Redistribution of Dynamic Routing Protocol in Ipv6 Network and their Analysis

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Abstract - ***Dynamic routing**, also called **adaptive routing**, describes the capability of a system, through which routes are characterized by their destination. This method is used in data networking to describe the capability of a network to 'route around' damage, such as loss of a node or a connection between nodes, so long as other path choices are available. The protocols used to achieve this are **OSPF**, **EIGRP** and **IS-IS**. A routing instance is a collection of routing tables, interfaces, and routing protocol parameters. The set of interfaces belongs to the routing tables, and the routing protocol parameters control the information in the routing tables. Routing protocol parameters and options control the information in the routing tables and analyses the performance metrics of the interconnected routers. The project deals with an approach in which the outcome of deployment of the various dynamic protocols on the ipv6 network is explored on the variation of parameters such as **packet loss**, **convergence time**, **throughput** and **latency**. Results manifest that the proposed approach yields better performance improvement over the existing strategies.*

1. INTRODUCTION

Even from the moment of the creation of the first computers, the need of their inter-linkage became a major interest in order to share the outputs obtained after the execution of various tasks they were originally programmed for. As the time passed by, some of the manufacturers began to develop their own systems of interlining for their computers. Afterwards, even though the necessity of Inter-linkage became a major issue among the users, this matter was still unable to be solved due to the diverse protocols that were used in order to intercommunicate in various geographical areas. Internet Protocol (IP) is the best-known Layer 3 or Network layer protocol. Presently two versions of IP are assigned by Internet Assigned Number Authority (IANA). The designers of IPv4 did not envision the explosive growth of its use. 4.3 billion addresses seemed more than enough. The IPv4 protocol is not particularly efficient in its use of the available space, with many addresses being wasted. The internet authorities started to predict address exhaustion in the late 1980s and IPv6 was developed in the 1990s as the long-term solution. It is possible to exchange the routing information between routers through the routing protocols. Routing protocols allow routers to share information about remote networks dynamically and add this information to their routing tables automatically. To recognize the best path to each network routing protocols are used and added to the routing table. The fundamental advantage of using dynamic routing protocol is that whenever there is topology change routers exchange routing information which permits routers to certainly learn about new networks as well as to find alternate paths if there is a link- failure to a running network. In comparison with static routing, less administrative overhead is required in dynamic routing protocols. However, the expense of using dynamic routing protocols is dedicating part of a router's resources for protocol operation including CPU time and network link bandwidth. Besides, to meet the demands of changing network requirements dynamic routing protocols have evolved over several years. Though several organizations have shifted towards more recent routing protocols such as Enhanced Interior Gateway Routing Protocol (EIGRP) and Open Shortest Path First (OSPF), many of the earlier routing protocols, such as intermediate system-intermediate system(IS-IS), are still in use today.

1.1 Related Works

Abdul Kadhim analyzed the performance of EIGRP, OSPF and IS-IS dynamic routing protocols in terms of the network convergence activity and time by using the GNS3simulator. He showed that OSPF has faster convergence time than EIGRP, and OSPF convergence activity is much more than IS-IS, therefore, OSPF can react more quickly in case of link failure [7]. Kodzo et al.

simulated EIGRP, OSPF and their combination in GNS3. They analyzed the performance of EIGRP, OSPF and EIGRP_OSPF for real time application. They found that EIGRP_OSPF has less end to end delay, packet delay variation and packet loss for real application than both EIGRP and OSPF, and the combination of EIGRP and OSPF has maximum throughput than EIGRP and OSPF [8]. Mardedi and Rosidi presented the analysis and comparison of performance between EIGRP and OSPF based on Cisco Packet Tracer 6.0.1. They found that EIGRP is better than OSPF in terms of delay and convergence time [9]. Whitfield and Zhu compared the performance of OSPFv3 and EIGRPv6 by using real Cisco hardware in experiments. They noticed that EIGPRv6 outperforms OSPFv3 in terms of start-up and re- convergence speed but EIGRPv6 authentication mechanism negatively affected its performance, in contrast IP Security (IPSec) in OSPFv3 improved its performance [10]. Dey et al. presented a simulation based on Cisco Packet Tracer for dynamic routing protocols and redistribution among the protocols [11]. Patel et al analyzed the performance of OSPF and EIGRP routing protocols in terms of route summarization and route redistribution in Graphical Network Simulator (GNS3) [12]. Farhangi et al. presented the GNS3 simulation based of a combination of EIGRP, OSPF and IS-IS routing protocols in a semi-mesh topology. A simulation showed that the performance of the mixed three protocols EIGRP, OSPF and IS-IS in terms of end to end delay, packet delay variation, Voice Jitter and Link throughput outperforms the other two combination of the same three routing protocols [13]. Jalali et al. evaluated the performance of IS-IS, OSPF, and EIGRP in terms of convergence, throughput, queuing delay, end to end delay and utilization by using the GNS3simulator. They found that EIGRP outperforms other routing protocols in their study [14]. Ashoor presented a survey in distance vector and link state dynamic routing protocols. She analyzed the performance of distance vector and link state algorithms in a mesh network [15]. Kuradusenge and Hanyuwimfura presented a comparative analysis of EIGRP configuration on IPv4 and IPv6 by modifying its metric of different values of composite metric to path selection [16]. Kaur and Mir demonstrated a comparative performance analysis of EIGRP, RIP and OSPF by using the GNS3 simulator. They concluded that EIGRP is better than OSPF and IS-IS in terms of network convergence, throughput, utilization, queuing delay, HTTP page response and email upload response time [17]. Singh et al. configured EIGRP on IPv6 by using Cisco Packet Tracer simulator and evaluated the performance of EIGRP in IPv6 for small network [18]. Pavani et al. surveyed the performance of dynamic routing protocols in terms of router updates, link utilization and end to end delay [19].

1.2 Existing system

Network plays a vital role that helps to share information and resources and implement centralized management system. To enable the network features, all organizations and ISPs have design and implemented IPv4 network to share their voice/data/video applications. IP is internet protocol and works on third layer of OSI model and forward packet from one node to another. IPv4 enables encapsulation and add more information that helps for efficient transmission of data.IPv4 address is 32bit address and have maximum of 2^32combination address.IPv4 address configured in devices either manually or automatically(DHCP).Used subnetting, VLSM and supernetting ,concepts to increase, Network performance. IP enables encapsulation and add information for error control and fragmentation that support to transport the data error free. Router has memory and stores routing more information due to expansion of network. NAT is used to better utilization of IPv4 address. Used ACL, firewall and check point to ensure the security for data in IPV4 network.IPv4 network supports mobility butt generates O/H information.IPv4 network supports dynamic routing by enabling Protocol such as EIGRP, OSPF, and IS-IS.

1.2.1 Limitations of Existing System

Existing system has the following limitations:

- Scarcity of Addresses.
- More latency.
- Less Security.
- Auto Configuration is difficult.
- Quality of Service.

1.3 Proposed system

Routers within one routing instance typically run the same routing protocol to fully share reachability information and by default do not exchange routing information with routers in other routing instances. For instance, Routers in the OSPF instance do not have visibility of the addresses and subnet prefixes in the EIGRP instance and vice versa. Similarly, Routers in the EIGRP instance do not have visibility of the addresses and subnet prefixes in the IS-IS instance and vice versa. To allow the exchange of routing information between different routing instances, we use a concept called as Route redistribution. Route Redistribution has become an integral part of IP network design. A router that runs multiple routing protocols actually instantiates a separate routing process for each protocol. Each instantiated routing process has its own Routing Information Base (RIB) to store routing information. And the router does not by default redistribute routes among these processes. We have explicitly configured the system according to the scope and measured the overall performance of the system. Parameters that will describe good functioning of a system like Latency, Throughput, Packet loss and Convergence time are measured.

1.3.1 Advantages of Proposed System

The advantages of proposed system are:

- Provides Auto configuration.
- Direct Addressing.
- Provides Interoperability.
- Improved Security features.

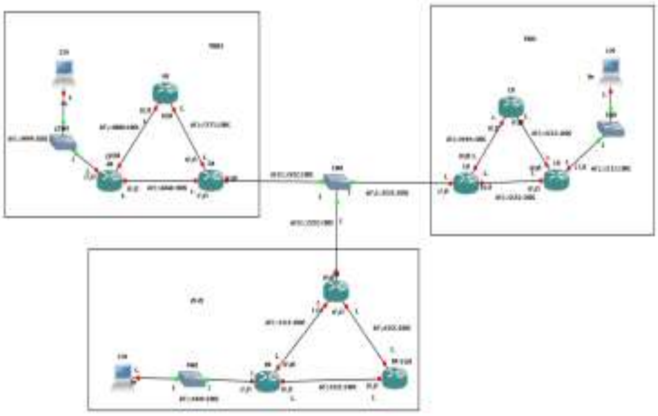


Fig-1: TOPOLOGY OF THE PROPOSED SYSTEM

2. ENABLING IPv6 ADDRESSES, CONFIGURATION & RE- DISTRIBUTION

```
R7#enable
R7#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R7(config)#router isis area2
R7(config-router)#net 49.0001.0000.0000.0006.00
R7(config-router)#exit
R7(config)#int f0/0
R7(config-if)#ipv6 add 2001:1111::1/56
R7(config-if)#exit
R7(config)#int f0/0
R7(config-if)#ipv6 add 2001:5555::3/56
R7(config-if)#ipv6 router isis area 2
```

Fig-2: Enabling IS-IS Protocol

```
R10#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R10(config)#ipv6 unicast-routing
R10(config)#ipv6 router ospf 100
R10(config-rtr)#router-id 10.10.10.10
R10(config-rtr)#exit
R10(config)#int f1/0
R10(config-if)#ipv6 ospf 100 area 0
R10(config-if)#exit
R10(config)#
*Mar 26 16:01:09.023: %OSPFv3-5-ADJCHG: Process 100, Nbr 9.9.9.9 on FastEthernet1/0
R10(config)#exit
R10#
*Mar 26 16:01:12.555: %SYS-5-CONFIG_I: Configured from console by console
R10#wr
Warning: Attempting to overwrite an NVRAM configuration previously written
by a different version of the system image.
Overwrite the previous NVRAM configuration?[confirm]
Building configuration...
[OK]
```

Fig-3: Enabling OSPF Protocol

```
R2#config t
Enter configuration commands, one per line.  End with CNTL/Z.
R2(config)#ipv6 unicast-routing
R2(config)#int f0/0
R2(config-if)#ipv6 enable
R2(config-if)#ipv6 eigrp 1
R2(config-if)#ipv6 router eigrp 1
R2(config-rtr)#router-id 2.2.2.2
R2(config-rtr)#exit
R2(config)#exit
R2#wr
Building configuration...
*Mar 26 15:13:45.663: %SYS-5-CONFIG_I: Configured from console by console
[OK]
```

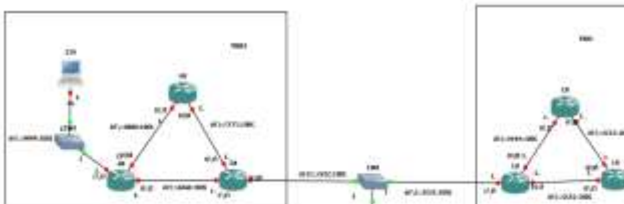
Fig-4: Enabling EIGRP Protocol

2.1 Redistribution between IS-IS and EIGRP:

This module is associated with establishing connection between two different protocols, IS-IS and OSPF.

```
router isis
 net 49.0001.0000.0000.0006.00
 !
 address-family ipv6
  redistribute eigrp 1 metric 1 include-connected
 exit-address-family
!
router isis area2
 net 49.0001.0000.0000.0006.00
!
ip forward-protocol nd
!
!
no ip http server
no ip http secure-server
!
ipv6 router eigrp 1
 eigrp router-id 7.7.7.7
 redistribute isis level-1-2 metric 1 1 1 1 1 include-connected
!
!
```

Fig-5: Packet transmission between IS-IS and EIGRP



2.2 Redistribution between OSPF and EIGRP:

This module is associated with establishing connection between two different protocols, OSPF and EIGRP.

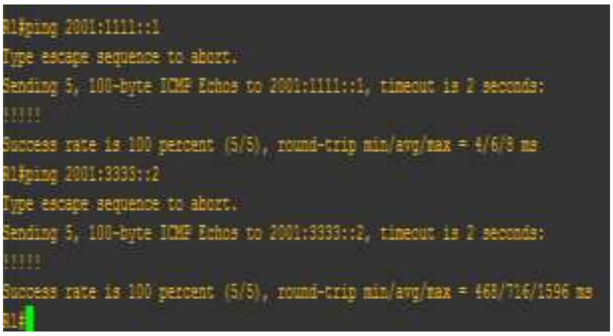


Fig-6: Packet transmission between OSPF and EIGRP

2.3 Redistribution between IS-IS and OSPF:

This module is associated with establishing connection between two different protocols, EIGRP and OSPF.

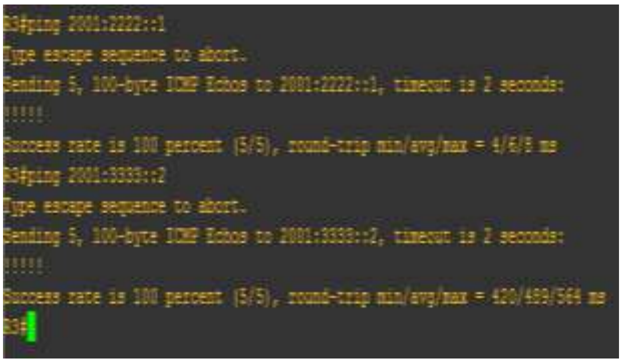


Fig-7: Packet transmission between IS-IS and OSPF

Fig-8: Performance Evaluation

IS-IS NETWORK:

Fig-9: Tracing path of convergence (IS-IS)

First, a formal definition of routing metrics and two important properties of boundedness and monotonicity are identified. We show that these two properties are both necessary and sufficient for a routing metric to be maximizing in any network. It shows how to combine two (or more) routing metrics into a single composite metric such that if the original metrics are both bounded and monotonic, then the composite metric is also bounded and monotonic. It shows that the composite routing metric used in the Inter-Gateway Routing Protocol (IGRP) is not maximizable and Enhanced IGRP (EIGRP) does not behave as expected for non-monotonic metrics. It also shows that a technique for scalable link-state routing does not work correctly when applied to composite metrics. A common theme throughout our paper is that the intuitions generated by using distance metrics to produce shortest paths do not carry over to other routing metrics.

OSPF NETWORK

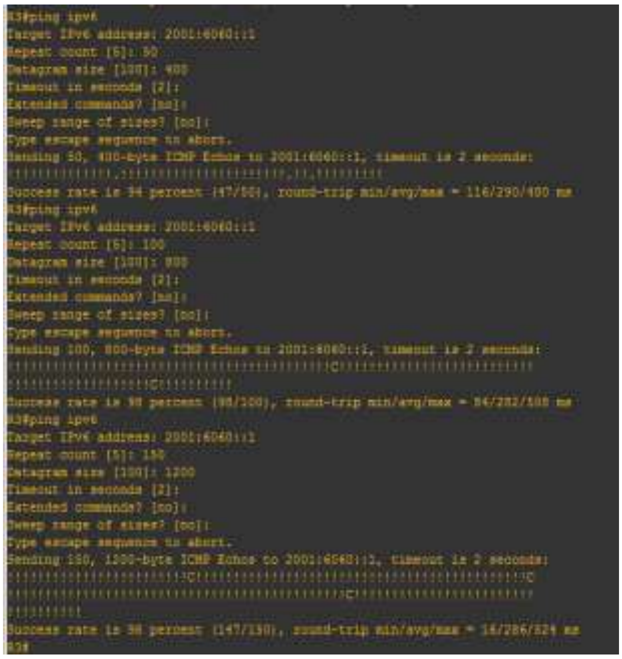


Fig-10: Packet transfer with varying packet size and datagram size (OSPF)

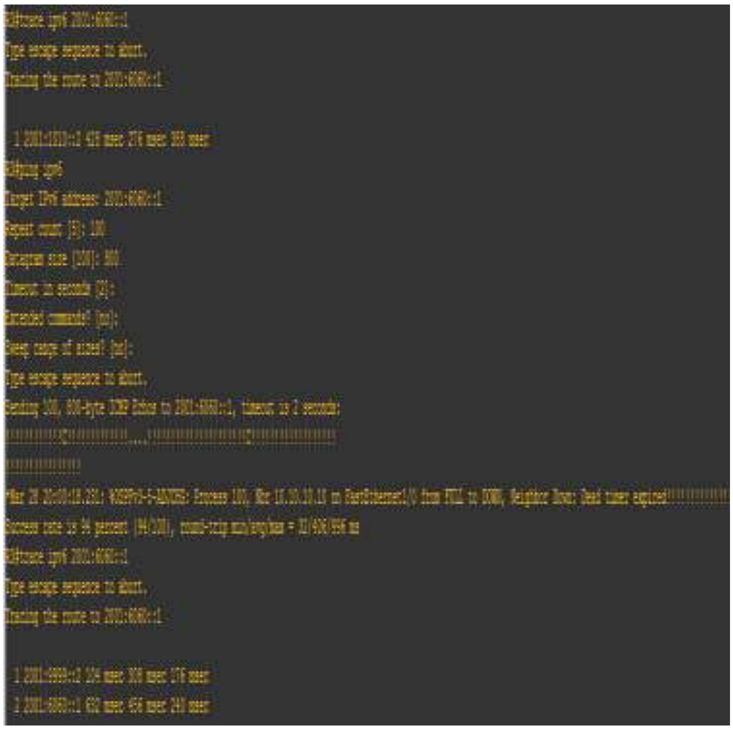


Fig-11: Tracing path of convergence (OSPF)

EIGRP NETWORK

Fig-12: Packet transfer with varying packet size and datagram size (EIGRP)

Dynamic routing has better scalability, robustness, and convergence. However, the cost of these added benefits include more complexity and some overhead -bandwidth that is used by the routing protocol for its own administration and route redistribution allows routes from one routing protocol to be advertised into another routing protocol.

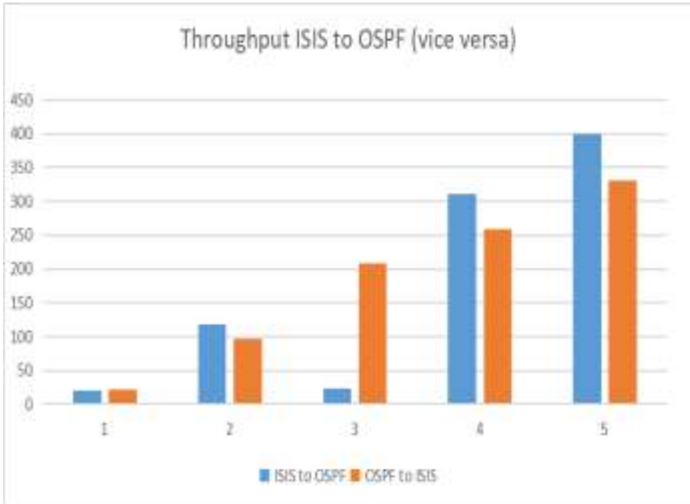


Chart-1: OSPF-IS-IS PERFORMANCE EVALUATION – THROUGHPUT GRAPH

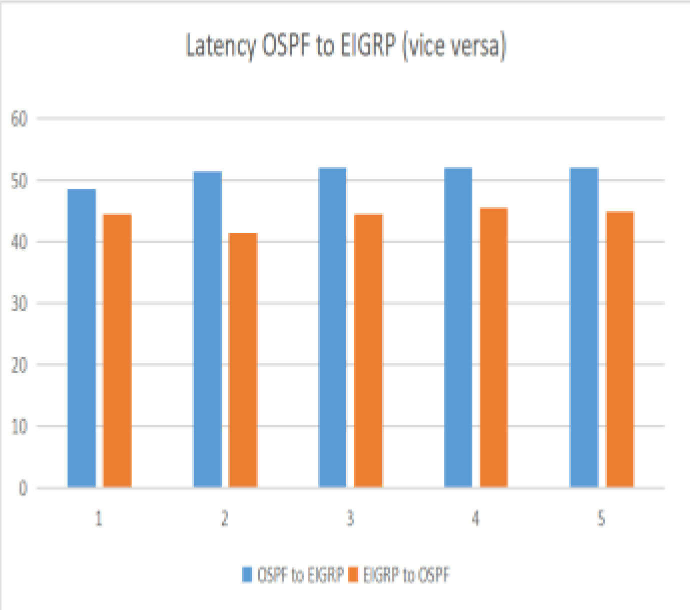


Chart-2: OSPF-EIGRP PERFORMANCE EVALUATION – LATENCY GRAPH

GNS3 allows the emulation of Cisco on our Windows or Linux based Computer. Emulation is possible for a long list of router platforms and PIX Firewalls. GNS3 is an invaluable tool for preparing for Cisco certifications such as CCNA and CCNP. There are a number of router simulators on the market, but they are limited to the commands that the developer chooses to include. Almost always there are commands or parameters that are not supported when working on a practice.

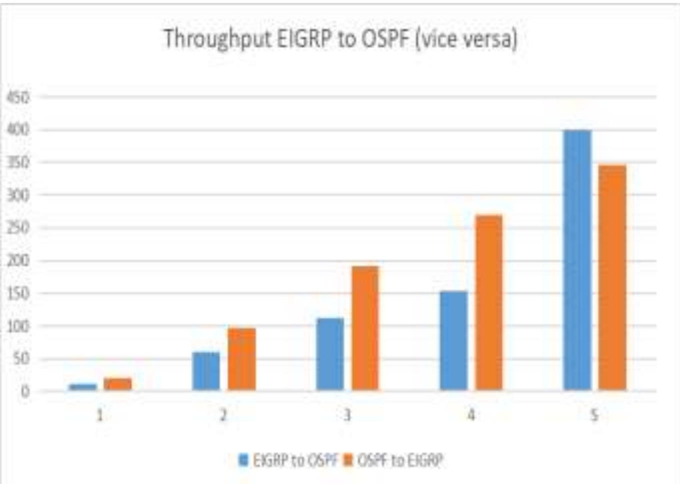


Chart-3: OSPF-EIGRP PERFORMANCE EVALUATION – THROUGHPUT GRAPH

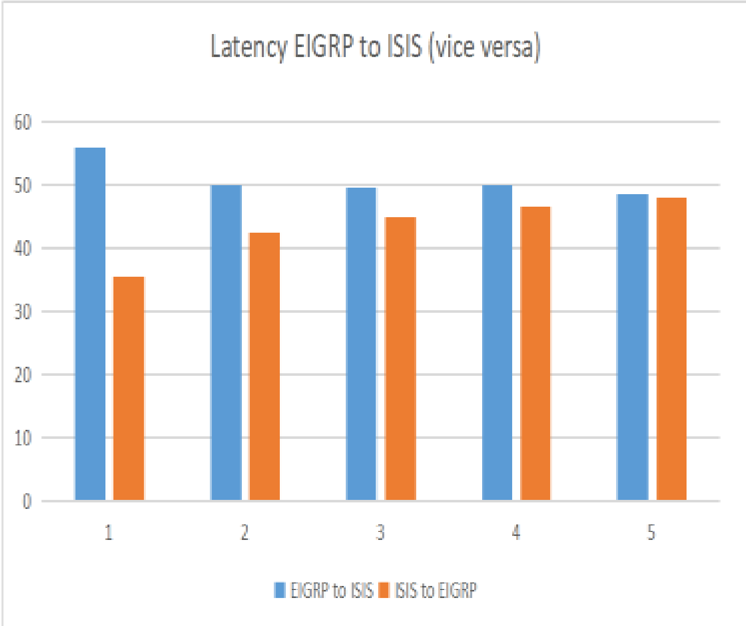


Chart-4: EIGRP-IS-IS PERFORMANCE EVALUATION – LATENCY GRAPH

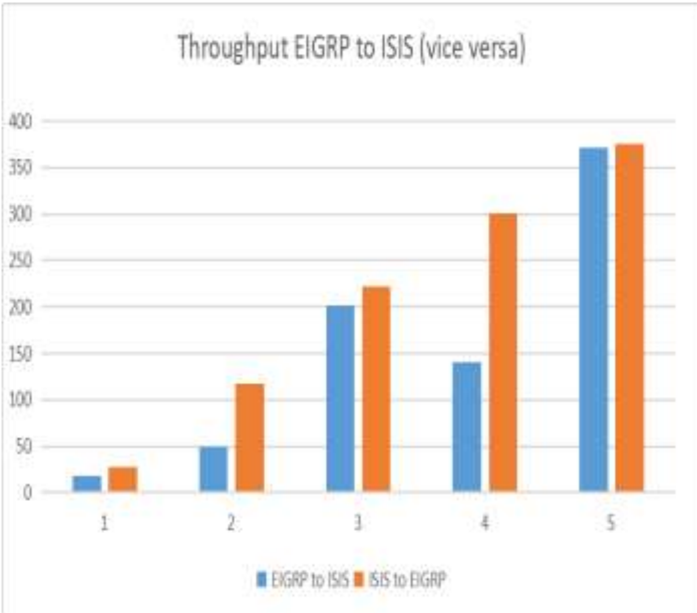


Chart-5: EIGRP-IS-IS PERFORMANCE EVALUATION – THROUGHPUT GRAPH

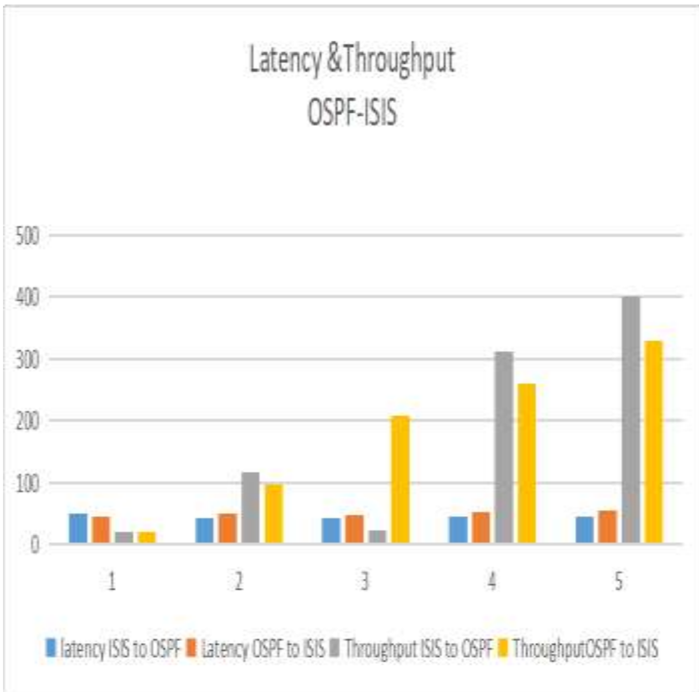


Chart-6: OSPF-IS-IS PERFORMANCE EVALUATION – THROUGHPUT GRAPH

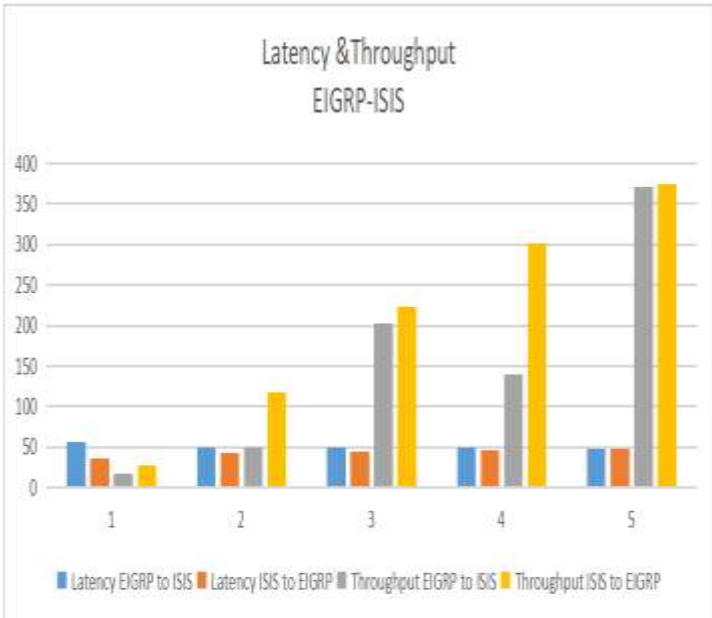


Chart-7: EIGRP-IS-IS PERFORMANCE EVALUATION – LATENCY & THROUGHPUT GRAPH

3. RESULT & DISCUSSION

This project deals with the option to interconnect routing instances that overcomes the deficiencies of current approaches and data transmission in IPV6 configured network using the user friendly software GNS3. The attributes from the different routing instances are globally ordered in a way that can be parameterized by a network operator. In the proposed form of interconnection, correctness is built in, resiliency is possible, and the end-to-end paths traversed by data packets can conform to performance criteria. Through our survey, we can conclude that this approach in ipv6 network is highly secured and also it has high address space which enables an individual to use approximately 3.6 million IP address. In this approach, the network was created using Dynamic routing Interior gateway protocols like RIP, OSPF and EIGRP. In near future, another protocol like IS-IS will be implemented. The scope, performance and routing instance of each protocols will be studied and measured.

REFERENCES

[1] Cisco Systems, San Jose, CA, USA, "Redistributing routing protocols," Doc. ID: 8606, Mar. 2012.

[2] G. Malkin, "RIP version 2," RFC 2453, Nov. 1998.

[3] J. T. Moy, "OSPF version 2," RFC 2328, Apr. 1998.

[4] Cisco Systems, San Jose, CA, USA, "OSPF redistribution among different OSPF processes," Doc. ID: 4170, Jan. 2006.

[5] Cisco Systems, San Jose, CA, USA, "Route selection in Cisco routers," Doc. ID: 8651, Jan. 2008.

[6] I. Pepelnjak, EIGRP Network Design Solutions: The Definitive Resource for EIGRP Design, Deployment, and Operation.. San Jose,CA, USA: Cisco Syst., 2000.

[7] F. Le, G. G. Xie, and H. Zhang, "Understanding route redistribution," in Proc. ICNP, Oct. 2007, pp. 81–92.

[8] F. Le and G. G. Xie, "On guidelines for safe route redistributions," in Proc. SIGCOMM Workshop Internet Netw. Manage., Aug. 2007, pp. 274–279.

[9] J. L. Sobrinho, "An algebraic theory of dynamic network routing," IEEE/ACM Trans. Netw., vol. 13, no. 5, pp. 1160–1173, Oct. 2005.

[10] J. L. Sobrinho and T. Quelhas, "A theory for the connectivity discovered by routing protocols," IEEE/ACM Trans. Netw., vol. 20, no. 3, pp. 677–689, Jun. 2012.

[11] M. G. Gouda and M. Schneider, "Maximizable routing metrics," IEEE/ACM Trans. Netw., vol. 11, no. 4, pp. 663–675, Aug. 2003.

[12] L. Lamport, “An assertional correctness proof of a distributed algorithm,” Sci. Comput. Program., vol. 2, no. 3, pp. 175–206, Dec. 1982.

[13] T. Thomas, D. Pavlichek, L. Dwyer, R. Chowbay, W. Downing, and J. Sonderegger, Juniper Networks Reference Guide: JUNOSRouting, Configuration, and Architecture. Reading, MA, USA: Addison-Wesley, 2002.

[14] R. Mahajan, D. Wetherall, and T. Anderson, “Mutually controlled routing with independent ISPs,” in Proc. 4th USENIX Symp. Netw.Syst. Design Implement., 2007, pp. 355–368.

[15] D. A. Maltz, G. G. Xie, J. Zhan, H. Zhang, G. Hjálmtýsson, and A. Greenberg, “Routing design in operational networks: A look from the inside,” in Proc. SIGCOMM, 2004, pp. 27–40.

[16] T. Benson, A. Akella, and D. Maltz, “Unraveling the complexity of network management,” in Proc. 6th USENIX Symp. Netw. Syst. Design Implement., 2009, pp. 335–348.

[17] M. G. Gouda and M. Schneider, “Maximizable routing metrics,” IEEE/ACM Trans. Netw., vol. 11, no. 4, pp. 663–675, Aug. 2003.

M. Pavani, M. Sri Lakshmi and Dr. S. Prem Kumar, "A Review on the Dynamic Routing Protocols in TCP/IP", The International Journal Of Science & Technoledge, vol. 2, no. 5, pp.227-234, May, 2014

P.Priyadhivya and S.Vanitha, "PERFORMANCE ANALYSIS OF INTERIOR GATEWAY PROTOCOLS", International Journal of Advanced Technology in Engineering and Science, vol. 3, No. 2, pp. 693-700 ,February, 2015.

Shah.A and Waqas J.Rana, "Performance Analysis of RIP and OSPF in Network Using OPNET", IJCSI. International Journal of Computer Science Issues, vol. 10, Issue 6, No 2, pp. 256-265, November, 2013.

S. Vissicchio, L. Vanbever, L. Cittadini, G. G. Xie and O. Bonaventure, "Safe routing reconfigurations with route redistribution", IEEE INFOCOM 2014 - IEEE Conference on Computer Communications, Toronto, 2014, pp. 199-207..
IKram Ud Din, Saeed Mahfooz and Muhammad Adnan, "Analysis of the Routing Protocols in Real Time Transmission: A Comparative Study", Global Journal of Computer Science and Technology, vol. 10, no. 5, pp. 18-22, July, 2010.

Jagmeet Kaur and Er. Prabhdeep Singh, "COMPARATIVE STUDY OF OSPFV3, IS-IS AND OSPFV3_IS-IS PROTOCOLS USING OPNET", IJARCET. International Journal of Advanced Research in Computer Engineering & Technology, vol. 3, no. 8, pp. 2656-2662, August, 2014. Xin Sun, Sanjay G. Rao, and Geoffrey G. Xie. "Modeling complexity of enterprise routing design." In Proceedings of the 8th international conference on Emerging networking experiments and technologies, Nice, 2012, pp. 85-96.

David A. Maltz, Geoffrey Xie, Jibin Zhan, Hui Zhang, Gísli Hjálmtýsson, and Albert Greenberg, "Routing design in operational networks: a look from the inside", In Proceedings of the 2004 conference on Applications, technologies, architectures, and protocols for computer communications, Portland, 2004, pp. 27-40.

Cisco, Redistributing Routing Protocols, Mar, 2012.
Cisco, OSPF Design Guide, Aug, 2005.

Cisco, Intermediate System-to-IntermediateSystem Protocol.
Mustafa Abdulkadhim, "Routing Protocols Convergence Activity and Protocols Related Traffic Simulation With It's Impact on the Network", IJCSET. International Journal of Computer Science Engineering and Technology, vol. 5, no. 3, pp. 40-43, March, 2015.

Anibrika Bright Selorm Kodzo, Mustapha Adamu Mohammed, Ashigbi Franklin Degadzor and Dr. Michael Asante, "Routing Protocol (EIGRP) Over Open Shortest Path First (OSPF) Protocol with Opnet", IJACSA. International Journal of Advanced Computer Science and Applications, vol. 7, no. 5, pp.77-82 , 2016

Lalu Zazuli Azhar Mardedi and Abidarin Rosidi, "Developing Computer Network Based on EIGRP Performance Comparison and OSPF", IJACSA. International Journal of Advanced Computer Science and Applications, vol. 6, no. 9, pp. 80-86, 2015.

Richard John Whitfield and Shao Ying Zhu,"A Comparison of OSPFv3 and EIGRPv6 in a Small IPv6 Enterprise Network", IJACSA. International Journal of Advanced Computer Science and Applications, vol. 6, no. 1, pp.162-167 , 2015.

G. K. Dey, M. M. Ahmed and K. T. Ahmmed, "Performance analysis and redistribution among RIPv2, EIGRP & OSPF Routing Protocol", International Conference on Computer and Information Engineering, Rajshahi, 2015, pp. 21-24.

Haresh N. Patel and Prof.Rashmi Pandey, "Enhanced Analysis on Route Summarization and Route Redistribution with OSPF vs. EIGRP Protocols Using GNS-3 Simulation", IJCTA. Int.J.Computer Technology & Applications, vol. 5, no. 5, pp. 1682-1689, ,Sept-Oct, 2014.

S. Farhangi, A. Rostami and S. Golmohammadi, "Performance Comparison of Mixed Protocols Based on EIGRP, IS-IS and OSPF for Real-time Applications", Middle-East Journal of Scientific Research, vol. 12 , no. 11, pp. 1502-1508, 2012.
Syed Yasir Jalali, Sufyan Wani and Majid Derwesh, "Qualitative Analysis and Performance Evaluation of RIP, IGRP, OSPF and EGRP Using OPNET™", Advance in Electronic and Electric Engineering, vol. 4, no. 4, pp. 389-396, 2014.

Asmaa Shaker Ashoor, "Performance Analysis Between Distance Vector Algorithm (DVA) & Link State Algorithm (LSA) For Routing Network", International Jiurnal of Scientific & Technology Research, vol. 4, no. 02, pp. 101-105, February, 2015.

Martin Kuradusenge and Damien Hanyuwimfura, "Operation and Comparative Performance Analysis of Enhanced Interior Routing Protocol (EIGRP) over IPv4 and IPv6 Networks", International Journal of Advanced Research in Computer Science and Software Engineering, vol. 6, no. 7, pp.174-182 , July, 2016.

Sukhkirandeep Kaur and Roohie Naaz Mir, "Performance Analysis of Interior Gateway Protocols", Advanced Research in Electrical and Electronic Engineering , vol. 1, no. 5, pp. 59-63, 2014.

Kuwar Pratap Singh, P. K. Gupta and G. Singh, "Performance Evaluation of Enhanced Interior Gateway Routing Protocol in IPv6 Network", International Journal of Computer Applications ,vol. 70, No.5, pp. 42-47, May, 2013.