

Emulation of a Backbone Area Network Configured over RIPv2 and OSPF protocol using GNS3 Simulator

Sanjay Maiduli¹, Anshika Garg²M.Tech Student, Department of CSE, Uttarakhand Technical University, Dehradun, India¹Asst. Professor, Department of CSE, Uttarakhand Technical University, Dehradun, India²

ABSTRACT: Backbone network is the core part of network at the service provider end, all the incoming and outgoing traffic must go through this network. So designing of a backbone will have effect on the overall performance of network. In this paper, we have designed a backbone area network by using CISCO 7200 series router's IOS image with GNS3 simulator tool and network is then configured with RIPv2 and OSPF protocol separately. Performance of RIPv2 and OSPF protocol is evaluated with packet request and reply time by sending the different size of messages from source router to destination router via designed backbone network.

KEYWORDS: RIPv2, OSPF, GNS3, Backbone area network, Autonomous System (AS), Routing Protocol

I. INTRODUCTION

The network virtualization and simulation tools like GNS3, is an alternative that allows network designers and developers to implement multiple networked computers, hosts and routers in virtualized environment in a cost effective manner to validate and test the new networking protocols and verify a specific network algorithm [4]. Routing is a process of moving a packet from source to destination via a set of available paths. Routing is a part of Network Layer (L3) of OSI model. Routing is done by using the Router as a physical hardware device and routing protocol which is responsible for calculating and selecting the path for packet forwarding. A Routing Protocol is a protocol that specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network [2]. Routing protocol can also be classified on the basis of autonomous system.(AS). Routing protocols that is used within the same autonomous system.(AS) is known as intra-domain routing protocol, distance vector and link state routing are example of intra-domain routing. RIPv2 is based on Distance vector and OSPF is based on the Link state routing. This paper is based on these two protocols.

A network topology can used any of the above protocols. Selection of protocol is done on the basis of certain parameters known as Metrics. Hop count, delay, throughput, bandwidth etc are example of metrics. This paper will focus on two commonly used intra domain routing protocol RIPv2 and OSPF configured over a backbone area network.

A backbone network does not directly deals with the users. The main aim of backbone area network is to transfer network traffic from one end to another end at high speed using high performance networking devices. A backbone network has two main components, hardware device such as Router, switch etc and a network cable that connects the networking devices.

Routing Information Protocol (RIP) is an intra-domain protocol. RIP is based on distance vector or distributed bellman or ford Fulkerson algorithm. Hop count is used as a metric in RIP. Hop count is the number of routers the packet must go through till it reaches the destination network. The maximum allowable number of hops a packet can go across in an

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

IP network implementing RIP is 15 hops. RIPv2 is an improved version over the first version of RIP. RIPv2 fully supports VLSMs, allowing discontinuous networks and varying subnet masks, encrypted authentication can be configured between RIPv2 routers [5]. To adjust RIP network timers, four types of timers are used while configuring the RIPv2 in the network topology in CISCO based router. The timers are Update, Invalid, Hold-down and Flush. Open Shortest Path First (OSPF) is a link-state routing protocol. It computes the shortest path tree for each route using a method based on Dijkstra algorithm, OSPF is an interior gateway protocol used for routing within the same autonomous system (AS). Link state protocol constructs a map of connectivity to the network, so routers in link state is able to inform all the nodes in a network of topology change. OSPF is a classless routing protocol that uses the concept of areas for scalability. RFC 2328 defines the OSPF metric as an arbitrary value called cost [6]. Section 2 outlines the related work. Section 3 describes the emulation setup, topology design and methodology used for RIPv2 and OSPF protocols. Section 4 shows the graph, tables for result analysis and finally section 5 concludes the paper.

II. RELATED WORK

A Survey of Various Routing Protocols by Kaur et al., has surveyed the various routing protocol used in routing. The paper gives detailed overview of RIP, OSPF and EIGRP protocol, their advantage and limitation [3].

A Survey on The Use of GNS3 for Vitalizing Computer Networks by Lal N. et al., has presented the importance of simulation by a simple powerful graphical simulator tool GNS3 which gives the functionality of CISCO switches and routers [4].

Analysis of RIPv2, OSPF, EIGRP Configuration on router Using CISCO Packet tracer by Archana., presents the comparison and analysis of three dynamic routing protocol OSPF, RIP and EIGRP on the basis of delay, Throughput and bandwidth utilization over a design topology by using Cisco packet tracer simulator tool [5].

Evaluation And Implementation of the Open Shortest Path First (OSPF) Routing Protocol by Nwalozie et al., presents the simulation study of OSPF protocol over a design topology in a OPNET simulator tool. [6].

Study and Analysis of Dynamic Routing Protocols in real time for Optimal Resource Utilization by Prasad et al., presents the study and analysis of dynamic routing protocol RIP, OPSF and EIGRP protocol by using the factor bandwidth used by these protocols [7].

III. METHODOLOGY AND EMULATION SETUP

The backbone network topology is designed by the GNS3 simulator tool which is an open source tools that allows emulation of complex system. By the help of GNS3 we can run CISCO devices in a virtual environment. GNS3 front end is used to design the topology and to configure the routers, we can use Dynamips command line interface which is an inbuilt tools in GNS3. For this analysis we are using CISCO 7200 series router's Inter Operating System (IOS) image which gives the functionality exactly to original CISCO 7200 series routers. The topology is designed by the 7 CISCO 7200 series routers and they are connected by the Serial interface. In first scenario we are configuring the RIPv2 protocol in the designed topology and again the OSPF protocol is configured to same topology. Results are analyzed on the basis of packet's request and reply time. Topology design for RIPv2 is shown in Fig 1. The backbone area network is created from five routers R2 to R6. They are interconnected by using the serial links. R1 is connected to R2 via serial interface S1/0 and R7 is connected to R6 via serial interface s1/2 of R6. All the interfaces of routers are assigned IP addresses and then all the 7 routers are configured over RIPv2 with Dynamips Command line interface by using the different command. After configuring the RIPv2, we pinged from R1 to R7 with different packet size and record the minimum, maximum and average time.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

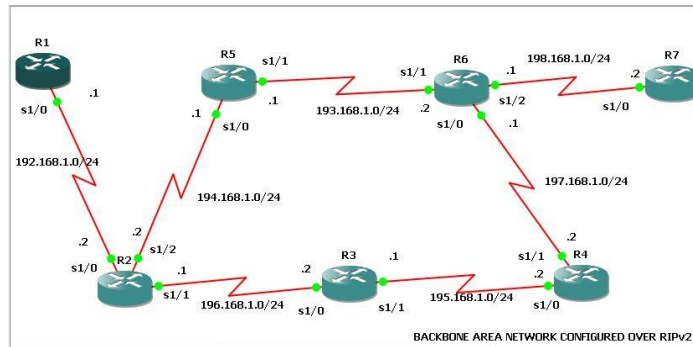


Fig 1: Topology design for RIPv2

Topology design for OSPF is shown in Fig 2. The topology used for configuring OSPF is same as used in RIPv2. The backbone area network is created from five routers R2 to R6. R2 to R6 are numbered as Area 0. R1 is numbered as Area 1 and R7 is numbered as Area 2. They are interconnected by using the serial links. R1 in area 1 is connected to R2 in area 2 via serial interface S1/0 and R7 is connected to R6 via serial interface s1/2 of R6. The bandwidth for each interface is set to 1544 Kbps and clock rate is set to 64000. All the interfaces of routers is assigned IP address and then all the 7 routers are configured over OSPF with dynamips Command line interface. After configuring the OSPF, we pinged from R1 to R7 with different packet size and record the minimum, maximum and average response time.

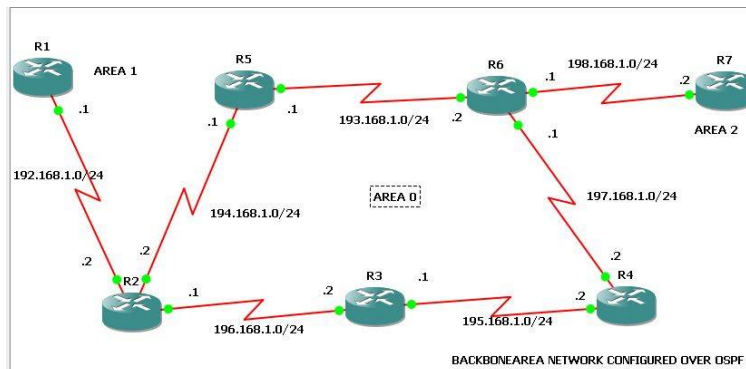


Fig 2: Topology design for OSPF

IV. RESULT ANALYSIS

For RIPv2, extended Ping command is used for analysis. The datagram of different sizes (2000, 4000, 6000, 8000 and 10,000 bytes) will be send from router R1 to R7 via the designed backbone network. Selection of router to forward the packets in backbone area will be selected bu using RIPv2 protocol. The results are shown in Fig 3-

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

Table 1: RIPv2 result table

DATAGRAM SIZE IN BYTE (REPEAT COUNT=100)	MIN TIME (ms)	AVG TIME (ms)	MAX TIME (ms)
2000	84	229	444
4000	656	700	1036
6000	1236	1309	1464
8000	1246	1338	1464
10000	1852	1917	1968

The graph in Fig 4 shows the performance of network configured over RIPv2

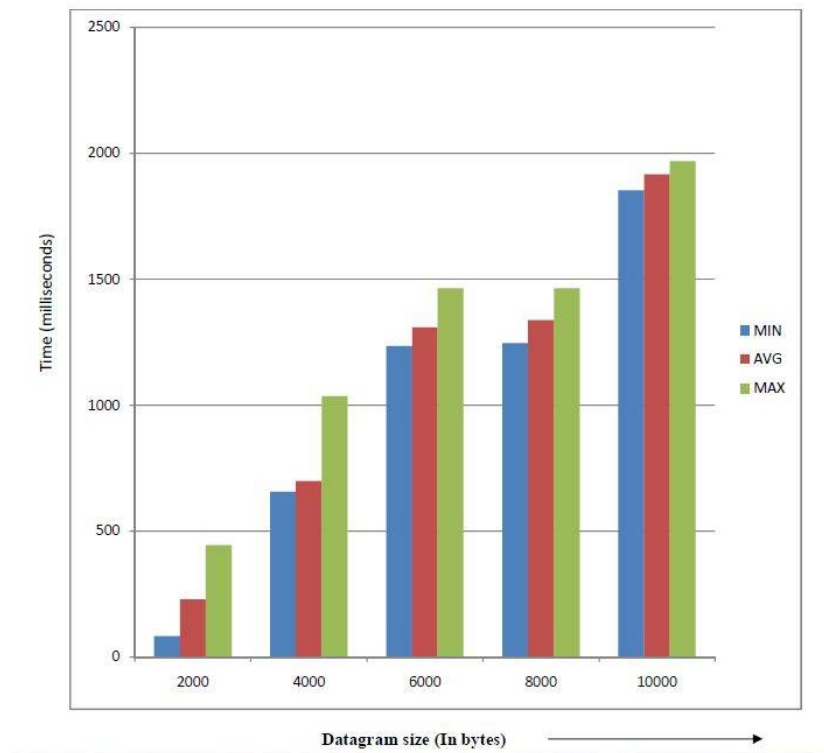


Fig 4: Graph for RIPv2

For OSPF protocol, extended Ping command is used for analysis. The datagram of different sizes (2000, 4000, 6000, 8000 and 10,000 bytes) will be send from router R1 in area 1 to router R7 in area 2 via the designed backbone network in area 0. Selection of router to forward the packets in backbone area will be done by using OSPF protocol. The results are shown in Fig 5-

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017



Fig 5: Response Time of the OSPF request (a) Time taken to send 2000 bytes (b) Time taken to send 4000 bytes (c) Time taken to send 6000 bytes (d) Time taken to send 8000 bytes (e) Time taken to send 10,000 bytes

Table 2: OSPF result table

DATAGRAM SIZE IN BYTE (REPEAT COUNT=100)	MIN TIME (ms)	AVG TIME (ms)	MAX TIME (ms)
2000	64	223	344
4000	640	686	828
6000	1236	1289	1376
8000	1272	1307	1368
10000	1840	1894	1980

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

Graph in Fig 6 shows the performance of network configured over OSPF

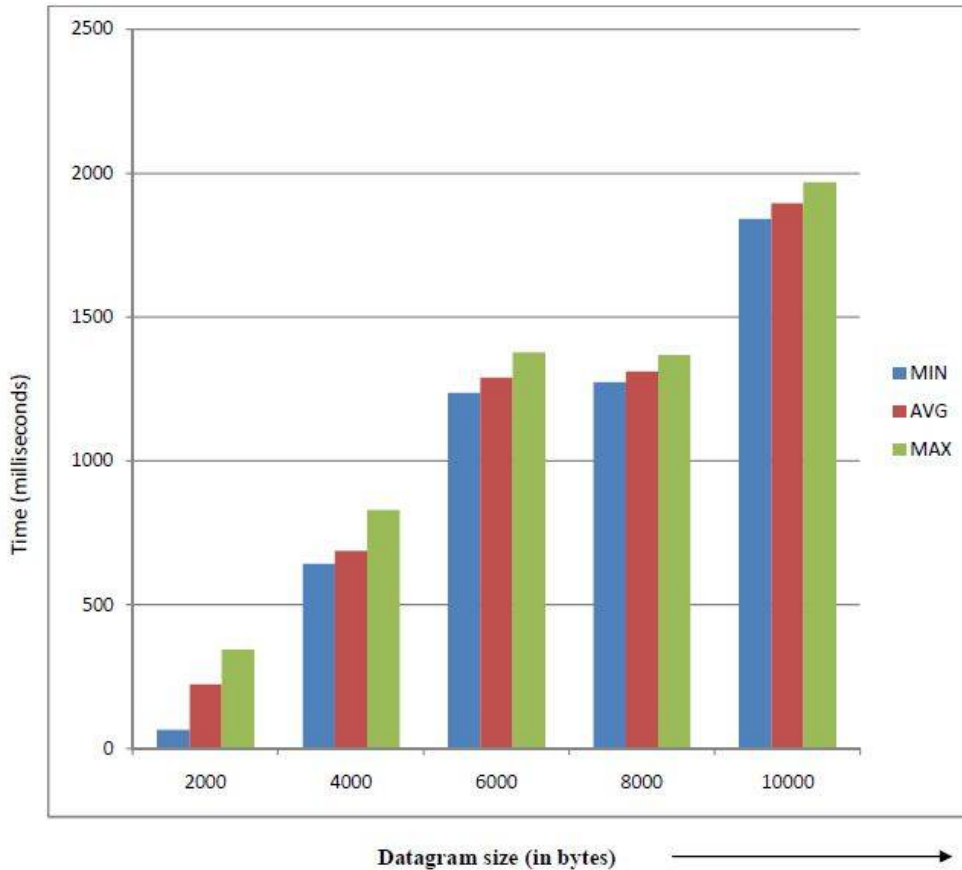


Fig 6 Graph for OSPF

A comparison of RIPv2 and OSPF protocols configured in backbone area network is presented in this paper. The GNS3 network simulator is used to compare protocol performance in designed network by taking the parameter of request and reply time given by ping command. It is found that the OSPF protocol is showing less time and less packet loss less than the RIPv2 protocol. Furthermore, the OSPF also presented higher utilization values when compared to the RIPv2 protocol

V. CONCLUSION

In this paper, the performance of the RIPv2 and OSPF protocol is analyzed. We have configured a backbone area network designed by CISCO 7200 series router's IOS connected by the serial links and their performance is analyzed by using the Dynamips command line interface. Both the protocols are used for routing within the same Autonomous System (AS). From the results we can conclude that OSPF protocol is better than the RIPv2. Backbone network are deployed and managed by a service provider to design their own network so it is a better idea to configure whole network topology in the same protocol, if we are building a core of backbone area network with routers. Furthermore, protocol mismatch (when routers in backbone are using different sets of protocol) can create extra delay and troubleshooting becomes more complex. In this case Admin has to keep track of protocols details used by different router in network.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Website: www.ijirset.com

Vol. 6, Issue 3, March 2017

This paper shows that between two intra-domain protocol (RIPv2 and OSPF), OSPF gives better result. But RIPv2 can still be deployed in the network since a backbone has limited number of routers. It will not suffer from count to infinity problem. But for a better performance, OSPF protocol is better choice as OSPF protocol does not periodically update its whole database, the database is updated only when there is a change in links or nodes, so it is faster and good option to be deployed in backbone network.

REFERENCES

- [1] Sirika, Shewaye, Mahajane, Smita, "Performance Enhancement of for OSPF video conferencing and VoIP", International Journal of Engineering Research-Online, Vol 4, Issue.2, 2016.
- [2] Devi, R., Sumathi B., Gandhimathi T., Alaiyarasi, G., "Performance Metrics of MANET in Multi-Hop Wireless Ad-Hoc Network Routing Protocols", International Journal of Computational Engineering Research (IJCER) ISSN: 2250-3005, 2016.
- [3] Kaur, Yashpreet, Kaur, Mandeep, "A Survey of Various Routing Protocols", International Journal of Advanced Research in Computer Science and Software Engineering, Volume 6, Issue 3, 2016.
- [4] Lal N., Dayanand, , Ghorbani, Behnam, Solmez, Vaghri, "A survey on the use of GNS3 for vitalizing computer networks", International Journal of Computer Science and Engineering (IJCSE) ISSN(P): 2278-9960; ISSN(E): 2278-9979 Vol. 5, Issue 1, 49-58, 2016.
- [5] Archana, C., "Analysis of RIPv2, OSPF, EIGRP Configuration on router Using CISCO Packet tracer", International Journal of Engineering Science and Innovative Technology (IJESIT) Volume 4, Issue 2, 2016.
- [6] Nwalozie, G.C., Okorogu, V.N., Okafor A.C., Umeh, A.O., "Evaluation and Implementation Of The Open Shortest Path First (OSPF) Routing Protocol", International Journal of Emerging Technology and Advanced Engineering, ISSN 2250-2459, Volume 2, Issue 12, 2012.
- [7] Prasad, D.Venkatavara, Jaganathan, Suresh, Saikalyan, G.P., "Study and Analysis of Dynamic Routing Protocols in real time for Optimal Resource Utilization", International Journal of Communications, ISSN: 2367-8887, Volume 1, 2016
- [8] Xhaferra, Edmira, "A Review Paper: Analysis of OSPF & RIPv2 over MPLS VPN with OPNET simulation", Imperial Journal of Interdisciplinary Research (IJIR), Vol-2, Issue-2, ISSN : 2454-1362, 2016
- [9] Gupta, Umesh, Pinky, "Review Paper on Open Shortage Path First (OSPF) Protocol in Network", International Journal of Enhanced Research in Science, Technology & Engineering, ISSN: 2319-7463, Vol. 5 Issue 6", 2016.
- [10] Chauhan, Dipti, Sharma, Sanjay, "Performance evaluation of different Routing Protocols in IPv4 and IPv6 Networks on the idea of Packet Sizes", International Conference on Information and Communication Technologies, volume 46, pp. 1072 – 1078, 2016.
- [11] Farouqui, M. S. Nigam, V., Gandhi, G., "Evolution of the Routing Protocols from RIP (1969) to OSPF (1998)", IJARCSSE ,ISSN: 2277 128X, , vol. 4, no. 2, 2014.
- [12] Tanenbaum, A. S., "Computer Networks", 4th edition, Prentice Hall Press, 2002.
- [13] Cisco Press, "Professional Development - Routing TCP-IP", Vol. I, 1998.
- [14] Doyle, Jeff, "Dynamic Routing Protocols, Routing TCP/IP Volume I (CCIE Professional Development), A detailed examination of interior routing protocols, CCIE No. 1919", Kindle Edition.
- [15] Cisco Systems Inc., "Internetworking Technologies Handbook: An Essential reference for every network Professional", 4th Edition, 2003.
- [16] Forouzan, Behrouz A., "TCP/IP Protocol Suite", McGraw-Hill Education Press. ISBN 0-073-37604-3,2009
- [17] Todd., Lammle, "Cisco Certified Network Associate Study Guide", Wiley Publishing, Inc., Seventh Edition, 2011.
- [18] Graziani, Rick, Jonson, Allan, Routing protocols and concepts: CCNA exploration companion guide, Pearson Education. London, 2008.