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Performance Analysis of Routing Protocols RIP, OSPF and EIGRP

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Abstract – *In network topology, Various Routing Protocols are used in the Routers for transmission of packets. The popular dynamic routing algorithm used to forward packets are Routing Information Protocol(RIP), Open Shortest Path First(OSPF) and Enhanced Interior Gateway Routing Protocol (EIGRP). The main aim is to characterize the performance analysis of these routing protocols and Redistribution amid these routing protocols. The protocols are implemented and analyzed in GNS3 Software. For performance analysis in the network use Wireshark Application. The parameters analyzed are Convergence time, End to End Delay and Throughput. The way to communicate within the different routing protocols are showed in redistribution commands.*

***Key Words*: RIP Version 2, EIGRP, OSPF, GNS3, Wireshark, Throughput, End to End Delay, Convergence Time.**

1. INTRODUCTION

Routing Protocols usually set out how routers hand on with each other. Routers perform traffic direction function in internet. Routing algorithm determine the choice of route. The specific feature of protocol is to avoid routing loops and they selected preferred routes. Routing process usually directs packet message forwarding on basics of Routing Tables. Routing table maintains a record of packet forwarding from source to Destination. The job of the Routers is to connect the networks in their business and manage traffic within the network. Routing process is essential for networks to get data where it need to as quick as possible. The main function of routing process is to route packet messages between various networks.

1.1 Dynamic Routing

Dynamic routing or Adaptive routing process is that how routers can forward packet message through different route or based on the destination current condition of communication topology within a system. They use protocols to know the route between source to destination and know the route to reach the destination in quicker way. The main benefit in dynamic routing protocols, if there is change in the topology of the network at the time of routers forward routing information, it permits routers to certain about new networks.

1.2 RIP

RIP – Routing Information Protocol.

It is dynamic routing protocol. It uses routing metric as Hop Count to find a dozy path to reach destination. It is protocol that uses Distance Vector Routing. Administrative Distance is the value used by the routers to select best path. The value of AD for RIP is 120. It uses 520 as port number. It turn asides routing loops by limit number of hop count to reach destination. Features of RIP are Update the network exchange Information periodically, Routing Information are always put on the air and Full table about routing is update effectively.

1.3 OSPF

OSPF – Open Shortest Path First

It is developed by IETF - Internet Engineering Task force. It is Interior Gateway Protocol- protocol which aims to forward packet within large autonomous system. It divides the entire network into various routing areas to make plainer administration and to optimize traffic ad resource utilization. It uses 89 as port number and value of AD is 110. It has may features that allows the attrition of proposed action about propagation of routes to keep local for load sharing and for selective routing message import.

1.4 EIGRP

EIGRP – Enhanced Interior Gateway Routing Protocol

It is designed by Cisco System as a proprietary protocol. It is a network protocol that permits the router to exchange information in efficient manner. EIGRP is an protocol that uses advanced Distance Vector Routing Protocol. It is used for automating routing decisions and configuration. The value of AD is 170. It determines the path by using five metrics- bandwidth, delay, load, reliability, and MTU. EIGRP uses five messages to communicate with their neighbours. They are Hello, Query, Update, Reply and Acknowledgement.

2. Simulation Work

The Packet messages are exchanged between routers. GNS3- Graphical Network Stimulator version 3 is used to transmit data among various networks that runs on

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different protocols by using redistribution of routes. The performance is analyzed in different networks as RIP, OSPF, EIGRP, RIP-EIGRP, EIGRP-OSPF, OSPF-RIP, RIP-OSPF-EIGRP. We use CISCO 7200 Series Router to design and to test virtual network.

Each routing protocol has its own metrics. RIP utilize Hop Count as metric. EIGRP uses Bandwidth, Delay, Reliability as metric. OSPF uses Bandwidth as metric. The networks are implemented and analyzed in GNS3 by Ping test and the parameters are analyzed.

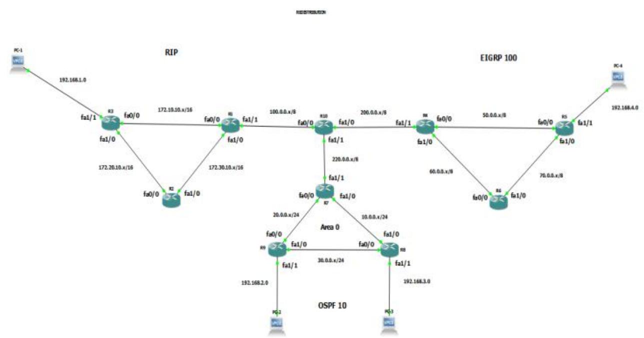

Fig-1: Simulated Topology

Redistribution is to import and export routes of the network from one to other routing protocols. Configuration of redistribution is that routers run with one or more routing protocols.

In our simulated network, we have to used 10 routers. Router 1, Router 7, Router 4 are connected to Router 10. Router 1 acts as a starting router for RIP network w.r.t Router 10. Router 4 is a starting router for EIGRP network w.r.t Router 10. Router 7 is a starting router for OSPF network w.r.t Router 10. Router 10 is a router which connects all three routers having different routing protocols.

Redistribution commands show that how the routers communicate with other routers of different routing protocols. Each routing protocol has its own metric for routing packet messages. In order to send packet messages between different routing protocols, we have to satisfy the metrics of other routing protocols. So that redistribution commands in the redistribute router for one protocol which able to get metrics of other protocols.

router rip version 2
redistribute ospf 10 metric 1 redistribute eigrp 100
metric 1 network 100.0.0.0

This command shows redistributing in RIP. It shows how Router 1 communicate with other routing protocol. Metric of RIP is Hop Count. Maximum Hops for RIP version 2 is 15. For redistribution metric used is 1, it is neither high nor low. It is not high to being advertised to other routers and it is not low to loop routing when multiple redistributing are there.

router ospf 10 redistribute rip metric
0 subnets redistribute eigrp 100 metric 0 subnets
network 220.0.0.0 0.255.255.255 area 0

This command shows redistributing in OSPF. Cost value is the metric in OSPF which is based on Bandwidth-10^8 per bandwidth.

router eigrp 100 network 200.0.0.0
redistribute rip metric 250 100 255 255 1500
redistribute ospf 10 metric 250 100 255 255
1500

This command shows redistributing in EIGRP. Metrics are bandwidth, reliability, delay, load and MTU.

Bandwidth – 250, Reliability – 100, Delay - 255, Load - 255, MTU - 1500.

```
R3#ping 70.0.0.1 repeat 350 size 50
Type escape sequence to abort.
Sending 350, 50-byte ICMP Echos to 70.0.0.1, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (350/350), round-trip min/avg/max = 196/342/572 ms
R3#trace 70.0.0.1
Type escape sequence to abort.
Tracing the route to 70.0.0.1
VRF info: (vrf in name/id, vrf out name/id)
  1 172.10.10.2 96 msec 72 msec 160 msec
  2 100.0.0.2 128 msec 116 msec 116 msec
  3 200.0.0.2 384 msec 264 msec 248 msec
  4 60.0.0.2 236 msec 412 msec 412 msec
R3#
```

Fig 2: Ping Test Result from RIP to EIGRP

```
R3#ping 30.0.0.2 repeat 350 size 50
Type escape sequence to abort.
Sending 350, 50-byte ICMP Echos to 30.0.0.2, timeout is 2 seconds:
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (350/350), round-trip min/avg/max = 232/382/748 ms
R3#trace 30.0.0.2
Type escape sequence to abort.
Tracing the route to 30.0.0.2
VRF info: (vrf in name/id, vrf out name/id)
  1 172.10.10.2 4 msec 104 msec 164 msec
  2 100.0.0.2 152 msec 216 msec 152 msec
  3 220.0.0.2 248 msec 248 msec 296 msec
  4 10.0.0.2 324 msec 396 msec 372 msec
R3#
```

Fig 3 : Ping Test Result from RIP to OSPF

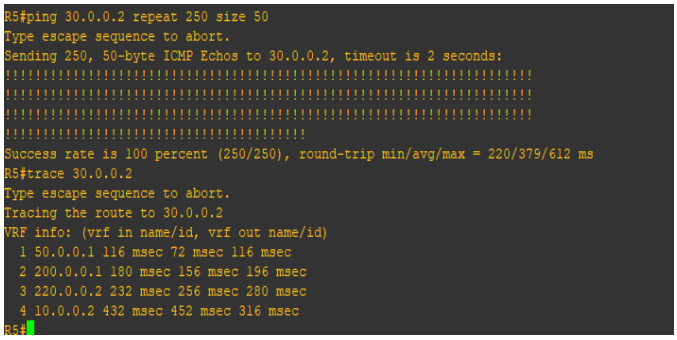

Fig 4 : Ping Test Result from EIGRP to OSPF

By sending ICMP – Internet Control Message Protocol packet messages forwarding from one router to other router (i.e) from one routing protocol to other routing protocol is further analyzed in Wireshark Application Software.

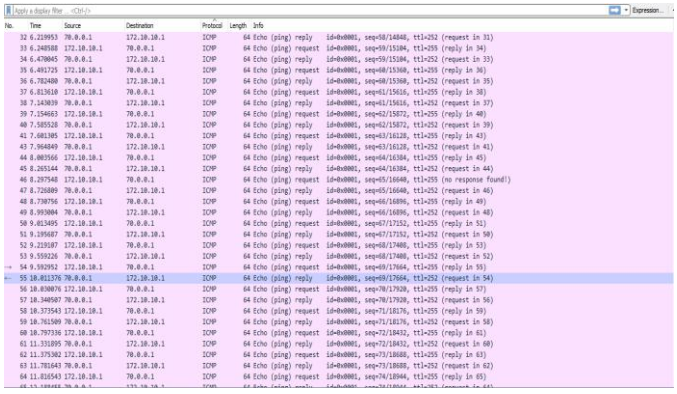

Fig 5 : Wireshark Reply-Response Result

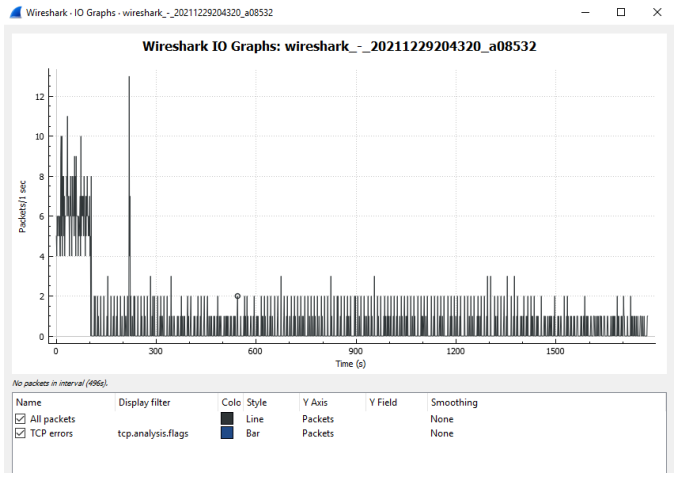

Fig 6 : IO Graph

IO Graph in Wireshark show that the overall traffic in capture file. It is rhythmical in rate per second in bytes or packets. It focus on packet forwarding and display information in background.

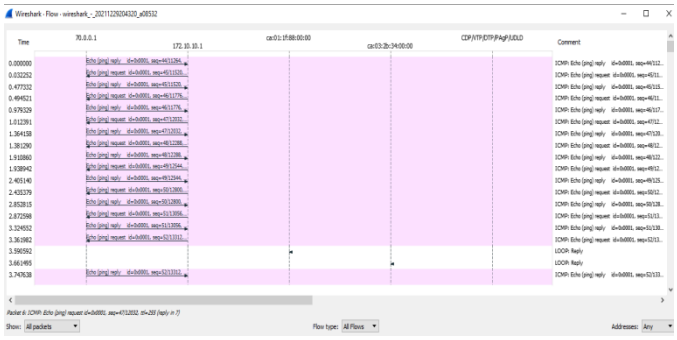

Fig 7: Data Flow Graph

Data Flow Graph shows connection between host router. It display comments, ports, packet time and direction to reach destination.

3. CONCLUSIONS

The performance of RIP, OSPF, EIGRP Routing protocols are analyzed in combination of network such as RIP, OSPF, EIGRP, RIP-OSPF, RIP-EIGRP, EIGRP-RIP and RIP-OSPF-EIGRP. It indicates that establish and stimulation of redistributive communication between the users of different networks with different routing protocols. RIP gives high throughput value in small and medium size network but it has slow Convergence Time in large network (i.e for more than 15 hops network). OSPF is a standard open protocol. It has ability to control with large networks. It drawback is that it rely on complex algorithm and so it requires large Convergence Time. EIGRP has low Convergence Time (i.e it is easily converge) and low Routing Traffic and delay compared to other two routing protocols RIP and OSPF. It has both link state and Distance Vector protocols characteristics. By comparative analysis among these networks EIGRP protocol is ameliorate than RIP and OSPF protocols.

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