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Differences between IPv4 and IPv6

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Abstract

With Internet Protocol v4 increasing in usage across the globe, the problems that plague the protocol such as space exhaustion and security are becoming more apparent. In this paper, a virtual scenario of networks has been created using the software GNS3 and Hyper V to test the overall performance of IPv4 and IPv6 using the routing protocols RIP, OSPF and EIGRP with the parameters of testing used being latency, end-to-end delay, throughput, packet loss and jitter. The tests done with this simulation scenario provide results that show IPv6 to be better than IPv4 in terms of overall performance based on all metrics used for testing.

Aims & Objectives

The main aim of this study is to determine the general differences between IPv4 and IPv6 as well as to ultimately determine which one is deemed superior in terms of overall performance.

To achieve the desired result of said study/experiment, 3 to 4 objectives had to be completed before the result could be achieved and a list of each objective is listed below as the following.

1. Analysis of each Internet Protocol (IPv4 and IPv6) as well as the routing protocols chosen for the experiment (RIP, OSPF, EIGRP) with their appropriate versions included.
2. To evaluate each of the protocols listed for experimentation as mentioned previously in their entirety using the parameters selected.
3. To design a suitable plan/model in handling and finding out the differences of each protocol.
4. To develop a viable solution in achieving the desired result based upon the hypothesis implemented for the test which was to create networks via simulation and then benchmark the results tests done using typical parameters for networks of today.

Design & Implementation

The design I had chosen for this project was to revolve around the use of tool/simulator called GNS3 to create the network topologies and configs and Hyper V to use with GNS3 to create the virtual operating system of the systems or routers, switches, pcs etc to use the Cisco Systems for creating said networks.
As for implementation, this was done using various methods and software to accomplish the main goals of the project.

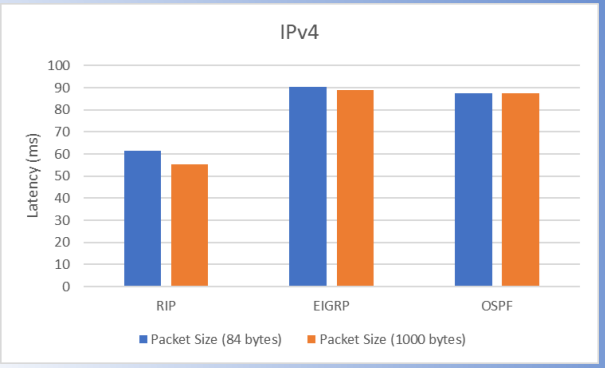
Regarding the tools and techniques used for the project, as mentioned previously GNS3 with Hyper V were used to simulate the virtual networking environment. The inbuilt Cisco system were used for each network topology. Parameters such as latency, which were tested using the built-in systems on the virtual networking nodes allowed for command consoles to ping pcs from separate subnets. This was to test the milliseconds of each ping response from source to destination, which with the results then being averaged, to find the overall response time of each system and test made.

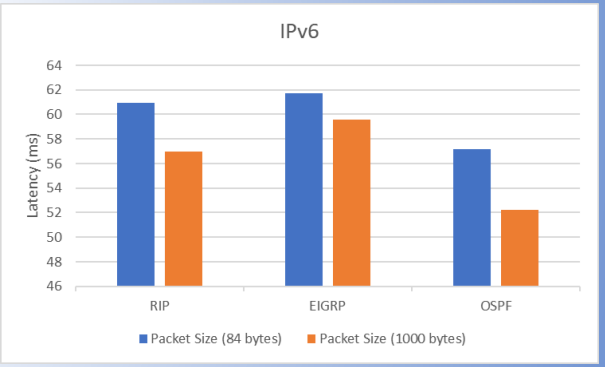
Results

As shown here in the data and graphs, there is a clear distinction in the response time or milliseconds of each internet protocol using the following routing protocols with different byte sizes used to test for differences in latency with small and big packet sizes.

The results in general show that overall, the latency is much more manageable regardless of size when using IPv6 with said routing protocols while IPv4 is shown to take considerably more time in sending the packets regardless of size.

Besides this, tests with other parameters were done with end-to-end delay being found to exist but on no perceptible level, throughput although briefly tested was deemed non applicable overall along with jitter and packet loss due to the nature of the experiment with packet loss being found to be of no issue with the network setup used for each routing protocol.





Conclusions

To summarise everything done in this report, an experiment was done to find the differences between IPv4 and IPv6 as well as see which one is superior in terms of general performance based on the parameters typically and currently used for testing networks of today.

There were some possible other avenues for potential research and experimentation mainly in wireless networks, tunnelling methods with these protocols as well as the use of other routing protocols old or new with IPv4 and IPv6.