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Comparison of Routing Protocols in-terms of Packet Transfer Having IPV6 Address Using Packet Tracer

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Abstract

In the network the transmission of data is based on the protocols which play a vital role in terms of packet transfer. A routing protocol is a protocol which is responsible to determine how routers communicate with each other and forward the packets through optimal path to travel from source node to destination node. Each routing protocols performs in different ways they have their own architecture, route to follow sometimes even delays in packets. This paper is basically the comparison of three different routing protocols which are RIP, EIGRP, OSPF using the network simulator called Packet Tracer having IPV6 as an address since IPv4 addressing space has almost been exhausted many organization will soon be required to perform the changeover to IPv6 which is more secure and a study analysis three popular routing protocols; RIP, OSPF and EIGRP and the major differences have been identified and discussed hence result show which protocols works more efficiently and have faster.

Keywords: RIP; EIGRP; OSPF; IPV6; Packet Tracer

Introduction

Background

In modern era of information technology, communication networks are growing rapidly day by day. To provide efficient routing in the network several routers take part in the networks which not only forwards the information in the form of packets but also keeps an eye on the data so that it remains in control manner. Routing protocols specify how routers communicate with each other by disseminating information. The router has prior knowledge about the adjacent networks which can assist in selecting the routes between two nodes [1].

Each routing protocols have their own algorithm and have difference in performance basically Three typical types of routing protocol are chosen as the simulation samples: RIP, OSPF and EIGRP. RIP (Routing Information Protocol) is one of the oldest routing protocols still in service. Hop count is the metric that RIP uses, and the hop limit limits the network size that RIP can support. OSPF (Open Shortest Path First) is the most widely used IOSPF is based on the Shortest Path First (SPF) algorithm which is used to calculate the shortest path to each node. EIGRP Enhanced Interior Gateway Routing Protocol) is Cisco's proprietary routing protocol based on Diffusing Update Algorithm.

Internet Protocol version 6 (IPv6) were designed to address the problem of limited address space by providing 128bits of addressing space, providing 2128 IP addresses; a practically limitless addressing space for new internet enabled devices to utilize IPv6 brings a number of improvements over IPv4 in addition to increased addressing space; IPv4 contains no securitymechanisms rather rely on the protocols and reason to switch from IPV4 to IPV6 is higher number of nodes can be connected and for the higher security mechanism.

In this paper we review the three different routing protocols in times-stamp to deliver the packet from one node then receive the message of delivery which simply show the time taken to travel the packet from source to destination. And time taken for message to travel is noted down, routing protocols are configuring separately and study using graph which is done in the network simulator called packet tracer which is the advance tools which provide the environment to configure the protocols virtually and study the times-stamp for each routing protocols.

Objective

The primary objective of this research paper is to study the different routing protocols by using the network simulator Packet Tracer and determine the transfer of packet from one node to another node and study how these protocols perform individually. In order to fulfill the primary objectives, secondary objectives of the research paper are to study the protocols in detail and in network simulator the nodes been configured with the IPV6 as an address which means large number of nodes can be added but, in this research, paper conducted with the configuration using two different networks. The outcomes been generated in the table

with respect to the sending and receiving packets and message from source to destination and from generated table the graph been plotted with their respective data and conclude that which routing protocols performs faster when the network model have same configuration using different routing protocols.

Research questions

1. The time taken by the packet to travel from source to destination and which route the packet travel?

2. Comparatively which routing protocols performs better?

The paper has been further divided into six sections. From brief introduction to the final conclusion where section 3 to 3 show the brief introduction about the protocols as well the IP address that conducted in the network model. Section 4 show the simulation setup where the model been design and implement the network with different routing protocols. Then finally methods in next section.

Dynamic Routing Protocols

In computer networks, the routing protocol specifies how routers communicate to select the routes for information or data transfer for that, the routing algorithm is more important First, the routing protocol informs or shares the information with their associative neighbors and then throughout the network, in which topology is determined [2]different types of dynamic routing protocols are RIP, EIGRP, OSPF. Dynamic routing protocols provide increased scalability over static alternatives and the ability to automatically adjust to network topological changes such as a failed component; rerouting traffic through alternative paths automatically with minimal disruption[3].

Rip(routing information protocol)

RIP stands for Routing Information Protocol in which distance vector routing protocol is used for data/packet transmission. In Routing Information protocol (RIP), the maximum number of Hop is 15,as the route goes beyond 15 then the hos is unreachable because it prevents routing loops from source to destination. As comparing to other routing protocols RIP have the less limit size and used for small network main advantage of RIP over other protocols is that it uses UDP(user data program).Rip has basically four timer which is update timer(default 30 seconds), invalid timer(default 180 seconds), hold down timer(default 180 seconds), flush timer(default 240 seconds). the only issue in the rip is that is performs slowly and for faster Rip in small network RIPV2 is used which is RIP version2.

Enhanced interior gateway routing protocol (EIGRP)

The Enhanced Interior Gateway Routing Protocol (EIGRP) is a hybrid routing protocol. EIGRP saves all routes rather than the best route to ensure the faster convergence. EIGRP keeps neighboring routing tables and it only exchange information that its neighbor would not contain. EIGRP is commonly used in large networks, and it updates only when a topology changes but not periodically unlike old Distance-Vector protocols such as RIP. The fast convergence feature in EIGRP is due to the Diffusing Update Algorithm (DUAL). The diffusing update algorithm is a routing protocol used by EIGRP to calculate and create routing tables to determine whether a path is looped or loop-free and it determine the most efficient (least cost) route to a destination. It also allows a router running EIGRP to find alternate paths without waiting on updates from other routers [1].

Open Shortest Path First (OSPF)

OSPF is the most widely used routing protocol in large enterprise networks. OSPF is based on link-state technology by using shortest path first(SPF) algorithm which calculates the shortest path among all the possible path. OSPF puts the possible route in the topology map and select the best route to travel.which will be the shortest path among all the possible route.Compare to RIP, OSPF has no limitation due to hops (RIP has a limit of 15 hops so any network with more than 15 hops cannot be achieved by RIP. OSPF can handle Variable Length Subnet Masks (VLSM) but RIP cannot. The most important is that OSPF converges much faster than RIP due to its calculation algorithm. This might not be significant in a small size network but in large enterprise networks, this will be a time out[4-6].

IPV6

The new version of the IP protocol that was to be developed required the following main objectives: extend the IP address space, correct the defects of IPv4 standard and improve its performance as much as possible, anticipate future needs, and promote innovation by simplifying the implementation of functional extensions to the protocol.First of all, IPv6 provides a much larger address space than IPv4, with the transition from 32-bit coding of IPv4 addresses (4.3 billion addresses) to 128-bit coding of IPv6 addresses (3.4 1038, or 340 billion, billion, billion, billion addresses)for IPV6 the router needs to turn ON for whereas IPV4 which is by default.

Simulation Setup

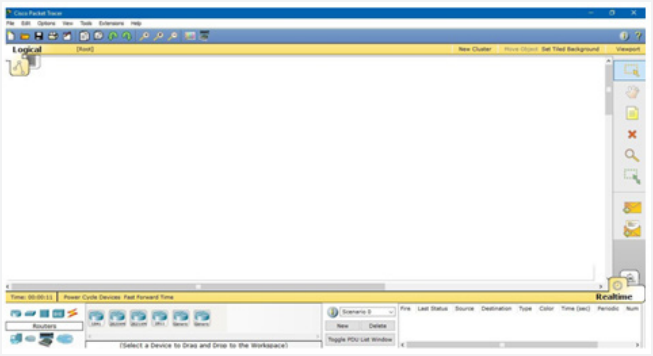

Figure 1: packet tracer running environment.

Packet tracer is the network simulator created by Cisco and they provide the free distribution to student and faculty. It is used to configure the routing protocols virtually and perform

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theoperations one by one and calculate the time travel for the message from one node to another node. Starting phase network model is design and secondary phase routing protocols been configured. Packet tracer environment is shown below in Figure1.

Methodology

In order to dig out the answers to the research questions, the study adopted network model as the research strategy and documents as data generation methods.

Network model

In the network model network topology been design in the network simulator which basically consist of Router, Switch, cable and End Nodes. In this work three different Network models were design where configured these routing protocols one by one in order to observe how theserouting protocols actually works. The network model which is used to evaluate the time to travel the packet from one end device(PC) to other end devices is shown belowFigure 2.

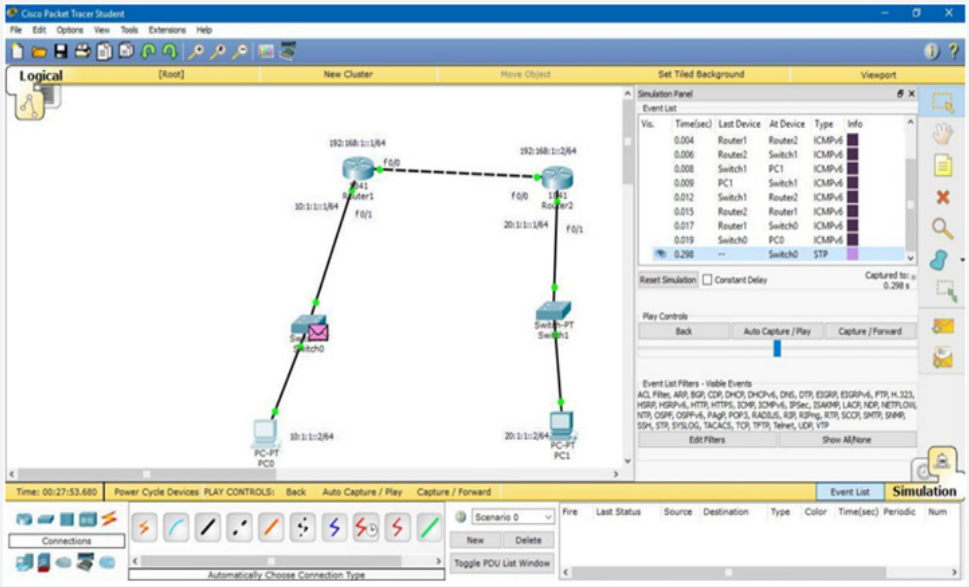

Figure 2: Network model a network topology configured three different routing protocols (RIP, EIGRP, OSPF).

Data collection

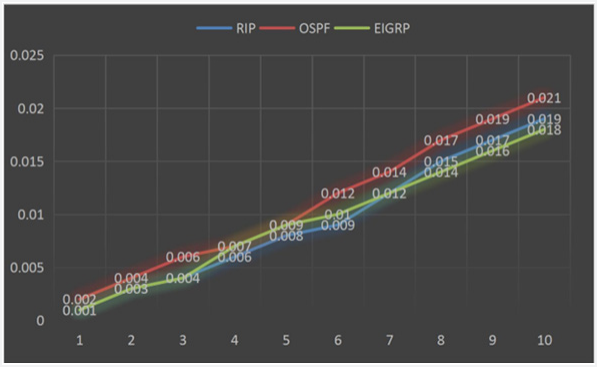

Figure 3: Comparison of three routing protocols with respect to time zone (from Table 1,2,3) and the number of stations it travels while packet transfer.

The research was carried out using ping techniques: which is basically to check the connectivity to one node to other node connected in different routing protocols RIP, EIGRP, OSPF and network may be different so that packet can be send from source to destination.as shown in Figure 3 a network model been design for each routing protocols and calculate the time taken for the packet to send and receive to the destination node. These data were obtained while we run ping command from the traffic generator and run the simulation using Auto/Capture/Play button which show the time taken by the packet to travel from one station to other station and finally reaching to the destination. These data been noted down in Table 1-3with their respective station which route the packet takes to reach the destination[5-10].

Table 1: Total time taken to travel from node PC0 to PC1 while having Rip as routing protocol and ICMP as a reference message with no constant delay.

Time(in sec)	Last Device	At Device	Type
0.001	PC 0	Switch 0	ICMPV6
0.003	Switch 0	Router 1	ICMPV6
0.004	Router 1	Router 2	ICMPV6
0.006	Router 2	Switch 1	ICMPV6
0.008	Switch 1	PC 1	ICMPV6
0.009	PC 1	Switch 1	ICMPV6
0.012	Switch 1	Router 2	ICMPV6
0.015	Router 2	Router 1	ICMPV6
0.017	Router 1	Switch 0	ICMPV6
0.019	Switch 0	PC 0	ICMPV6

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Table 2: Total time taken to travel from node PC0 to PC1 while having OSPF as routing protocol and ICMP as a reference message with no constant delay.

Time(in sec)	Last Device	At Device	Type
0.002	PC 0	Switch 0	ICMPV6
0.004	Switch 0	Router 1	ICMPV6
0.006	Router 1	Router 2	ICMPV6
0.007	Router 2	Switch 1	ICMPV6
0.009	Switch 1	PC1	ICMPV6
0.012	PC1	Switch 1	ICMPV6
0.014	Switch 1	Router 2	ICMPV6
0.017	Router 2	Router 1	ICMPV6
0.019	Router 1	Switch 0	ICMPV6
0.021	Switch 0	PC 0	ICMPV6

Table 3: Total time taken to travel from node PC0 to PC1 while having EIGRP as routing protocol and ICMP as a reference message with no constant delay.

Time(in sec)	Last Device	At Device	Type
0.001	PC 0	Switch 0	ICMPV6
0.003	Switch 0	Router 1	ICMPV6
0.005	Router 1	Router 2	ICMPV6

Data analysis

To measure and assess the impact of the traffic sent/received in the network, the simulator was run under Best effort and traffic generated through a ping method from PC0 to PC1 which show the connectivity and transfer of packet from one node to other and return the delivered message (reference Figure 2) varying the simulation time with the observed parameters. Taking Figure 2 as a reference in ping method connectivity is checked from PC0 to PC1 from the network model which is done for each routing protocols and have different time simulation from sending and receiving packets done by the traffic generator and table is constructed from the simulation time as shown in Tables1-3. And from each table a graph is constructed as shown in Figure 3and finally reveled how these routing protocols performs.

Conclusion

Findings

The overall finding of the research provides the following result

1. The generated tableshow the different timezone(second) in each station while traveling from one node to other node with the path it follows that is the name of device where packet take one station to check the destination address(Tables 1- 3).

2. Plot these generated timezone in a graph to show the comparison between three different routing protocols(RIP,EIGRP,OSPF). Which show EIGRP is comparatively faster while other two protocols but in some respect and small connection could lead to RIP faster.

3. IPV6 implemented in each routing protocols while IPV4 is outdated in some organization.

Contribution

My contribution in the field of computer networking while working with these routing protocols are as follows:

1. Analysis of the time generated by each routing protocols.

2. Formulate the steps to calculate the evaluation of the routing protocols on the basis of traffic generator

Limitation

Some limitations of this research can be summarized as follows:

1. This research covers the small network as shown in Figure2.

2. Although that is done on the simulator, but these values could be difference in Router.

3. Among different routing protocols only three protocols taken as major and evaluated.

4. As for IPV6 small number of nodes were define,where nodes like PC0,PC1.

Recommendation for Future Work

The recommendations to the researchers for future work have been listed below:

1. Researcher could include expand the research calculating all the routing protocols in IPV6 which is currently running in different organization.

2. Only conducted on PING traffic generator could extend on different sector like HTTP,TELNET.

This paper demonstrated that CISCO Packet Tracer can be employed by network planners to select the most suitable routing protocol for various networks and to design an optimal routing topology. Among RIP and OSPF routing protocols the best protocol is EIGRP because it provides a better performance than RIP and OSPF, it has a good impact in the world ofnetworking due to its fast convergence time improved scalability and for sure the great handling of routing loops and also EIGRP has a great impact in PING application which gives it the power to be in the lead of routing protocols.

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