

Protocol Data Unit (PDU): A Simulation

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Abstract

The use of routing protocols plays an essential and major role on the performance of a network. These protocols vary in terms of its application, features and configuration and management. Each routing protocol exhibits some characteristics which may be the same or may differ with other protocols.

While there are protocols categorized as distance-vector and link state protocols, this study investigates Routing Information Protocol specifically, version 2 (RIPv2), and Enhanced Interior Gateway Routing Protocol. The purpose of which, is to compare these two protocols on the basis a Protocol Data Unit that is sent from a specific source to a destination. The performance activity of a packet as it moves toward the destination is simulated and as a result will show which packet will arrive first under certain circumstances.

Keywords: Protocol Data Unit (PDU), Routing Information Protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), Variable Length Subnet Mask (VSLM), Classless, Packet

Introduction

In a packet-switched network, routing protocols play a significant role on how protocol data unit travel through the network. The utilization of these protocols, among other factors, governs the behavior of packets from the source up to the destination.

Routing protocols, such as Routing Information Protocol and Enhanced Interior Gateway Routing Protocol are some of the used protocols today. These dynamic routing protocols are used to find networks and update routing tables on routers.

In this study, RIP version 2 and EIGRP were used in the configuration of the routers. RIPv2 is a distance-vector routing protocol, hence, uses hop count in the determination of the best path to a remote network. EIGRP, on the other hand, is an enhanced distance-vector protocol which uses the idea of autonomous system in describing the set of adjacent routers running the same routing protocol and share routing information. Both protocols support Variable Length Subnet Mask (VLSM) networks.

For purposes of determining the time it takes for a packet to reach the destination, from a specified source to a specified destination, a given network scenario was presented, having the same classless addressing scheme but with the application of the two different routing protocols as mentioned.

This research aimed to examine the performance of a network in terms of the time it takes a packet to arrive at the destination, passing through several intermediary devices.

Related Studies

In a study conducted by Xu, et.al (2011), "routing protocols are key elements of modern communication networks. Currently deployed dynamic routing protocols that are used to propagate network topology information to the neighboring routers are Routing Information Protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), and the Open Shortest Path First (OSPF) protocol. The choice of the right routing protocol depends on a number of parameters. In their paper, they used OPNET Modeler to analyze the performance of RIP, EIGRP, and the OSPF protocols, which are commonly deployed in Internet Protocol (IP) networks. They designed various simulation scenarios to compare their performance in terms of network convergence, routing traffic, ethernet delay, email upload response time, video-conferencing packet end-to-end delay, and voice packet delay. Simulation results indicate that RIP performs better in terms of voice packet delay because it is a simple routing protocol that relies on distance vector algorithms. RIP generates less protocol traffic compared to EIGRP and OSPF, especially in medium size networks simulated in this project. RIP's weakness is slower convergence time in larger networks. This weakness may cause inconsistent routing entries and occasionally results in routing loops or metrics approaching infinity. RIP is preferred in networks smaller than 15 hops. EIGRP performs better in terms of network convergence, routing traffic, and Ethernet delay. EIGRP has the characteristics of both distance vector and link state protocols, has improved network convergence, reduced routing protocol traffic, and less CPU and RAM utilization compared to RIP and the OSPF protocol".

In another study conducted by Ayub, et.al (2011), "the main goal behind their investigation was to provide understanding of Interior Gateway Protocols (OSPF and EIGRP) regarding best possible efficiency, and to provide a guideline for optimal use while choosing routing protocols to obtain faster convergence and improved performance. Different routing protocols were defined on the basis of their comparative performance regarding to the convergence and link state advertisements (LSAs). Various scenarios have been considered and these were analyzed with simulation tool OPNET. Among the various findings of their study: the most important regarding convergence issues are the better performance of EIGRP as compared to OSPF. EIGRP found much better on basis of its good CPU utilization, less time consumption, better convergence performance and ease in management."

Methodology

The study made use of theoretical presentation of RIPv2 and EIGRP along their features and implementation. Further, an experimental method through the Packet Tracer Simulation Tool was utilized in determining the time it takes a PDU to reach a specific destination. The data was analyzed by averaging the time the PDU passed through one device to another towards the remote network.

Results

The network scenario comprised of three subnets, each of which had been assigned of an IP address which was subnetted in a classless method. The experiment consisted of 3 Cisco routers and switches. The end devices (PC) are a representation of the actual number of hosts. For purposes of showing that hosts are connected, 2 hosts per subnet were used. Table 1 shows the hardware used; Table 2 shows the addressing scheme; Figure1 shows the Time Difference between RIPv2 and EIGRP; and Figure 2 shows the network topology used for the simulation.

With a given network topology, having the same IP addresses, but configured with two different protocols, it can be seen from the results that one protocol exceeds the other in terms of the time it takes a packet to reach the destination.

In the scenario presented, a PDU was sent from a specific host in one subnet to a host in another subnet. And with 10 instances using the Packet Tracer simulator, the average time it took for RIPv2 packet is faster than the EIGRP network.

Conclusion

Based on the presentation of data and the results generated, it can be deduced that, for a similar network scenario and circumstances and using the simulator, the use of the RIPv2 protocol in a network leads to a packet reaching the destination faster than EIGRP. This can be anchored on the experimentation done.

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Notes

Table 1. Hardware Used

Device Name	Model
Router 0, Router 1, Router 2	Cisco 1841
Switch 0, Switch 1, Switch 2	Cisco 2960

Table 1 shows the devices which are used in the network topology. PC0, PC1 and PC5 are representation of the actual hosts which can be used (refer to Table 2). Serial DCE is used for the link and Straight-through cables are used for the interconnection between switch to PC and switch to router.

Table 2. Addressing Scheme

Subnet Name	Needed Size	Allocated Size	Network Address	Host Address	Broadcast Address	Subnet Mask
A	30	30	192.168.1.0/27	192.168.1.1 - 192.168.1.30	192.168.1.31	255.255.255.224
B	10	14	192.168.1.32/28	192.168.1.33 - 192.168.1.46	192.168.1.47	255.255.255.240
C	3	6	192.168.1.48/29	192.168.1.49 - 192.168.1.54	192.168.1.55	255.255.255.248
D	2	2	192.168.1.56/30	192.168.1.57 - 192.168.1.58	192.168.1.59	255.255.255.252
E	2	2	192.168.1.60/30	192.168.1.61 - 192.168.1.62	192.168.1.63	255.255.255.252

Table 2 shows the addressing scheme for the network. The Major Network is 192.168.1.0/24; Available IP addresses in major network: 254; Number of IP addresses needed: 47; Available IP addresses in allocated subnets: 54; About 25% of available major network address space is used; About 87% of subnetted network address space is used.

Figure1. Time Difference between RIPv2 and EIGRP

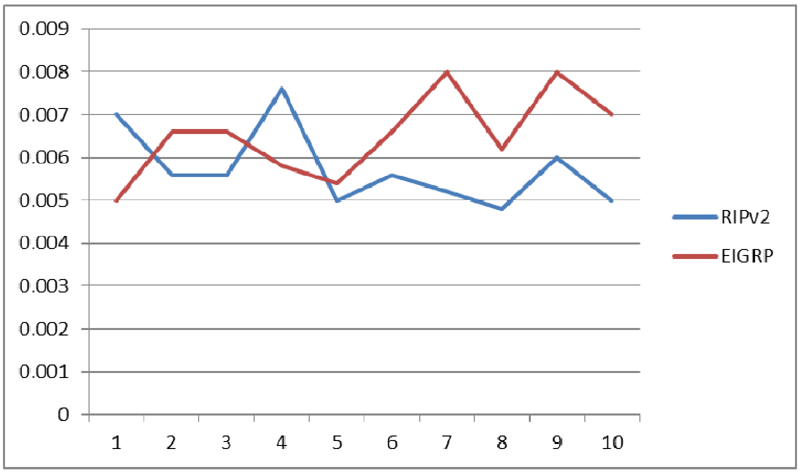

Figure 1 shows the graph of the 10 instances with which the PDU was sent from source to destination. Values are presented in seconds. On the average, RIPv2 packet reached faster than EIGRP packet.

Figure 2. Network Scenario

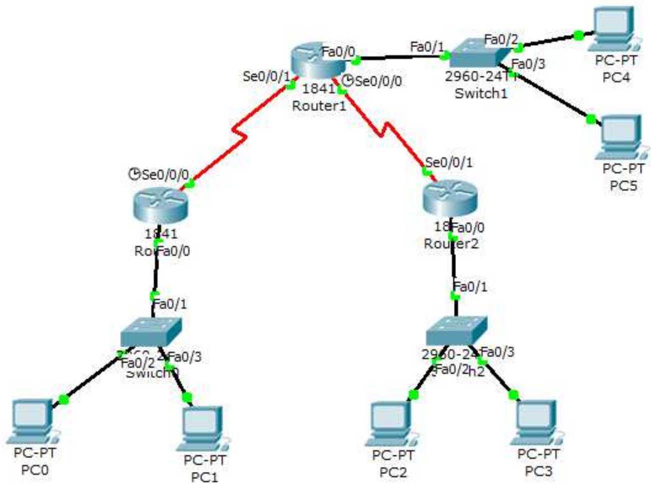

Figure 2 shows the network scenario used for both protocols.