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Institute of Graduate Studies

Electrical and Computer Engineering

A PERFORMANCE EVALUATION BETWEEN OSPF AND RIP ROUTING PROTOCOLS BASED ON ENTIRE NETWORK

Muhmednwman Najeh Razzaq ABODRAUB

Master`s Thesis

Supervisor

Asst. Prof. Dr. Ayça TÜRKBEN

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The thesis titled A PERFORMANCE EVALUATION BETWEEN OSPF AND RIP ROUTING PROTOCOLS BASED ON ENTIRE NETWORK prepared by MUHMEDNWMAN NAJEH RAZZAQ ABODRAUB and submitted on 10/12/2022 has been **accepted unanimously** for the degree of Master of Science in Electrical and Computer Engineering

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I hereby declare that this thesis meets all format and submission requirements of a Master`s Thesis.

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I hereby declare that all information presented in this graduation project has been obtained in full accordance with academic rules and ethical conduct. I also declare all unoriginal materials and conclusions have been cited in the text and all references mentioned in the Reference List have been cited in the text, and vice versa as required by the abovementioned rules and conduct.

Muhmednwman Najeh Razzaq ABODRAUB

Signature

DEDICATION

According to to dedicate partition, the journey will not accomplish without my parents, my brothers, my sisters, my advisor, and who gave me his/her time and support to achieve this work.

PREFACE

According to the preface, this work was submitted as a gift to my main advisor Asst. Prof. Dr. Ayça TÜRKBEN for her time and advice.

ABSTRACT

A PERFORMANCE EVALUATION BETWEEN OSPF AND RIP ROUTING PROTOCOLS BASED ON ENTIRE NETWORK

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Path loss and packet down for routing protocols can be a huge issue should solve, additionally, two routing protocols will be utilized in this work according to the Open Short Path First that is known as (OSPF) will be implemented to choose the best path in the overall network that is based on Point to Point Protocol Over Ethernet (PPPOE) that will connect the entire internal network and in the same design Route Information Protocol (RIP) will be used as auto-updated messages sender and each interval update about 180 sec in additional to that, the overall comparison it will be implementing the OSPF and RIP to see the network convergence duration and the queuing delay by inserting the bridge piece between each one of neighbor is an expression as the best solution for the network to enhance the entire network. Different protocols are used to transmit packets in the network topology. The routing table is supported. It successfully routes the packet from the source node to the correct destination node through the router. participle for direct application the amount of information that the router stores in the network depend on the algorithm implemented by it. most of them Such popular routing algorithms such as RIP, and OSPF are used. In our project, we evaluate the performance of RIP, OSPF for Parameters: Coherence, Throughput, View Delay, Utilization by Simulation expressed as a simulation tool with OPNET Modeler. As in the IP network convergence duration curve, the OSPF gave regard 4 duration in 13 min while RIP reached 3.1 duration at the same time.

Keywords: Local Area Network, Open Short Path First, OPNET Modeler, Point to Point Protocol Over Ethernet, Route Information Protocol.

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ABBREVIATIONS

LAN	:	Local Area Network.
PPPOE	:	Point to Point Protocol Over Ethernet.
RP	:	Routing Protocols.
OSPF	:	Open Short Path First.
RIP	:	Route Information Protocol.
DV	:	Distance Vector.
OPNET	:	Optimized Network Engineering Tool.
ISIS	:	Intermediate System - Intermediate System.
EIGRP	:	Enhanced Interior Gateway Routing Protocol.
EGP	:	Exterior Gateway Protocol.
CD	:	Compact Disc.
VoIP	:	Voice over Internet Protocol.
BGP	:	Border Gateway Protocol.
LSA	:	Link State Advertisements.
IP	:	Internet Protocol.
IGRP	:	Interior Gateway Routing Protocol.
MTU	:	Maximum Transmission Unit.
IT	:	Information Technology.
MAN	:	Metropolitan Area Network.
BAN	:	Body Area Network.

NS	:	Network Simulator.
Telnet	:	Teletype Network.
OMNET	:	Objective Modular Network Testbed.
VLSM	:	Variable Length Subnet Mask.
CIDR	:	Classless Inter-Domain Routing.
SPF	:	Shortest Path First.
LSDB	:	Link State Database.
DBD	:	Database Descriptor.
LSR	:	Local Service Request.
LSU	:	Link State Update.
LSDB	:	Link State Database.
ID	:	Identification.
CPU	:	Central Processing Unit.
DR	:	Designated Router.
ABR	:	Area Border Router.
ASBR	:	Autonomous System Border Router.
ARP	:	Address Resolution Protocol.
PARC	:	Palo Alto Research Center.
PUP	:	PARC Universal Protocol.
HWINFO	:	Hardware monitoring Information.
XNS	:	Xerox Network Services.
IGP	:	Internal Gateway Protocol.
UDP	:	User Datagram Protocol.

VRF	:	Virtual Routing and Forwarding.
MD5	:	Message Digest Method 5.
RAM	:	Random Access Memory.
3^{rd} Gen	:	Third Generation.
7^{th} Gen	:	Seven Generation.
HTTP	:	Hypertext Transfer Protocol Secure.
ATM	:	Asynchronous Transfer Mode.

1. INTRODUCTION

These days the world has known an enormous improvement in the correspondence field between individuals. from one side of the planet to the next and we overall can see the huge capability between the past and the present and all of this is conceivable considering the way that the towards of connections.

The connection in the network contains somewhere near two machines that are related to share assets or permit electronics exchange. These machines in the connections may be relate during join, phones line, radios wave, satellites, and bars of infrared light. There is a gigantic heap for picks and methodology have permits the machines to interconnect and see one another and move messages in the connection, and we suggest these standards and procedures as shown. There are two kinds of shows which are: Inside gateway shows, for example, Open Short Path First (OSPF), Route Information Protocol (RIP), Intermediate System - Intermediate System (ISIS), Enhanced Interior Gateway Routing Protocol (EIGRP) that area shows Exterior Gateway Protocol (EGP). the tests were makes around the amusement and association between 2 inside entrance shows which are OSPF and RIP as presents in the figure 1.1[1].

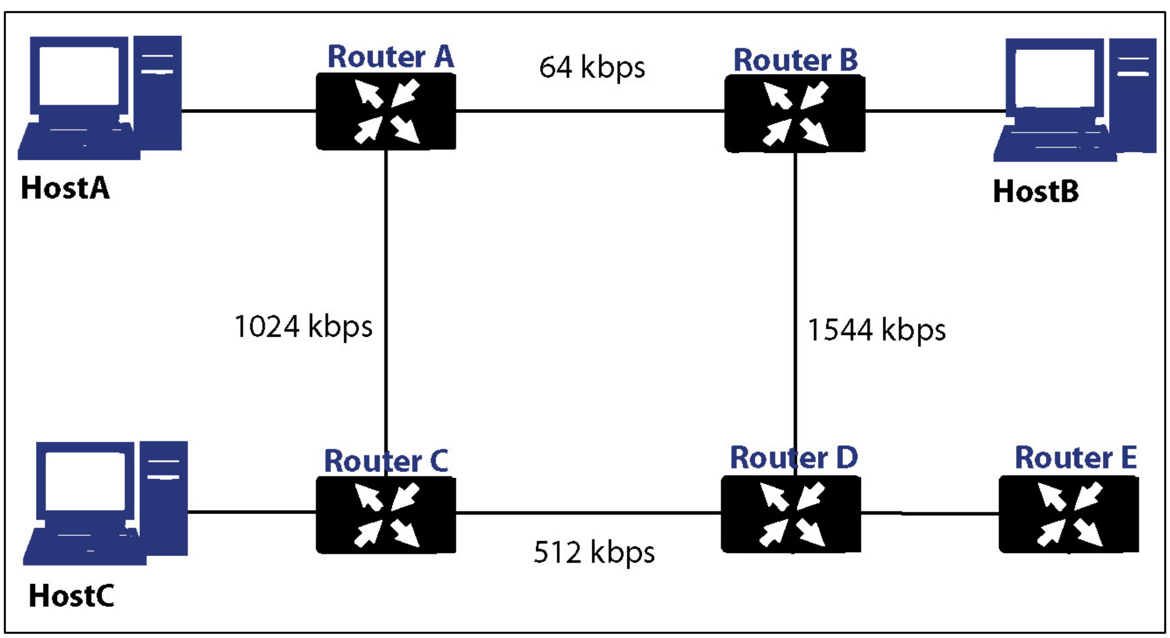


Figure 1.1: OSPF and RIP Protocols Example [1].

The fundamental demands that we will address are: First we need to know hypothetically What is a connection then we plunge somewhat more important to get a handle on shows, after that want to learn both RIP and OSPF shows and the purposes behind all of them, how everyone works and how we can duplicate each one. For that they picked this topic on account of its significance particularly after it became fundamental in a colossal heap of correspondence fields. In this manner, the objective of the tests is to imitate the way to deal with the acting of OSPF and RIP guiding Conventions and present a near report between them while showing which show is reasonable for which sort of connections that mentioned in the figure 1.2 [2].

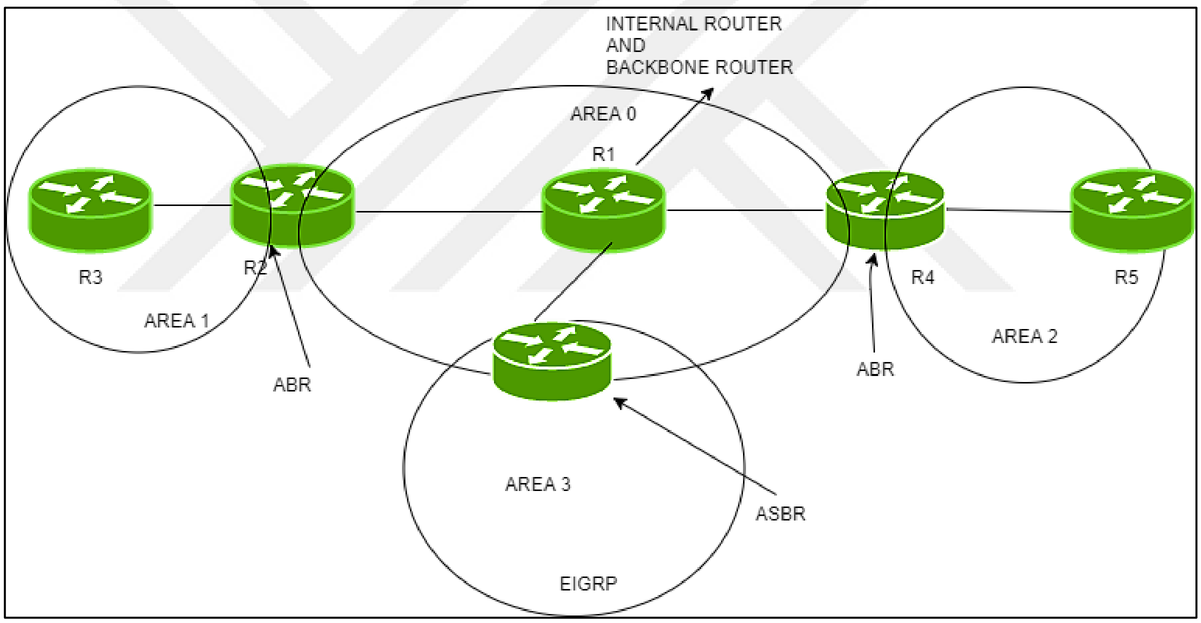


Figure 1.2: Internal and Backbone Routers for Distance Vector [2].

Nowadays, the world has experienced enormous changes in the sphere of human relations. All over the world, we all see a big difference between the past and the present. According to the Compact Disc (CD), file sharing or electronic communication. Can connect devices to the network. By cable, telephone line, radio waves, satellite, or infrared. There are many rules and methods for connecting and identifying machines with each other. A network sends messages and these rules and methods for call protocols. There are two types of protocols. Internal gateway protocols such as OSPF, RIP, ISIS, EIGRP and External Gateway Protocol (EGP) the study revolves around the simulation and comparison between two internal gateway protocols. OSPF and RIP. Key direction towards the need to understand what a network is in theory and then made deeper in the field to understand it. To utilize the protocol, the RIP and OSPF and know how to use each other additionally, how each works and how each protocol can be modeled. Can choose this topic considering its importance. Especially since it is discussed in many fields in general communication. The purpose of the simulation for the routing issue of OSPF and RIP [3]. It provides a protocol-by-protocol comparison and shows which protocol is better for each network this will help readers understand routing protocols (RIP and OSPF). They identify for the differences between them and choose the protocol that works best for them. The work with the following desktops: Recommended: Personal Computer (PC) with 7th Gen Intel i3 processor, 8 GB Random Access Memory (RAM), and 3rd Gen Intel i5 processor. Microsoft Word Office 2016 Reporting and Modeling the OPNET Modeler 14.5. Starting with the network definition, and the appropriate geographic and functional network types. Not to refer to the respected network category. regard the routing protocol and can explain the area and the protocol that described in the figure 1.3 [4].

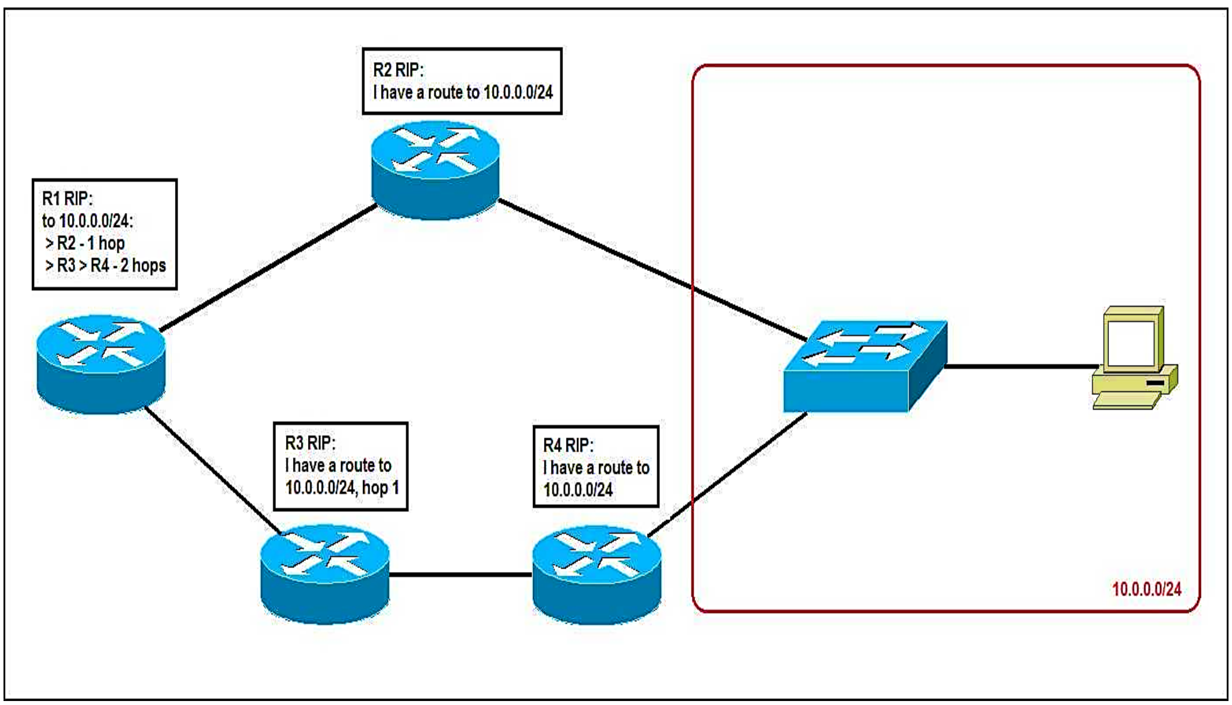


Figure 1.3: Routing Mechanism Oriented to Host [4].

1.1 MOTIVATION

Using routing protocols in the network would decrease the entire latency and throughputs in addition, the trajectory path recovery was proposed to bring and enhance the efficiency of the Routing protocols while oriented by the PPPOE DS3 interface within hosts, we have seen a huge explanation in these highlighted issues to the distance vector protocols while computer transmission exchange information between hosts. Furthermore, the distance vector protocols require an effectiveness direction, for example, VoIP, file transfer protocol, video conferencing, and a variety path would need more ability for transmitting, for example, OSPF, and RIP protocols. illustrating for the fee, could bring many focused on the flexibility for the utilize within upper initialization in fees. The ability to implement the idea could be executed in the upper coverages on Routing Protocols. The achievement within previous research is applied to direct the path toward another place via selecting the suitable and better path at least [5].

1.2 PROBLEM DEFINITIONS

When enhancement issues for routing protocols depend on distance vector, the major need for the shortest path with the lowest delay was illustrated in the information exchange for the theoretical the calculation, exactly, the deals within the routing table for the better route information protocol, many issues shall lead for shut down the routing protocols like weakness in transmitting on distance within the routing protocols for short path exactly the huge issue in the model OSPF and RIP protocols such as lower bitrate with the given PPPOE when put for OSPF, low distance with a high delay, lower throughput with choosing a short path, and lowest responses with the conventional method of OSPF and RIP protocols.

1.3 CONTRIBUTION OF THESIS

The major objective of the suggested routing protocols is prepared and made toward the distance vector based OSPF and RIP with the following goals:

a. Suggest and design the distance vector with the shortest path and use the double scenarios between OSPF and RIP to suitable direction for support the better path depending in the major components.

b. Studying the proposed system by illustrating for the different paths for routing protocols with the PPPOE DS1 depends on these enhanced estimates with reduce the paths trajectory error to avoid the weakness for utilizing OSPF and RIP.

c. The entire network on OSPF and RIP utilize can be expressed as a general problem for this type of typologies and can decrease the overall network convergence duration and queuing delay over overall network/nodes to avoid this type of loss is to add a new bridge piece to each node of the network because the OSPF protocol it will take the shortest path that's why we should use more one of bridge pieces and apply it for overall network and also the RIP it will update its information for each 180 sec of one min.

1.4 ROUTING PROTOCOLS

The purpose of the routing protocol is to find routes in the corporate network, build routing tables and make routing decisions. The most common routing protocols are RIP, Interior Gateway Routing Protocol (IGRP), EIGRP, OSPF, IS-IS, and Border Gateway Protocol (BGP). There are two types of controlled protocols, but both types define different methods. Label sample norms and interval vectors are simple types. The distance vector protocol requires bandwidth and aggregates routing tables for all directly connected neighbors at a constant low rate. If no route is found, most routers lists should be updated with this newest information. The issue is that since every router must send newest information to their neighbors, that takes the long duration to many routers to discover the network correctly. The interval vector protocol uses scale-free fixed-length subnet masks. Link-layer protocols use bandwidth more efficiently and report routing updates only as they occur. Routers do not advertise their routing table to speed up convergence. The routing protocol is populated by advertising all neighboring routers to join the network with new routing information. Another change is that everything is advertised as a multicast Link State Advertisements (LSA) update to all routers. Use a variable-length subnet mask as present in the figure 1.4 [6].

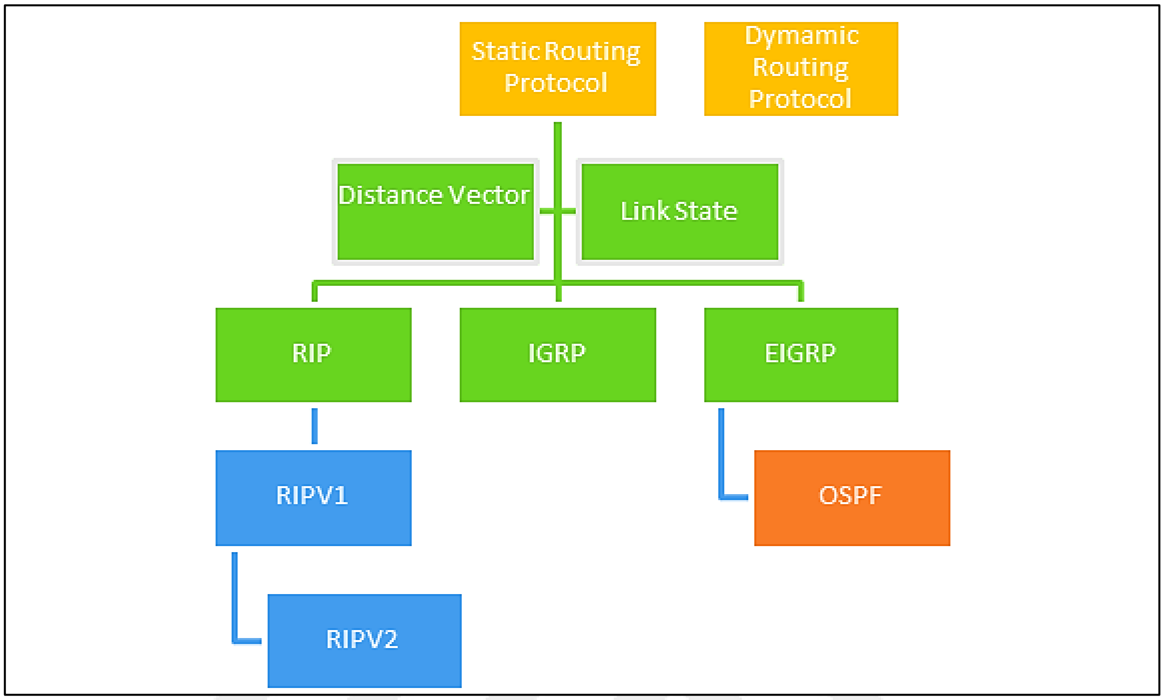


Figure 1.4: Routing Protocols Categorize [6].

1.5 INTERIOR GATEWAY ROUTING PROTOCOL

The distance vector routing protocol, developed by Cisco Systems, can be specified for multiprotocol routing in small and medium-sized Cisco networks. It is proprietary and requires the use of a Cisco router. This is the difference between Internet Protocol (IP) RIP and the family of IP RIP for multi-vendor networks. IGRP routes IP, IPX, Decent, and AppleTalk networks and is very useful for clients using a variety of protocols. It is slightly more scalable than RIP as it accepts up to 100 seconds, advertises every 90 seconds, and uses a combination of 5 different values to choose the best route. IGRP uses less bandwidth than RIP because it advertises less but runs slower because the IGRP router takes 90 seconds to advertise network topology changes. IGRP recognizes the operation of multiple independent systems and automatically summarizes network class boundaries. the split traffic issue between paths with equal or unequal speeds. IGRP is a distance vector routing protocol developed by Cisco Systems for multiprotocol routing in small and medium-sized Cisco networks. It is proprietary and requires the use of a Cisco router. This is the difference between IP RIP and IPX RIP for multi-vendor networks. IGRP routes IP, IPX, Decent, and AppleTalk networks, making it very useful for clients using a variety of protocols. It is more scalable than RIP because it takes up to 100 seconds, advertises every 90 seconds, and uses a combination of 5 different values to choose the best route. Because IGRP is less advertised, it uses less bandwidth than RIP, but IGRP convergence is slower because it takes 90 seconds for the router to detect a change in network topology. IGRP recognizes traffic from multiple independent systems and automatically summarizes them into network classes. The upload of existing traffic to a single payment method or a payment method. Interior Gateway Routing Protocol (IGRP) is a proprietary distance vector routing protocol used to convey routing information in host networks that described in the figure 1.5 [7].

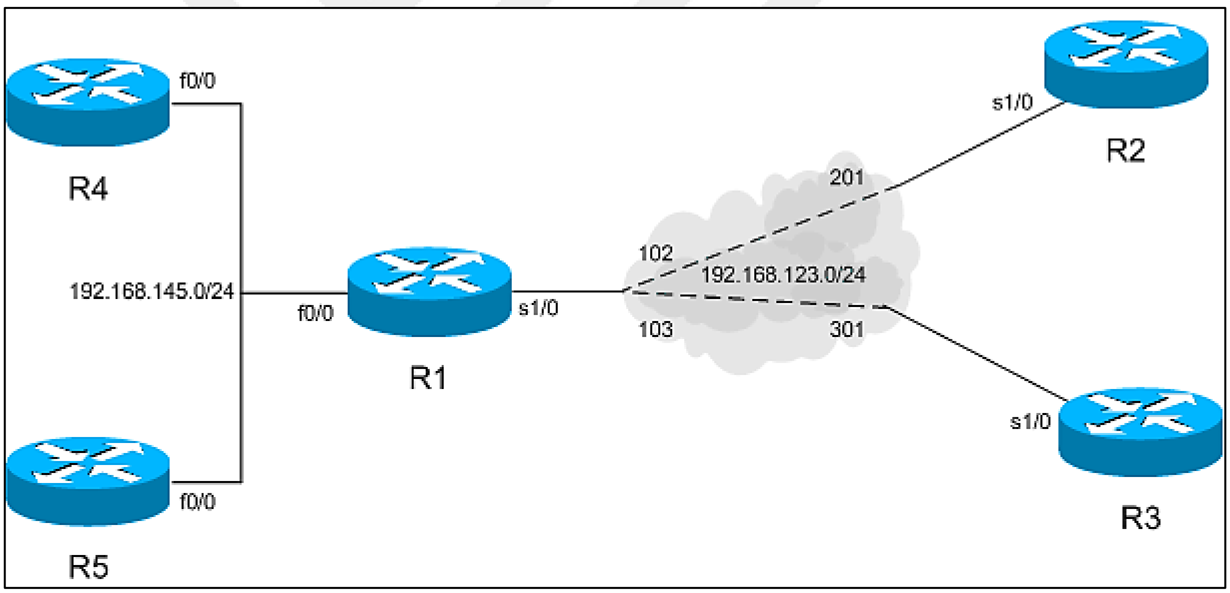


Figure 1.5: Example on Interior Gateway Routing Protocol [7].

IGRP is a Cisco innovation, that manages the flow of routing information between routers connected to host networks or independent systems. This protocol allows each router to update its routing table. IGRP prevents routing loops by updating the network with changes and handling errors. Cisco developed the IGRP in response to the limitations of the 15-segment Routing Protocol RIP. IGRP supports up to 255 hops. IGRP has two main purposes. Send route information to all routers connected to the environment or stand-alone system. Updates When a topology of the network, or route changes for IGRP sends new traffic and status messages to its neighbors every 90 seconds. IGRP stores routing tables with the correct nodes and networks on the main network. IGRP, a remote vector, uses some parameters to calculate the optimal road statistics for a given space. These parameters include latency, throughput, reliability, load, and Maximum Transmission Unit (MTU). However, an important difference between RIP and IGRP is that RIP allows expressing the cost of network access in terms of the number of hops, while IGRP provides more complex statistics. In IGRP, the total cost of network access is calculated based on several different criteria, including network latency, throughput, reliability, and load. Costs can be set by managers who can assign relative weights to components to reflect the priorities of that independent network. If some executives can reduce travel costs by focusing on broadband reliability can be done by these systems add more flexibility to the powerful RIP system. According to the RIP, IGRP 15 has no internal boundaries between networks. IGRP adds a feature called multipath routing to the main algorithm. It can automatically distribute traffic between multiple paths. Depending on the relative economic efficiency of each route, traffic may be equally or evenly distributed. This increases efficiency and flexibility. Because IGRP is a distance vector protocol like RIP, it shares many of the problems of the RIP algorithm. Recently, IGRP could contain many of the same flexibilities as RIP, including split boundaries, toxic reverse split boundaries (in some cases), and hold timers such as RIP, IGRP uses timers to determine how often updates are sent, how long routers are active, and how long they remain in the routing table. Cisco originally developed IGRP for IP networks and is often considered the better IP software. However, IGRP is not limited to IP and can be used with other network protocols if implemented for that purpose. Cisco used IGRP as the basis for an advanced routing protocol called EIGRP. This protocol was developed several years after the original version [8].

1.6 ENHANCED INTERIOR GATEWAY ROUTING PROTOCOL

The hybrid protocol for multiprotocol routing in enterprise networks is expressed as EIGRP. This feature can be used for both distance vector routing protocols and link layer routing protocols. The Cisco routers for personal use with the IGRP, EIGRP, and routes protocols all run on the same protocol and use the same criteria to choose the best route. Can distribute traffic to routes with equal or unequal cost indicators. Aggregation is when two or more things are going together to form a whole. In networking, aggregation is when multiple network addresses are brought together to form a single address. This is done automatically on network class addresses, but it can also be configured to happen across subnet boundaries. Automatic redistribution between IGRP and EIGRP exists. 255^{th}-order transients and variable-length code masks are supported. The dual algorithm is a mathematical formula used by computers to figure out the best route for data to travel from one point to another. Integration with EIGRP makes routing faster because EIGRP also uses the dual algorithm. Routers ask their neighbors if they have any spare successors. It is the set of points with the cheapest route to a given destination that does not form a road loop. EIGRP is a routing protocol that updates the routing table with new routes and their values. Route changes are reported when the routers change. This sentence is saying that a certain thing uses bandwidth more efficiently than another thing. The first thing is called distance vector routing protocols and the second thing is just called bandwidth. EIGRP is aware of the activity of other independent routing systems running in the same administrative domain. The sets of different independent system numbers are not intended to override underlying routing protocols, such as OSPF. Endpoint redistribution, filtering, and switching are accomplished using IGRP and EIGRP [9]. Backup Routes: EIGRP is the only routing protocol that supports backup routes. As in other routing protocols like OSPF, loose its best route in a network due to some failure then it must broadcast for a help whereas EIGRP simply look at its backup routes which are maintained in the topology table that presents in the figure 1.6 [9].

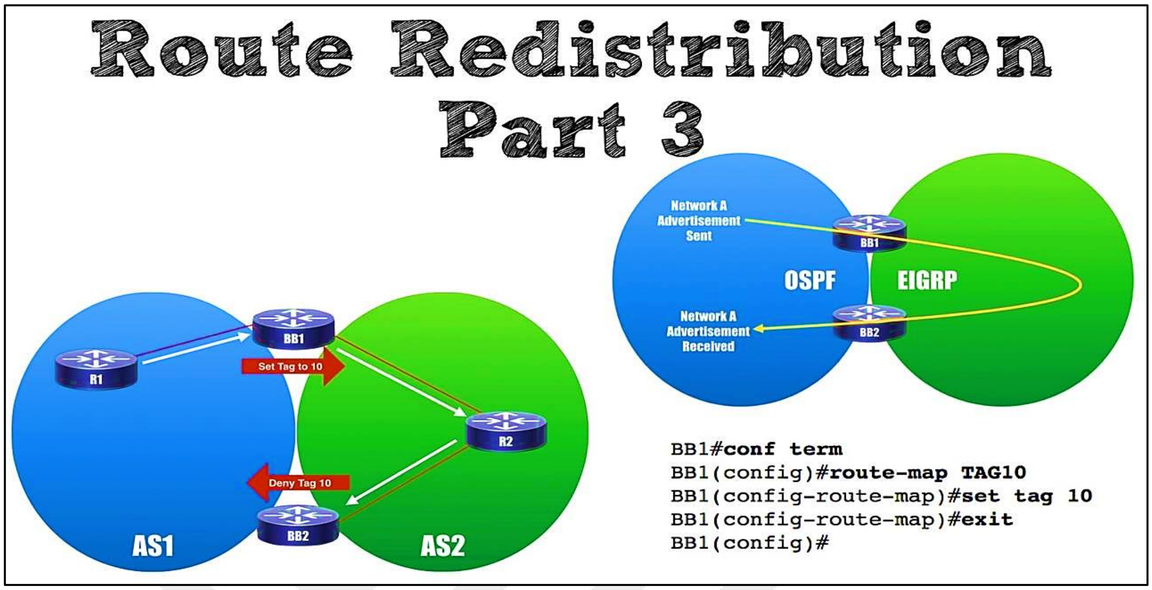


Figure 1.6: Route Redistribution Part three Configuration During Using EIGRP [9].

Simple Configuration: EIGRP considers the advantages of both link-state and distance-vector routing protocols. Thus, it achieves the ease of configuration from the distance vector routing protocols. Flexibility of Summarization: This refers to the ability to summarize anyplace on the network as opposed to using certain routers for the task. To summarize while designing is entirely possible. No other routing protocol performs unequal cost load balancing. EIGRP can handle a load distribution that is uneven as described in the figure 1.7 [10].

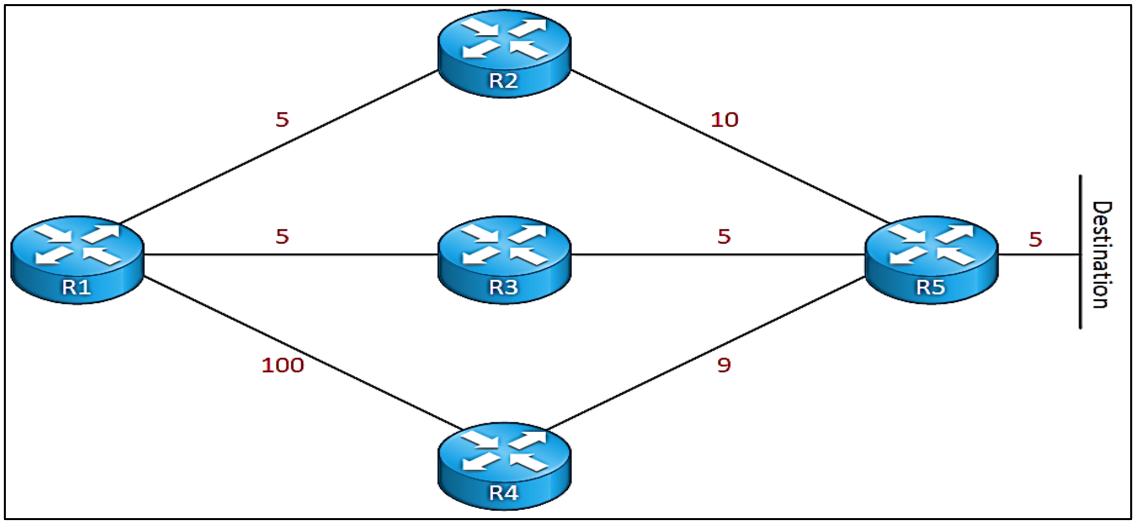


Figure 1.7: EIGRP Unequal Cost Load Balancing [10].

It is a Cisco router-specific protocol called Enhanced Interior Gateway Routing Protocol. These days, it is the most widely used routing protocol. Comparing EIGRP to other Cisco proprietary protocols like IGRP, the latter is a classless, improved distance-vector protocol. It is a stand-alone system that defines a group of adjacent routers that use the same routing protocol and exchange routing data. Since the subnet mask is included in the routes updates of EIGRP when designing a network, we can use variable length subnet masks (VLSMs) and summarization, which is not feasible with IGRP. Typical distance-vector updates include details about the network and the cost of connecting to it from the router's perspective.

Each router keeps track of the neighbors' current states in a neighbor table. When a neighbor is found for the first time, the neighbor's address and interface are noted and made available in the neighbor table, which is kept in RAM. One neighbor table is present for each protocol-dependent module. The sequence numbers are used to match update packets to acknowledgements. Out-of-order packets can be recognized by looking at the most recent sequence number that was received from the neighbor. EIGRP routers must become neighbors to exchange routes with one another. Three factors are considered for determining the neighbor ship: hello or ACK received, matching AS numbers, and identical metrics (K values) as presented in the figure 1.8 [11].

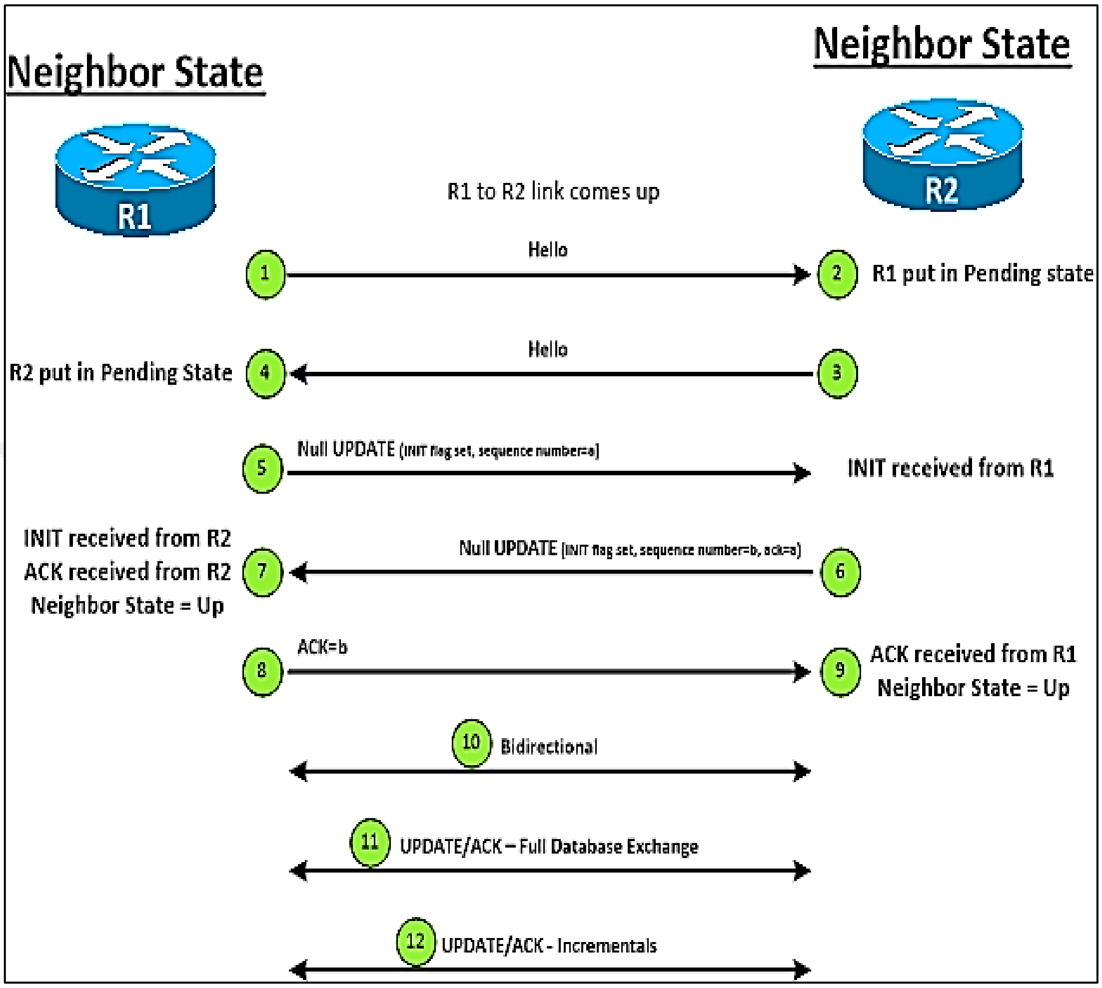


Figure 1.8: EIGRP Responses Messages [11].

Although it employs an Autonomous System, the Interior Gateway Protocol includes the protocol EIGRP. A major internet network will be separated into smaller networks known as autonomous systems. Each independent system will oversee managing its own region, and its router will be known as the Interior Gateway Protocol (IGP). Since the EIGRP protocol makes use of link-state and distance vector protocol capabilities, Cisco first launched it under the name Balanced Hybrid Routing Protocol. EIGRP employs calculations based on bandwidth and delay that are helpful in determining metrics that correspond to the routes traveled. This formula is almost identical to the one used by IGRP, with the exception that 256 has been added to the number to allow for calculations as in the figure 1.9 [12].

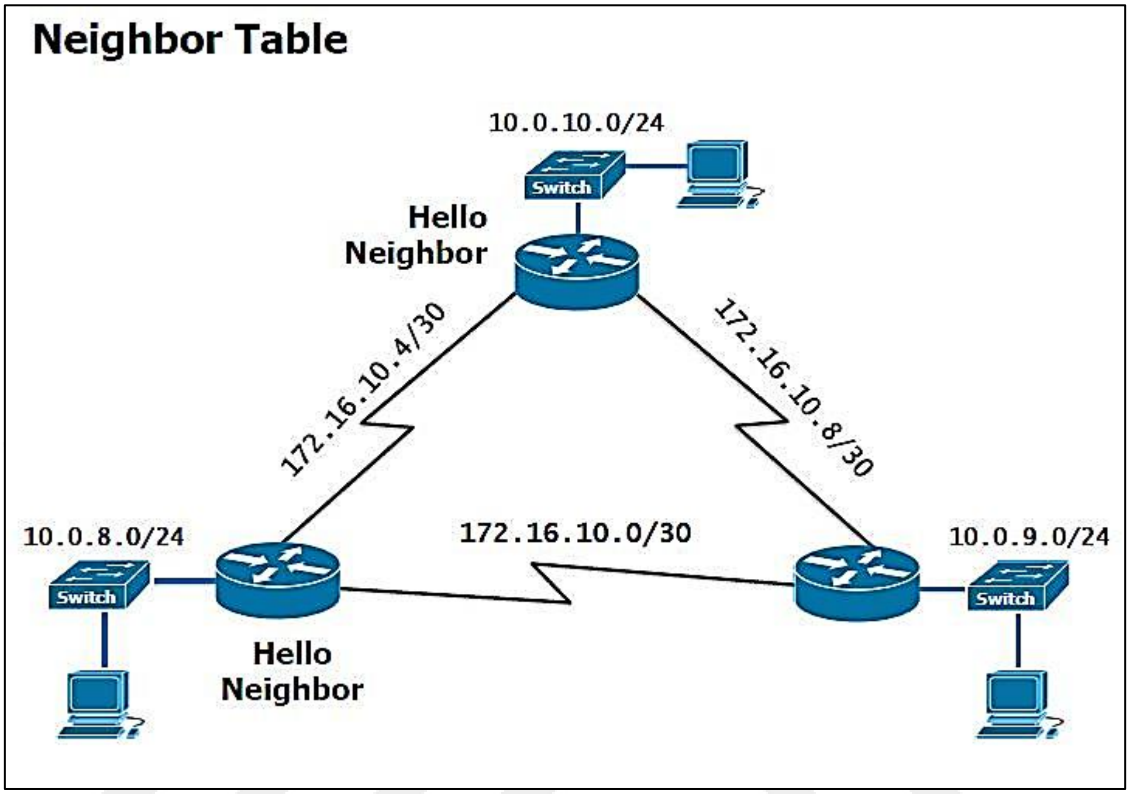


Figure 1.9: Enhanced Interior Gateway Routing Protocol Information Exchange [12].

1.7 OSPF AND RIP ADVANTAGES

a. The OSPF routing protocol has full knowledge of network topology and allows routers to calculate routes based on incoming requests.

b. Better than RIP, which has a maximum of 15 hops, OSPF has no limit. Therefore, OSPF assembles faster than RIP and does a better task of balancing the load.

c. OSPF sends multicast state updates and only sends updates when there are changes in the network. According to the OSPF, other protocols are not easy, as this requires more knowledge of complex networks.

d. OSPF does not measure the router because more routers are added to the network. OSPF's lack of scalability makes it unsuitable for Internet routing.

e. OSPF maintains multiple copies of routing information, which requires a lot of memory.

While the RIP Protocol is as follows:

a. RIP is best for small networks.

b. Easy to understand and set up.

c. All routers support RIP routing. There is no need to update RIP every time the network topology changes. RIP broadcasts update every 30 seconds, which disrupts traffic for each routing update in RIP and consumes a lot of bandwidth, which limits resources for critical Information Technology (IT) processes [13].

d. The number of RIP hops is limited to 15 seconds, this made routers outside this range considered unlimited and unreachable. The level in this case for integration is low.

e. If the fails, choosing an alternate route takes a long time. RIP does not support multiple routes in the same direction, which can lead to multiple routing loops [14].

f. RIP does not work when comparing routes based on real-time data, a fixed value of hop is used to select the best route. This leads to network congestion due to packet loss and duplication of processes [15].

1.8 THESIS ORGANIZATION

The chapter one, which describes the overall organizations about the nearest problems within OSPF and RIP routing protocols, the routing protocols, and their status are tested in this chapter. Moreover, exactly at this note, routing protocols design is given regarding the Open Short Path First (OSPF) and Route Information Protocol (RIP) components. In the end, both routing protocols utilize advantages, and routing protocol’s structure is overhand on the remaining of this chapter.

In chapter two, many authors and researchers are added to the respected literature survey, were proposed, and briefed, on the biggest properties and multi-focused compared with each review article. The written issue was directed to our objective, and the results in various numerous were added.

The chapter three, it experiments on the routing network connection applied with OPNET Modeler software that highlights routing protocols with their path trajectory recovery to our suggested system. In addition, the major components for the suggested system are made in this section. Furthermore, the different perspectives are modes within a variety of given methods that are seen on this section.

The chapter four presents the suggested structure analysis by make different methods for routing protocols addition and nearest by different services in path trajectory. That presented analysis would be initialized on the delay and throughput. Furthermore, this section reached the new links to the OSPF and RIP issue about our suggested system comparative done within reference work suggested by major researchers for achieving the effectiveness of the suggested design.

The fifth chapter presented the problems with the conclusion and the future advice.

2. LITERATURE SURVEY

In this section, we are presenting the literature survey of the reference work for OSPF and RIP protocols as the following:

In [16] scientists suggested the routing protocols with 4 routers that illustration had made to 64 Kbps utilize Metropolitan Area Network (MAN) network by OPNET Modeler program. The data transfer rate collected was 100 Mbps with the distance area reached at 5 kilometers. The hosts are combined to utilize the major architecture of the routing concept that is used for recovering the full network. The applicated for distance vector is merged to utilize the path trajectory recovery to the major system. the full performance is described on the many tests done to the network throughputs. Afterward, the suggested performance application was made to utilize 2 main bridges-based distance vectors with given regard to network IP convergence analysis are about 500 Mbps while proposed for the initialized points for starting with open short path first and route information protocol. These protocols are needed to become many maintenances by the coefficients regarding relation convergence.

In [17] authors proposed the distance vector within 5 routers that considered have reached 128 Kbps using the Border Area Network (BAN) model via OPNET Modeler. The bit rate achieved was 150 Mbps utilizing the area of distance arrived at 6 km. The clients were merged using the main structure for route theory that was used for covering the entire network. The applied routing protocols are combined using the trajectory recovery for a path for the main architecture. the completed performance is presented in the multi experiments made for the full network with an estimated time of the simulation. Furthermore, the proposed application was done using 3 major bridges with a centralized edge for each one depending on routing protocols with obtaining regard to point-to-point utilization results were around 650 Mbps when suggested to the started initializing to illustrates within RIP and OSPF.

In [18] researchers suggested the protocols were dealt with route by 6 routers that illustrated had arrived at 512 Kbps utilize Local Area Network (LAN) model for OPNET simulator. The data rate accomplished was 200 Mbps with the use for the coverages limited to 8 km. The end users are combined utilizing the major structures to the issue that made for routing while utilizing to recovering all the detailed model. The execution for distance vector was merged using the path recovery for a trajectory to the major architectures. the full network performed is described on the most tests were done to the mentioned network and time regard simulation remaining time. Therefore, the suggested model that applied was made utilized 4 mainly bridges within the edge were centered for everyone based on distance vector within obtained about point-to-point utilizations and IP network convergence analysis were about 650 Mbps while proposed for the started for considers with two protocols, route information protocol and open short path first.

In [19] scientists proposed the routing issue are made utilize directing via 8 routers that are considered has reached 1 Gbps using LAN network achieved for the mentioned simulator: OPNET Modeler. The bit rate achieved was 300 Mbps within the utilize to the distances around at 10 kilometers. The hosts were merged using the main architectures for the problems that solved to the path when using to recover all the equipment regard model. The implementation to coverage factor is combined utilize the trajectory recovery to the major importance of trajectory. the overall network performance is presented in the many experiments made for this mentioned model and times about time of simulation remaining. Furthermore, the proposed model that was executed was able to use 6 majorly multiple bridges utilize edges are centralized to each one depends on routing protocols with received usage regard utilization of PPPOE with the convergence of internet protocol network result are around 700 Mbps when suggested to the initialized to compared within these two protocols, RIP and OSPF.

In [20] authors suggested the issues regarding the usage of routers were done using routing by 10 of CS-1000 model of routers that illustrated has limited at 1.2 Gbps utilize BAN model accomplished to the preferred OPNET Modeler. The transferring rate accomplished was 350 Mbps with the usage for the coverages about 11 km. The clients are combined using the major structures to the issues that resolved for trajectory while using for maintaining the full components about the network. The simulated distance factor is considered using the path recovery for the importance of path. the full entire network is described in most experiments made to this reference model with the intervals around remaining time. Moreover, the suggested system that was implemented was capable of usage of 8 bridges using multi-edges were centered based on distance protocol within receiving utilize about the usage for point-to-point within convergences for IP network analysis were about 800 Mbps while proposed for the initial part of comparative with double protocols were mentioned such open short path first with the route information protocol.

In [21] researchers proposed the problems about the utilization for distance vector were used path via 12 for CS-2000 routers type that considered had around at 1.4 Gbps using MAN network achieved for the important OPNET Modeler. The transmission per second achieved was 400 Mbps within the use to the distances regarded at 14 kilometers. Therefore, the proposed technique that simulated had abled to made via 10 bridges utilize many edges are between routers depend on routing distance with received using regard used to utilizations of PPPOE with IP network convergences for results are regard 1000 Mbps when suggested to the started partition for comparative within 2 protocols are referred by the route information protocol and OSPF.

In [22] scientists proposed the routing issue are made utilize directing via 8 routers that are considered to have reached 1.6 Gbps utilizing BAN network accomplished for the mentioned simulator: OPNET Modeler. The bit rate achieved was 650 Mbps with the utilization to the vectors around 17.5 km. The clients were merged using the main structures for the issues that resolved to trajectory when used to cover all the components of network. The implementation to coverage factor is combined utilize the trajectory recovery to the major importance of trajectory. the overall network performance is presented in the many experiments made for this mentioned model and times about time of simulation remaining. Furthermore, the proposed model that was executed was able to use 12 majors of many bridges using edges were centralized for each other based on routing protocols with the usage about point-to-point within convergences for internet protocol network result are around 1200 Mbps.

3. METHODOLOGY

3.1 INTRODUCTION

This section shall illustrate the briefed about the suggested Open Short Path First that is implemented to choose the best path in the overall network that is based on Point to Point Protocol Over Ethernet (PPPOE) that would connect the entire internal network and in the same designed for RIP would use as auto-updated messages sender and each interval update about 180 sec, in addition to that, the overall comparison it will be implementing the two scenarios OSPF and RIP to see the network convergence duration and the queuing delay by inserting the bridge piece between each one of neighbor is an expression as the best solution for the network to enhance the entire network, the parameters with their values has been presented and executed for the results would be focused in this chapter. This chapter discusses the various main points of the research work. An alternative route This section presents the rationale for comparing and choosing methods. Three ways: It can be used to evaluate the performance of network protocols, including mathematical or analytical protocols. Analysis, direct measurement, and computer simulation. Once acceptation all restrictions and settings for the Mathematical and computational modeling considerations are relevant to our study. The Advantages of mathematical analysis, such as cost, time, and efficiency, which produce better predictive results. Direct measurement is expensive, but it is a replacement for modeling. Direct Analysis of measurements must be performed on a working network that may cause failure. Product networks can be very expensive in terms of structural complexity. Direct benefits the measurement results are very accurate. There are many simulators such as Network Simulator (NS)-2, NS-3, Teletype Network (Telnet), Objective Modular Network Testbed (OMNET++), Optimized Network Engineering Tool (OPNET), etc. Choosing the right simulator for modeling After many experiments, we chose the OPNET simulator from OPNET Technologies [23].

3.2 OPNET MODELER

OPNET Modeler 14.5 is the evident level-based network level. It might be used as an assessment instrument or as a network plan for tests that occurred in the laboratories. They work with various kinds of activities for correspondence networks, show social events, and application programming. OPNET Modeler 14.5 has a wide variety of mechanical assemblies for arranging, researching as well as making models of various kinds of associations and their display. This application speeds up the read and writes process for inspecting and arranging correspondence associations, shows, contraptions, and applications. It wires a wide extent of shows and developments. It furthermore joins a progression environment to merge exhibiting all network component types and developments. Clients can without a doubt inspect networks to take at the impact of various advancements from beginning to the end of the administration. Considering, OPNET Modeler 14.5 is a particularly compelling and accommodating certain level event-based network level device that can be used as an assessment device or as a network plan and experiment. As mentioned in figure 3.1 which presents the OPNET Modeler window [24].

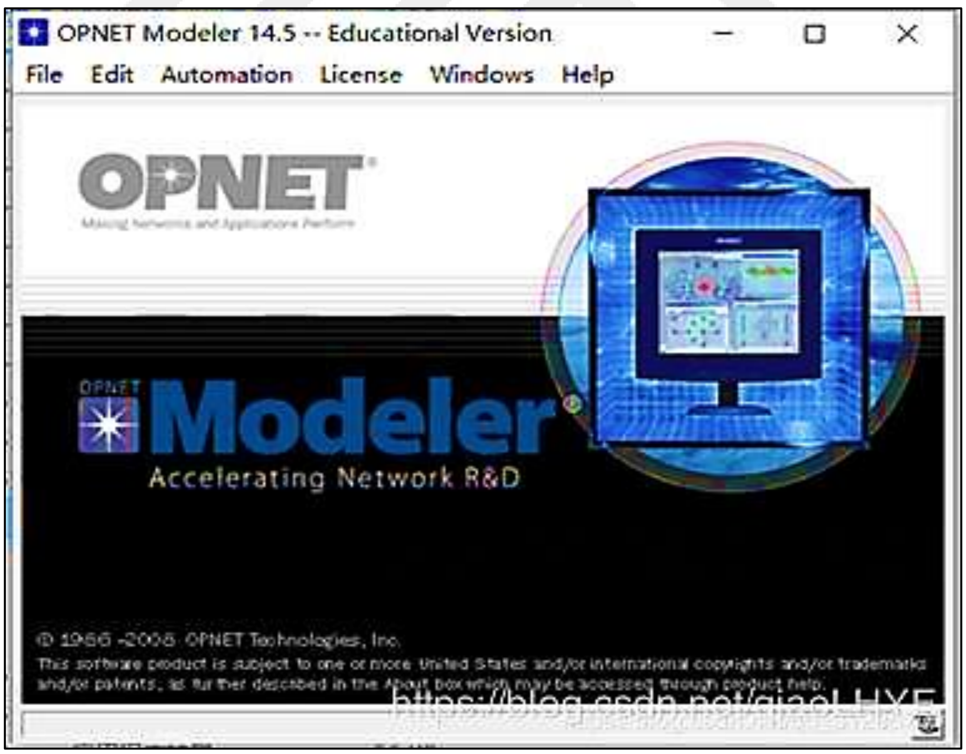


Figure 3.1: OPNET Modeler Program Window [24].

3.3 NETWORK MODEL IMPLEMENTATION

This section can describe the different parts used to build these networks with this capacity. The following were these parts suggested on the network model run in OPNET.

Application Configuration: is the middle while it is used for settings this application during this network that can use to ends such as the main Information, application points of interest, webs service such as Hypertext Transfer Protocol Secure (HTTPS).

Profiles Configuration is the middle point while it is used for portraying application with able for applied the applications. This client's profile modes in these middle direct were involved in various focuses on relation toward convey applications layers trafficable. Profiles Configurations it in like way utilized to depict this trafficable plan followed via these apps. CS_7000_6s_a_e6_fe2_fr4_slr4_tr4: these models can be made for the arrangement for the internet protocol depending on switch area models. The particulars were Ethernet workstation: it the middle models which watch out for the workstations and client's servers' application running on transmission control protocol over internet protocol and user datagram protocol over internet protocol. These workstations keep 1 hidden away.

Ethernet relation that made for 10m, 100m, and 1000m data rates. PPP_DS3: It is a full duplex affiliation that interface this 2 internet protocols places 100BaseT: 100BaseT full duplex affiliations were utilized to address the Ethernet affiliations. These affiliations can relate to any blend of the middle focuses such as Station, Hub, Bridge, Switch and LAN focuses. Thwarted expectation Recovery: this regulator community point is utilized to show the slip-up recuperate conditions. By giving the time and status of the model it gives the attributes as presents in figure 3.2, and 3.3.

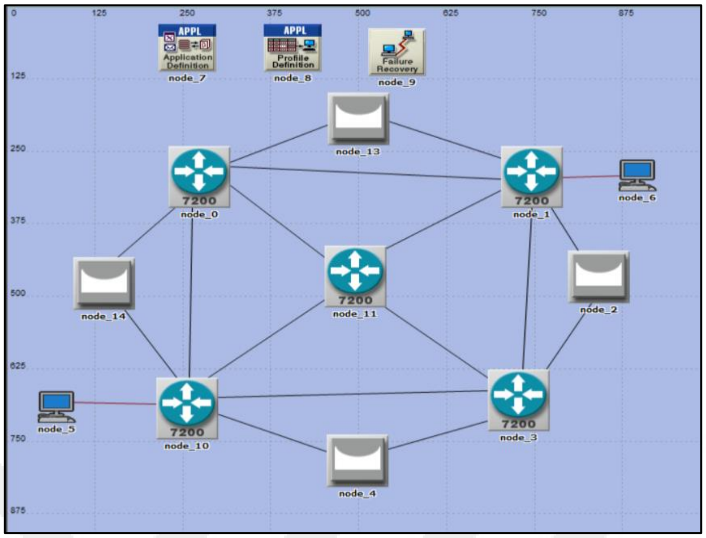


Figure 3.2: Proposed OSPF with Bridge Components for OSPF Scenario.

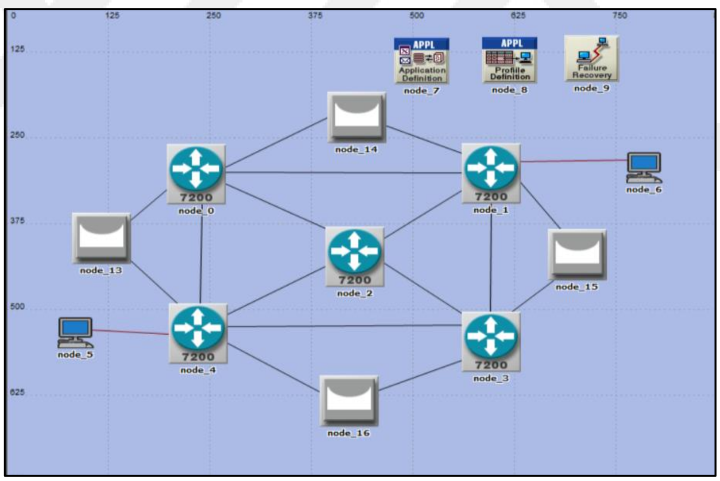


Figure 3.3: Proposed OSPF with Bridge Components for RIP Scenario.

3.3.1 Simulation Scenarios

OPNET Modeler 14.5 was used to estimate the parameters. This section describes the common design and how the program achieved that network model. The two interaction terms are ordered as follows, which are presented above in the previous section. The first implementation is specified as the default OSPF mapping. The second implementation shows standard RIP rules. Focus on the results for different values and Point-to-Point Digital Signal line three for implementing the network and common models with the two CISCO 7000 connections between them via an Ethernet workstation by inserting 4 bridges were centralized for each edge of routers. The two pieces of our network are workstations for video conferencing. The OSPF configuration and models to read the shown network [25].

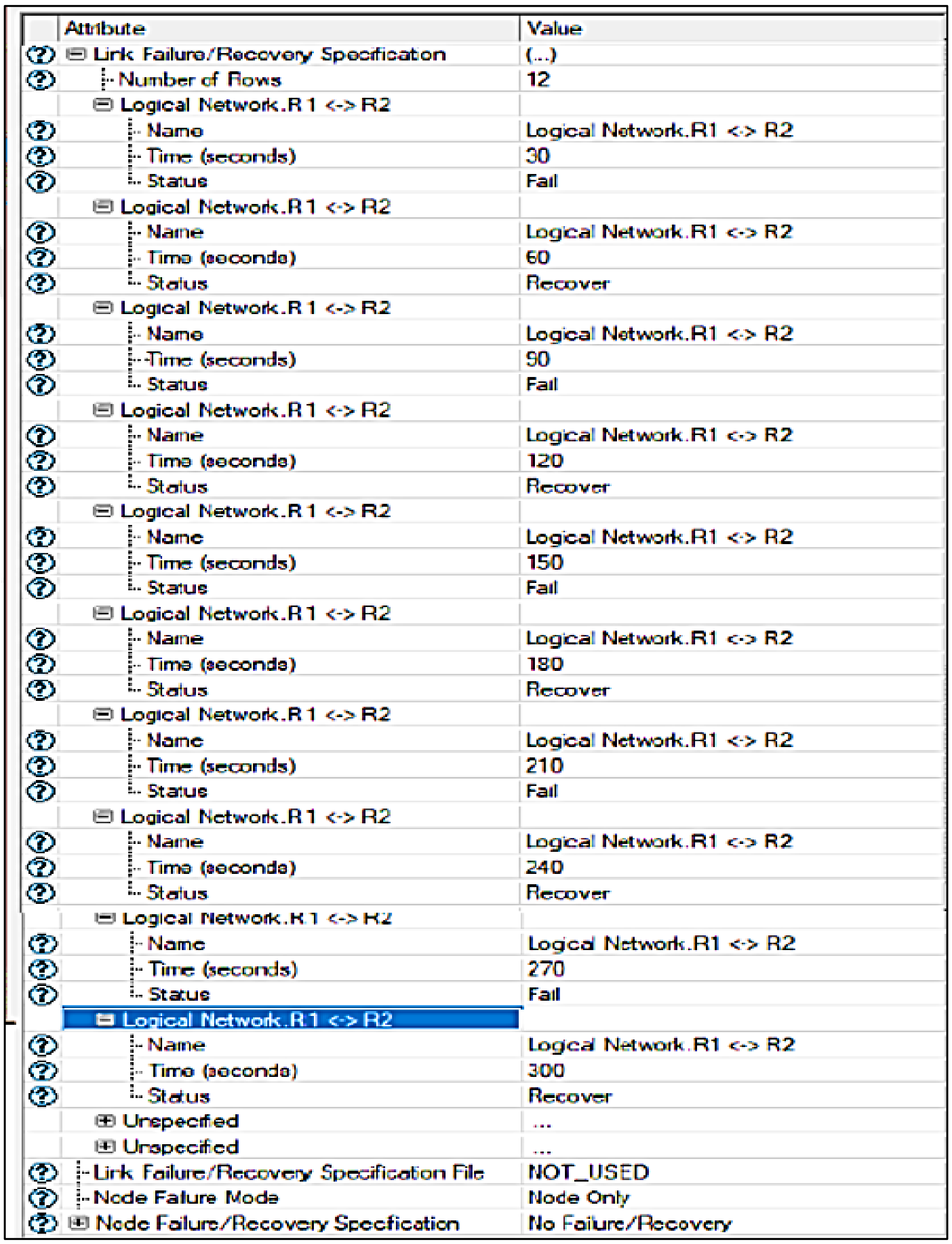
3.4 SIMULATION SETUP

The plan for path trajectory and recovery configuration. The parameters were set to be 10 minutes, and the times for trajectory and recovery are shown in the figure 3.4.

Attribute	Value
Failure/Recovery Modeling	Enabled
Link Failure/Recovery Specification	(...)
Number of Rows	10
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	240
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	420
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	520
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	580
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	610
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	620
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	625
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	626
Logical Network. R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	726
Status	Fail
Logical Network. R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	826
Status	Recover
Link Failure/Recovery Specification File	NOT_USED
Node Failure Mode	Node Only
Node Failure/Recovery Specification	No Failure/Recovery

Figure 3.4: Failure Recovery Configurations for RIP Scenario.

The arrangement for path trajectory and recovery configuration. The parameters were estimated for sets to be 6 minutes, and the times for path trajectory and recovery are presented in the figures 3.5, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, and 3.11.



Attribute	Value
Link Failure/Recovery Specification	(...)
Number of Rows	12
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	30
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	60
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	90
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	120
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	150
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	180
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	210
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	240
Status	Recover
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	270
Status	Fail
Logical Network.R1 <-> R2	
Name	Logical Network.R1 <-> R2
Time (seconds)	300
Status	Recover
Unspecified	...
Unspecified	...
Link Failure/Recovery Specification File	NOT_USED
Node Failure Mode	Node Only
Node Failure/Recovery Specification	No Failure/Recovery

Figure 3.5: Failure Recovery Configurations for OSPF Scenario.

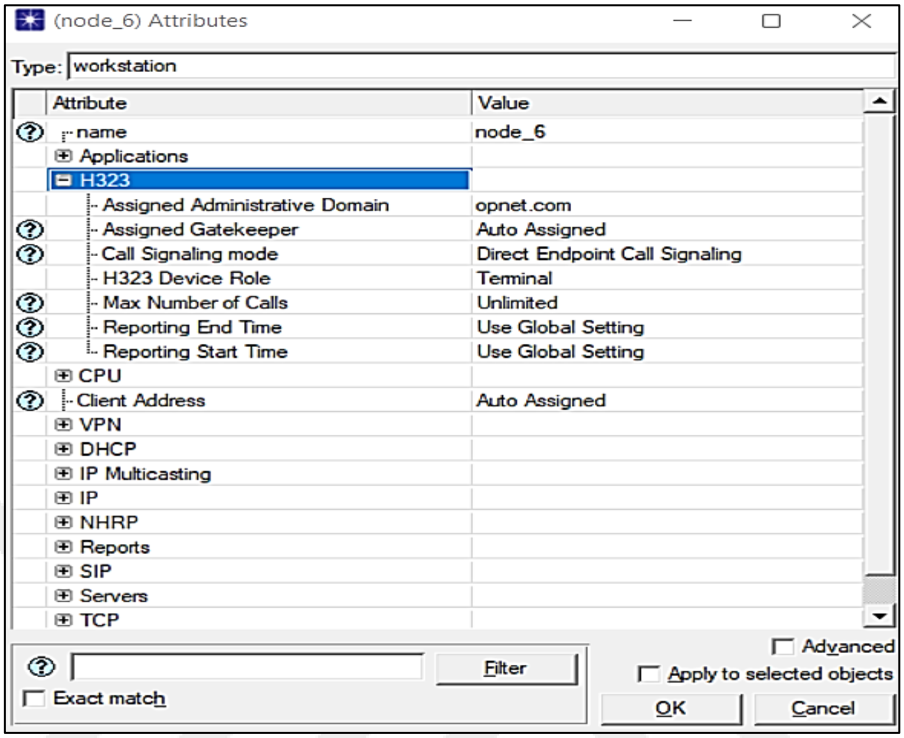


Figure 3.6: Computer Settings for OSPF Scenario.

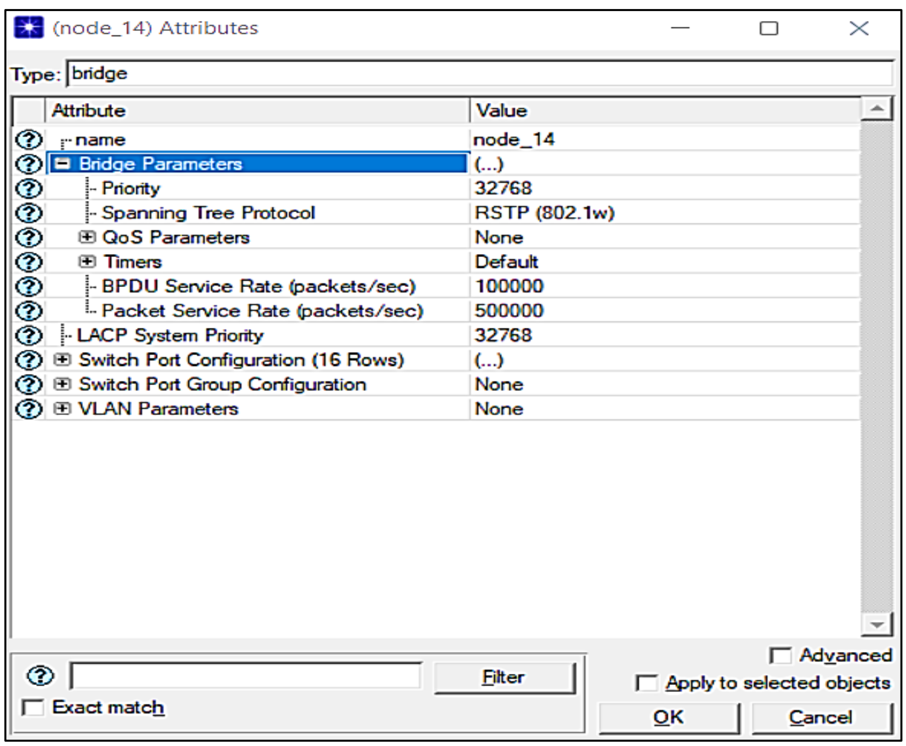


Figure 3.7: Bridge Parameters for OSPF Scenario.

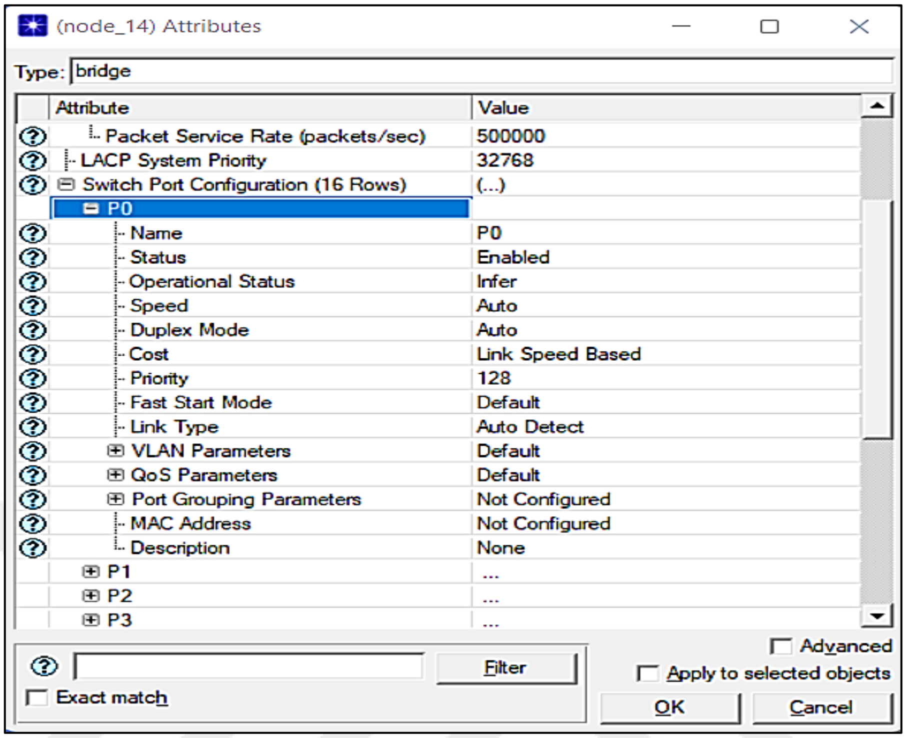


Figure 3.8: Port Zero Settings for Bridge Component.

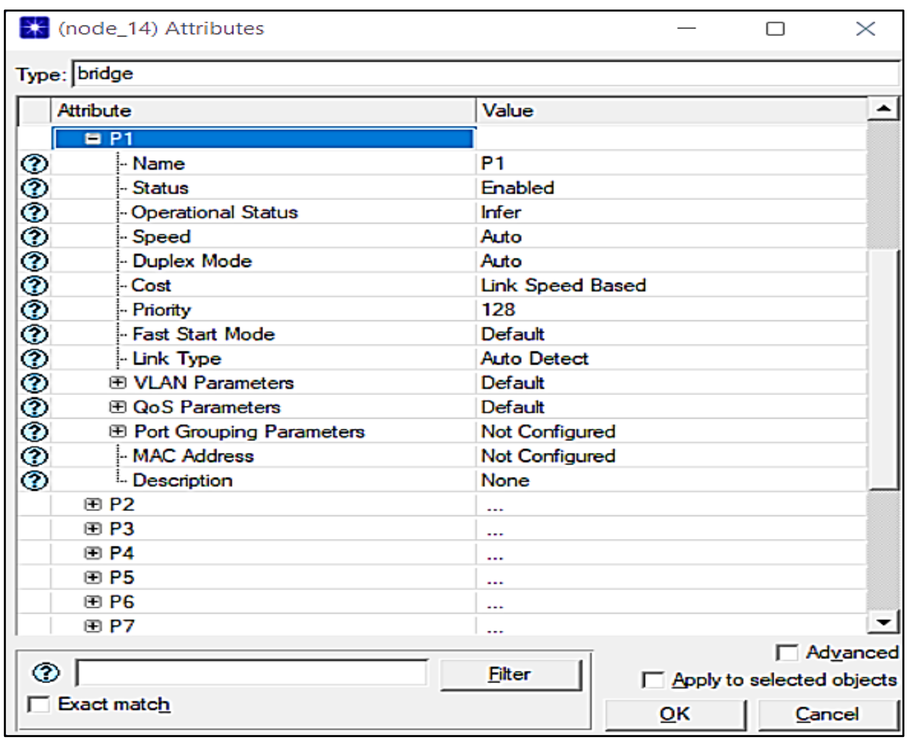


Figure 3.9: Port One Settings for Bridge Component.

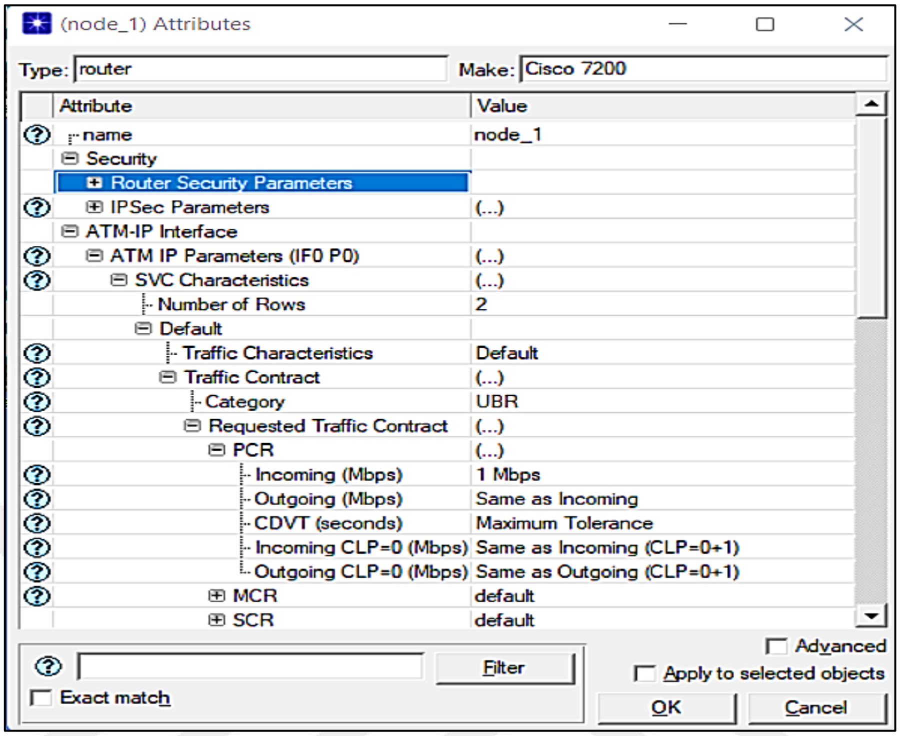


Figure 3.10: ATM-IP Interface Settings in the Router One.

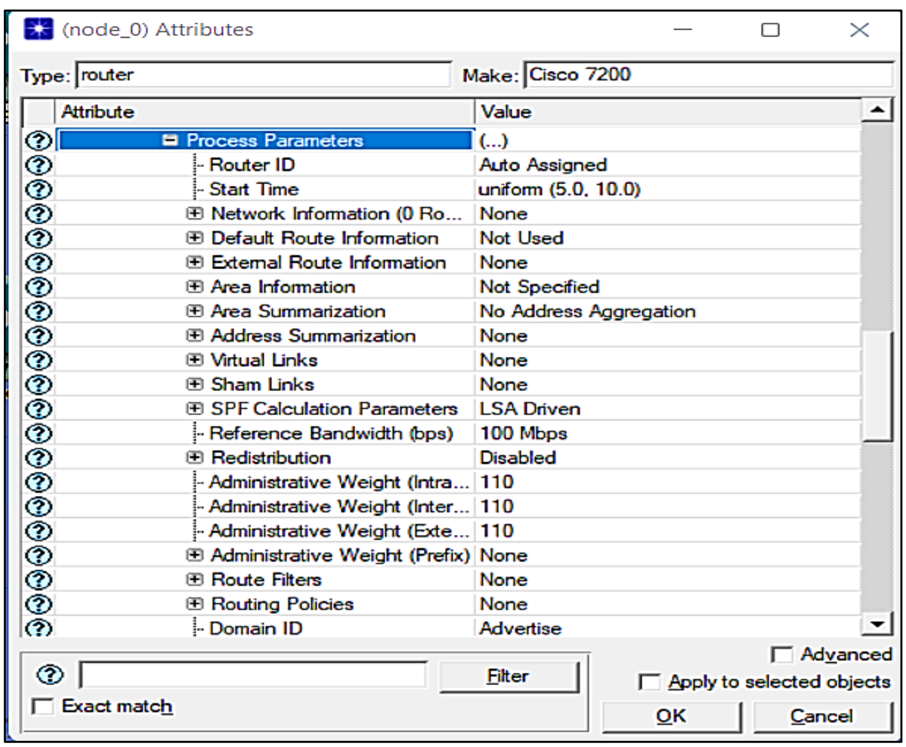


Figure 3.11: OSPF Settings for Routing Issue.

3.5 OSPF WORK CONCEPT AND DESIGN

OSPF is a link-state routing protocol because it is an open standard, it is implemented by various network providers. OSPFs are performed in many routers and Cisco routers (excluding Cisco routers than EIGRP). Important OSPF properties are as follows:

The main point is a quarterly direction protocol. Variable Length Subnet Mask (VLSM), Classless Inter-Domain Routing (CIDR), hand-over, the same cost for balance is additional update support only one set is used as metrics for interface costs. The managed distance for OSPF paths defaults to 110. Update routing with multicast addresses 224.0.0.5 and 224.0.0.6. A router running OSPF must establish a neighbor relation before it can receive a route. Because OSPF is a link-state routing protocol, neighbors do not exchange routing tables. Instead of, the exchange network topology information for each OSFP router runs the Shortest Path First (SFP) algorithm to calculate the best route and add it to the routing table. Since each router knows the overall network topology, there is little chance of a routing loop. Each OSPF router stores routing and topology information in three tables [26].

a. Neighbor Table - Stores information about OSPF neighbors.
b. Topology table – stores the topological structure of the network.
c. Route table - stores optimal routes.

OSPF routers make establish adjacencies before receiving routing updates. OSPF neighbors are dynamically discovered by sending a hello packet to the router's OSPF-capable interface. The hello packet is sent to the multicast IP address 224.0.0.5.

OSPF routers are going through some state changes before establishing a neighbor relation. These conditions are described as follows.

a. Startup State – The router has received a hello message from another OSFP router.
b. Two-way state – The neighbor receives the Hello message and responds with a hello message.
c. The extra state is the beginning of a Link State Database (LSDB) exchange between the two routers. Routers start exchanging link state information.

d. Exchange Status – Database Descriptors (DBD) are being exchanged. The DBD contains Link State Advertisements (LSA) headers. Routers use this information to determine which LSA to exchange.
e. Load Status – The neighbor sends a Local Service Request (LSR) for each network it does not know about. The other neighbor responds with a Link State Update (LSU) containing information about the requested network. After receiving all the requested information, the other neighbors do the same.
f. Full Status - Databases are synchronized and completely side-by-side on both routers as described in the figure 3.12[27].

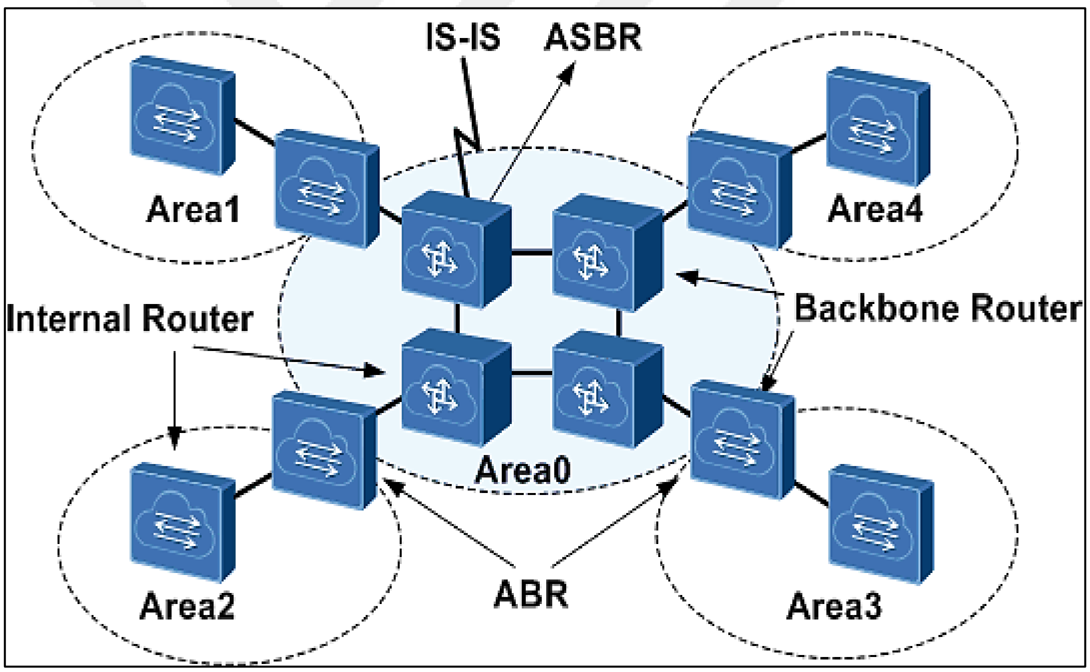


Figure 3.12: OSPF Overview Example [27].

OSPF uses the concept of domains. An area is a logical grouping of adjacent networks and routers. All routers in one area have the same topology table but know nothing about routers in another area. The main benefits of areas are that the size of the router topology and routing tables are reduced, the SFP algorithm takes less time to run, and routing updates are also reduced.

Each area in the OSPF network must be connected to a trunk area (area 0). All routers in an area must have the same area Identification (ID) to be an OSPF neighbor. A router that has interfaces in multiple areas (for example, Area 0 and Area 1) is called an ABR (Area Border Router). A router that connects an OSPF network with other routing domains (such as an EIGRP network) is called an Autonomous System Border Router (ASBR). All routers run OSPF. Routers R1 and R2 are in the backbone area (Area 0). Router R3 is ABR because it has interfaces in two areas, area 0 and area 1. Routers R4 and R5 are in area 1. Router R6 is the ASBR because it connects the OSFP network to another routing domain, in this case, the EIGRP domain. If the subnet that R1 is directly connected to goes down, router R1 will only send routing updates to R2 and R3 because all routing updates are internal. LSAs are used by OSPF routers to exchange topology information. Each LSA contains routing and topology information that describes a part of the OSPF network. When two neighbors decide to exchange routes, they send each other a list of all LSAs in the topology database. Each router checks the topology database and sends an LSR message to request all LSAs that are not in the topology table. The other router responds with an LSU that includes all LSAs requested by the other neighbor as shown in the figure 3.13 [28].

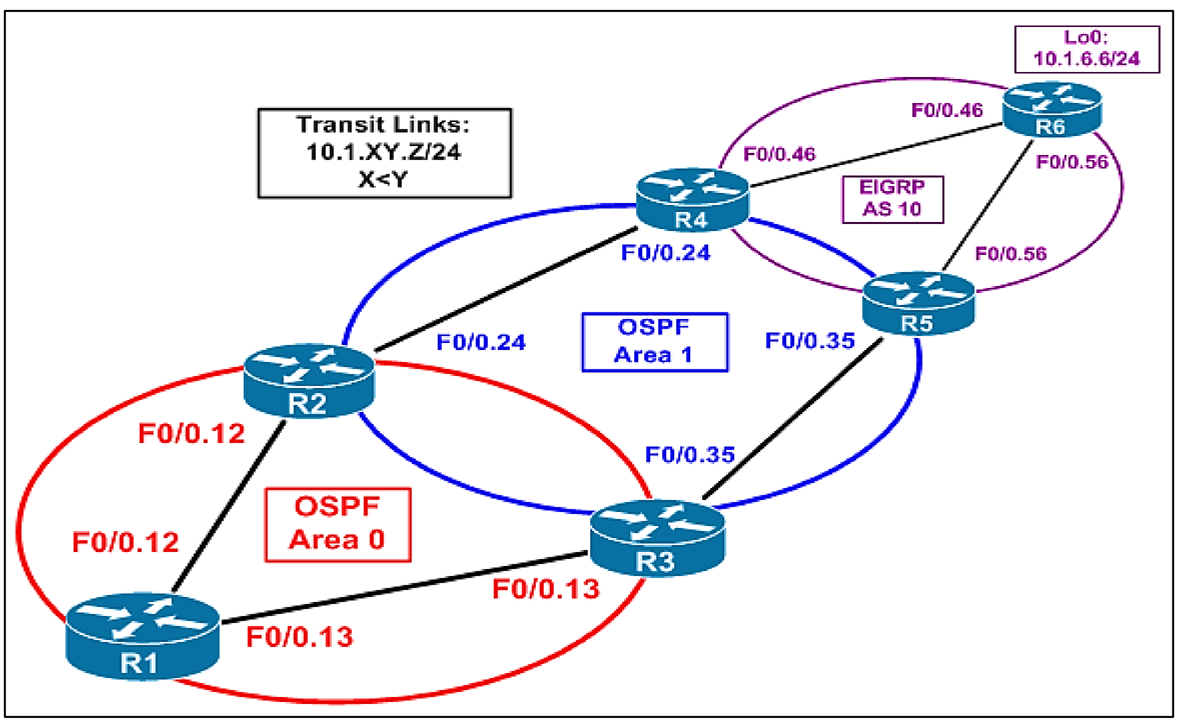


Figure 3.13: OSPF Around Area 0, 1 with EIGRP Enhance [28].

OSPF performance is enhanced by the overall network architecture and addressing scheme. As discussed in the previous section on network topology and route abstraction, adopting a hierarchical addressing environment and creating structured address maps are key determinants of web service scalability. Key criteria affect operational and technical considerations. This section explains how advanced routing settings are configured using OSPF. It explains how OSPF schemes scale and the factors that affect OSPF integration in large networks. Scalability is determined by three router parameters: memory, processor, and interface bandwidth. The amount of work that OSPF does on a router depends on the following factors:

Several nearest neighbors per router: OSPF sends all link state changes to all routers in the area. Many neighboring routers do most of their work when the link state changes. In total, a router should not have more than 60 neighbors.

Several neighbors in the area: OSPF uses a Central Processing Unit (CPU)-intensive algorithm. Given several packets per channel, the number of calculations performed is proportional to n log n for mathematical calculations. Therefore, greater distance and greater variability can cause problems in providing standard calculations for routing. The total number of areas should not exceed 50 routers. In some regions, the relationship is unstable. Several areas supported by the router.

The router must have a connection mode corresponding to each area. Each has at least two parts (spinal and proximal). In general, routers should not have more than 3 areas to be trusted. Designated Router (DR): In general, most OSPF operations are performed using a multi-access trunk (such as Ethernet) and a designated backup router. It is recommended to choose a router that has not been started, for example, DR, backup designated router. A router such as a trunk cannot be selected for multiple channels at the same time. The first and most important decision in OSPF network design is the paths and links connecting the backbone and all neighbors. Each OSPF neighbor belongs to a different route, which is used to support the following features: Special design options reduce the impact of OSPF.

Select for the most powerful router or the least loaded router in the LAN network as a DR candidate. Give priority to other routers to avoid DR candidates. If you have multiple remote nodes or routers, the workload is evenly distributed among the peers.

Verified: point-to-point with interpenetrating polymer networks such as Internet Protocol Security tunnels are considered more secure than OSPF using Point-to-Point for Virtual Private Network. When determining the number of main routers, the number of switches or relays and other workloads must be considered. Normal working conditions must be considered in all laboratory studies. The disadvantage of OSPF is that all nodes reboot or go down immediately. The workload depends on the amount of route and area information in the independent OSPF administration. OSPF routing information depends on the number of routers and connections to neighboring routers in the area. Some methods and tools can reduce this information. Global and local areas contain less routing information than regular non-domain areas or routing areas. Therefore, using automatic and fully inactive partitions reduces the load on the OSPF router. Routes and costs between regions are advertised by each ASBR in that region. For the full areas, this information should be included not only outside the road but also occur between the internal and external areas. One way to think about ASBR is that it provides a list of routes and costs, each of which is essentially a distance vector. The more foreign prefixes and ASBRs, the greater the workload for LSA types 5 and 7. All these details ensure that there is no congestion in the pipeline area. The area size and layout design, area type, route type, compression, and decompression affect area LSA database size. area templates can be used to reduce routing information for areas. Consider geography and web addresses when designing the network. Therefore, the network should be fully functional with topology and addressing. EIGRP allows the network topologies, while OSPF requires a pure hierarchical structure with a segmented and columnar topology. Geographical and operational constraints must be considered when implementing OSPF areas. As mentioned above, productivity grows without direction and purpose. All LSA database entries must be available to all routers in the field. OSPF must propagate all changes to the LSA database. Bandwidth and CPU usage for links and routers in this area. Unexpected changes or noise exacerbate this effect because the router must constantly transmit the changes. Nearest areas, unselected interfaces, and neighborhoods reduce the size of LSA databases but reduce external variation. In general, when people do OSPF for the first time, they always fall into this area. Some companies believe that many routers will end up zero-zero. It is recommended that the trunk and Adaptive Data Rate be in Area 0 as in the figure 3.14 [29].

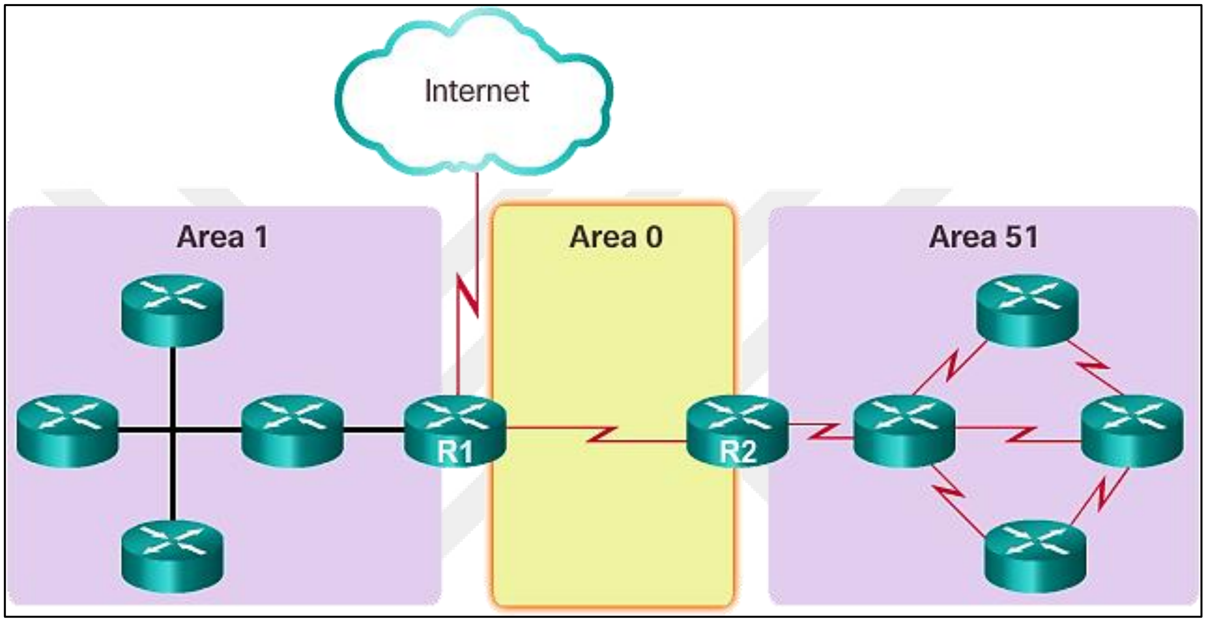


Figure 3.14: OSPF Hierarchy [29].

Route compression is essential for reliable and scalable OSPF networks. Abstractions in OSPF naturally correspond to domain boundaries. If the trunk area is zero and there is no trunk area, one or more routers connect other areas to area 0. If a large network requires a third layer, BGP can be used to connect different OSPF routing domains. The service enables two-process OSPF deployment but is not recommended for most networks due to complex and unpredictable negotiations. The difficult thing in OSPF is to issue an Address Resolution Protocol (ARP) or key route. Common design support breaks down the complexity and layout of complex network components. Parts of a network are considered complex if there is a lot of routing information, such as the entire network, core hubs, or additional topologies such as secondary campuses or data centers. It provides the ability to maintain edge compression or create an area or completely dark area. The organized IP address system must match the region for effective redirection. One of the simplest ways to assign addresses in OSPF is to assign a unique network number to each area. The source area cannot distinguish between ARPs and OSPF destinations. It does not matter that all this does not exist geographically. When it is fully charged, it cannot be separated from one hop to another. It does not matter if the ABRs are not geographically distant from each other [30].

3.6 RIP WORK CONCEPT AND DESIGN

The history of RIP is very similar to that of other Ethernet networks. Like many modern LAN technologies, RIP began as a computer pioneer at the Xerox Palo Alto Research Center (PARC). Because Ethernet was designed to connect LANs, PARC developed Xerox PUP (PARC Universal Protocol), an advanced protocol that runs over Ethernet. Because PUPs require a directing convention, Xerox fostered a convention called the Hardware Monitoring Information (HWINFO). Later it was called directed data convention and was utilized as a component of the Xerox Network Services (XNS) convention set. Tear became standard when engineers at the College of California at Berkeley embraced the Unix working network to utilize the Binary Search Tree. Tear previously showed up in Berkeley Software Distribution variant 4.2 in 1982 and was carried out as a Unix working network planning as in the figure 3.15 [31].

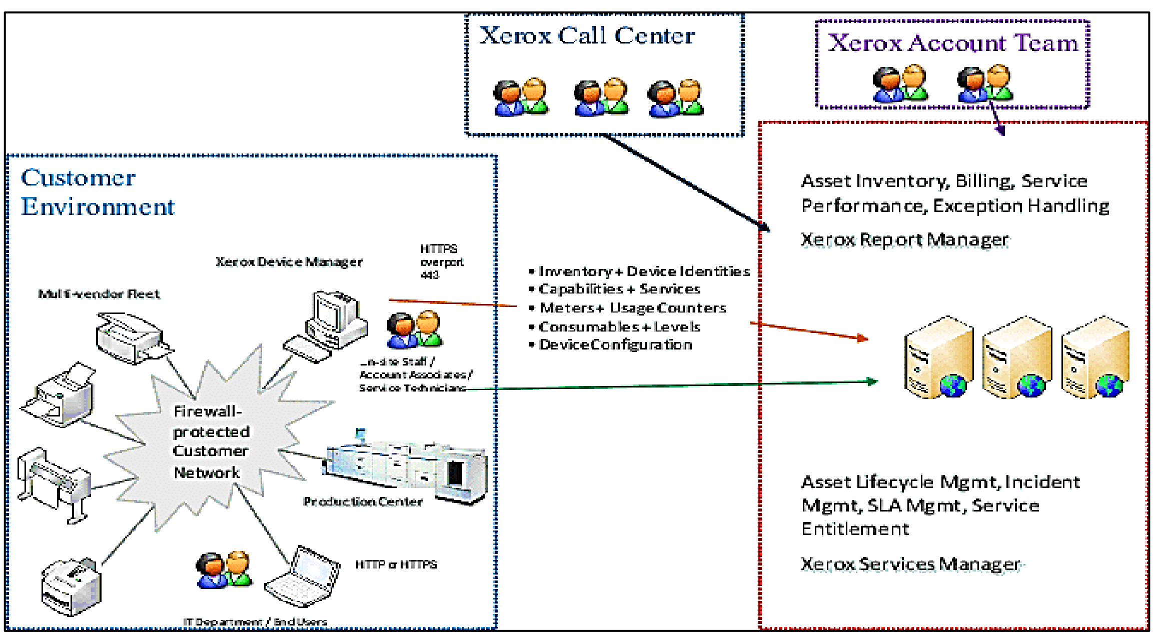


Figure 3.15: XNS Relation with Xerox Manager [31].

Berkeley Software Distribution was the most widely recognized working network, particularly on the main Personal Computers (PCs) associated with the Web. Subsequently, Tear turned out to be broadly utilized and turned into the business standard for inside steering conventions. It was utilized for Transmission Control Protocol / Internet Protocol and numerous different conventions. Truth be told, many data conventions, like the Real-Time Transport Protocol convention of the AppleTalk family, depend on this prior adaptation of Tear. For quite a while, the root executions of Berkeley Software Distribution were viewed as convention norms. Be that as it may, there is no conventional meaning of how these function as no authority standard have been characterized. This has caused contrasts in the execution of different conventions over the long run. Web standard Request for Comments 1058, distributed in June 1988, characterizes Tear as the Internet Engineering Task Force for Data Convention to address potential interoperability issues between executions as described in the figure 3.16 [32].

Figure 3.16: BSD UNIX Operating System Example [32].

The Request for Comments is straightforwardly founded on the Berkeley Software Distribution-based program. This unique variant of Tear is currently known as Tear 1 to recognize it from later adaptations. Tear's prominence is generally because of its consideration in Berkeley Software Distribution. This is a consequence of the overall effortlessness of the convention. Tear utilizes a distance vector system (otherwise called a two-finder Bellman-Passage guidance) to decide the route. Each router has other networks or routers connected to it. Each element contains two important pieces of data: the email address or host address and the measurement distance. This is the number of routers that reach the main object. RIP is the most common internal routing protocol in the family of Transmission Control Protocol / Internet Protocol. The history of the protocol and how it became popular is very interesting. For many other major protocols in the Transmission Control Protocol / Internet Protocol family, RIP was not formally developed through the Request for Comments standardization process. Instead of, it became an industry standard and then an Internet standard as present in the figure 3.17 [33].

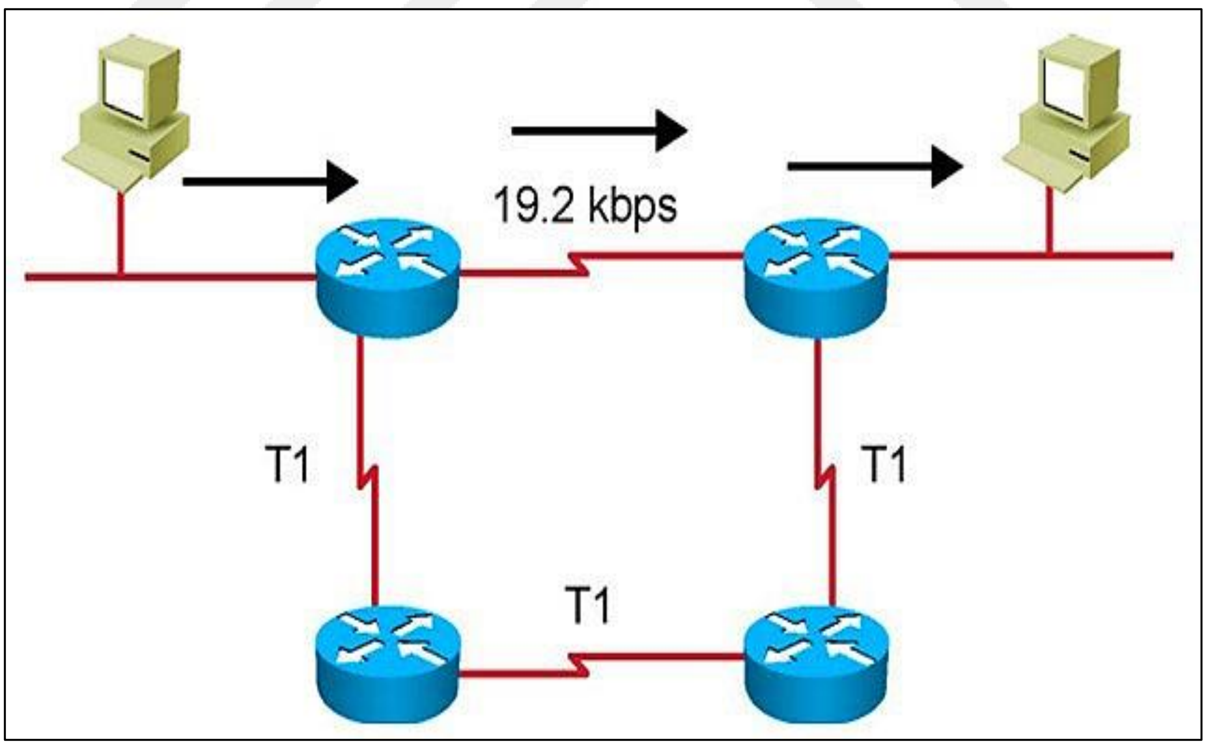


Figure 3.17: RIP Overview Example [33].

RIP is part of the IP routing protocol and is an Internal Gateway Protocol (IGP) for distributing routing information within an autonomous system. RIP is a simple vector routing protocol with many implementations in the field. The router changes the network information with the closest neighbors in the distance vector protocol. In other words, the router communicates with the list of the available list (prefix of address) and the next address to reach the next location. This connection is more than a public IGP. Holoimage -paltocks-exchange with each other, associate locations, and count local groups. distance vector routing protocols create routes between all routers with routing applications and perform a series of switches. In a nutshell, RIP works like this:

Each router initializes its routing table with a list of locally connected networks. Each router periodically activates the entire contents of its routing table on all RIP-enabled interfaces. Whenever the RIP router receives these advertisements, it places all matching routes in its routing table and starts using them to send packets. This process ensures that all networks connected to each router are advertised to all routers. If the router does not continue to receive advertisements for the remote route, the route terminates at the end and no more packets are sent. In other words, RIP is a soft protocol. Each route has an attribute called a metric that represents the distance to the route's destination [34].

Each time the router receives a unidirectional advertisement, the counter is incremented. When deciding to reserve a bidirectional option in the routing table, the router chooses the shortest route from the longest route. The maximum number allowed by RIP is 16, which means that the route is unreachable. This means that the protocol cannot scale to networks with more than 15 hops to a given destination. RIP also includes several improvements to this basic algorithm to improve routing database stabilization and eliminate routing loops. When a router detects a change in its routing table, it immediately sends an update. These speeds up the routing table layout and eliminates routing loops as in the figure 3.18 [35].

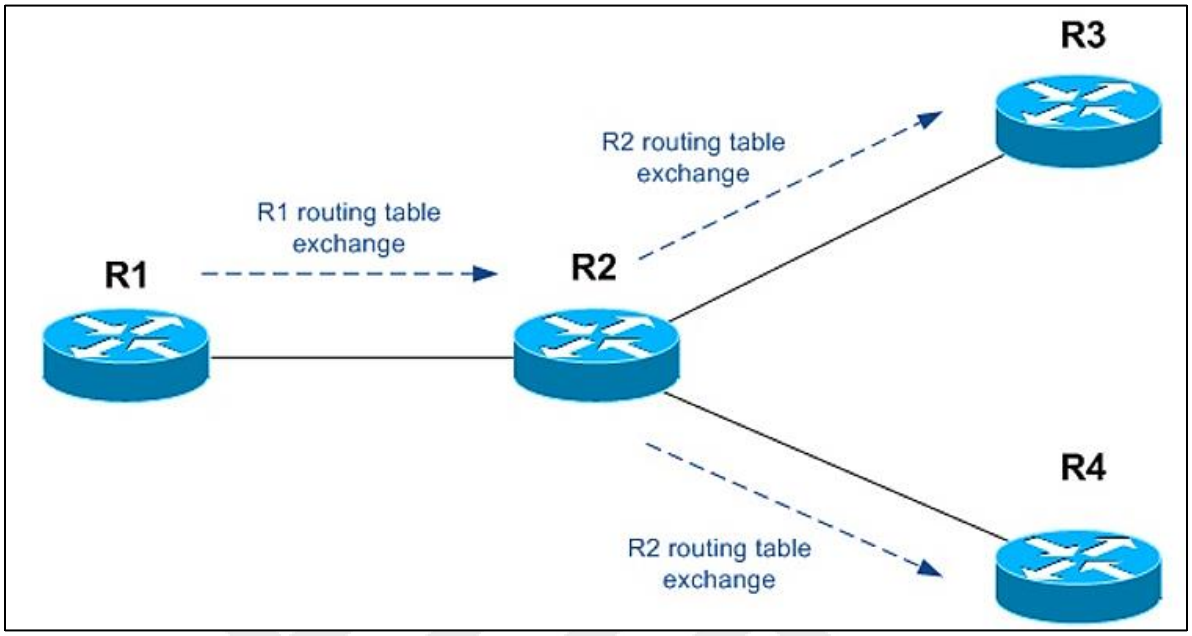


Figure 3.18: RIP Routing Table Exchanges [35].

If the route is determined to be unreachable, the RIP router does not immediately drop the route. Instead, routes with a value of 16 (not available) are still waiting. This allows us to quickly inform the neighbors about an unavailable route instead of waiting for the software to become expired. When a router that learns a route from router B, it advertises route B with metric 16 (unreachable). Therefore, B does not suspect that A has another way to achieve the same goal. This pattern is called the return horizon of poisons. The query message allows the new router to quickly look up the routing tables of all neighboring routers. The RIP provides a standard IGP protocol for local area networks so that if one network connection is lost, network connectivity can be quickly restored over another. The following sections describe RIP outputs, actions and workflows, and other RIP resources. RIP is written in C. June 1988 Rutgers University Hetrick is the most widely used routing protocol on the Internet for intranet routing. RIP is based on the popular Berkeley Software Distribution Unix 4.3 routed desktop program and has become the de facto standard for lab routing supported by gateway vendors. All RIP routing protocols are based on a distance vector algorithm called the Bellman-Ford algorithm.

After bellman developed the equations that served as the basis for dynamic programming, Ford began working in the field. Software based on these algorithms was used by Advanced Research Projects Agency Network in 1969, but the development of the underlying protocol was provided by Xerox's network research and development department. The first entrance RIP to transfer routing information with the information protocol, Found by the command. Then Medco provided an Ethernet network for the actual level. The Little guy convention was subsequently refreshed to help the XNS engineering and became known as the data convention, regularly known as Tear. Data Convention utilizes the jump consider worth to assess the worth of different protocols. The quantity of bounces is the number of routings that can be served on the network. For the associated networks have a list of area 0. Detached networks have 16 qualities. Considering this restricted measurement range, Tear isn't appropriate for huge organizations. data convention rendition 1 purpose User Datagram Protocol (UDP) broadcast information bundles, while RIP version two utilizes multicast parcels to the convention of data.

Cisco programming sends directing data refreshes. If a gadget doesn't get an update from one more gadget for over 180 seconds, the getting gadget drops the network given by the non-refreshed gadget. Assuming there are no updates following 240 seconds, the gadget eliminates all non-refreshed sections from the routing table. The Tear gadget is by refreshing the organization naturally by refreshing another gadget that runs Tear or Tears through Tear. In the two cases, the primary organization is publicized by Tear to another. The Cisco Tear version 2 execution Message Digest Method 5 (MD5), digest directing, raunchy between CIDR and VLSM. routing data convention (Tear) occasionally sends directing update messages when the organization's geography changes. At the point when a gadget gets a Tear routing update containing a change to a component, the gadget refreshes its directing table to mirror the new network as in the figure 3.19 [36].

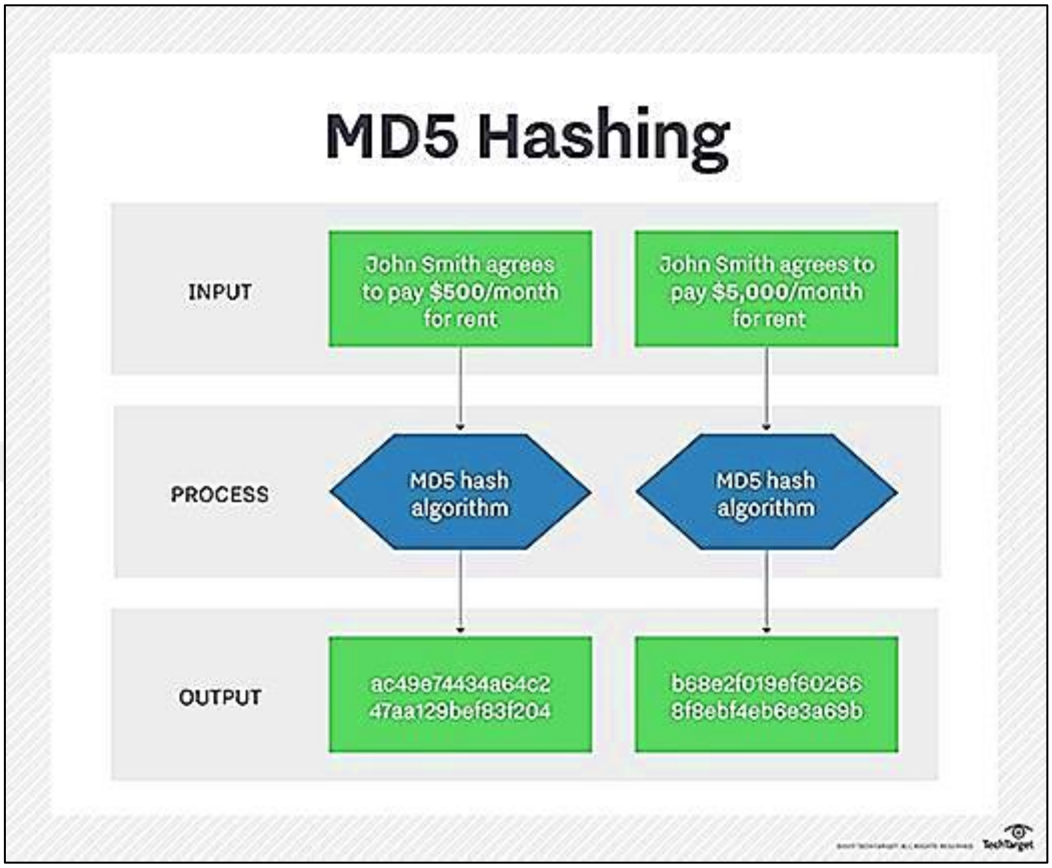


Figure 3.19: MD5 Hashing Process [36].

The way pointer is increased by 1 and the network is appointed as the following bounce. Tear gadgets just store the best way to the objective (the way with the least measurement estimation). When the directing table is refreshed, the gadget quickly starts sending Tear routing updates to tell different areas on the routing tables of the changes. These updates are sent independently from the consistently planned refreshes sent by the Tear gadget. The Cisco Directing Data Convention and RIP version 2 execution uphold confirmation, key administration, network topology, CIDR, and VLSM. As a matter of network, the product gets a routing table for RIP version 1 and RIP version 2 parcels, however, just sends RIP version 1 bundle. The product must be arranged to get and send RIP version 1 parcel. The product can likewise be designed to get and send RIPv2 bundles as it were as given in the figure 3.20 [37].

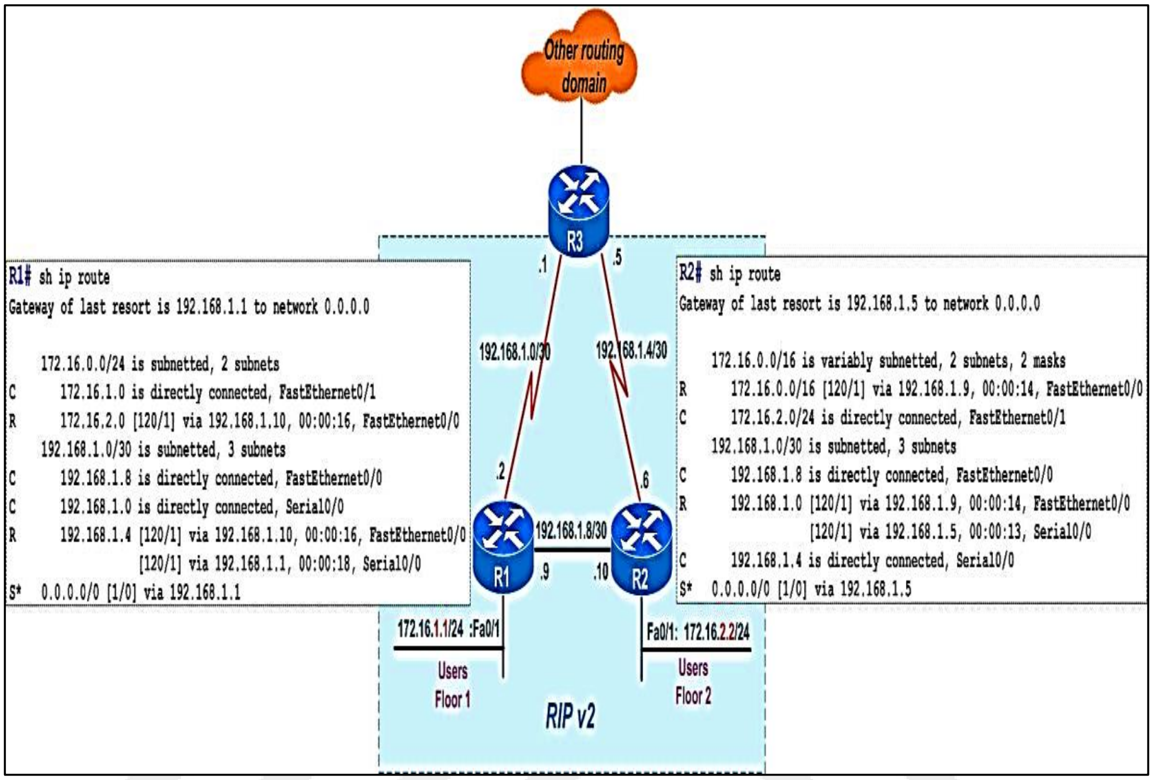


Figure 3.20: RIP Routing Tables Settings Example [37].

The default conduct by designing the variant of Tear that the connection point sends. You can likewise control how parcels got from a connection point are handled. RIP version 1 doesn't uphold validation. Tear validation can be empowered on the connection point while sending and getting Tear version 2 bundles. Confirmation, including static validation, is possibly performed on this point of interaction on the off chance that a key is designed. Cisco Tear upholds two validation strategies on the related connection point: clear message verification and MD5 confirmation. Clear text confirmation is the default validation for all RIP version 2 parcels as mentioned in the figure 3.21 [38].

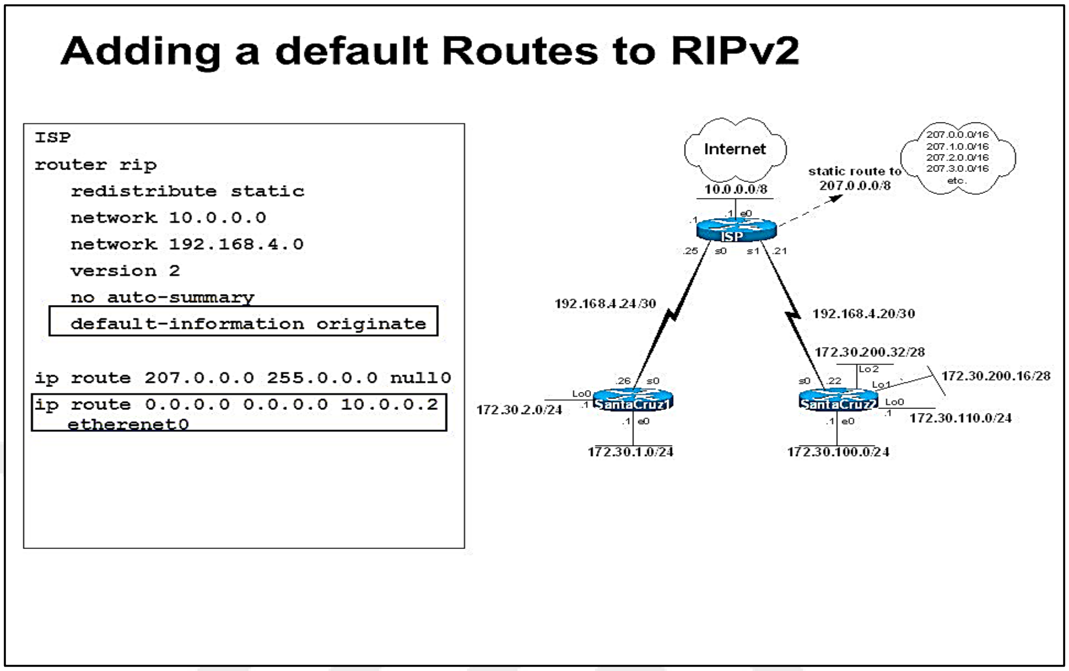


Figure 3.21: Default Routes Example [38].

Routing data convention utilizes directing data to quantify the distance among source and objective networks. Each jump on the way from the source to the objective is doled out a bounce count esteem. At this point, when a gadget incorporates a new or changed target network input, the gadget enters the network on the routing by adding 1 to the worth demonstrated in the update of the gadget. The source IP address is utilized as the following leap. If a connection point network isn't recorded in the routing table, it won't be publicized in the Tear update. The underlying variant of routing data convention was called RIP version 1. The Tear detail characterized in RFC 1058 purposes class-based directing. Intermittent directing updates don't uphold VLSM because occasional routing refreshes don't contain subnet data. All subnets of a network class should be a similar size. As per RFC 1058, Tear doesn't uphold VLSM, an network class can't have subnets of various sizes. This restriction is powerless against Tear assaults. RIP version two was initially intended to address the weaknesses of the Tear detail as depicted in RFC 2453. RIP version two can send data about subnets. All things considered; it upholds Between CIDR.

Routing data convention is normally a transmission convention, and for Tear routing updates to arrive at a non-broadcast network, Cisco programming should be designed to permit the trading of directing data. And can cripple the sending of directing reports on a particular point of interaction by designing the manual point of interaction switch setup in order to control the arrangement of points of interaction that trade routing refreshes. Switch records can be utilized to build the entrance and departure measurements of courses got by Tear. If essential, the obligation rundown can be constrained by an entrance rundown or point of interaction. Routing conventions utilize a few clocks that decide factors, for example, how frequently directing is refreshed, how long it takes for a route to become invalid, and other parameters. Can set this timer to adjust the performance of the routing protocol according to the needs of the Internet. And set the following stopwatch. Rating update sent (time, and seconds between updates) as shown in figure 3.22 [39].

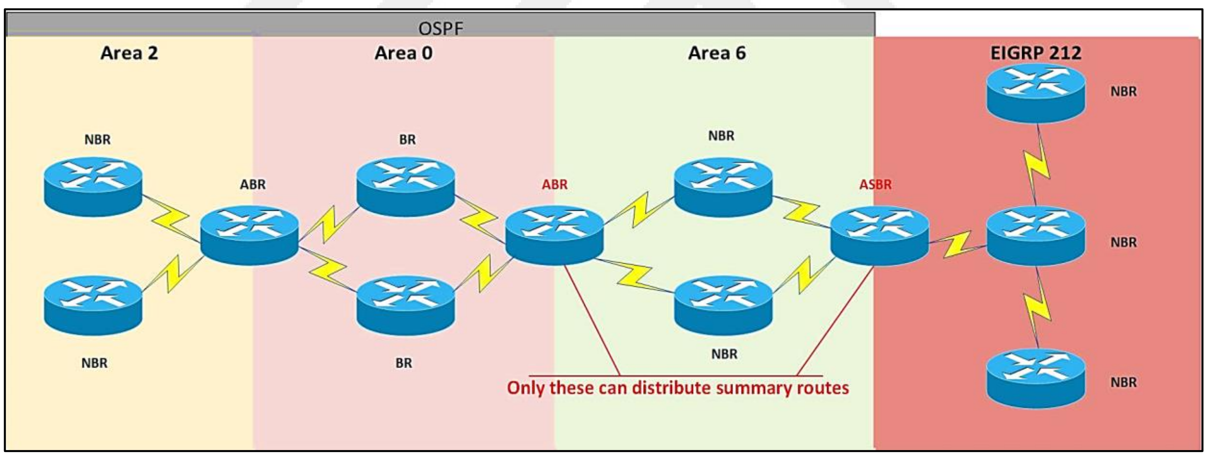


Figure 3.22: Routing in Various Areas [39].

The route was reported to be closed at the specified time and closed a few seconds later. The duration is removed from the route program and is given in seconds. The route is updated with a delay. Cisco software can configure support for IP routers so that the rapid integration of different IP router algorithms can quickly reduce the number of redundant devices. The overall effect is to minimize disruption to network end users if rapid recovery is required. Address groups can contain timers specific to that address group or virtual routing and forwarding. The timer start command must be specified for the address group. Otherwise, the system default value for the main timer command is used, regardless of the timer configured for RIP routing. The Virtual Routing and Forwarding (VRF) does not inherit the timer value from the default RIP configuration [40].

The VRF always uses the default system timer unless the timer is specifically changed using the timer-default command. Configure a neighbor's router authentication to prevent the routers from receiving incorrect router updates. If configured, neighbor authentication occurs when routing updates are exchanged between neighboring routers. This authentication ensures that the router receives reliable routing information from a trusted source. Unauthorized or malicious route updates from neighbors can compromise the security of network traffic. If an attacker intercepts or analyzes network traffic, security can be compromised. For example, a router can send fake route updates to trick the router into sending traffic to the wrong destination that described in the figure 3.23 [41].

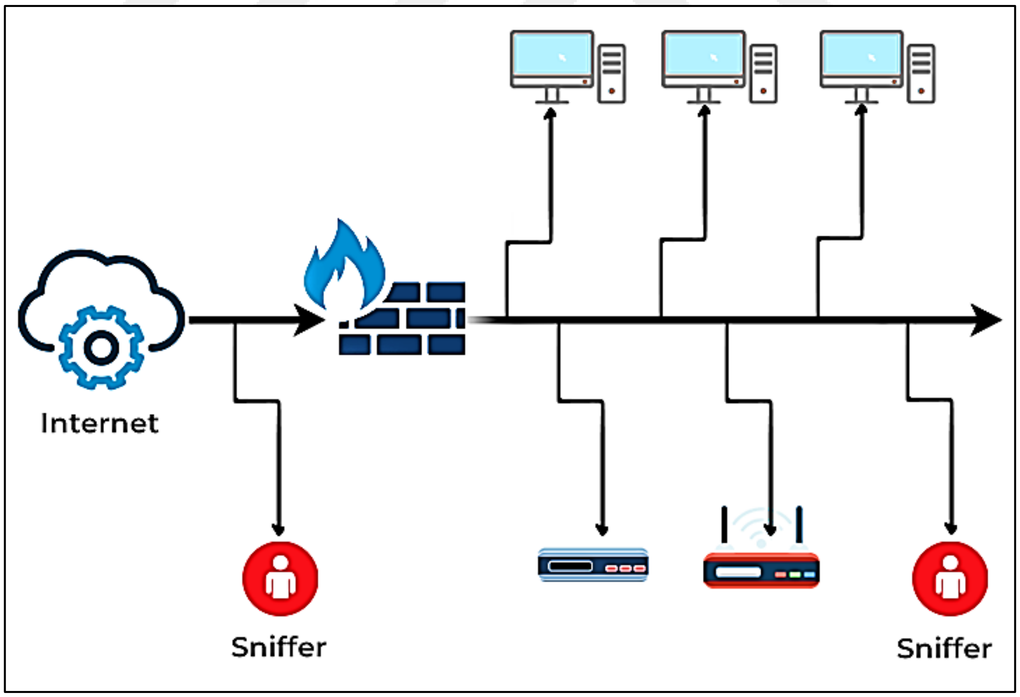


Figure 3.23: Packet Sniffing Attack Works in Routing Issue [41].

This redirected traffic can be analyzed and used to reveal sensitive information about your organization or interfere with your organization's ability to communicate effectively on the network. Neighbor authentication prevents routers from receiving these incorrect routing updates. If neighbor verification is configured on a router, the router determines the source of each routing update packet it receives. This is done by exchanging an authentication key (also known as a password) known to the sending and receiving routers. Two types of neighbor authentication are used:

Clear text authentication and MD5 authentication. Both formats work the same, except that MD5 sends a summary message instead of an authentication key. Capability messages are generated using keys and messages but cannot be read. Plaintext authentication is sent to the parent thread [42].

4. RESULTS AND ANALYSIS

We have explored the show of shows explicitly Route Information Protocol, Open Short Path First independently over an association with different conditions and on imitating the association for 15 minutes assuming there ought to emerge an event of situation 1 and for 6 minutes in the occurrence of situation 2, we have explored the presentation regarding the blend of RIP and OSPF independently. At the point when the association was attempted under these two conditions, the result for mix on the off chance that there ought to emerge an event of Tear, OSPF separately is shown in the referenced figures underneath.

In figure 4.1, as mentioned below, the blue curve presents the OSPF line, in addition, to the red curve which describes the RIP line, as a comparative study, the two curves are closed to each other, based on the Internet Protocol (IP) network convergence duration in seconds, the blue line while raise at 7 for the duration interval and settled at 4 while the time around 12.5 minutes. When the red curve raised at 9.8 and settled at 3.2 in the interval of duration and reached the 12.6 at approximately time.

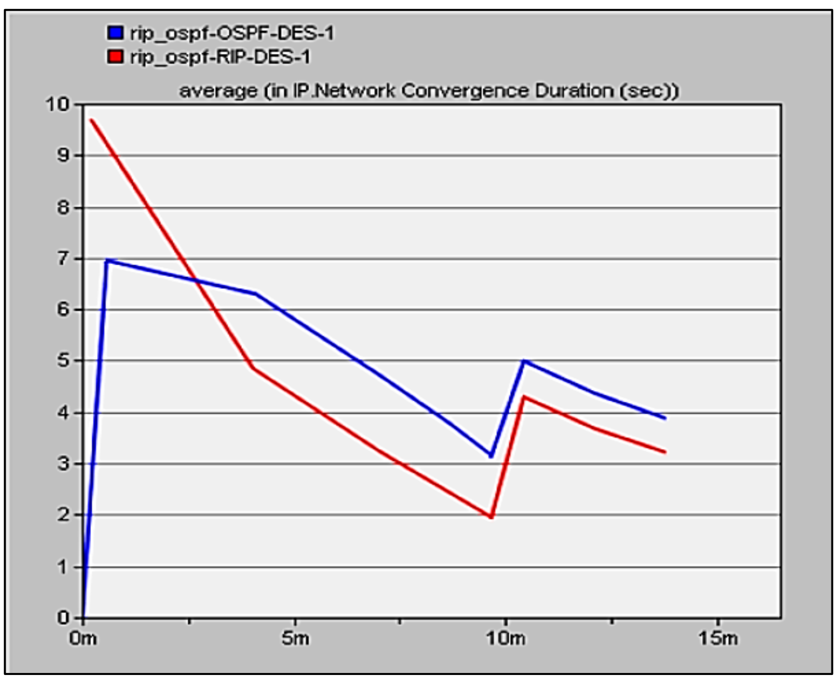


Figure 4.1: IP Network Convergence Duration between OSPF and RIP.

According to figure 4.2, a comparison which occurs between distance vector protocols while the red line describes the RIP protocol and the blue line presents the OSPF protocol, the two curves were more different which measure the speed for each one of the mentioned protocols, as seen in the figure, the raising issue that occurs from 0 up to 24.4 as a speed performance and settled at 20.9 in the preferred performance while the time reached at the end of 5 minutes, in RIP line, the initialization issue occur in 9.9 as a speed number while the raising at 2 minutes when the estimated time been occur in the last of simulation assets in the software were 5 minutes with each other.

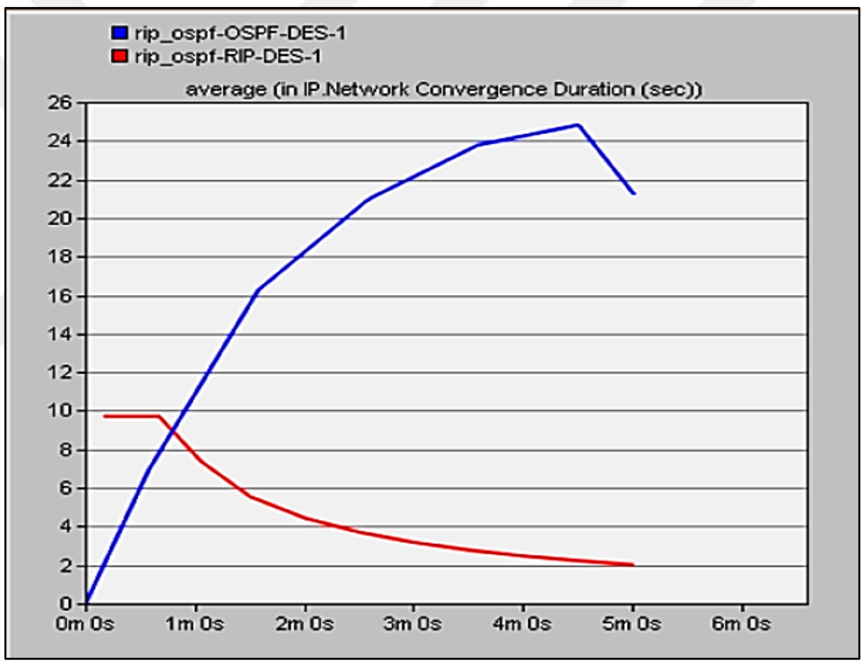


Figure 4.2: IP Network Convergence Duration between OSPF and RIP overall.

Distance vector convention Route Information Protocol is famously delayed uniting or adjusting to organize geography changes. After a change to the organization, and before every one of the switches has united, there is the likelihood of steering mistakes and lost information. Interface state directing convention, Open Shortest Path First is quicker in combination. Since Open Shortest Path First promotes less often, it utilizes less data transmission than RIP yet combines a lot slower. Combination with Open Shortest Path First is quicker Since each Open Shortest Path First switch has a duplicate of the geography data set and directing table for its specific region, any course changes are distinguished quicker than with distance vector conventions and backup ways to not entirely settled. Also, on examining the boundaries of execution like throughput, usage, and deferral, according to the results plotted OSPF has the most extreme throughput followed by Route Information Protocol for the instance of lining postpone OSPF has the least postponement followed by Route Information Protocol, and for the instance of connection use Open Shortest Path First has the greatest connection use followed by Route Information Protocol as displayed in the figures beneath.

In figure 4.3, which presents both OSPF and RIP results, with the curves performance, the variations occur on the point-to-point protocol over ethernet, in the blue line made for the OSPF utilization for each interval of a time and according to the performance issue, the blue line has started at 0.0000 and raising as overshoot in 0.00095 as a utilization usage from one interface to another while settled at 0.0002 with an estimated time 5 minutes and 50 sec, compared to RIP, the red line which makes the initialization at 0 and raising with the overshoot with 0.00036 in a utilization issue and settled at 0.0000.3 due to the weakness in the speed of the RIP when compared with OSPF.

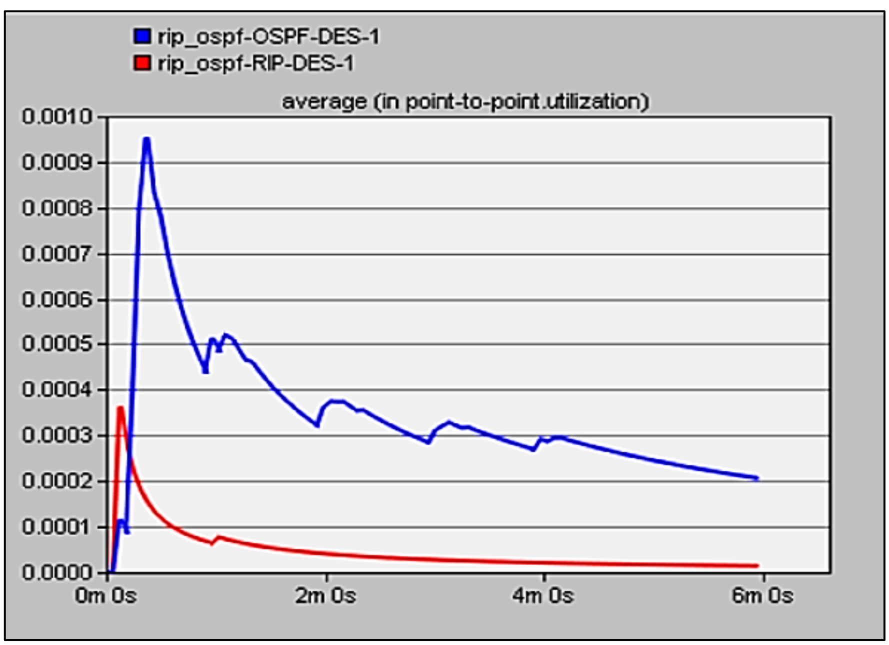


Figure 4.3: Point-to-Point Utilization between OSPF and RIP.

In figure 4.4, which describe the point-to-point for throughput while measure in data rate, according to the description of the curve, the blue curve presents the open short path first when made for comparison in the performance of the throughput while occurring between two or more devices and referred to the mentioned figure, the blue curve is started via 0 as initial point and raising with 360 as data rates rely up on throughput and settled with 70 as the end of the simulation estimated time while the given time limited at 5 minutes and 50 sec when the red curve initialized at 60 for the data rates on throughput and raised at 180 data rates while the time of estimation is around at the end of the mentioned simulation.

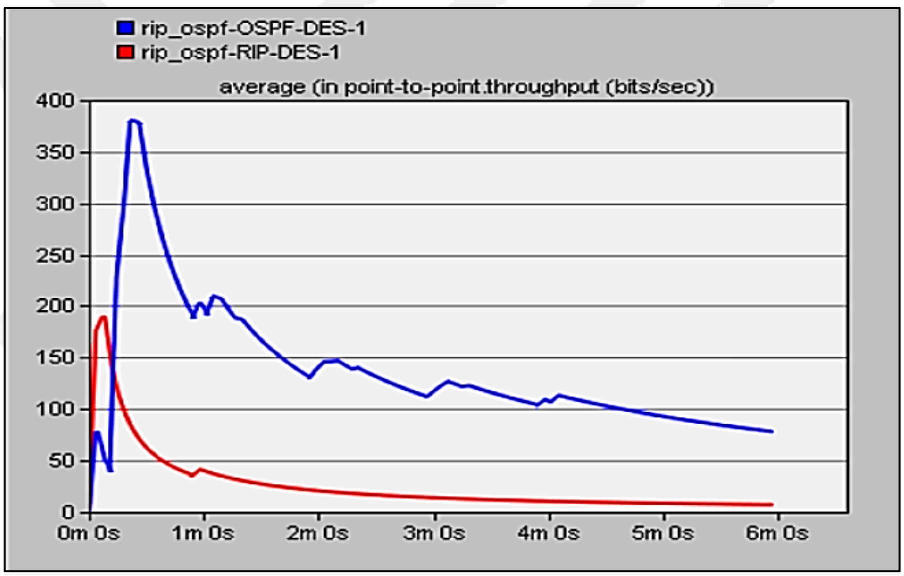


Figure 4.4: Point-to-Point Throughput between OSPF and RIP.

According to figure 4.5, based on the queuing delay that occur between two interfaces while the buffer will upload all the packets on it, the performance, in this case, can be estimated via the number of uploaded packets on it as a sequential issue, the delay in this issue can give how much the time that remains to execute or send the packet from one computer to another, because of each one should utilize the ethernets, and about the simulation, the blue curve which describes the OSPF when started at 0.0000135 as a delay in seconds while the raising issue occurs in 0.000021 seconds and settled at 0.000016 seconds with the end of simulation remaining time that reached at the same estimated time.

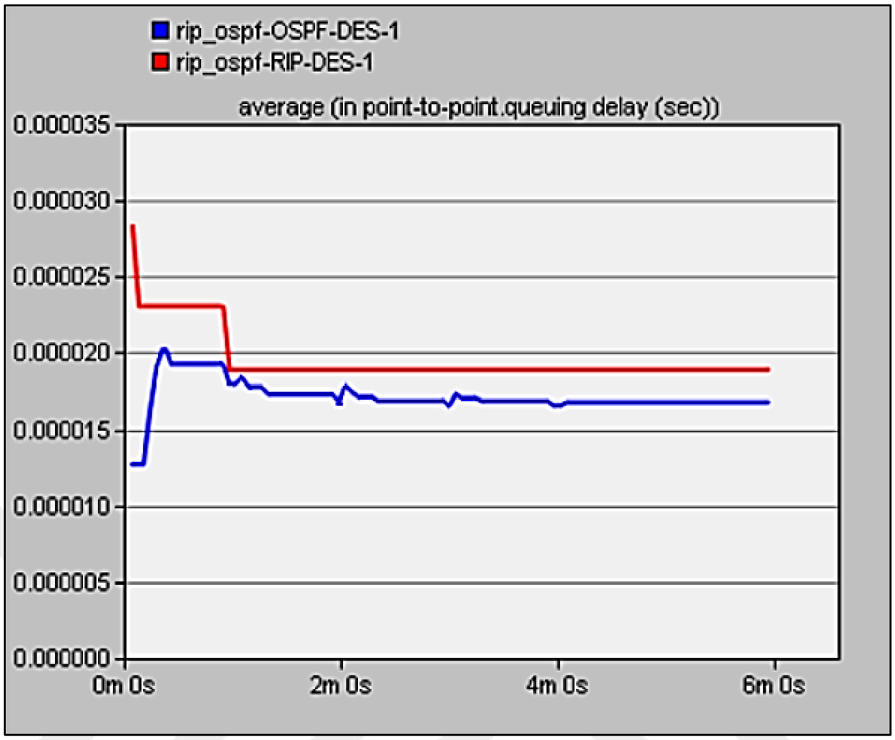


Figure 4.5: Point-to-Point Queuing Delay between OSPF and RIP.

On taking a gander at the outcomes of the diversion of shows explicitly Route Information Protocol, Open Short Path First for the association, throughput, interface use, and coating delay, we can trust the display of Open Short Path First to be magnificent. Thusly, we could deduce that when we consider the above circumstances, Open Short Path First performs even better when the other model like the most insignificant cost of transmission and lower switch are contemplated Open Short Path First can be a substitute choice.

5. CONCLUSION

a. The objective of our examination was to mimic the way of behaving of Open Short Path First and Route Information Protocol and present a relative report between them while showing which convention is appropriate for which sort of organization.

b. Our commitment with this undertaking was to assist the per users with understanding the behavior of the conventions Open Short Path First and Route Information Protocol Furthermore, the distinctions among them and have the option to pick which convention suits them best. After the reenactment of both Open Short Path First and Route Information Protocol and examining the outcomes.

c. We reasoned that OSPF is a superior directing convention than Route Information Protocol in fundamentally every one of the correlations which were union, throughput, connect use, and lining delay. So, for us, we can't say a convention isn't effective however everyone has its highlights, and if we somehow managed to pick between these 2 behavior conventions Open Short Path First and Route Information Protocol in a major scale network that contains more than, at that point Taking note of that moving information in networks doesn't rely just upon these two conventions

d. Open Short Path First and Route Information Protocol and as we notice that Open Short Path First is better than Route Information Protocol however, we notice that Route Information Protocol is better in specific undertakings like in the introduction time and the expense adding that OSPF isn't the best behavior convention contrasted with different conventions, for example, the EIGRP which consolidate the two conventions Open Short Path First and Route Information Protocol.

In the future advice recommended utilization:

a. Make the comparison of utilization with EIGRP using Bridges.
b. Using PPPOE DS3 link with the Bridges.
c. Changing the type of routers and applying it to the network.

REFERENCES

[1] S. G. Thorenoor, “Dynamic routing protocol implementation decision between EIGRP, OSPF and RIP based on technical background using OPNET modeler,” Second International Conference on Computer and Network Technology, pp. 191–195, 2010.

[2] S. Y. Jalali, S. Wani, and M. Derwesh, “Qualitative analysis and performance evaluation of RIP, IGRP, OSPF and EGRP using OPNETTM,” Adv. Electron. Electr. Eng., vol. 4, no. 4, pp. 389–396, 2014.

[3] R. Narula and P. Aggarwal, “Performance Evaluation of RIP and OSPF in IPv6 using OPNET 14.5 Simulator,” Int. J. Tech. Res. Appl., vol. 2, no. 6, pp. 37–41, 2014.

[4] P. Kalamani, M. V. Kumar, M. Chithambarathanu, and R. Thomas, “Comparison of RIP, EIGRP, OSPF, IGRP Routing Protocols in Wireless Local Area Network (WLAN) by using OPNET Simulator tool-A Practical Approach,” IOSR J. Comput. Eng., vol. 16, no. 4, pp. 57–64, 2014.

[5] M. A. Hossain, M. M. Ali, M. S. Akter, and M. S. A. Sajib, “Performance comparison of EIGRP, OSPF and RIP Routing protocols using cisco packet tracer and OPNET simulator,” Glob. J. Comput. Sci. Technol., 2020.

[6] I. Fiţigău and G. Toderean, “Network performance evaluation for RIP, OSPF and EIGRP routing protocols,” in Proceedings of the International Conference on electronics, computers and artificial intelligence-ECAI-2013, pp. 1–4, 2013.

[7] A. N. Hameed, S. A. Alabady, and M. A. Thanoon, “Performance Analysis and Evaluation of Distance Vector and Link State Routing Protocols Over a Large Area Networks,” TELKOMNIKA (Telecommunication Comput. Electron. Control., vol. 20, no. 6, 2022.

[8] D. El Idrissi, N. Elkamoun, and R. Hilal, “Study of the Impact of the Profoundness of Tunnel in the Context of Transition from IPv4 to IPv6 at the Local, Regional, and National Levels,” in Advances on Smart and Soft Computing, Springer, pp. 261–270, 2022.

[9] N. Jain and A. Payal, “Performance Comparison Between Different Tunneling Techniques Using Different Routing Protocols,” Wirel. Pers. Commun., vol. 123, no. 2, pp. 1395–1441, 2022.

[10] Mittal, I., & Anand, A., “WLan Architecture, "International Journal of Computer Trends and Technology", Vol. 8, No. 3, pp. 148-151, 2014.

[11] Alimi, I. A., & Mufutau, A. O., “Enhancement of network performance of an enterprises network with VLAN”, American Journal of Mobile Systems, Applications and Services, Vol. 1, No. 2, pp 82-93, 2015.

[12] S. Mogensen; F. Pajukoski; T. Tiirola. Centimeter-wave concept for LTE ultra-dense small cells. In Proceedings of the 2014 IEEE 79th Vehicular Technology Conference, Seoul, South Korea, vol. 11, pp. 23–28, 2015.

[13] Elechi Onyekachi O., “Design and Simulation of Wireless Local Area Network for Administrative Office using OPNET Network Simulator: A Practical Approach”, Information and Knowledge Management, Vol.4, No.10, pp. 27-34, 2014.

[14] Krupanek, B., & Bogacz, R., “OPNET Modeler simulations of performance for multi nodes wireless systems”, International Journal of Metrology and Quality Engineering, Vol. 7, No. 1, pp 105, 2016.

[15] H.S.Mewara,B., Mukesh Kumar Saini, “ Performance Analysis of Access Point for IEEE802.11g Wireless LAN Using Opnet Simulator” , International Journal of Advanced Engineering Research and Science (IJAERS), Vol.1, Issue.1, pp. 14-18, 2014.

[16] Sarah Ali Abdullah, “Simulation of Virtual LANs (VLANs) Using OPNET”, IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Vol .11, Issue. 6, Ver. II, pp. 67-80, 2016.

[17] AL-Khaffaf, D. A. J., “Improving LAN Performance Based on IEEE802. 1Q VLAN Switching Techniques”, Journal of University of Babylon, Vol. 26, No. 1, pp 286-297, 2018.

[18] Chokshi, R., & Yu, C, “Study on VLAN in Wireless Networks”, Technical Report, 2007.

[19] Ali, A. H., Abbas, A. N., & Hassan, M. H., “Performance Evaluation of IEEE802. 11g WLANs Using OPNET Modeler”, American Journal of Engineering Research (AJER), Vol. 2, Issue. 12, pp. 9-15, 2013.

[20] Meen, Parneek Kaur, “Performance Metrics of WLAN for Different Applications using OPNET”, International Journal of P2P Network Trends and Technology (IJPTT), Vol. 4 Issue. 5, 2014.

[21] Alisa, Z. T., B “Evaluating the performance of wireless network using OPNET modeler”, International Journal of Computer Applications, Vol. 62, No. 13, 2013.

[22] Jayakumar, G., & Ganapathy, G., “Performance comparison of mobile ad-hoc network routing protocol”, International Journal of Computer Science and Network Security (IJCSNS), Vol. 7, No. 11, pp 77-84, 2007.

[23] Manickam, P., Baskar, T. G., Girija, M., & Manimegalai, D. D., “Performance comparisons of routing protocols in mobile ad hoc networks”, 2011.

[24] M. G. Castillo-Pinargote, E. M. San Andrés-Laz, and J. L. Veloz-Zambrano, “Diseño de Red, Servicios de Internet y Telefonía IP en las Unidades Educativas Rurales.,” Rev. Científica Informática ENCRIPTAR-ISSN 2737-6389., vol. 5, no. 10, pp. 13–29, 2022.

[25] N. Jain, A. Payal, and A. Jain, “Effect of data packet size on the performance of RIP and OSPF routing protocols in hybrid networks,” Int. J. Pervasive Comput. Commun., 2021.

[26] A. Albaour and Y. Aburawi, “Performance Comparison of Routing Protocols,” Int. Res. J. Eng. Technol., vol. 8, no. 2, pp. 1–5, 2021.

[27] K. Gilbert and S. M. Musa, “Open Shortest Path First Protocol with Failure Recovery in IP Network Performance Measurement,” in 2021 6th IEEE International Conference on Recent Advances and Innovations in Engineering (ICRAIE), vol. 6, pp. 1–4, 2021.

[28] S. S. Hameed and H. M. Saleh, “The impact of Routing Protocols and topologies on IOT Based Systems,” in Journal of Physics: Conference Series, vol. 1804, no. 1, p. 12112, 2021.

[29] D. N. S. Ariawan, G. S. Santyadiputra, and I. K. R. Arthana, “Perbandingan Performa Routing Protocol antara Mixed Routing Protocol dengan Single Routing Protocol pada Aplikasi VoIP Menggunakan Riverbed Modeler Academic Edition 17.5,” J. Ilmu Komput., vol. 14, no. 1, pp. 11–19, 2021.

[30] W. Mwewa and S. C. Lubobya, “Performance Evaluation of Routing Protocols in Enterprise Networks,” Am. J. Comput. Eng., vol. 5, no. 1, pp. 24–35, 2022.

[31] M. N. Shehzad, U. R. Kamboh, M. D. Taqdees, Z. Waheed, M. Usman, and A. M. Buttar, “Diverse Dynamic Routing Protocols Distribution in the Large Network with Route Redistribution Techniques using GNS3,” in 2021 International Conference on Innovative Computing (ICIC), pp. 1–7, 2021.

[32] N. Jain, A. Payal, and A. Jain, “Analysis of link failures and recoveries on 6to4 tunneling network with different routing protocol,” J. Intell. Manuf., pp. 1–27, 2021.

[33] R. Essah and Y. A. Asante, “Comparative Analysis of OSPFv3/IS-IS and RIPng/IS-IS Mixed Protocols for Real-Time Applications in IPv6 Communication Networks,” Asian J. Res. Comput. Sci., pp. 111–131, 2021.

[34] Z. A. Yau and K. C. Arun, “Comparative performance evaluation of RIP with OSPF routing protocol,” J. Appl. Technol. Innov. (e-ISSN 2600-7304), vol. 5, no. 3, p. 67, 2021.

[35] N. Jain, A. Payal, and A. Jain, “Performance analysis of routing protocols on IPv4 and IPv6 addressing networks,” J. Web Eng., pp. 1327–1366, 2021.

[36] A. Hasan, “Application Based performance monitoring heavy data transmission of Local Area Network,” Kufa J. Eng., vol. 13, no. 3, pp. 14–40, 2022.

[37] M. Ashar and A. P. Wibawa, “IPv6 vs IPv4 Performance Simulation and Analysis using Dynamic Routing OSPF,” in 2021 4th International Conference of Computer and Informatics Engineering (IC2IE), pp. 452–456, 2021.

[38] A. M. Ali, M. Dhimish, and P. Mather, “Optimization and Selection of Best Sustainable Services in Various IEEE 802.11 Technologies,” J. Green Eng., pp. 420–439, 2021.

[39] A. V Podsadnikov, K. V Rozov, and S. V Kratov, “The methods and approaches to computer networks simulation using virtual network infrastructure,” in Journal of Physics: Conference Series, vol. 1791, no. 1, p. 12082, 2021.

[40] J.-H. Huh, “Implementation of Smart Grid Test Bed Using OPNET and PLC,” in Research Anthology on Smart Grid and Microgrid Development, IGI Global, pp. 635–671, 2022.

[41] V. Chang, A. Kamireddy, Q. Xu, J. Li, C. Psarros, and P. L. Chong, “Simulate and compare routing protocols for smart green systems,” Int. J. Bus. Syst. Res., vol. 16, no. 3, pp. 302–329, 2022.

[42] W. M. Lafta, A. A. Alkadhmawee, and M. A. Altaha, “Best strategy to control data on internet-of-robotic-things in heterogeneous networks,” Int. J. Electr. Comput. Eng., vol. 11, no. 2, pp. 1830–1838, 2021.