Performance Analysis between dynamic routing protocols using IPv4 and IPv6 Addressing Scheme

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Aim and Objectives

The aim of this project was to analyse the performance of dynamic routing protocols using IPv4 and IPv6 addressing scheme.

5 objectives were followed and completed before the result was achieved.

1. Analysis of each internet protocol version and dynamic routing protocol based on the literature researched.
2. Evaluate each internet protocol version and dynamic routing protocol selected based on the literature to assess their validity for the experiment.
3. Design a suitable plan in handling and finding out the differences of each protocol via network topologies.
4. Implement and test the performance of the network designs.
5. Analyse outcomes to ascertain a conclusion.

```
C:\Apps\iperf-3.1.3-win64>iperf3 -c 192.168.7.100
Connecting to host 192.168.7.100, port 5201
[  4] local 192.168.1.100 port 49676 connected to 192.168.7.100 port 5201
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-1.05   sec  1.00 MBytes  8.00 Mbits/sec
[  4]   1.05-2.01   sec  1.12 MBytes  9.81 Mbits/sec
[  4]   2.01-3.01   sec  1.25 MBytes  10.5 Mbits/sec
[  4]   3.01-4.02   sec  1.38 MBytes  11.5 Mbits/sec
[  4]   4.02-5.01   sec  1.38 MBytes  11.5 Mbits/sec
[  4]   5.01-6.01   sec  1.38 MBytes  11.5 Mbits/sec
[  4]   6.01-7.02   sec  1.25 MBytes  10.5 Mbits/sec
[  4]   7.02-8.01   sec  1.38 MBytes  11.5 Mbits/sec
[  4]   8.01-9.01   sec  1.38 MBytes  11.6 Mbits/sec
[  4]   9.01-10.01  sec  1.25 MBytes  10.4 Mbits/sec
- - - - - - - - - - - - - - - - - - - - - - - - -
[ ID] Interval           Transfer     Bandwidth
[  4]   0.00-10.01  sec  12.8 MBytes  10.7 Mbits/sec                  sender
[  4]   0.00-10.01  sec  12.7 MBytes  10.6 Mbits/sec                  receiver

iperf Done.
```

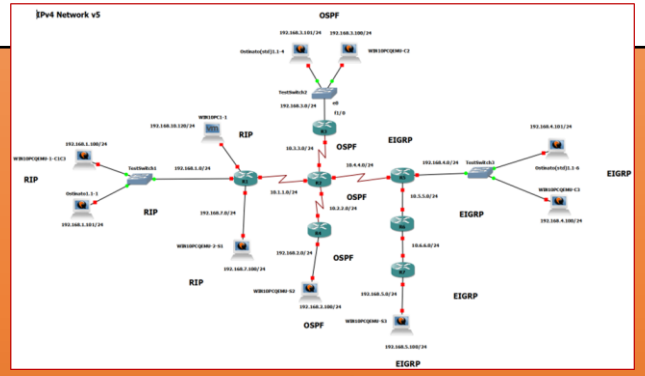
Test 1 RIP TCP MSS 1460 Iperf

Key Literature Findings

Three authors discussed the affect packet size had on performance of networks with Shaneel Narayan saying that packets bigger than 256 bytes will become affected performance wise.[7]
A contradiction was found between two authors' regarding performance of packets based on size as Dipti Chauhan et al said that bigger packets meant better performance all around however Dalya Raad Al-Ani et al says that the bigger packet sizes affected the time it took for packets to reach their destination which suggests that bigger packet sizes doesn't equate to better performance all of the time.[10][11]
EIGRP and OSPF were discussed in detail by Alex Hind et al and Justin Deng et al where both discussed that EIGRP was found to be just as good if not better than OSPF in performance regardless of the size of networks however Alex Hind et al mentions its lack of more usage was down to its proprietary nature and cost.[8][9]

Design & Implementation

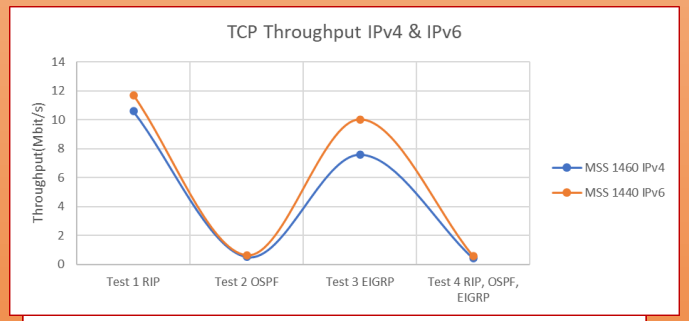
The design of the experiment involved creating 2 network projects (IPv4 and IPv6) in GNS3 that each contained 3 or more interconnected networks based around RIP, EIGRP or OSPF. The routing data was redistributed via the configuration on router R2.
The implementation part of this study was done using varying methods and software to complete the goals of this project.
The tools used for the project were GNS3[2], Hyper V[1], VMware Workstation Pro[3], Wireshark[6], Iperf[5] and Ostinato[4]. The underlying networking system used for the communication and delivery of data was Cisco based.

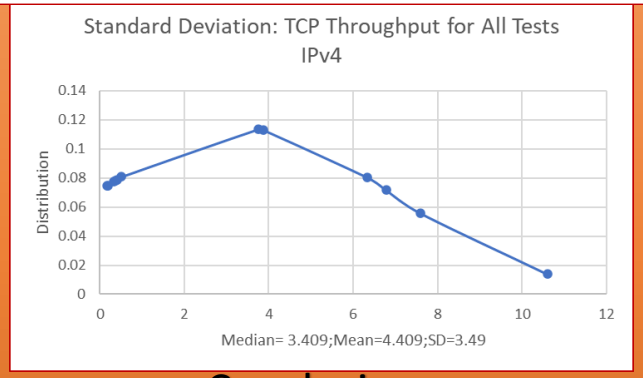


Results

The results from the analysis performed were found to be as follows:

- Multi Hop & Multi Routing Protocols with Test 4 showed the most latency & delay. Mostly because of the serial links and the number of hops.
- Smaller Packet sizes directly reduced throughput.
- Single Hop tests with RIP and EIGRP showed the best throughput whereas OSPF was one of the worst next to Test 4
- Test 4 (3 dynamic routing protocols) was found to be impacted the most performance wise for all testing parameters (throughput, packet loss, latency, delay, jitter).
- IPv6 performed better than IPv4 especially with throughput and larger packet sizes.
- UDP throughput was largely unaffected by the testing parameters such as latency, delay, packet loss and jitter.
- Standard Deviation which was used to investigate distribution of throughput test results for both IPv4 and IPv6 indicated most tests fell within one standard deviation of the mean.





Conclusions

To summarise this project report, an experiment was done to find the performance differences between IPv4 and IPv6 using specific dynamic routing protocols.

All aims and objectives set for the project were achieved. The networks worked as intended, data collected from tests were valid and a adequate analysis and conclusion was made.

Some potential improvements that could be made in the future would be looking into the effect of bandwidth cost on networks, duel stacking with IPv4 and IPv6, using other software, upgrading hardware, and redundancy systems etc.

References

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