# Performance Evaluation Of OSPFv3 Routing Protocol On IPv6 Heterogeneous Network

**Ms.Jacqulin Veda Jancy. S, Sujit Kumar, Arup Kumar Sahoo, Varun Kumar**

SRM Institute of Science and Technology, Ramapuram, Chennai-600089

***Abstract:*** **IPv6 also known as next generation protocol has abundant address space and various advance features to meet varying demands of present and future networks. Once migrated to IPv6, OSPFv3 an IPv6 based Routing Protocol will be first choice among various users to replace its predecessor IPv4 based OSPv2 Routing Protocol. Internet protocol (IP) traffic follows rules established by routing protocols, such as open shortest path first (OSPF). Each router computes shortest paths using weights assigned by the network operator, and creates destination tables used to direct each IP packet to the next router on the path to its final destination. Furthermore, the routing protocol is used to establish procedures to be taken in case of a failure in the network. In this paper, a new genetic algorithm for designing a network with minimal total link capacity is introduced which is necessary to route without overload in case of any single edge or node failure. The real time environment approaches a lot of latency, propagation & process delay which reduces the throughput count and reliability. In order to enhance the reliability, the proposed system will route the data packets dynamically in between the networks to ensure the best delivery and quality maintenance of data packets.**

***Keywords*:** **IPv6; OSPFv3; Routing Protocol; convergence; area; link; network.**

NOMENCLATURE

| | |
|---|---|
| OSPFv2 | Open Shortest Path First Version 2 |
| OSPFv3 | Open Shortest Path First Version 3 |
| IPv6 | Internet Protocol Version 6 |
| IS-IS | Intermediate System to Intermediate System |
| RIP | Routing Information Protocol |
| RIPng | Routing Information Protocol Next Generation |
| DR | Designated router |
| BDR | Backup designated router |
| GNS | Graphical Network Simulator |
| ABR | Area Border Router |
| DRP | Dynamic routing protocol |
| ASBR | Autonomous system border router |
| GNS | Graphical Network Simulator |
| VPCS | Virtual PC Simulator. |

## I. Introduction

As number of devices which need internet access increase day by day, which results in tremendous use of limited IPv4 address space, thus the transition to IPv6 will happen very soon, moreover IPv6 routing protocols are not tested much compared to IPv4 routing protocols. Various researchers have analyzed that OSPFv3 protocol has various advantages like open standard, better overall performance, low packet loss ratio, low convergence time, less cost of transmission and better throughput, less bandwidth utilization etc. Thus OSPFv3 will be given first priority, among other IPv6 routing protocols, because of its many unique routing features like small header; same interface can be configured with multiple addresses, uses services of IPSec, no need of network mask to from adjacency, supports unicast, multicast and anycast. The main reason for measuring the performance of OSPFv3 Routing Protocol is to analyzed various parameters and features which can be improved to increase and enhance the performance of OPSFv3 routing protocol and overcome any bottle neck parameter which is trying to degrade the performance of OSPFv3 routing protocol. Thus the main objective is to make OSPFv3 routing protocol to take advantage and get benefited from various new, unique, improved and advanced features of IPv6 protocol.

## II. RELATED WORK

Implementing OSPFv3, performance analysis of various routing protocols and comparisons of Ipv4 and Ipv6 has been studied and analyzed by various researchers. OSPF has low packet loss ratio and reaches to convergence faster when compared with RIP, hop limit of 15 in RIP, limits the size of the network and has slow convergence. RIP is quick in small or medium sized networks, has minimum link utilization and minimum overhead whereas OSPF has least cost of transmission and maximum throughput[1]. There is no authentication feature in OSPF header, as it takes the advantage of authentication of IPv6 and doesn't require network mask to from adjacency, also hello packet sent by OSPFv3 has low overhead and link state update traffic is lower when compared with OSPFv2[2]. OSPFv3 has better performance in jitter and end-to-end delay, whereas IS-IS has better performance in video end-to-end delay also in future, research work can be conducted on other servers like remote login, telnet, database query response time and security analysis can be done for both ospfv3 and IS-IS[3]. Overall performance of OSPFv3 is better than RIPng when comparing the performance of OSPF and RIP individually. Once migrated to IPv6, OSPFv3 will be main routing protocol to be used because of its various unique features and several advantages. EIGRP has smaller packet size, sends smaller number of packets, and has low packet loss when compared to OSPF, but Migrating to Ipv6 is needed if network address translation needs to be extended, address space is exhausted, IPV6 applications need to be configured, end-to-end security is needed, hardware and applications reach end of their life cycle[4]. As the size of internet is very large thus transition to Ipv6 at a time is not possible because of large no of Ipv4 users; also it is very difficult for various organizations to tolerate downtime even for a second as they are totally dependent on the internet for various day to day activities. As IPv6 deployment is increasing very much on day-to-day basis, depending on type of networks and geographic region. Performance of OSPF is very much as compared to RIP in throughput and delay of packets in various networks of varying sizes[5]. There is a problem of heterogeneous traversing and interconnection while shifting to Ipv6, also introduces the principles of various alternatives in the form of various tunneling and transition technique. OSPF reaches to convergence more quickly as compared to RIP[6]. By configuring stub-areas and using the technique of route summarization, the size of data base and processing overhead can be reduced tremendously to permit large networks to be configured with less powerful routers further to reduce the problem of frequent routing meltdowns in multiple and continuous topology change . The analysis of routing table, metric, packet loss, shortest route, and packet is observed[7]..

When transition to IPv6 occurs, OSPFv3 will be one of the most widely used protocol. Observed refreshed LSA rates were as expected, the refresh time of various routers was intact with predicted behavior of the internetwork operating system versions, and also LSAs indicating topology changes were mainly due to external factors[8].

## III. RESEARCH METHODOLOGY

Among the available methodologies , a lot of research papers published in various international journals related to the research topic have been searched and referred .

FIG1.0


The systematic literature review refer Fig 1.0 was conducted as: Planning, Conducting and Reporting. In the planning phase, the main objective of the review is discussed, and the review methodology is identified. In the conducting phase, primary studies are conducted, the quality of study is defined, data is collected and analyzed.Finally, in the reporting stage, review report is presented by filtering many research papers. The research process will start with selecting the research topic, literature review, selecting the research tool, designing IPv6 network, implementing OSPFv3 routing protocol in IPv6 network, measuring the performance of various parameters like bandwidth, delay, convergence, jitter etc, and then finally doing the comparisons and need for improvement[10].

## IV. EXISTING SYSTEM

The Existing system of single area network comprises of only one area. The interconnected devices are assigned to a single area by using the DRP OSPFv3.Single area network is an example of LAN which consists of DR,BDR and DRother.

DR possesses the highest priority followed by BDR and then DRother. Data packets is updated first to DR then to BDR and then forwarded to the other routers.

Consider the figure1.1 shown below.All the routers are connected by broadcast connection. Data is being sent form vpcs[4]-source to vpcs[1]-destination via the switches which is a single path. DR has been assigned according to the priority value given to the router.The second highest priority is given to BDR.Router R2 has been assigned as DR which is far from the source.If any updation is done in the network the convergence time, so it leads to packet loss.

In figure 1.2, the routers are connected by point to point connection. The whole network comes under a single area but the router senses multiple routing path in the network so the router takes time to select the proper routing path to the destination by taking into account the shortest path and the metric(cost). The metric depends on the interfaces. Gigabitethernet offers 1000 mbps transmission speed followed by fastethernet 10 mbps, Ethernet offers 1 mbps and serial 64kbps.Data is being transmitted from VPCS[1] to VPCS[4] which has multiple paths.The shortest path will be determined first to route the packet.When the shortest link fails then the next shortest path is selected by the router.During failure of the path the packet loss is noted down from VPCS and simultaneously the convergence time is noted from Wireshark.



 

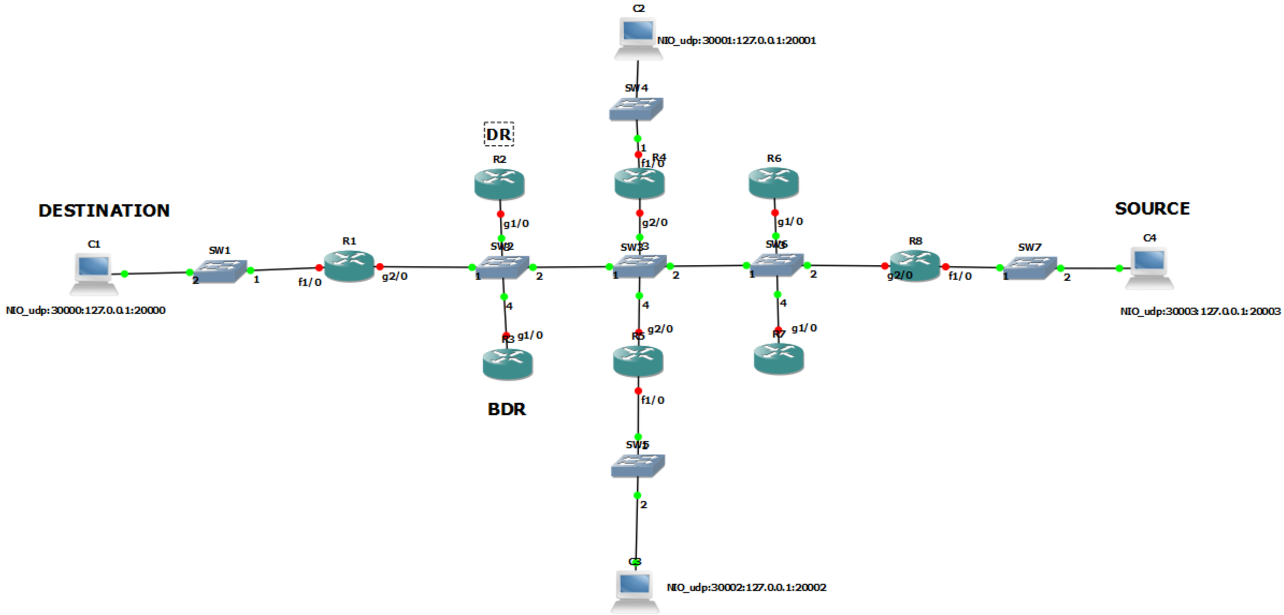
DESTINATION
SOURCE
DR
BDR
C1
C2
C4
SW1
SW4
SW7
R1
R2
R6
R8
NIO_udp:30000:127.0.0.1:20000
NIO_udp:30001:127.0.0.1:20001
NIO_udp:30002:127.0.0.1:20002
NIO_udp:30003:127.0.0.1:20003

FIG 1.1

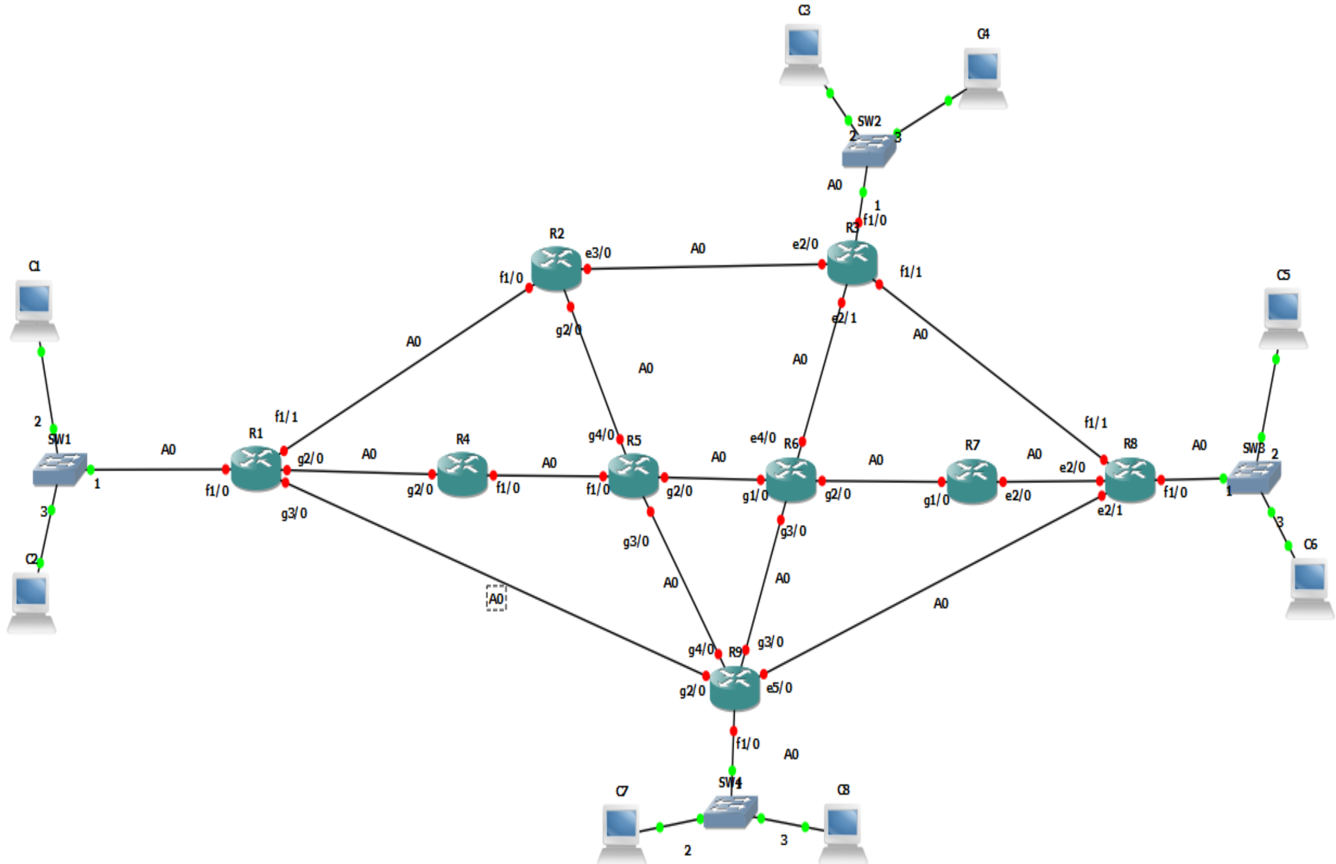
C1
C2
C4
C5
C6
C7
C8
SW1
SW2
SW4
R1
R2
R4
R5
R6
R7
R8
R9

FIG 1.2

## V. PROPOSED SYSTEM

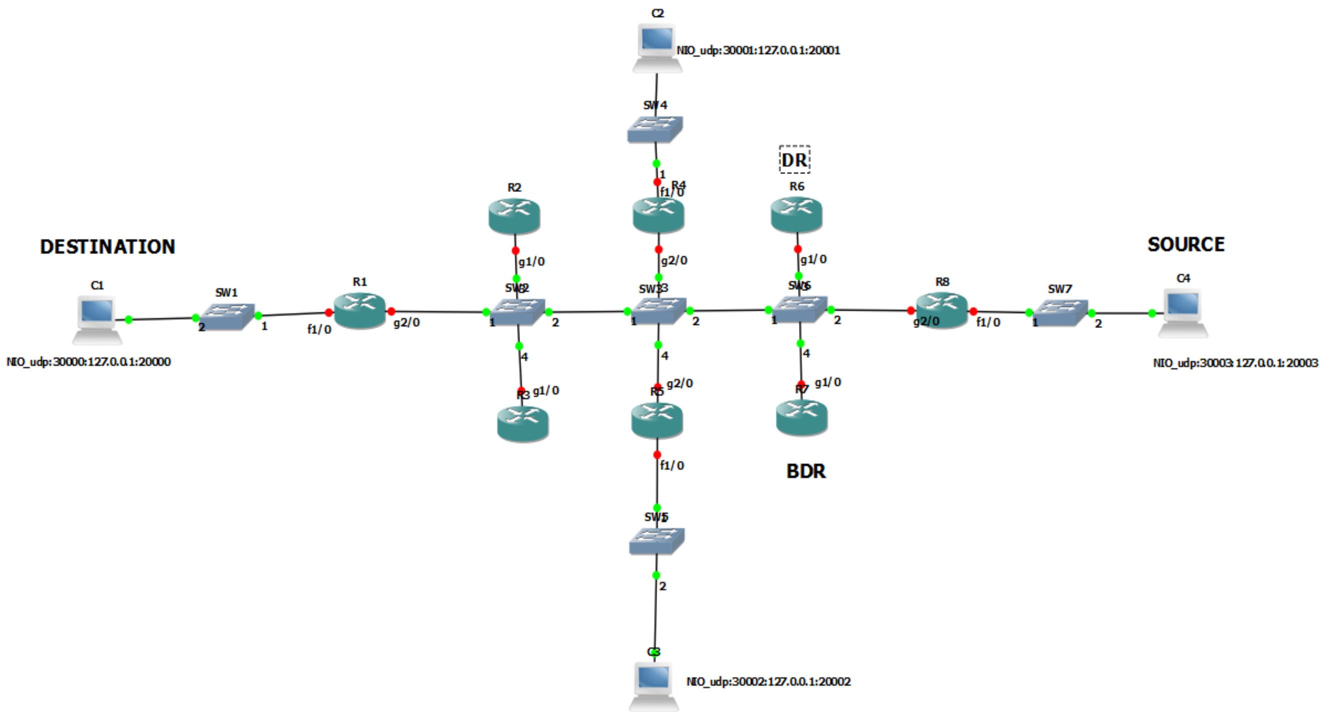


FIG 1.3

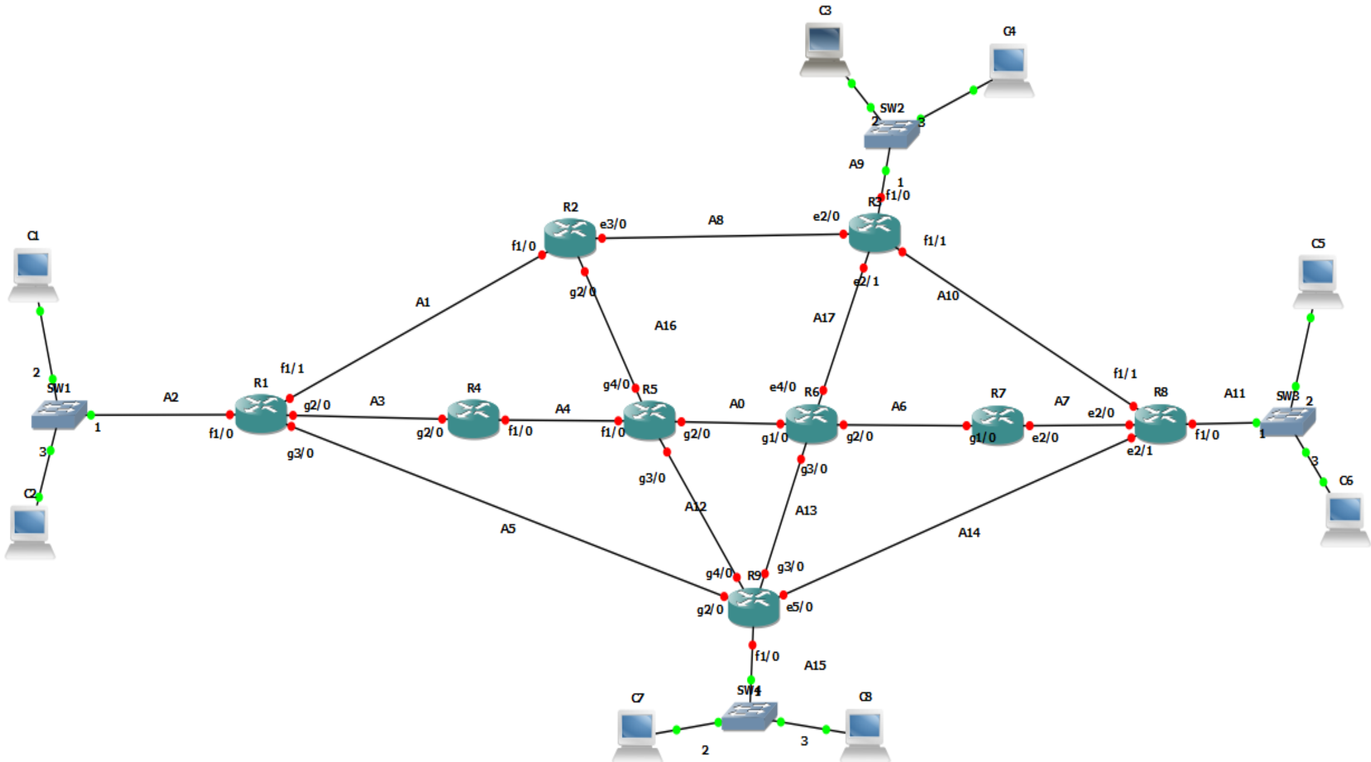


FIG 1.4

| SOURCE HOST | DESTINATION HOST | NO.OF NODES | SHUTDOWN PATH | EXISTING PACKET LOSS | EXISTING CONVERGENCE TIME(s) | PROPOSED PACKET LOSS | PROPOSED CONVERGE NCE TIME(s) |
|---|---|---|---|---|---|---|---|
| VPCS[4] | VPCS[1] | [8] S7-R8-S2 | g 2/0 | 14 | 18.625 | 10 | 14.085 |

TABLE 1.1

| SOURCE HOST | DESTINATION HOST | NO.OF NODES | SHUTDOWN PATH | EXISTING PACKET LOSS | EXISTING CONVERGENCE TIME(s) | PROPOSED PACKET LOSS | PROPOSED CONVERGENCE TIME(s) |
|---|---|---|---|---|---|---|---|
| VPCS[1] | VPCS[4] | [3] R1-R2-R3 | No shutdown | 12 | 14.67 | 09 | 11.40 |
| VPCS[1] | VPCS[4] | [4] R1-R9-R6-R3 | f 1/1 | 16 | 17.14 | 13 | 14.23 |
| VPCS[1] | VPCS[4] | [5] R1-R4-R5-R6-R3 | g 3/0 | 19 | 20.25 | 15 | 17.78 |

TABLE 1.2

Consider Fig 1.3.the DR is changed to R6 by changing ther priority of the router.Now when the data packet is transferred from VPCS[4] to VPCS[1] the packet loss is redced and the convergence time is found to be less as shown in the table 1.1.
Consider Fig 1.4,each interface has been assigned with a unique area;.Routers R5 and R6 are chosen as the ABR and the interface between them is considered as the backbone area(A0).All routers are virtually connected to ABR, so that all the routers would get converged faster than the proposed system.Packet loss was found to be less in proposed system as shown in the table 1.2, simultaneously the convergence time was checked in wireshark.

## VI. ANALYSIS

SINGLE AREA

Refer Fig 1.5 Packet loss v/s no.of nodes graph and Table 1.1.It can be seen that the packet loss is less in proposed system than the existing system.

Refer Fig 1.6 Convergence time v/s no of nodes graph and Table 1.2.It can be seen that the convergence time is less in proposed system than existing system.

MULTIAREA

Refer Fig 1.7 Packet loss v/s no.of nodes graph and Table 1.1.It can be seen that the packet loss is less in proposed system than the existing system.

Refer Fig 1.8 Convergence time v/s no of nodes graph and Table 1.2.It can be seen that the convergence time is less in proposed system than existing system.

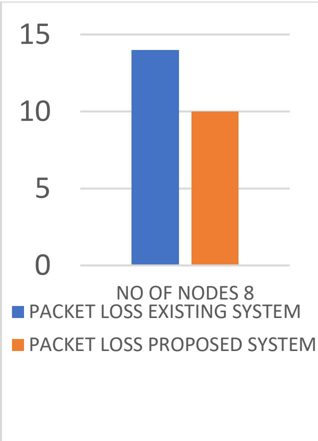


FIG 1.5

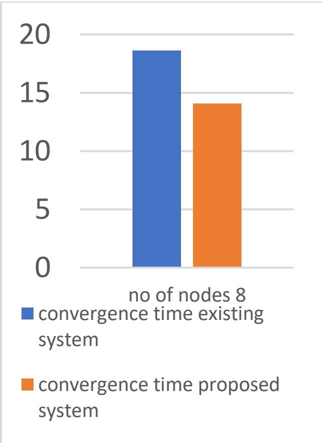


FIG 1.6

 

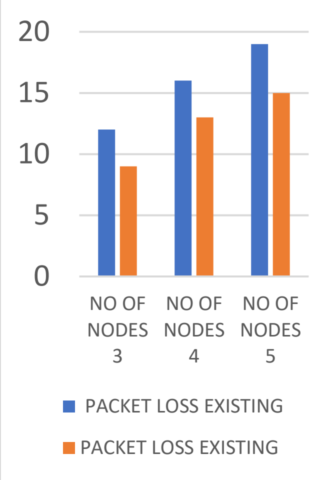


FIG 1.7

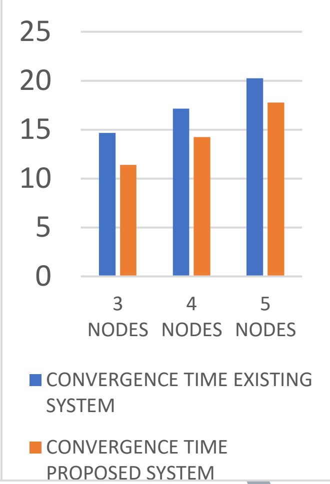


FIG 1.8

## VII. CONCLUSION

Performance analysis and OSPFv3 implementation is discussed in this research paper. The standard literature review is done for this purpose and research questions are framed. The process of selecting primary data is also discussed in this research paper. Thus performance analysis and implementation of OSPFv3 can be done to measure and improve the performance of this routing protocol, so that OSPFv3 runs successfully once migration to IPv6 occurs. Further, research objective, research findings and conclusion of all the research papers is studied, analyzed and tabulated..

## VIII. REFERENCES

[1] R. J. Whitfield, S. Y. Zhu, “A Comparison of OSPFv3 and EIGRPv6 in a small IPv6 Enterprise Network”, *IJACSA*, Vol. 6, No. 1, pp 162-167, 2015.

[2] S.Kamalakannan, S.Venkatesh, M.Mohan, “Convergence Anal ysis of RIP and OSPF in IPv6 Network”, *IJIREEICE* ,Vol. 2, Issue. 3, pp 1281-1284, March 2014.

[3] V.Vetriselvan, P. R Patil, M.Mahendran, “Survey on the RIP, OSPF, EIGRP Routing Protocols”, *IJCSIT*, Vol. 5, No. 2, pp 1058-1065, 2014.

[4] M. E. Mustafa, “Comparison between OSPFv3 and OSPFv2”, *Wireless Sensor Networks, Scientific Research*, Vol. 6, pp 43-48, 2014.

[5] J. Kaur, P. Singh, “Comparative Study of OSPFv3, IS-IS and OSPFv3_IS-IS Protocols using OPNET”, *IJARCET*, Vol. 3, Issue. 8, pp 2656-2662, Aug. 2014.

[6] R. Narula, P. Aggarwal, “Performance Evaluation of RIP and OSPF in IPv6 using OPNET 14.5 Simulator”, *IJTRA*, Vol. 2, Issue. 6, pp 37-41, Nov. 2014.

[7] Sunjian, Yin YaFang, “Research and Implement of OSPFv3 in IPv6 Network”, *IEEE Cross Strait Quad-Regional Radio Science and Wireless Technology Conference*, pp 743-746, July 2011.

[8] C. Wijaya, “Performance Analysis of Dynamic Routing Protocol EIGRP and OSPF in IPv4 and IPv6 Network”, *First International Conference on Informatics and Computational Intelligence, IEEE Computer Society*, pp 355-360, 2011.

[9] A. Nizar A. Ali, “Comparison study between IPv4 & IPv6”, *IJCSI*, Vol. 9, Issue. 3, pp 314-317, May 2012.

[10] A. Dhamdhere, Matthew Luckie, Bradley Huffaker, “Measuring the Deployment of IPv6: Topology, Routing and Performance”, *IMC*, Vol. 12, Nov. 2012

 