 and R2 can be routed by OSPFV3 protocol while R2 and R3 can be routed by RIPng, however, a suggestion is all routers in same network should be configured in same routing protocol [11]. It assists network be more secure and consistent. Dynamic routing protocols are divided in two categories: distance vector routing protocol and link-state routing protocol. Distance vector routing protocol is move on routers to publicize its connected routes and learn new routes from its neighbours. In Distance vector routing protocol, the number of hops is used to observe the routing cost to reach from one end to another end [12].

V. ROUTING PROTOCOL COMPARISION

Protocol	RIPng	OSPFv3
convergence	Slow	Fast
Update timers	30 Seconds	Only when changes occur;
Default Metric	Hop count	Cost
Classless	No	Yes

Algorithm	Bellman-Ford	Dijkstra
Interior/Exterior	Interior	Interior
Type	Distance Vector	Link state
Updates	Full table	Only Changes
AD	120	110
Hop count Limit	15	None

VI. CONCLUSION

This paper deals with the all aspects of routing Protocol such as RIPng and OSPF V3 with IPv6. Before it lot of work has been done with ipv4. But this paper shows all the aspects of RIPng, OSPF V3 as what we have examined in this paper, it is clear that we may create and established the well-defined network by OSPF V3 and RIPng (IPV6) protocols rather than ipv4. Interior routing protocols like RIPng, and OSPF v3 are widely being used in the computer networking.

VII. FEATURE WORK

For future references, we will try to do more experiment to get better result for various kinds of routing with having IPV6 based protocols in GNS-3.The routing protocol is the preparation of the analysis is to determine the ratio of OSPFv3 and RIPng routing protocol on the IPv6 network based Packet Sending test, using the Routing Table Ping and Trace route commands in GNS3.

REFERENCES

[1] Abdulrahman, A. A. (2013). Performance Analysis and Comparison of Ad Hoc Routing Protocols AODV and OLSR on Video Conferencing using OPNET Simulator, Eastern Mediterranean University (EMU)-Doğu Akdeniz Üniversitesi (DAÜ).
[2] Vetriselvan, V., P. R. Patil, et al. (2014). "Survey on the RIP, OSPF, EIGRP Routing Protocols." International Journal of Computer Science and Information Technologies 5(2): 1058-1065.
[3] Imadali, S. (2015). Large scale addressing and routing mechanisms for highly mobile networks.
[4] Dlodlo, N., M. Mofolo, et al. (2015). Research Trends in Existing Technologies that are Building Blocks to the I nternet of Things. Innovations and Advances in Computing, Informatics, Systems Sciences, Networking and Engineering, Springer: 539-548.
[5] Fall, K. R. and W. R. Stevens (2011). TCP/IP illustrated, volume 1: The protocols, addison-Wesley
[6] Halcu, I., G. Stamatescu, et al. (2016). IPv6 Sensor Networks Modeling for Security and Communication Evaluation. Recent Advances in Systems Safety and Security, Springer: 241-259.
[7] Winter, T. (2012). "RPL: IPv6 routing protocol for low-power and lossy networks."
[8] Hoang, T. D. (2015). "Deployment IPv6 over IPv4 network infrastructure."
[9] Saputro, N., K. Akkaya, et al. (2012). "A survey of routing protocols for smart grid communications." Computer Networks 56(11): 2742-2771.
[10] Bhuiyan, M. and M. Haq (2015). An Efficient Approach of Converting an IPv4 Network to IPv6 Network through Dynamic Enhance Interior Gateway Routing Protocol, East West University.
[11] Chen, W., R. K. Guha, et al. (2011). "A survey and challenges in routing and data dissemination in vehicular ad hoc networks." Wireless Communications and Mobile Computing 11(7): 787-795.
[12] pompili, D. and I. F. Akyildiz (2009). "Overview of networking protocols for underwater wireless communications." IEEE Communications Magazine 47(1): 97-102.
[13] Hossain, M. A., M. M. Islam, et al. (2016). "Comparative Analysis of Two Prominent Routing Protocols in IPv6 Network: OSPFv3 & EIGRPv6." International Journal of Computer (IJC) 22(1): 79-89.
[14] Teare, D. (2010). Implementing Cisco IP routing (ROUTE) foundation learning guide.
[15] Kantola, R. (2011). Equal Cost Multipath Routing in IP Networks, Aalto University.
[16] Paul, S. (2012). Multicasting on the Internet and its Applications, Springer Science & Business Media.
[17] Goyal, M., M. Soperi, et al. (2012). "Improving convergence speed and scalability in OSPF: a survey." IEEE Communications Surveys & Tutorials 14(2): 443-463
[18] Lidholm, G. and M. Netterberg (2012). "Evaluating an IPv4 and IPv6 Network."
[19] Davenport, J. (2009). "Notes on "TCP/IP Illustrated" Version 10 (with changes noted)."
[20] Chowdhury, D. D. (2012). Unified IP internetworking, Springer Science & Business Media
[21] Li, Q., J. Tatuya, et al. (2010). IPv6 advanced protocols implementation, Morgan Kaufmann.

