ADAPTIVE ROUTING PROTOCOL ANALYSIS AND PERFORMANCE EVALUATION IN IPv6

1Aditya Naik, 2Onkar Kolate, 3Omkar Kokane, 4Dr.S.B..Dhonde
Department of Electronics & Telecommunication,
AISSMS, Pune, India

Abstract: This paper presents the performance evaluation and comparison of various routing protocols such as IS-IS, RIP, EIGRP, OSPF in an IPv6 network. Gns3 software is used to simulate the network and Ostinato packet generator is imported in Gns3 for TCP packet generation and transmission through the network. The generated packets are captured using wireshark analysis tool. Further these packets are analyzed based on parameters such as throughput and delay. The result of analysis concluded that EIGRP has better performance in terms of end to end delay and throughput, While RIP has maximum delay and least throughput. This indicates that EIGRP is best suited for IPv6 network.

Index Terms – EIGRP, Gns3, IPv6, IS-IS, OSPF, Ostinato, RIP

I. INTRODUCTION

Now a days, computers have become tools which cannot be separated from our daily lives. From the simple task, up to the need to socialize using social networking sites such as facebook, twitter, etc. For this the Computers had to get connected to the remote host via internet initially, the computers in the network were using IPv4 addressing method, So that each computer can communicate with the other using its IP address as the identity while connected to the network. But IPv4 addressing space is limited and will soon be exhausted due to this reason IP protocol version 6 is developed.[1]

IPv6 has number of improvements, simplifications and advantages over IPv4. Such as quality of service mechanism, Addressing space, Security, etc. The basic requirement for developing an IPv6 network is routing. Routing basically means the process of determining the best route which is suitable for the transmission of data packets from source to destination and for that purpose routing protocols are used.[4] When the host try to communicate with each other they use routing protocols. These routing protocols rely upon the routing algorithm which uses metrics to find the best path to transfer the data across networks. The metric is defined as the cost of link which can be hop count, traffic, load at other end, bandwidth etc.

Static and dynamic are the two categories of routing protocols. Static routing is manually configured routing technique in which routes are fixed and they dont get changed, That means the route does not depend upon the metric. On the other hand dynamic routing is technique in which the routes are dynamically decided depending upon the metric. Further there are again two types of dynamic routing protocols: Interior gateway protocol (IGP) and Exterior gateway protocol (EGP). Routing within the autonomous system uses interior gateway protocols whereas Routing between the autonomous systems uses exterior gateway protocols. Interior gateway protocols are EIGRP, RIP, OSPF, IS-IS and Exterior gateway protocol is BGP. Distance vector dynamic routing protocols are RIP and EIGRP that uses hop count as its routing metrics. Link state routing protocols are OSPF and IS-IS that uses bandwidth as its routing metrics[5].

As there are various routing protocols, So one question arises which protocol to be used, Hence this paper concludes that which protocol amongst IS-IS, RIP, EIGRP, OSPF is best suited for an IPv6 networks. The parameters used for comparison are Max throughput and Avg end to end delay.

**MAX THROUGHPUT:**-Max number of bits transmitted successfully per second

**AVG. END TO END DELAY:**-Avg time taken for a packet to be transmitted across a network from source to destination.
II. LITERATURE SURVEY

A simple comparative study of RIP and OSPF protocols is done which gives the information about RIP protocol and its versions such as RIP v1, RIP v2, RIPng. The difference between these versions is stated whereas it also gives information of OSPF and its versions. The comparison between RIP and OSPF is carried out by considering parameters such as latency, Packet loss, Throughput, Convergence time. [1]

At the end, the result was concluded in the form of comparison graph. Here RIP sends the contents of the routing table every 30s whereas OSPF sends ‘hello’ packets in every 10s and when any data is updated, it sends the updated data alone and not the whole routing database. OSPF has fast convergence and efficiently uses the bandwidth. Due to this packet loss is also less. The throughput for OSPF is higher than RIP. Therefore all over analysis says that OSPF is better than RIP. [1]

The comparison of performance is done for RIP and EIGRP on the basis of throughput, end to end delay and link utilization via simulation. The models of the EIGRP and RIP routing protocols throughout a 802.3u network had been created based on metric such as throughput, delay and utilization. The final results show that EIGRP protocol for this network has high performance in terms of throughput, delay and utilization. [2]

The performance evaluation of hybrid network is done by using RIP & IGRP routing protocols for different applications. The network model is based on OPNET IT GURU software. The model is analyzed against various types of applications such as Email, Print server, & FTP in Hybrid Networks. OPNET simulation shows the significant impact of IP routing protocols in hybrid networks for different applications. [3]

Two protocols which are RIP & IGRP are used to study the browsing behavior for Email application. The observed result states that Email download response time with RIP is more & for IGRP is less respectively. In case of Remote Login response time, performance is better when these two routing protocols are used. Further, WLAN media access delay is less for RIP and more for IGRP. Overall results concluded that the performance is better with RIP & IGRP routing protocol networks. [3]

A detailed information of EIGRP, RIP, OSPF routing protocol is described and analysis of their performance is done. It provides information about header format of the routing protocols. The performance analysis is based upon parameters such as router updates, Number of next hop updates, Utilization, Throughput, Queuing delay. [4] It concluded that OSPF has the least cost of transmission and maximum throughput. whereas, Queuing delay of EIGRP is least followed by OSPF, RIP, And Link utilization is maximum for EIGRP followed by OSPF, and RIP. [4]

OPNET simulation tool 14.5 was used to analyze the performance of RIP and OSPF. Three network models are created in which two network models will perform on one routing protocol only and the third one is used to evaluate the performance of combination of RIP and OSPF protocols. Packet delay variation, traffic received, traffic sent, response time, end to end delay, object response time, jitter, traffic dropped for IPv6 etc are parameters used for analysis. [5]. By comparing these protocols performance, The results shows that combined implementation of RIPNG and OSPFv3 routing protocol in the network in IPv6 performs much better than individual RIPNG and OSPFv3. In case of individual OSPFv3 performs better than RIPng.[5]
III. METHODOLOGY

In this paper simulation and analysis is carried out using GNS3, OSTINATO and WIRESHARK software.

A topology is created which consist of 5 routers and 2 PC’s. Four different network models are created in GNS3 using similar topology which are based on RIP, OSPF, EIGRP, IS-IS protocol. In each network routers and PC’s are addressed using IPv6 addressing. Each of network project is configured based on specific routing protocol and analyzed separately using wireshark software. For connections between routers and PC’s fast Ethernet and serial cable are used. As multiple path options are available in network, And Link state protocol considers bandwidth as a metric to select one of them, So to differentiate between links two types of cables are used, Those are ethernet which provides with high data rate path and serial cable which provides slow data rate path. Analysis requires actual data traffic so for that Ostinato is used. Ostinato is basically a traffic generator using that TCP packet traffic is generated in each of the different network. For that ostitnato is imported into GNS3 using VMware. After successful creation of protocol based network and connecting of ostitnato for traffic generation, Analysis is done by capturing the TCP packets in wireshark software.

Wireshark software is an analysis software. The TCP packets are captured of each network separately and they are analyzed based on different parameters such as Max. Throughput and End to End Delay. Based on the analysis the final comparison of RIP, OSPF, EIGRP and IS-IS is done which the result of the paper.

IV. RESULT

The performance analysis is done of various routing protocols such as RIP, EIGRP, OSPF, IS-IS. Based on maximum throughput and end to end delay. The following fig.2 shows the results obtained for max throughput.

Fig.1. Software Network Diagram
These results were obtained by transferring 100 TCP packets using OSTINATO packet generator and then capturing packets through one of the link in wireshark.

As seen in the fig.2, OSPF protocol has max Throughput which is shown in terms of bits/sec. It is followed by EIGRP, IS-IS and RIP.

Further the avg. End to End Delay results are shown in fig.3 which shows that EIGRP protocol has least end to end Delay followed by IS-IS, OSPF, and RIP.
V. CONCLUSION

On analyzing the results of various protocols such as RIP, EIGRP, OSPF, IS-IS which are based upon max Throughput and avg. End to End Delay. We can say that OSPF has maximum Throughput which is 19,800 Bits/sec, Whereas EIGRP is second highest in terms of throughput having value of 19,600 Bits/sec and RIP has lowest value for throughput that is 18,200 Bits/sec , In terms of delay EIGRP has least delay of 0.413 ms , whereas RIP has delay of 0.934 ms which is maximum. So overall analysis says that EIGRP works well in Ipv6 network as it has least delay and also throughput is good enough.

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