COMPARATIVE ANALYSIS OF RIP, EIGRP AND OSPF PROTOCOLS USING RIVERBED (OPNET) AND PACKET TRACER

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Abstract: Computer networks are a system of interconnected computers for sharing digital information by selecting the best routes between any two nodes which based on the routing protocol. There are many types of routing protocols which can be dynamic or static, as well as distance – vector or link – state. In this project, there are three typical types of routing protocol chose to simulate which are Routing Information Protocol (RIP), Open Shortest Path First (OSPF), and Enhanced Interior Gateway Routing Protocol (EIGRP).
Detailed descriptions of these routing protocols are provided later in this research. We are using Riverbed (OPNET) modular and packet tracer to simulate RIP, OSPF and EIGRP in order to compare their simulation results and compare their performance. We aim to analyze the performance of these three protocols such as their network convergence duration, total number of update, traffic dropped, throughput, queuing delay, bandwidth, delay, minimum, average and maximum packet round trip time, administrative distance and MTU (minimum transmission unit) in order to determine the best routing protocol for a given wired network topology.
There have been a large number of static and dynamic routing protocols available but choice of the right protocol for routing is dependent on which routing protocol is best according to various network convergence duration, total number of update, traffic dropped, throughput, queuing delay, bandwidth, delay, minimum, average and maximum packet round trip time, administrative distance and MTU (minimum transmission unit).Through this paper we define and understand the concepts of routing and routing protocol by comparing, analyzing the performance these three protocols such as (RIP),(EIGRP) and (OSPF) in computer network system which deal with video conferencing , voice and packet route networks system and comparison of these protocols done in Riverbed (OPNET) modular and packet tracer to show the result in the graph.

Key word :(RIP) Routing Information Protocol, (EIGRP) Enhanced Interior Gateway (OPSF) Routing Protocol Open Shortest Path First, and Riverbed (OPNET) modeler and packet tracer simulator, IPv4

1. INTRODUCTION AND THEORETICAL VIEW

A routing protocol works based on an algorithm. Routing algorithm also based on metrics to find the path to transmit data across two networks. Metrics and parameter also include network convergence duration, total number of update, traffic dropped, throughput, queuing delay, bandwidth, delay, minimum, average and maximum packet round trip time, administrative distance and MTU (minimum transmission unit) these some metrics parameter also save or store in routing Table but some parameter is not by default store in the routing table like network convergence duration, total number of update, traffic dropped, throughput, queuing delay.

Routing protocol has two types. First one is an interior gate way protocol and other one is an exterior gateway protocol. OSPF is also interior gate way protocol, other interior gate way Protocol are RIP,EIGRP, IGRP. BGP and BGP4 is Exterior gate way protocol.

The dynamic routing protocols keep the routing tables updated. This thesis specifies the Open Shortest Path First (OSPF), Enhanced Interior Gateway Routing Protocol (EIGRP) and Routing Information Protocol (RIP) TCP/IP internet routing. The network based on TCP/IP protocol permits the efficient routing of data packets based on their IP address. Routers are used in the network to control and forward data. In the packetized communication of information, the function of routing is moving traffic across networks and the routers should be aware of where they should forward the traffic next in order to reach the final destination. In order for routers to effectively and efficiently distribute data, the choice of the routing protocol becomes very critical factor to define the success of the network over time. Factors that differentiate one routing protocol from another include the speed that it adapts to topology changes called as convergence, the ability to choose the best route among multiple routes and the amount of network traffic that the routing protocol creates.

1.1 ROUTING PROTOCOL BASICS

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. A routing protocol includes an algorithm to determine the best rough among immediate neighbors. Routing protocols are according to the OSI routing framework. Routing protocols are layer management protocols for the network layer.
Network layer

1.2 ROUTING METRIC BASICS

Different routing protocols have different metrics. If there are two more routes between two nodes, each router must determine a method of metrics by choose the routing protocol to calculate the best path. A metric is a variable assigned to routers as a means of tanking them from the most preferred to the last preferred.

1.3 STATIC ROUTING AND DYNAMIC ROUTING

Static routing is a form of routing that occurs when a router uses a manually – configured routing entry, rather than information from a dynamic routing protocol to forward traffic. Static routes are usually configured by a network administrator by adding in entries into a routing table. In static routing, all the changes in the logical network layout need to be manually done by the system administrator. However, Dynamic routing is adaptive routing which describes the capability of a system are characterized by their destination, to alter the path that the route takes through the system in response to a changed conditions. Dynamic routing allows routers to select the best path while there is a real time logical network layout change. In our project, RIP, OSPF and EIGRP are belonging to the dynamic routing protocols.

1.4 DISTANCE VECTOR AND LINK STATE

Distance vector protocols is a vector which contains both distance and direction such as RIP, determine the path to remote networks using hop count as the metric. Distance vector protocol is based on Bellman – Ford algorithm and Ford –Fulkerson algorithm to calculate paths. It also transmits routing information that includes a distance vector, typically expressed as the number of hops to the destination. Distance vector requires a router informs its neighbors of topology changes periodically. Link state protocols are routing protocols which calculate the best paths to networks differently than distance vector routing protocols. Link state protocols also calculating their network routes by building a complete topology of the entire network area. It is calculating the best path from the topology of the entire interconnected network

1.5 ROUTING INFORMATION PROTOCOL (RIP)

RIP stands for Routing Information Protocol in which distance vector routing protocol. RIP is the first routing protocol implemented on TCP or IP. RIP can't guarantee that the route it's using is loop free like OSPF or EIGRP can. RIP is basically just making a guess based on the limited information that it knows. RIP uses `next - hop` as it's metric and calculates the best route based on the number of hop it takes to reach the specified subnet. The advantage of RIP is that it's very simple to implement, and that it's an open standards based protocol. The maximum number of hops allowed for RIP is 15. If the number of hops goes beyond 15, the route will be considered as unreachable. At the first developed, RIP only transmitted full updates every 30 seconds. As the networks become larger, `the reactive time of RIP is longer. RIP has four basic timers which are Update Timer (default 30 seconds), Invalid Timer (default 180 seconds), Hold – Down Timer (default 180 seconds), and flush Timer (default 240 seconds).

- Update Timer defines how often the router will send out a routing table update.
- Invalid Timer indicates how long a route will remain in a routing table before being marked as invalid. Moreover, the route is marked with a metric of 16, means the route is unreachable.
- Hold – Down Timer specifies how long RIP will keep a route from receiving updates when it is in a hold – down state. A route will go into a hold down state if the invalid timer has expired or the route goes into a higher metric that what it is currently using.
- Flush Timer indicates how long a route can remain in a routing table before

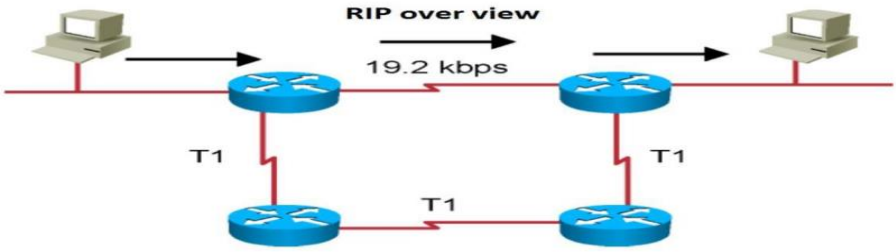

Figure 1:1.5 RIP over view

Getting flushed out The flush timers operates simultaneously with every 60 seconds, the route will get flushed out after it is marked invalid. The popularity of routing information protocol is largely due to its simplicity and its easy configurability. RIP`s disadvantages include slow convergence times and its scalability limitations. In conclusion, routing information protocol works best for small networks.

1.6 SHORTEST PATH FIRST (OSPF)

OSPF stands for open shortest path first which uses link-state routing algorithm. OSPF is a routing protocol for internet protocol networks. It uses a link state routing algorithm and falls into the group of interior routing protocols. OSPF is the most widely used interior gateway protocol in larger enterprise networks. OSPF routing protocol is a typical link-state routing protocol, commonly used for the same routing domain. Here, the routing domain is an Autonomous System (AS) . with the expansion of the network, when large network routers run OSPF routing protocol will result in an increase in the number of routers, then the LSDB very large and take up a lot of storage space. It also makes the complexity of running the SPF algorithm. increases the CPU load heavy. After the network size increases, the probability of topology changes also increased, the network will always be in "hunting", it will cause a lot of network OSPF protocol packets in the transmission, reducing the bandwidth utilization of the network. Even more serious is that each change will cause all the routers in the network to re-route calculation. OSPF protocol is dividing the autonomous system into different areas to solve the above problems. Area is logically divided router from different groups, each with a zone number to identify. Boundary region is a router rather than a link. A network segment belongs to only one region, or each OSPF interface must be specified to belong to an area.

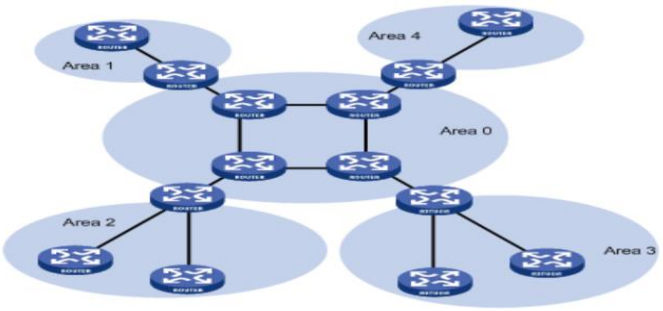

Figure 2:1.6 OSPF area diagram

OSPF routing computation can be simply described as follows:

- Each OSPF router generated based on the network topology around itself, LSA (Link State Advertisement, LSA) and LSA update packets will be sent to other OSPF routers in the network.
- Each OSPF router collects other router advertisements LSA, put all LSA together compose a LSDB (Link State Database). LSA is a network topology around a router description; LSDB is a description of the entire autonomous system network topology.
- OSPF router change LSDB into a weighted directed graph, which is on the whole a true reflection of the network topology. All the routers have the same map.
- The follows graph is a simple network formed by five routers; all the paths are figured out, the path information are stored in the link database. The link database for the above model is : [A, B, 3], [A, D, 6], [B, A, 3], [B, C, 5], [C, D, 3], [C, B, 5], [C, E, 6], [E, C, 6], [E, D, 3], [D, E, 3] , [D, C, 3] and [D, A, 6].Each term is referred to the originating router, the router connected to and the cost of the link between the two routers. Once the database of each router is finished, the router determines the Shortest Path Tree to all the destinations.

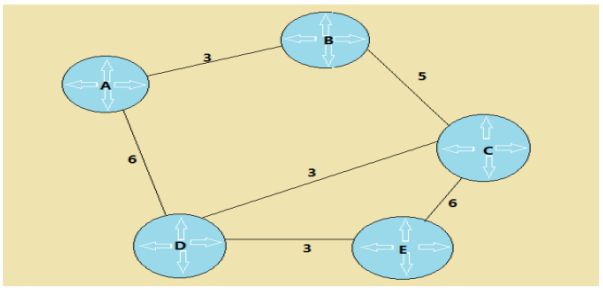

Figure 3:1.6 OSPF simple networks

- The metric of OSPF is the cost of sending packets across a certain interface. The formula to calculate the cost is: cost= 10000 0000 /bandwidth in bps. The cost of OSPF computing and interface bandwidth is also inversely proportional to, the higher the bandwidth, the smaller the Cost value. For example, calculating cost of a 10 Mbit / s interface, convert the 10 Mbit into bit, it is 10 000 000 bit, then with 100 million divided by the bandwidth, the result is 10000 0000/10 000 000 bit = 10, so that is a 10 Mbit / s interface. Each router has a directed graph, using the SPF algorithm to calculate the tree itself is the root of the shortest path tree, and tree shows the routes to the nodes in the autonomous system. When the Shortest Path Tree is completed, the router will work on the routing table.

1.7 ENHANCED INTERIOR GATEWAY ROUTING PROTOCOL (EIGRP)

EIGRP is an advanced distance-vector routing protocol that is used on a computer network to help automate routing decisions and configuration. EIGRP is in many different structures and media for interior gateway protocol. In the designed network, EIGRP is the good extension of time to provide fast convergence to minimize network traffic.Some advantages of EIGRP are:

- Very low network resource usage during normal operation.
- When the changes occur, only propagate routing table changes, not the entire routing table; this reduces the load placed of routing protocol in the network.
- Fast convergence time as a change in the network topology (confluent in some cases can be almost instantaneous).
- EIGRP is an enhanced distance vector protocol, which relies on the diffusion Update Algorithm (DUAL) to calculate the shortest path to a network destination. EIGRP uses the minimum bandwidth on the path of the destination network, and calculate a route from the total delay metrics. Although you can configure additional weights, we do not recommend it, because it can cause your network routing loops. Bandwidth and latency metrics depends on the value leading to the destination network router interface. In the following Figure 4, the router calculates the best path to the network a:

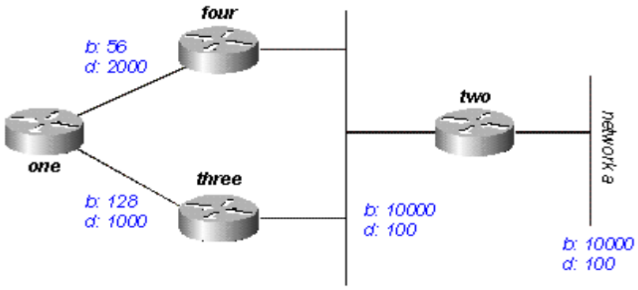

Figure 4:1.7EIGRP simple network

This network is constructed by four routers and two paths. The router four, with a minimum bandwidth of 56 and total delay is 2200; the other path through router three, the minimum bandwidth of 128 and total delayed is 1200. Select the path router with a lower metric.

Metric = (bandwidth + Delay) *256

Let's calculate the weights. EIGRP calculates the total weight by extending the bandwidth and latency metrics. EIGRP bandwidth expansion using the following formula:

Bandwidth = (10000000 / bandwidth (i)) * 256

Where the bandwidth (i) is a minimum bandwidth of all outgoing interface in the routing network to the destination indicated in kilobits The default EIGRP algorithm DUAL requires guaranteed and ordered delivery of packets for transmission. DUAL, the Diffusing Update Algorithm is the default convergence algorithm which is used in EIGRP to prevent routing loops from recalculating routes. DUAL tracks all routes and detect the optimal path in terms of efficiency and cost which will be added in the routing table.

2. RESEARCH METHODOLOGY

2.1 SIMULATION

In this research, Riverbed Modeler Academic Edition 17.5 and packet tracer is the main simulations tool used in our research work. This Riverbed (OPNET) simulator is a GUI based and an object–oriented simulator enabling users to model real world systems in form of graphics modeling in riverbed modeler is done on project basis. A project contains at least one scenario in which there are network devices and channels, configuration utilities, and different network application traffics that can be put together for any simulation design. The nodes and links included in the simulation represent real world network devices that are used as an input for performing the simulation and Packet Tracer is a Cisco router simulator that can be utilized in training and education, but also in research for computer network simulations. Packet Tracer supports users for creation of simulations, visualizations, and animations of networking phenomena

2.2 SIMULATION DESIGN

In this research, three routing protocols have been compared in IPv4 network. These protocols are RIPPING, EIGRP and OSPF .In other to achieve the objectives of the paper. And for these protocols we design network topology in two simulators like packet tracer and riverbed (OPNET) the riverbed (OPNET) simulation was divided into three scenarios. The first scenario is IPv4 network model configured with OSPF. The second scenario is a copy of the first scenario but configured with RIP protocol. The third scenarios are a copy of the second scenarios but configured with EIGRP protocol these scenarios were simulated on the basis of the following quantitative parameters: convergence duration, traffic dropped, throughput, and queuing delay. The packet tracer simulator use to create network topology for these three routing protocol like RIP, EIGRP and OSPF to compared their performance regarding some parameter which is already exist in the routing table like bandwidth, delay MTU administrative distance and minimum, average and maximum packet round trip time and analysis the outcome of these existence parameter.

2.3 NETWORK TOPOLOGY AND CONNECTIONS

Figure 5:2.3 shows the riverbed (OPNET) network topology used for the simulation. The topology models an IPv4 campus network consisting of five modular cisco series rooters 7200 there are four routers R1, R2, R3 and R4 which are connected together using the PPP DS3 link. And router R5 is connected to R1, R3 R4 using the PPP DS1 duplex link and there are have two PC in this topology which is PC1 is connected to router R2 using 100BaseT LAN fixed node link and PC2 is connected to router R3 using 100BaseT LAN fixed link.

The application definition object to set the application through the network to generate like video conferencing ,voice and any other we can use in this network topology, the Application Definition and the Profile Definition objects are added from the object palette dialog box into the modeler's workspace to define the application and manage the application from the network. Both objects are respectively renamed as application definition and profile definition in the modeler's workspace as shown in Figure 5:2.3

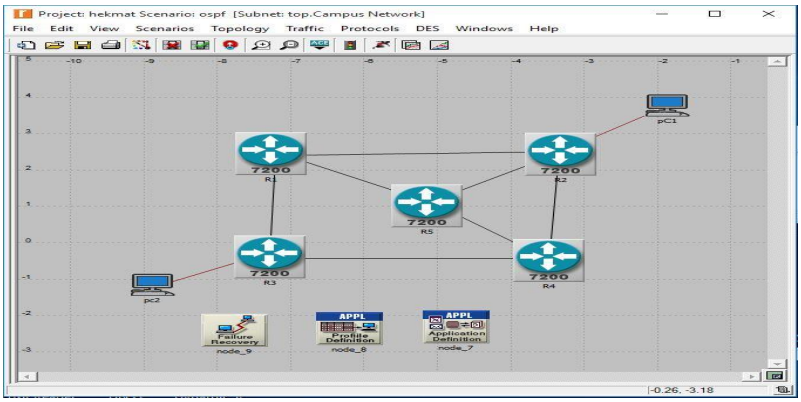

Figure 5:2.3 riverbed (OPNET) network topology and connection

Failure recovery use and enabled in the network topology to make the link status like up and down the purpose of this cause some links to fail and then recover so that the network convergence duration and throughput can be measured for all scenarios.

Figure 6:2.3 shows the packet tracer network topology used to simulate and compared the performance of already existence parameter in the routing table like delay, bandwidth, MTU, administrative distance etc.

This topology of network consist two routers and two switch and two PC which is router R1 is connected to router R2 using the serial DTE link or cable and the switch1 is connected to router R1 using straight through cable and PC1 is connected to switch 1 using straight t through cable and also use the straight through cable for the connection between router R2 and switch2 and PC2 is connected to switch2.

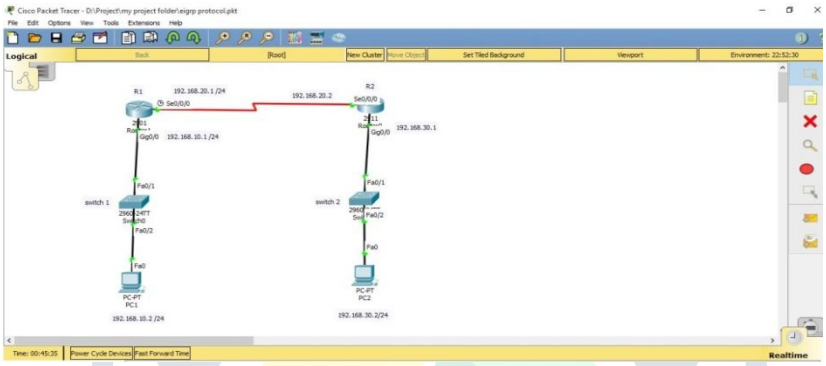

Figure 6:1.3 packet tracers network topology

After that Create same network topology for implemented and configuring of these three routing protocol like RIP, EIGRP, OSPF in the packet tracer to compared these three routing protocol regarding their already existence parameter in the routing table we used packet tracer to configure all the logical router their relevant Ip addresses and port interface's and also stabilized network with Ip address We use same Ip address class for implemented and configuring of all these three routing protocols like RIP, EIGRP and OSPF protocol to

2.4 RIP SCENARIO

Figure 7:2.4 show the Rip scenario used in this research the network topology shown in this figure is the same as the network topology described in figure 8:4.2 However, in this topology, only RIP is enabled. The reason for doing this is to separately measure the effect of RIP performance on the selected applications that are defined in the network topology. Since RI is an IPV4 supported routing protocol, IPV4 addresses were automatically enabled in the topology before RIP was configured.

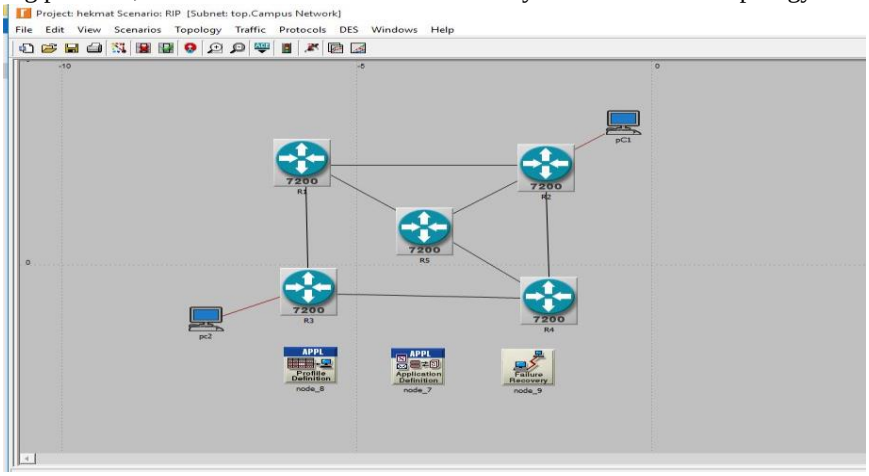

Figure 7:2.4 RIP scenarios

After enabling IPv4 Addresses and RIP, the following parameters were chosen to measure how RIP will perform when it is used separately to route traffic in IPv4: convergence duration, traffic dropped, throughput, queuing delay , total number of

update . After choosing these parameters, total simulation time for this scenario was set to last for15 minutes and then the simulation was run. After the simulation, results obtained for each parameter were observed and show at a particular graph

2.5 OSPF SCENARIO

Figure 8:2.5 shows the OSPF scenario used in the simulation. This scenario is a copy of the RIP scenario but configured with OSPF only. The reason for doing this is to separately measure the effect of OSPF performance on the selected applications that are defined in the network topology. Since the performance of OSPF is measured in IPv4, IPv4 addresses were automatically enabled in the topology before this protocol was configured. After enabling IPv4 Addresses and OSPF, the same parameters chosen for the RIP scenario were again chosen to simulate this scenario.

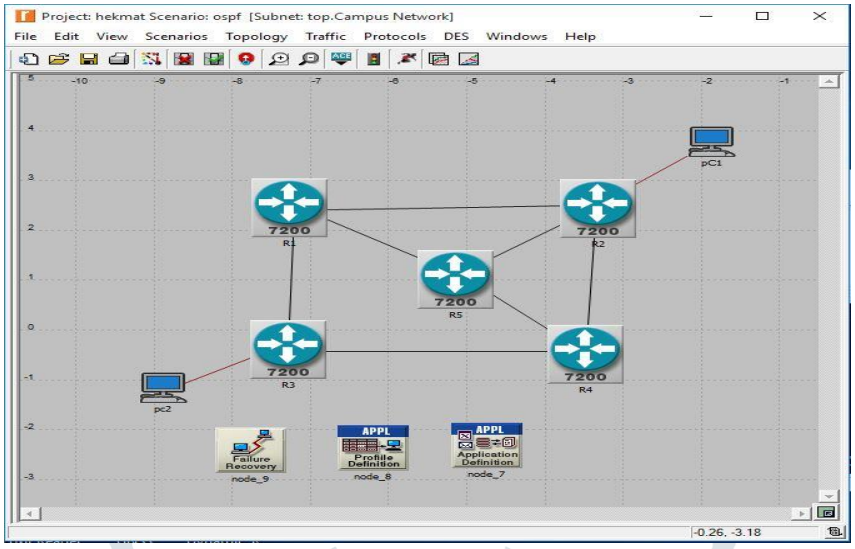

Figure 8:2 OSPF scenario

this was done so that the Performance of the OSPF routing protocol can be observed and show at a particular graph. Choosing the parameters was done by following the same procedure used to set parameters in the RIP scenario. After choosing these parameters, total simulation time for this scenario was also set to last for 15 minutes and then the simulation was run

2.6 EIGRP SCENARIO

Figure 9:2.6 shows the EIGRP scenario used in the simulation. This scenario is a copy of the RIP and similar to OSPF scenario but configured with EIGRP only. The reason for doing this is to separately measure the effect of EIGRP performance on the selected applications that are defined in the network topology. Since the performance of EIGRP is measured in IPv4, IPv4 addresses were automatically enabled in the topology before this protocol was configured. After enabling IPv4 Addresses and EIGRP , the same parameters chosen for the RIP scenario were again chosen to simulate this scenario.

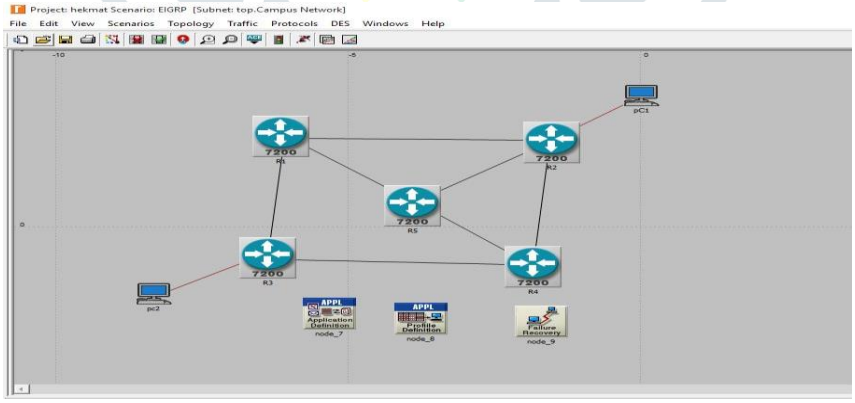

Figure 9:2.6 EIGRP scenario

This was done so that the Performance of the EIGRP routing protocol can be observed and show at a particular graph. Choosing the parameters was done by following the same procedure used to set parameters in the RIP and OSPF scenario. After choosing these parameters, total simulation time for this scenario was also set to last for 15 minutes and then the simulation was run

3. SIMULATION RESULT AND COMPARISON ANALYSIS

3.1 SIMULATION RESULT

This section presents the discussion of results obtained from the simulation. Each result is obtained based on the parameters chosen to measure the performance of three routing protocols. The results are presented in form of graphs. Riverbed Modeler Academic Edition 17.5, which is the main simulator used is configured to produce a graphical result of all the simulation parameters chosen

3.2 NETWORK CONVERGENCE DURATION

The convergence time of three routing protocols is shown in Figure 10.3.2 from this figure, it can be observed that convergence duration for three routing protocols. However, there is a slight variation as shown in the graph. At 0.5 minute into the simulation EIGRP Converged faster than OSPF and RIP because The value for convergence duration in the EIGRP network at this time is 560 seconds but the value for convergence time in the OSPF network at 0.5 minute time is 25 seconds and at 5 minute into the simulation OSPF converged is faster than EIGRP and RIP because the value of convergence duration RIP network at 5 minute time is 0 second and the value of convergence duration EIGRP network at 5 minute time is 410 second and at 12 minute to 15 minute into the simulation RIP converged id faster the EIGRP and OSPF because the value of convergence duration RIP network at 12 minute to 15 minute time is 225 second after that Initial convergence duration of EIGRP has a better convergence time than OSPF and RIP protocol and RIP takes a long time

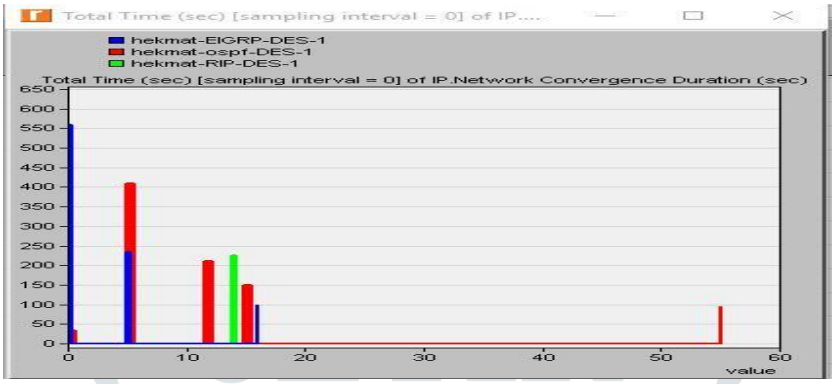

Figure 10:3.2 netwoork convergence duration

3.3 THROUGHPUT

Network throughput is an important parameter. This parameter is used to measure the average number of bits received or transmitted successfully by the receiver or the transmitter channel per second. Measuring network throughput is done in bits per second or sometimes in packets per second the throughput obtained from the campus network R2 and campus network R1 link is shown in Figure11:3.3 it can be seen in this figure that the OSPF network has a higher throughput than the RIP and EIGRP network. At around 0.5 minute during simulation, the average number of bits transmitted successfully via the campus R2 and campusR1 link per second in the OSPF network is 490 bits. This value higher than the 320 bits and 160 bites delivered through the same link in the EIGRP and RIP network. As the link fails at 1.5 minute, throughput values of RIP network dropped the throughput value for RIP falls to 60 bits. But as the link is recovered at 5 minute during the simulation
And after that at 7.5minute and 9 minute time links is fails of OSPF and EIGRP but the value for both OSPF and EIGRP falls below 60, 70 and 80 bites/sec However, performance of the OSPF network is better than the RIP and EIGRP network.

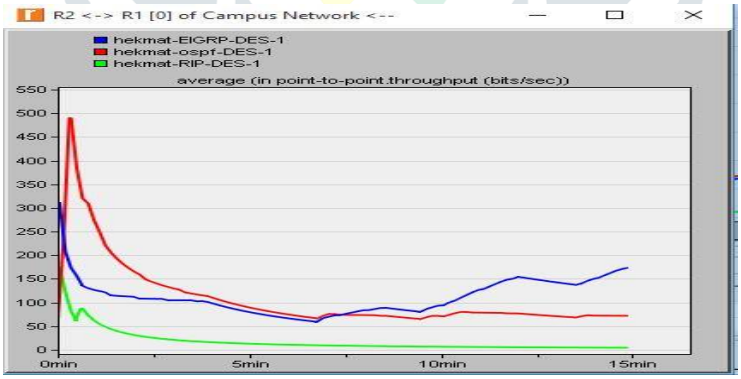

Figure 11:1.2 throughputs

3.4 QUEUING DELAY

This parameter measures the time taken by each packet to wait in a queue before it can be forwarded over a link. Queuing delay can be caused by several factors. For example when the speed of the link via which a router received packets is faster than the speed on the link through which the router can forward these packets, queuing delay can occur. Figure 12:3.4 shows results obtained for queuing delay in three scenarios used. It can be observed that as the simulation started, queuing delay value for EIGRP started from 0.000018 second and decreased to 0.000014 second. This value then began to decrease gradually and finally settled at 0.00015 second when the simulation ended. And the queuing delay value for OSPF started from 0.000012 second and increase to 0.000013 this value of OSPF queuing delay to increase finally settled at 0.00003 seconds and the queuing delay value for RIP started from 0.000028 seconds and decreased to 0.000020 second this value of RIP queuing delay to increase finally settled at 0.000066 Hence on the basis of queuing delay, OSPF Performed better than EIGRP and RIP protocol but the EIGRP performance according queuing delay is better than RIP protocol .

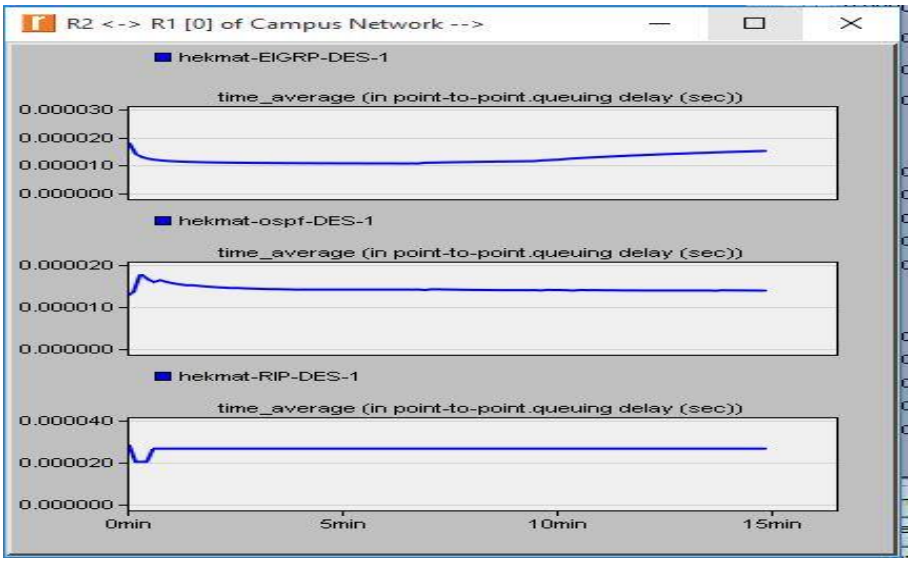

Figure 12: 3.4 queuing delay

3.5 TRAFFIC DROPPED

This parameter measures the total amount of packets lost by every router within a network. Several reasons could lead to a packet being dropped in a network. For example when more traffic is forwarded through the network, the network can become congested leading to higher bandwidth utilization. In a congested network, packet delivery is delayed. When this happens some packets are dropped without reaching their destination. Figure 13:3.5 shows traffic dropped by EIGRP and OSPF. From this figure, it can be seen that EIGRP protocol dropped a maximum number of 0.39 packets per second within 14.7 minutes of simulation time. And that the EIGRP protocol dropped a minimum number of 0.22 packet per second within 0 minute of simulation time in the EIGRP network this value start from 0 to the maximum number of 0.39 packet per second However, the OSPF protocol dropped a maximum number of 0.19 packet per second within 3.15 minutes of simulation but the OSPF minimum number of is 0.11 within 0 minute of simulation time, Now the outcome of this figure the EIGRP protocol traffic dropped is higher than the OSPF protocol traffic dropped

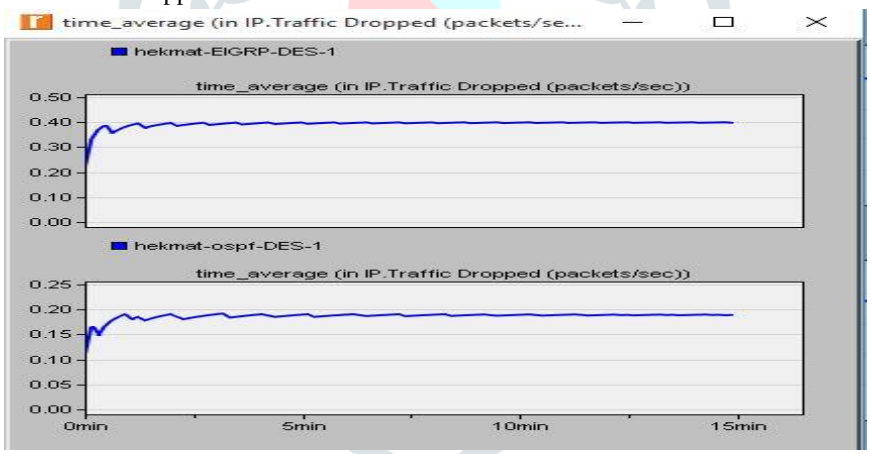

Figure 13:3.5 traffic dropped

3.6 TOTAL NUMBER OF UPDATE

Total number of times the routing table at this node gets updated (e.g., due to new route addition, existing route deletion, and/or next hop update). By default, this is collected the number of update when a router is send the routing table to another router in network topology that routing table is after every second is updated in router and total number of update is represent the value of all time of the routing table which is updated NOW show the figure 28:1.5 total number of update of RIP, EIGRP and OSPF protocols during the simulation in the router R2 campus network EIGRP protocol is in the 0 to 14.85 minutes the number of update is 9 to 14 which is update routing table with their neighbor router and the OSPF routing protocol is in the 0 to 14.85 minutes the number of update is 4 to 7 which is OSPF update the routing table with neighbor router and the RIP protocol in the 0 minutes the number of update is 8 but in the 14.85 minutes is decrease to the number of update is 3.125 which is RIP update the routing table with their neighbor router now the total number of update of EIGRP is higher than OSPF and RIP protocols but the total number of update of RIP protocol is lower than OSPF and EIGRP protocols

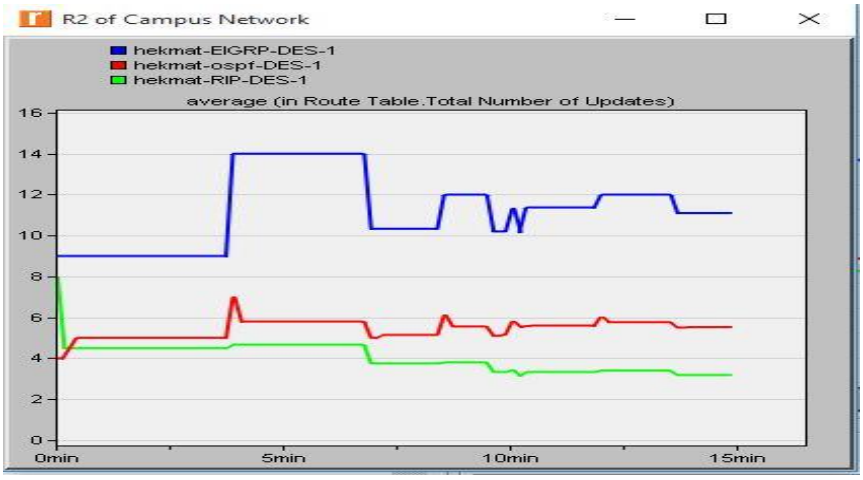

Figure 14:1.5 Total number Of update

Now we will analysis the outcome from implementation and configuration of RIP, EIGRP and OSPF protocols and analysis difference between RIP, EIGRP and OSPF protocols according to many parameters

3.7ADMINISTRATIVE DISTANCE

After that Now We Compare the Administrative Distance between RIP EIGRP and OSPF Protocols and show the result below figure

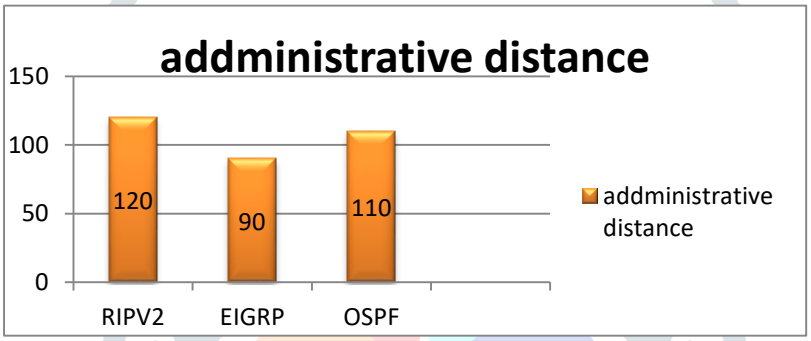

Figure 15:3.7 administrative distance

This the administrative distance of RIP is greater than from both EIGRP and OSPF protocols and the administrative distance of EIGRP less than form both RIP and OSPF but the administrative distance of OSPF is greater than of EIGRP administrative distance and less then RIP administrative distance .

3.8 MINIMUM, AVERAGE AND MAXIMUM ROUND TRIP TIME OF RIP, EIGRP AND OSPF PROTOCOLS.

Sending 1000 byte size packet from one router to another router via designed backbone topology by using RIP, EIGRP and OSPF protocols after that we compare the minimum, average and maximum round trip time of all these routing protocols
The maximum round trip of RIP and EIGRP is greater than to the maximum round trip time of OSPF protocol but maximum round trip times of EIGRP and RIP protocols are equal and average round trip time of both OSPF are greater than to the average round trip time of both RIP and EIGRP but the average round trip time of EIGRP less than from both RIP and OSPF protocols and the minimum round trip time of RIP is greater than from the minimum round trip time of EIGRP and OSPF protocols and minimum round trip time of OSPF is greater than to the minimum round trip time of EIGRP protocol and minimum round trip time of EIGRP is less than from both RIP and OSPF protocols show in the follow figure16:3.8

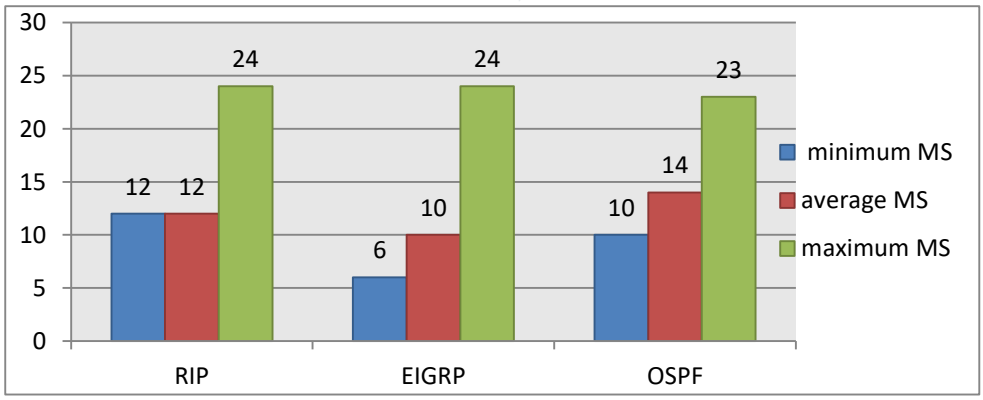

Figure 16:3.8 minimum, average and maximum time

3.9 COMPARISON AND ANALYSIS BANDWIDTH AND MTU OF EIGRP AND OSPF PROTOCOLS

Now we compare the bandwidth and MTU of EIGRP and OSPF protocols to find the result which protocol is greater than according their bandwidth and MTU metrics shoe in the following figure17.3.9

Figure 17:3.9 bandwidth and MTU

After the comparisons find the result which is the bandwidth of EIGRP is higher than OSPF And the MTU parameter of OSPF is equal to MTU parameter of EIGRP protocol.

3.10 COMPARISON OF EIGRP AND OSPF PROTOCOL ACCORDING DELAY

Now we will comparison delay between EIGRP and OSPF protocol to find the result which routing protocol delay is high and which routing protocol delay is low show in the following figure 18:3.10

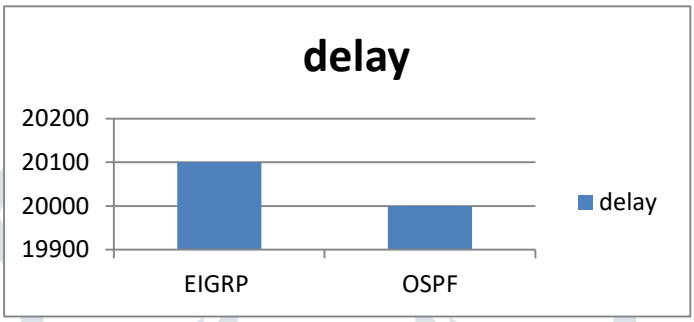

Figure 18:3.10 delays

According our comparison analysis we find the outcome of this comparison the delay of EIGRP protocol is higher than OSPF protocol

4. RESULT ANALYSIS

A comparison of RIP, EIGRP and OSPF protocols configured in campus and backbone area network is presented in thesis. The riverbed (OPNET) modeler network simulator is used to compare and analysis these three routing protocols like RIP, EIGRP and OSPF protocols performance in designed campus network according to by taking and adding some new parameters like network convergence duration ,throughput , queuing delay, traffic dropped and total number of update. Based on the above experiment it found that the EIGRP has network convergence duration faster than OSPF and RIP protocols because OSPF and RIP takes a long time and performance of OSPF protocol regarding throughput is better than performance of EIGRP and RIP protocols and OSPF performance according to queuing delay is better than EIGRP and RIP protocol but in the EIGRP protocol network the traffic dropped is higher than OSPF traffic dropped. However the EIGRP protocol total number of update is faster than OSPF and RIP protocols

After that packet tracer simulator is used to compare and analysis these three routing protocols like RIP, EIGRP and OSPF protocols performance in designed backbone network according to by default already existence in the routing table of router like request and reply time given by ping command. Based on above experiment it is found that the EIGRP and OSPF protocols is showing less time and less packet loss less than the RIP protocol. Furthermore, the EIGRP, OSPF also presented higher utilization values when compared to the RIP protocolAnd also the rip protocol not use metric calculates like bandwidth, delay, load etc. Only based on the hop count metrics calculation

Now the outcome the results from this research work the EIGRP and OSPF protocols performance regarding some parameter is similar we can conclude that combination of EIGRP and OSPF protocol is better than the RIP, EIGRP and OSPF protocols for the finding best route for packet sending in network system.

5. BRIEF LITERATURE SURVEY

1: Performance Analysis of Distance Vector and Link State Routing Protocols International Journal of Computer Science Trends and Technology (IJCST) – Volume 3 Issue 4, Jul-Aug 2015 by Bhavna By Bhavna Rathi [1], Er. Far minder Singh [2] Department of Computer Science and Engineering PTU/RIMT Institute of Engineering and Technology Sir Hind Side, Mondi Gobindgarh Punjab – India

Explains the distance vector and link state routing protocols used for internal routing purposes in enterprise or service provider networks Link state and Distance Vector protocols use different algorithms and includes the differences between various link state and distance vector routing protocols and compares the performance of all the distance vector and link state routing protocol.

2 : Performance Analysis of Dynamic Routing Protocols Using Packet Tracer Volume 3, Special Issue 1, February 2014 by N.Nazumudeen and C.Mahendran explain the propose and idea of routing protocols, starting with an overview of the basics of Interior Gateway Protocols (IGP). Later, we describe the idea of Link State Routing Protocols (LSRP) and Distance Vector Routing Protocols (DVRP) while making a comparison which should determine the protocol needed for each network topology.

3: Validation of RIP, EIGRP and OSPF Routing Protocols Simulation with Sub netting Implementation to Actual Operation using HyperTerminal Emulator World Applied Sciences Journal 35 (4): 585-591, 2017 ISSN 1818-4952 by Archival Sebial, Chris Jordan Alice and Elmer Mara villas This paper focuses on corroborating the simulated performances of the RIP, EIGRP and

OSPF routing protocols to actual operations. Simulation was employed with the use of a packet tracer and authenticated to real time situation with the use of hyper terminal emulator. Sub netting was also utilized to address and relieve network congestion and security in both environments.
4: Comparative Analysis of Distance Vector Routing & Link State Protocols Vol. 3, Issue 10, October 2015 by Shubhi[1], Prashant Shukla[2] explain distance vector protocol and Link state protocol are presented based on Bellman–Ford algorithm and Dijkstra‟s algorithm respectively and compares the advantages and disadvantages of DVF and OSPF on the basis of their performance. In computer communication system which deals with packet switched networks a distance-vector routing protocol(RIPv2) and link-state protocol(OSPF) are the two major classes routing protocols.
5: A Review on Routing Information Protocol (RIP) and Open Shortest Path First (OSPF) Routing Protocol International Journal of Future Generation Communication and Networking Vol. 9, No. 4 (2016), pp. 161 170http://dx.doi.org/10.14257/ijfgcn.2016.9.4.13 by Abhishek Verma and Neha Bhardwaj in this paper discus about the RIP and OSPF protocol from a theoretical point of view in this work accessible the comparative study of two protocols RIP and OSPF. Finding the best route in both protocols in wired and wireless LANs and implementation in various fields works in these protocols
6: Comparison of RIP, EIGRP, OSPF, IGRP Routing Protocols in Wireless Local Area Network (WLAN) by using OPNET Simulator tool - A Practical Approach IOSR Journal of Computer Engineering (IOSR-JCE)e-ISSN: 2278-0661,p-ISSN: 2278-8727, Volume 16, Issue 4, Ver. VI (Jul – Aug. 2014), PP 57-64 In this paper, explain the analyzed and simulated a proposed Wireless Local Area Network (WLAN) using different routing protocols. The performances of different protocols are compared and analyzed using Optimum Network Performance (OPNET) simulator tool in which metrics like delay, throughput, packet delivery, load, Ethernet delay, are measured.
7: Performance Analysis of Dynamic Routing Protocols Using Packet Tracer An ISO 3297: 2007 Certified Organization, Volume 3, Special Issue 1, February 2014International Conference on Engineering Technology and Science-(ICETS'14) On 10th & 11th February Organized by Department of CIVIL, CSE, ECE, EEE, MECHNICAL Engg. And S&H of Muthayammal College of Engineering, Rasipuram, Tamilnadu, India In this paper, explain the idea of routing protocols, starting with an overview of the basics of Interior Gateway Protocols (IGP). Later, we describe the idea of Link State Routing Protocols (LSRP) and Distance Vector Routing Protocols (DVRP) while making a comparison which should determine the protocol needed for each network topology
8: A Survey on Routing Protocols with Performance Parameters for Different Number of Nodes Journal of Network Communications and Emerging Technologies (JNCET) Volume 6, Issue 2, February (2016) by Rajeev Kumar Sri Satya Sai Institute of Science and Technology, Sehore (M.P.)
Kailash Patidar Sri Satya Sai Institute of Science and Technology, Sehore (M.P.) Megha JainSri Satya Sai Institute of Science and Technology, Sehore (M.P.) This paper presents the study of protocol properties of MANET routing protocols and analyzed them with respect to different number of nodes. The routing protocols considered in this study are Bellman-Ford, DSR and WRP

6. OBJECTIVE

1. To explain the concepts of RIPv2, EIGRP and OSPF routing protocols.
2. To find the best routing protocol for LAN and other any network system its depend on various parameters like delay , bandwidth, MTU , administrative distance and minimum, average and maximum packet round trip time, total number of update, traffic dropped, network convergence duration , throughput and queuing delay .
3. Compare and analysis the performance of RIP, EIGRP and OSPF routing protocol regarding by default parameter which id existence in the routing table like delay , bandwidth, MTU, administrative distance and minimum, average and maximum packet round trip time
4. Our aim to compare the performance of these routing protocol like RIP,EIGRP and OSPF according some new parameter like total number of update, traffic dropped, network convergence duration , throughput and queuing delay
5. Compare and analysis the performance of RIP, EIGRP and OSPF routing protocol for network system which deal with video conferencing, voice and packet route networks.
6. To select the right routing protocol for network system regarding above various parameter.

7. CONCLUSION AND FEATURE OF WORK

Interior routing protocols like EIGRP RIP and OSPF are widely being used in the computer networking. In this thesis, performance of three routing protocols (RIP, EIGRP andOSPF) for IPv4 has been measured and compared by simulation. The comparative analysis has been done in the same network with different protocols for network system. Performance evaluation was carried out on the basis of the following quantitative parameters: network convergence duration, throughput, traffic dropped, queuing delay and total number of update.
In our thesis work, implementation of EIGRP shows that network convergence duration is little faster than RIP and OSPF networks because EIGRP network learns the topology information and updates faster than RIP and OSPF.
The simulation result has shown that throughput of OSPF network is better than EIGRP and RIPS networks. As a result, traffic dropped in EIGRP network higher than OSPF and RIP networks
Another performance metrics for a network system is total number of update, which measures the Total number of times the routing table at this router gets updated. And queuing delay of OSPF is better than EIGRP and RIP.
In comparison, the simulation results have shown that the throughput in the EIGRP and OSPF network is much higher than RIP networks. And also the delay of EIGRP protocol is higher than OSPF protocols and bandwidth and MTU of EIGRP approximately equal to bandwidth and MTU of OSPF protocol
In this thesis work, the comparative performance and analysis among EIGRP, OSPF and RIP routing protocols for campus and backbone network has been analyzed. By comparing these protocols performances, we have come the outcome across this research work that the combination of EIGRP and OSPF routing protocols for a network is better than RIP EIGRP and OSPF. In

future, a research work can be done on the explicit features of both OSPFv3 and EIGRP protocols in the IPv4/IPv6 environment. Security analysis for both OSPF and EIGRP can be done.

8. REFERENCE

Journal

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Website

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