PERFORMANCE ANALYSIS OF EIGRP AND OSPF ROUTING PROTOCOLS FOR A CLIENT NETWORK

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Abstract

In a computer network, the transmission of data is based on the routing protocol which selects the best routes between any two or more nodes. Different types of routing protocols are applied to specific network environment. Two types of routing protocol are chosen as the simulation samples; OSPF (Open Shortest Path First) and EIGRP (Enhanced Interior Gateway Routing Protocol). OSPF is the most widely used IGP (Interior Gateway Protocol) large enterprise networks. OSPF is based on the shortest path first algorithm which is used to calculate the shortest path to each node. EIGRP is Cisco's proprietary routing protocol based on diffusing update algorithm. This paper aims to analyze the performance of the two protocols based on their network convergence (sec) and traffic dropped (packets / sec). The simulation was carried out with the use of opnet, taking the Department of Computer Science, School of Technology, Kano State Polytechnic, Nigeria, as a case study. In terms of convergence time, it was found out that EIGRP is faster than OSPF.

Keywords: OSPF, EIGRP, IGP, OPNET, Client Network

1. Introduction

Routing algorithms defines routing protocols in which various metrics are relied upon in order to transmit data across a network. These metrics include bandwidth, packet delay, hop count cost and maximum transmission unit. Routing tables are utilized by routing protocols to store the results of the metrics mentioned, based on whether the routing is within an autonomous system or systems. The two protocols EIGRP and OSPF that were to be analyzed in this work are part of interior gateway protocols.

Routing is the process of selecting the best possible paths in a network, and in packet switching networks, routing directs the traffic forwarding of logically addressed packets through intermediate nodes from their source to their destination. Routing protocols are designed in such a way as to select and determine the best possible route to each router in the network. Forwarding of data should be very efficient and also effective. Therefore, the routing decision of a protocol is very important for network performance.

Two major classes of routing protocols that are used extensively are; Interior Gateway Protocol (IGP) and Exterior Gateway Protocol (EGP). Exterior Gateway Protocol is used to exchange routing information between autonomous systems. An example of a typical EGP is the *Border Gateway Protocol* (BGP), which is used in data transfers between Internet Service Providers (ISPs to ISPs) or between autonomous systems to Internet Service Providers. While on the other hand, Interior Gateway Protocol is a routing protocol that is used for exchanging routing information between routers within an autonomous system, for example, transferring data within an organization’s local area network. Interior Gateway Protocol can further be divided into two categories, that is; Distance-Vector Routing protocols and Link-State Routing Protocols. In Distance-Vector Routing Protocols, routers communicate with nearby routers from time to time to inform them about network topology changes. While in link-state routing protocol, routers normally create a roadmap of how they are connected in that network by calculating the best path from that router to every other possible destinations within the network, link state routing protocols form the routing table. Enhanced Interior Gateway Protocol (EIGP) is part of Distance-Vector Routing Protocols. Whereas, Open Shortest Path First (*OSPF*) is a part of Link-State Routing Protocols.

1.1 Objectives of the Study

This research work will aim to achieve the following objectives:

i. Analyse the performance of OSPF and EIGRP in terms of network convergence and packet drop in a traffic.
ii. To subsequently select which among the two routing protocols is suitable for a client network.

2. Review of related works

Xu & Trajković (2011) uses OPNET Modeler to analyze the performance of RIP, EIGRP, and the OSPF protocols, which are the commonly deployed in Internet Protocol (IP) in a network. Various simulation scenarios were designed to compare their performances. Which, they concluded that OPNET Modeler can be employed by network planners to select the most convenient routing protocol for various networks and to design an optimal routing topology.

Kudtarkar, Sonkusare, & Ambawade (2014) in their work use OPNET (Optimized Network Engineering Tool) to compare among Interior Gateway Protocols (IGP) protocols for real time application which is done with Weighted-Faired Queuing (WFQ) technique using different scenarios. The result provides guidelines to network engineers to decide which protocol should be deployed for a custom application. In their conclusion they found out that EIGRP will be the best choice for File Transfer Protocol, Email and Database access as compared to other protocols for non-real time applications, whereas OSPF and IGRP were found out to give a better performance in terms of real time application.

Syed, Sufyan, & Majid, (2014) in their work simulated the performance of four routing protocols using OPNET, which are RIP, OSPF, IGRP and EIGRP using the following parameters: queuing delay, end to end delay, convergence, and throughput. They found out that; EIGRP performs better in terms of highest link utilization and throughput then followed by OSPF. But, OSPF has a slight edge in terms of least cost transmission and lower overhead

3. Methodology

In order to analyse the performance of OSPF and EIGRP, OPNET Riverbed Modeler Academic Edition 17.5 for simulation was used.

3.1 NETWORK TOPOLOGY

Figure 3.1 is the simulated network which consists of five Cisco routers and two Personal Ethernet workstations computers connected to each other with Point to Point Protocol (PPP) using Digital Signal 3 (DS3). Moreover, the network consists of configured application definition, profile definition and failure/recovery node.

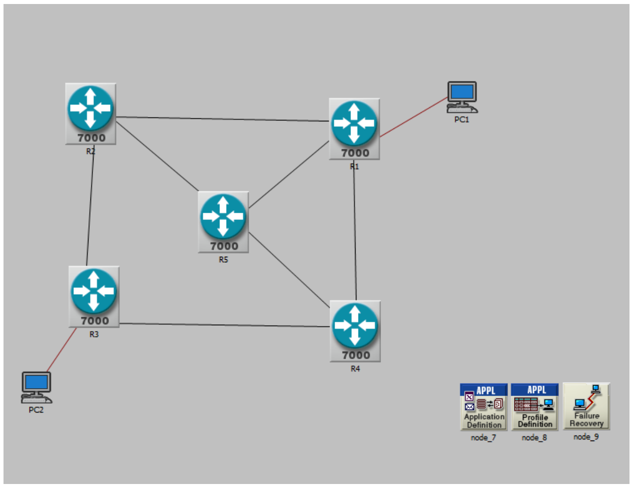

Fig 3.1 OPNET simulated network topology.

3.2 **Simulation Setup for Failure/Recovery Configuration**

Figure 3.2 shows the setup for Recovery Configuration. The simulation time is set to be 15 minutes for the first situation and 24minutes for the second situation, the first failure is set to be 4 minutes which is 240 second, and the recovery is set to be 420 seconds and so on.

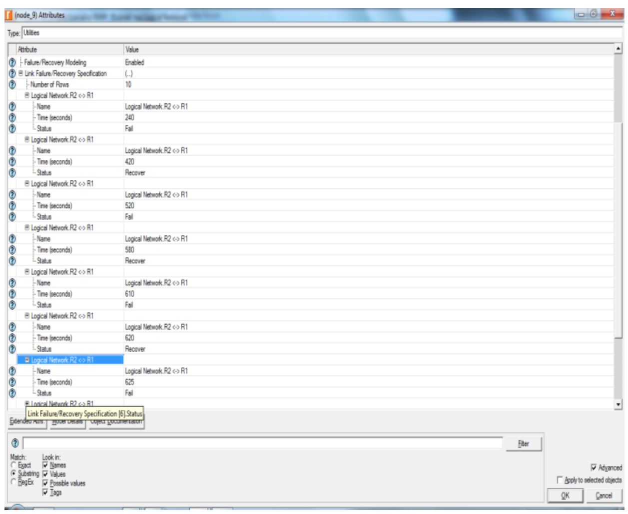

Fig 3.2 failure/recovery configuration

3.3 **Simulation Setup for Individual DES statics**

For the two protocols that will be examined, their individual statics will be set differently. This concludes the features that will be compared in the research work which is Convergence Duration and Traffic drop (packet/sec).

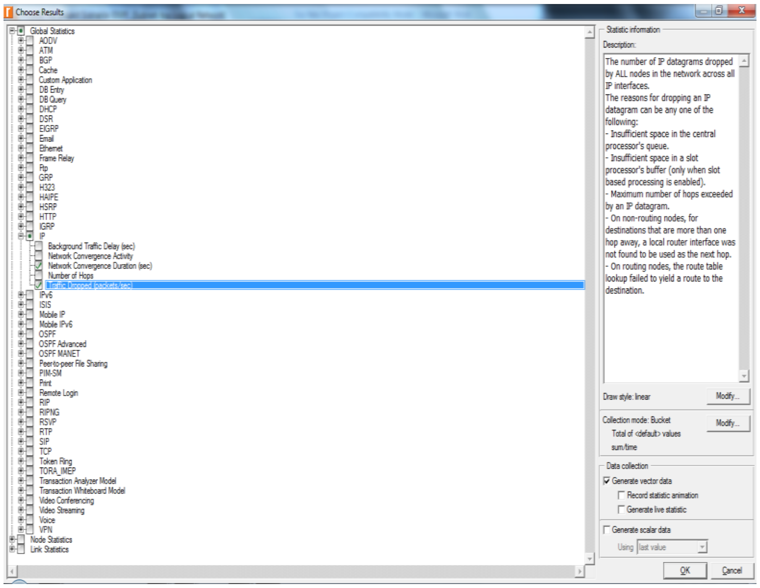

Fig 3.3 EIGRP DES statics

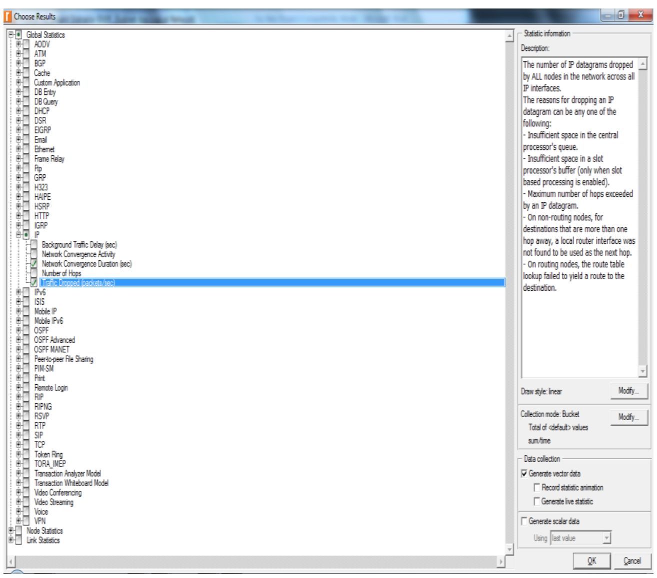

Fig 3.4 OSPF DES statics

3.4 **Simulation setup for EIGRP and OSPF** routing protocols configuration.

The simulation for the individual routing protocol that is EIGRP is shown in fig. 3.5 while that of OSPF is shown in fig.3.6

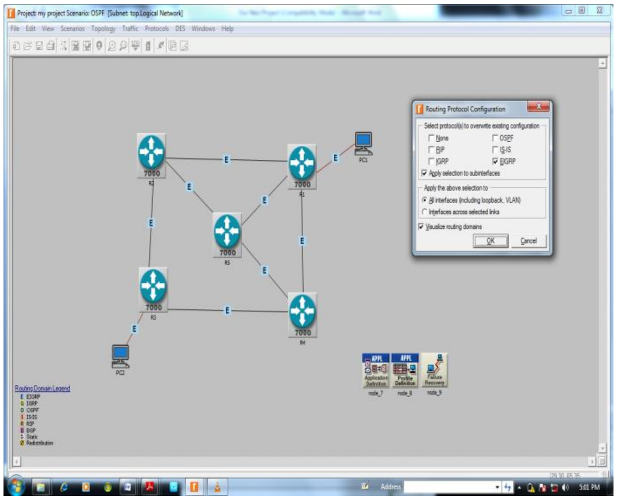

Fig3.5 EIGRP routing protocol configuration

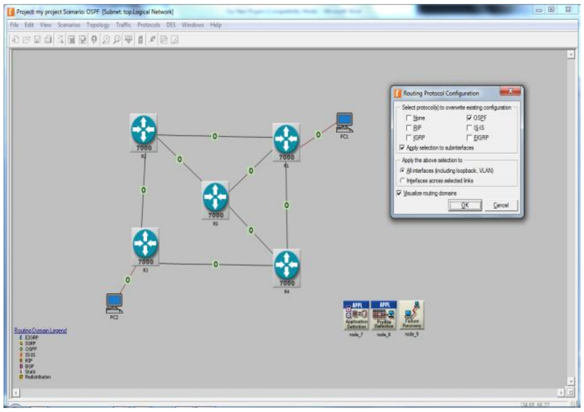

Fig 3.6 OSPF routing protocol configuration

These networks were analyzed under two situations to check the convergence of OSPF and EIGRP, as shown in tables 3.1 and table 3.2 with different timing for the failing and recovery time.

Table 3.1: first situation for link failure recover

STATUS	Time (sec)
Fail	240
Recover	480
Fail	720
Recover	960
Fail	1200
Recover	1440

Table 3.2: second situation for link failure recover

STATUS	Time (sec)
Fail	240
Recover	420
Fail	520
Recover	580
Fail	610
Recover	620
Fail	625
Recover	626
Fail	726
Recover	826

4 Analysis and Results

The performance of the two protocols namely OSPF and EIGRP were analysed respectively over a network with different scenarios. The performance was analyzed in terms of convergence time and traffic drop (package/second) for 15 minutes in case of situation 1 and for 24 minutes in case of situation 2. When the network was tested under these two situations, the result for convergence time in case of OSPF and EIGRP are shown respectively in fig 4.1 and fig.4.2

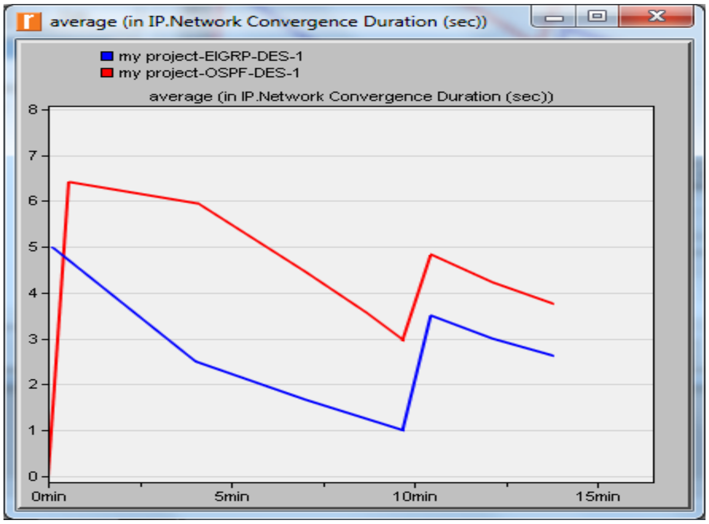

Fig. 4.1 Convergence in case of situation 1

Fig 4.2 Convergence in case of sitiuation 2

From the result from fig. 4.1 and fig. 4.2 above, it can be seen that convergence time with EIGRP is faster, this may be because it uses an algorithm called dual update algorithm or DUAL, which is run when a router detects that a particular route is unavailable. Since each OSPF router has a copy of the topology database and routing table for its particular area, any route changes are detected faster than with distance vector protocols and alternate routes are determined.

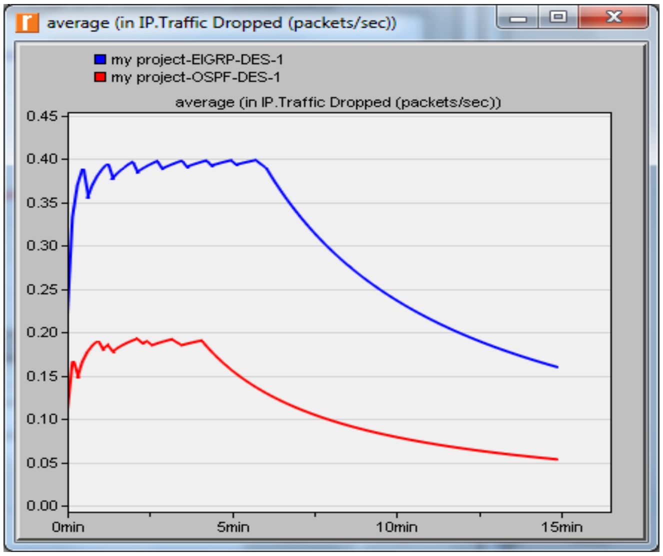

Fig 4.3 Traffic dropped (packets/sec) in case of situation 1

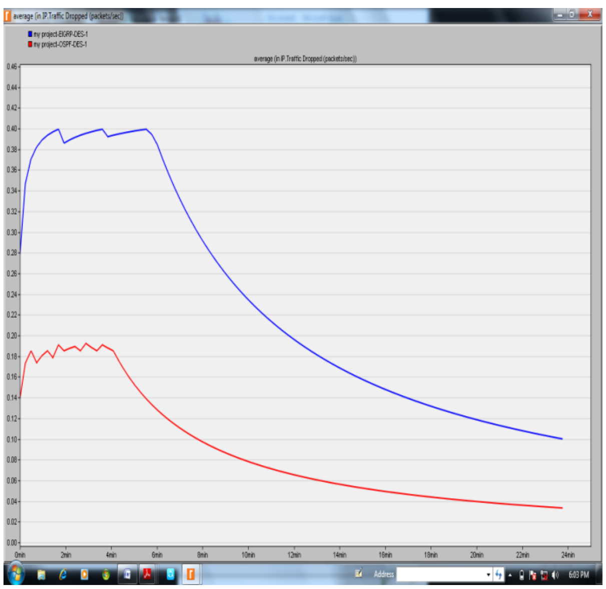

Fig 4.4 Traffic dropped (packets / sec) in case of situation 2

IP Traffic Dropped: Simulations have also been carried out as shown in fig.4.3 and 4.2 in terms of packet dropping, where the traffic dropping statistics is shown. It can be observed that OSPF have a higher packet drop than EIGRP which is the lowest.

5. CONCLUSION

The performances of OSPF and EIGRP were analysed under two different situations, with two different parameters. And it was observed that, according to the convergence duration results, EIGRP is the fastest routing protocol among the two protocols during initializing, failing and recovering. While, OSPF has the slowest convergence (OSPF has to let all the routers to know each other).

In terms of packet dropped, the results of the simulation of two protocols reveal that the performance of EIGRP to be higher because of the low packet drop.

From the analysis of all simulation results, it can be concluded that EIGRP is the best choice for a client network since it has the fastest convergence time and low traffic dropped.

5.1 Future Research

In future or as a frontier for further research, the security aspect analysis for OSPF and EIGRP should be looked into. In addition, different topologies in terms of the number of routers and links, distance and topology types should be tried to be implemented. In this research, the analysis for OSPFv2 and EIGRP in the IPv4 environment based on OPNET was carried out. In the future OSPFv3 and EIGRP in the IPv6 environment using OPNET should be carried out.

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