Network Performance Analysis of Routing behaviour between OSPF and EIGRP on the basis of Hierarchical and Flat Structures using Cisco Packet Tracer

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ABSTRACT
Networking has evolved immensely in recent years. With the increasing need to distribute applications across multiple networks, and the availability of high capacity, high-performance intermediate switching nodes and networks, the core requirement has become an efficient routing mechanism. Standard based protocols have become a requirement of the networks of today. Enhanced Interior Gateway Routing Protocol (EIGRP) and Open Shortest Path First (OSPF) protocol are currently deployed dynamic routing procedures which are used to circulate network topology data to adjoining routers. Choosing the right procedure to route depends on a number of factors. The simulator software cisco packet tracer shows the impact of routing protocol for different types of applications in hierarchical and flat structures. In this research work, it will evaluate OSPF and EIGRP's routing behavior regarding their hierarchical and flat structure, and will also consider parameters such as bandwidth and delay.

KEYWORDS: *Routing, OSPF, EIGRP, Structure, Packets*

1. INTRODUCTION

Routing is the process of moving data from a source to a endpoint over an internetwork. Usually, at least one transitional node comes across alongside the way. Routing is often compared with bridging, which to the casual observer could seem to be doing exactly the same thing. The major difference among the two is that linking occurs in the OSI reference model's Layer 2 (the data link layer), while routing arises in the Layer 3 (the network layer). This feature delivers routing and bridging with various data to be used in moving data from source to endpoint, so that the two functions perform their jobs differently. The issue of routing has been covered for more than two decades in computer science literature, but routing reaches commercial popularity as late as the mid-1980s. The major reason for this time delay is that, in the 1970s, networks were modest, homogenous environments. But now large-scale internetworking is becoming popular for days.

1.1 Dynamic Routing Protocols Overview

Routers use dynamic routing procedures to make route determinations. Statically configured routers can not find routes; there is no mechanism for contact with additional routers of routing information. Statically configured routers can only promote packets using network administrator-defined routes.

1.2 OSPF (Open Shortest Path First)

Open Shortest Path First (OSPF) is a conne-state routing procedure that usages its own Shortest Path First to discover the finest pathway among the source and the endpoint router. OSPF is defined as one of the Interior Gateway Protocol (IGP) by the Internet Engineering Task Force (IETF), i.e., a procedure that aims to handover the envelope inside a large autonomous system or routing province. It is a protocol with a network layer that activates on procedure number 89 and usages AD value 110. OSPF usages the assigned router(DR)/Backup Assigned Router (BDR) multicast address 224.0.0.5 for regular communication, and 224.0.0.6 for upgrading.

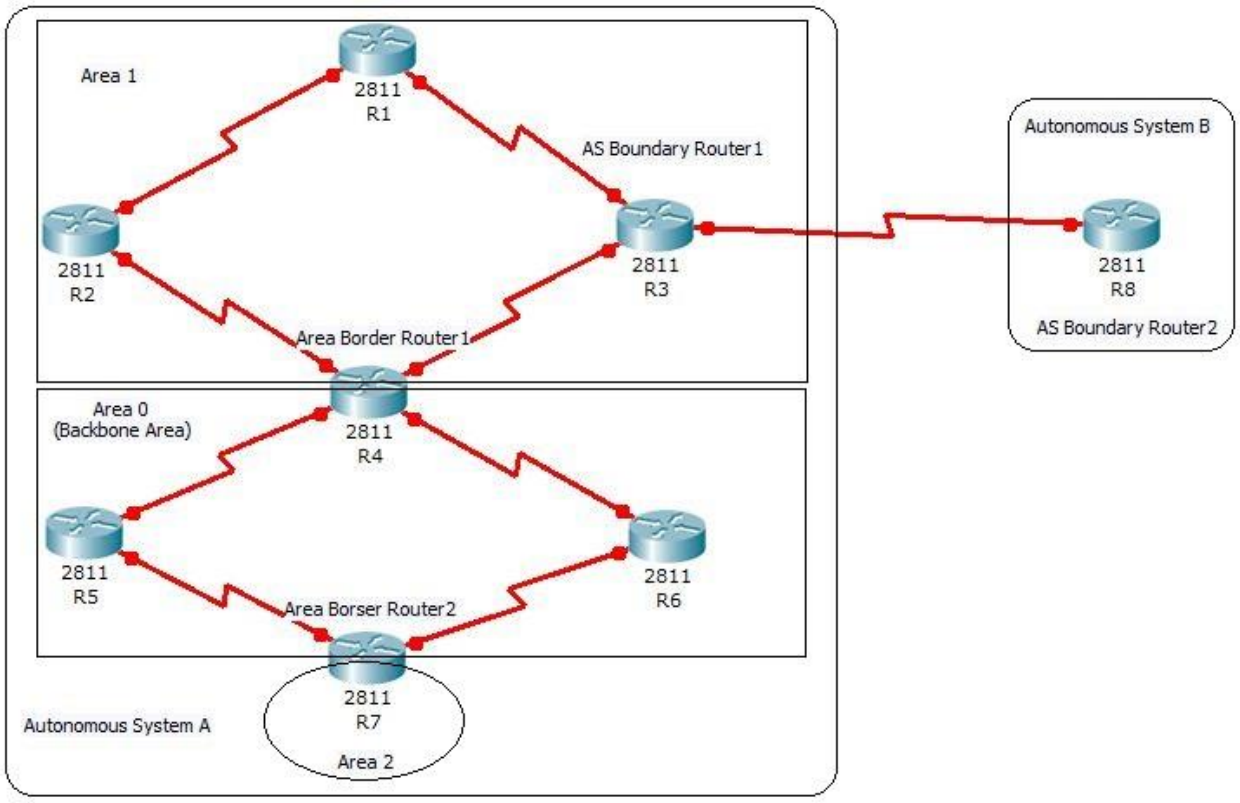

Figure 1: Basic OSPF Network Topology

1.3 OSPF Routing Hierarchy

The Routing Hierarchy of OSPF contains the following organizations:

- Autonomous systems
- Areas, including the backbone and normal areas
- Area Border Router (ABR)
- AS Boundary Router (ASBR)

1.4 EIGRP (Enhanced Interior Gateway Routing Protocol)

EIGRP is a proprietary protocol for a cisco. EIGRP is a relatively new, IGRP-based advance from Cisco. EIGRP shares the distance-vector technology of its predecessor, but varies widely in their operational mechanics. In addition, there are several important new features in the EIGRP functions. EIGRP is sometimes referred to as an advanced distance vector protocol (or hybrid routing procedure). It incorporates the finest link-state routing features by the finest distance vector routing parameters. An EIGRP network, accurately planned and employed, is really firm and effective, and quickly joins afterwards any topological modification. A distinctive breakthrough in Cisco is the Improved Interior Gateway Routing Protocol (EIGRP). Highly appreciated for its ease of deployment and rapid convergence, EIGRP is commonly used in many vast networks of companies. EIGRP retains all the benefits of protocols for distance vector routing, while eliminating parallel inconveniences. EIGRP efficiently scales over a well-designed network and delivers tremendously fast convergence times with limited network traffic.

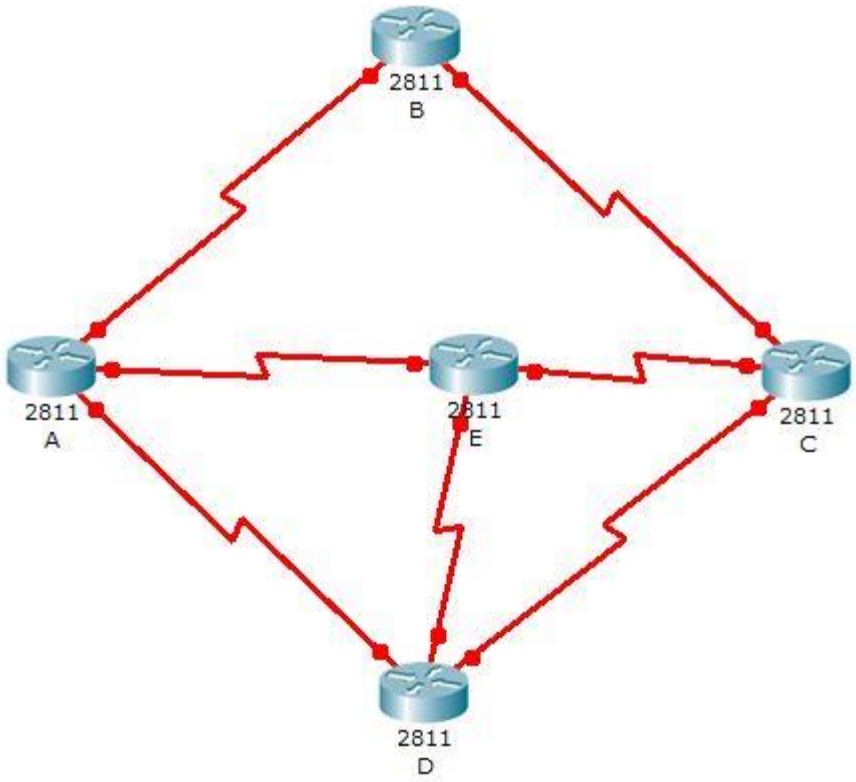

Figure 2: Basic EIGRP Network Topology

1.5 EIGRP Flat Structure

There are five routers in Figure 2, A, B, C, D and E, but in this case no specific areas that are routers are not separated into areas such as the backbone area or stub area as in OSPF.

2. LITERATURE REVIEW

Lesage, et. al. (2008) proposed the application and implementation of the OLSR extension Multiple Path Routing and Multiple Description Coding (MDC), called MP-OLSR. It was built on the algorithm of the link-state and periodically messages were exchanged to preserve network topology knowledge. Meanwhile, in an on-demand scheme, it updates the routing table and forward the envelopes in multiple paths that were identified at the source node. If a link failure is noticed, the algorithm will automatically reclaim the route. With respect to wireless network volatility, multiple definition coding has been used to improve network transmission efficiency, and numerous approaches are planned to distribute redundancy across dissimilar pathways. The virtual reality in NS2 shows that the new procedure should actually recover network performance.

Baccelli, et. al. (2010) noted that IETF has projected three dissimilar MANET extensions to the OSPF procedure, enabling heterogeneous networks that encompass both wired and wireless routers, which could be self-organizing and mobile as multi-hop wireless subnetworksTwo of those extensions are based on multipoint relaying (MPR) techniques. So they equate and scrutinize these two extensions in this paper and have proposed a unique, merged approach that outperforms the existing extensions.

Din, et. al. (2010) studied the conduct of real time routing protocols. This literature tells us how to evaluate RIP, OSPF, IGRP, and EIGRP performance for factors: dropping packets, end-to-end delay, traffic received, and delay variation (jitter). Virtual reality for assessing these routing procedures in contrast to each parameter was done in OPNET. The findings were publicized in the graphs showing that IGRP achieves the best in falling envelopes, receiving traffic, and end-to-end delay compared to its other acquaintances (RIP, OSPF, and EIGRP), while RIP performs well comparatively in the case of jitter.

Xu, D. and Trajkovic, L. (2011) an overview of RIP, EIGRP and OSPF output using OPNET. Routing procedures are important components of recent communication networks. Routing Information Protocol (RIP), Enhanced Interior Gateway Routing Protocol (EIGRP), and the Open Shortest Path First (OSPF) protocol are currently deployed dynamic routing procedures that are used to circulate network topology data to neighboring routers. Choosing the right procedure to route depends on a number of factors. OPNET Modeler has been used

to scrutinize the performance of the RIP, EIGRP, and OSPF procedures typically implemented in Internet Protocol (IP) networks. To compare their results, they conceived various simulation scenarios. Routing procedures are built on routing algorithms which rely on different metrics to discover the finest path for network-wide data transmission. Metrics embrace cost, bandwidth, maximum MTU, packet latency, and hop count. Routing procedures use a routing table to store such metric performance. In this literature, they demonstrated that network planners can use OPNET Modeler to select the most appropriate routing procedure for different networks and to design an optimum routing topology.

Sasthiri B. and Prakash T. (2012) identified outdated routing arrangements that direct all traffic one way, multi-path routing strategies that divide traffic across multiple pathways to control congestion. We said multi-path routing can be significantly more effective than conventional single-path routing approaches. Nonetheless, compared to the single pathway routing attitude, utmost studies are based on heuristic approaches in the sense of multipath routing. They show the substantial benefit of optimal (or near-optimal) solutions. We therefore studied multi-path routing with a detailed approach (theoretical). They formalized problems which incorporate two major multi-path routing requirements. Then, in computational intricacy requirements they established the intractability of these problems.

3. PROBLEM FORMULATION

According to the numerous literatures I studied, I came to the conclusion that they all operated on the routing behavior of different dynamic routing protocols with respect to different parameters such as CPU utilization, point-to-point throughput, latency, bandwidth, packet loss ratio, but they did not consider any structure on how the routers are connected in a large network. There are various kinds of problems within a large network such as Congestion, Load Balancing, Bandwidth, Delay, Proper Network Utilization but massive bandwidth and better management are the criteria for solving these kinds of problems. Some strategies have been proposed to solve these problems but better routing approaches are required to provide fault tolerance and quality assurance, due to growing needs.

3.1 Methodology

Our focus will be on developing a better solution to this problem, as some of the most common simulators like cisco packet tracer solve routing problems.

3.2 Flowchart for methodology / planning of work

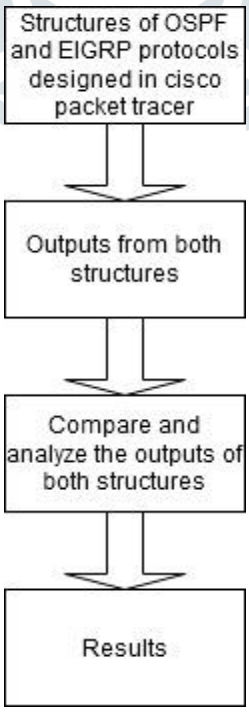

Figure 3: Methodology and Planning of Work

4. SIMULATION STUDY AND ANALYSIS

This section provides our findings on virtual reality to equate routing protocol performance.

Experimental Tools:

CISCO Packet Tracer: Packet Tracer is a Cisco Systems-designed, cross-platform visual simulation tool that permits users to form network topologies and pretend recent computer networks. The software permits users to usage a virtual command line interface to pretend the configuration of Cisco routers and switches. Packet Tracer usages a drag-and-drop user interface to permit users to add and eradicate virtual network devices as they deem appropriate.

4.1 Lab scenarios using CISCO packet tracer

Lab scenarios are made in CISCO packet tracer as the real scenarios.

4.1.1 Scenario depicting only Area 0

Overview of Scenario:

There is only one region in this scenario which is area 0 or backbone area, in which we find the number of times that the SPF (Shortest Path First) is measured. The all four routers serve as routers for Backbone. In this scenario performance we'll see how many times the SPF is measured.

Scenario of Lab 1:

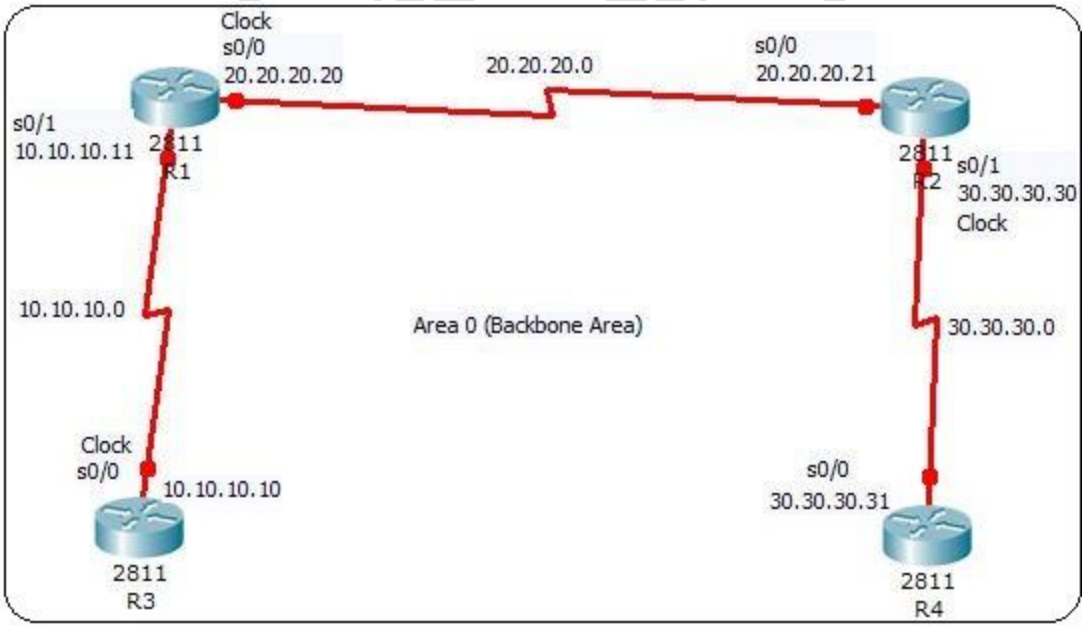

Figure 4: Scenario depicting only Area 0

Outputs:

Router R3 :

R3#show ip ospf

Area BACKBONE(0)

SPF algorithm executed 9 times

Router R1:

R1#show ip ospf

Area BACKBONE(0)

SPF algorithm executed 9 times

Router R2:

R2#show ip ospf
Area BACKBONE(0)
SPF algorithm executed 5 times

Router R4:
R4#show ip ospf
Area BACKBONE(0)
SPF algorithm executed 2 times

Explanation:
In the above results we found that router R1 has executed SPF 9 times, router R2 has executed SPF 5 times, router R3 has executed SPF 9 times and last router R4 has executed SPF 2 times because all routers are located in only one common area which is area 0 or backbone region.

4.1.2 Scenario depicting areas as Area 0, Area 1 and Area 2

Overview of Scenario:
We listed area 0 as backbone area in this scenario and area 1, area 2 as ordinary areas. There are four routers out of which the R1 and R2 routers serve as ABR – Area Border Routers, which connect Backbone Area and Normal or Ordinary Areas with one another.

Scenario of Lab 2:

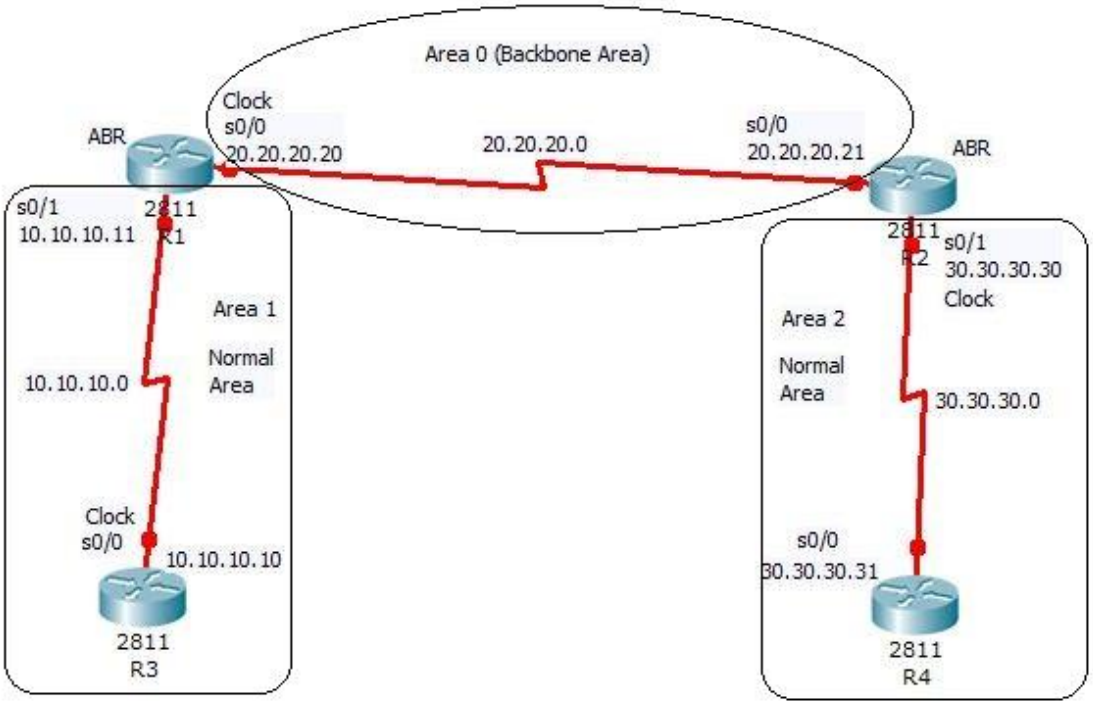

Figure 5: Scenario depicting areas as Area 0, Area 1 and Area 2

Outputs:
Router R1:
R1#show ip ospf
Area BACKBONE(0)
SPF algorithm executed 5 times

Area 1
SPF algorithm executed 3 times

Router R2:
R2#show ip ospf
Area BACKBONE(0)
SPF algorithm executed 3 times
Area 2

Router R3:
R3#show ip ospf
Area 1
SPF algorithm executed 5 times

Router R4:
R4#show ip ospf
Area 2
SPF algorithm executed 1 times

Explanation:
The result of lab 2 indicates that router R1 occurs in two areas of area 0 and area 1 so SPF measured 2 times that is 5 times for area 0 SPF performed and 3 times for area 1 SPF executed. Also the R2 router exists in 2 areas which is area 0 and area 1 so SPF calculated 2 times which is one for area 0 SPF executed 3 times and for area 2 SPF executed 4 times. The R3 router falls into area 1 and SPF has been running 5 times and the last R4 router has performed SPF just 1 time.

Comparison of Scenario 1 with Scenario 2:
As we compare the two scenarios, we find that when the entire scenario is divided into different areas, the execution of the SPF is also less than one area. This also reduces the convergence time, with lower queuing delay and thus congestion can be controlled as well.

Area	Name of Router	Scenario 1 having Area 0 only (SPF executed)	Scenario 2 having Area 0, 1 and 2 (SPF executed)
0	R1	9	5
0	R2	5	3
0	R3	9	-
0	R4	2	-
1	R1	-	3
1	R2	-	-
1	R3	-	5
1	R4	-	-
2	R1	-	-
2	R2	-	4
2	R3	-	-
2	R4	-	1

Table 1: Comparison of two different scenarios

4.1.3 Scenario depicting EIGRP with 4 Routers and 2 Hosts

Overview of Scenario:
Four Routers are used by serial connection in this scenario and are linked by EIGRP protocol. The goal of this lab is to research traffic in the EIGRP.

Scenario of Lab 3:

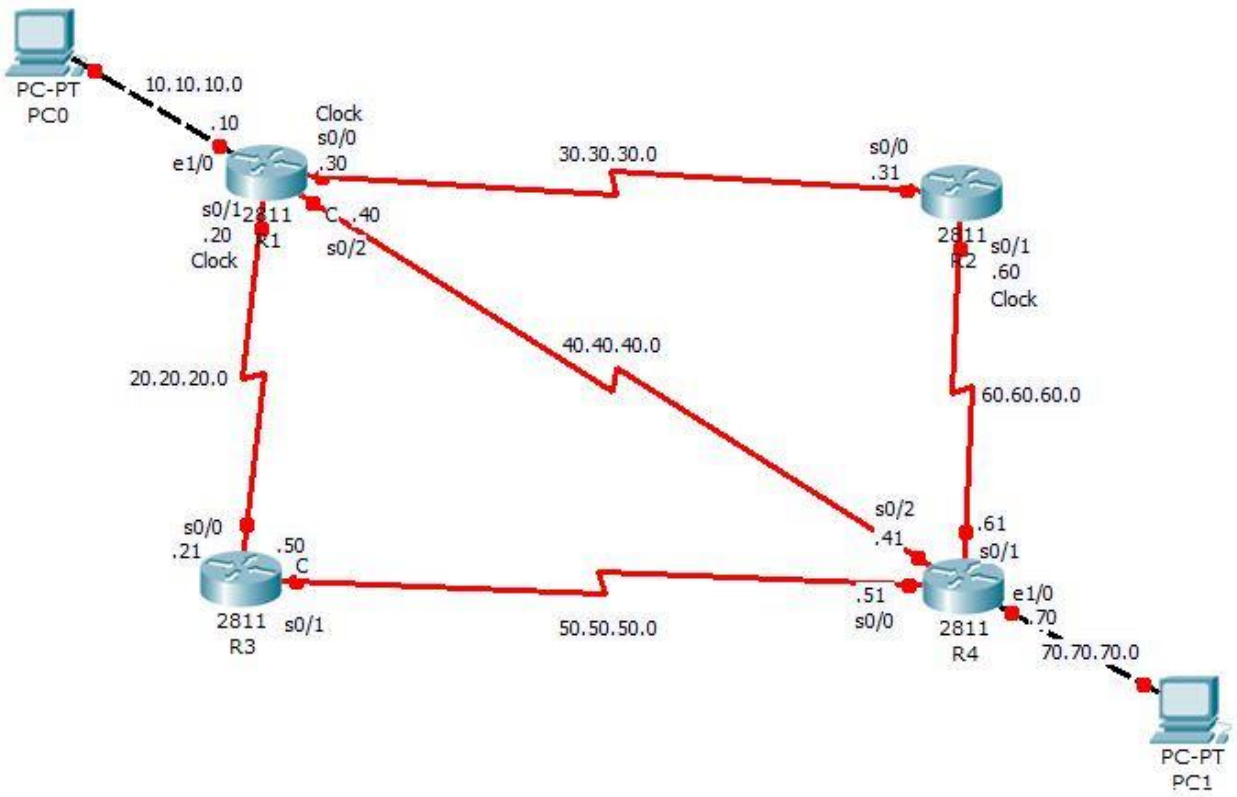

Figure 6: Scenario depicting EIGRP with 4 Routers and 2 Hosts

Outputs:
Router R1:
R1#show ip eigrp traffic
IP-EIGRP Traffic Statistics for AS 10
Hellos sent/received: 438/286
Updates sent/received: 21/21
Queries sent/received: 0/2
Replies sent/received: 2/0
Acks sent/received: 17/14
Input queue high water mark 2, 0 drops
SIA-Queries sent/received: 0/0
SIA-Replies sent/received: 0/0
Hello Process ID: 184
PDM Process ID: 182

Explanation:
This example describes the EIGRP traffic statistics as sent / received by Hellos, notifications sent / received, requests sent / received, responses sent / received, acknowledgments sent / received, input list.

5. CONCLUSION

Conclusion can be drawn by considering OSPF in both the scenarios i.e. one having only backbone region and another having different areas such as area 0, area 1 and area 2 and then comparing the outputs with the EIGRP. Only area 0 is configured in OSPF according to the first example, then there is a shortage of traffic sent (bits / sec) and network convergence parameters. About Ethernet delay, OSPF with area 0 only has better performance. So EIGRP stands best during the traffic sent (bits / sec) and the network convergence parameters. On the other hand, when we configure the OSPF with multiple areas, we found that in the case of network convergence and Ethernet delay parameters, OSPF could get better output as compared to EIGRP.

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