Performance Analysis of Routing Information Protocol Using Riverbed Simulator

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***Abstract* - In this paper an attempt has been made to analyze the failure mechanism between the router and workstations of RIP in terms of update interval, route invalidates, hop count with respect to simulation time in the context of link failure and recovery using Riverbed simulator. We estimate the route invalid time and it is reduced to approximately half of its value than the defacto value of RIP.**

***keywords* - RIP, Riverbed, Defacto.**

I. INTRODUCTION

All RIP is nothing but Routing information protocol which comes under distance vector-based algorithm. It is one of the routing protocols which is implemented on the basis of TCP/IP.to avoid routing loops maximum number of 16 hops are used .it is an intradomain routing protocol used within an autonomous no of systems.it is a dynamic routing protocol in this we use hop count to find the best path between the source and destination as a routing metric.it uses port number 520.and it is an interior gateway protocol to distribute routing information within an autonomous no of systems. This protocol works best for small scale networks. RIP is updated to IPv6 which is called as a (RIPng) standard RIP next generation.

II. LITERATURE REVIEW:

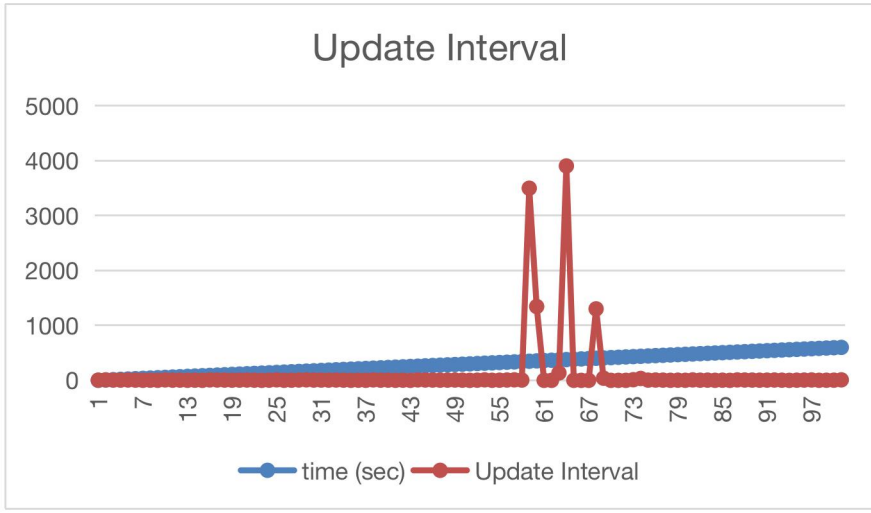
The effort of researchers is to identify the best the suitable routing protocol which gives the desired result in a few seconds Suman et. al. [1]. presented finding the best route in wireless LANs. Implementation in various fields works these protocols. result analyzes that the delay is increased by increasing the transmission rate i.e., EIGRP is more efficient than RIP routing protocols in terms of throughput and load. The EIGRP routing protocol has the least delay than the RIP protocol. A comparison between different protocols was analyzed and we can suggest that markets like large enterprises, educational institutes, industrial sites can implement EIGRP and OSPF routing protocol for better performance. Arsalan Iqbal et. al. [2] (2015) in this study observed the packet drop and network convergence time RIP was better than OSPF. from that we observed that the performance of EIGPR is better when compared to RIP and OSPF in one link failure. Abdullah Gani et. al. [3] suggested that a modern method improves the efficiency of RIP by incorporating an element of intelligence. The update of the routing table is triggered by the mechanism that observes the manipulations in the topology. This method avoids the waste of bandwidth while updating the routing table by activating a required update only when there is a need for manipulating in topology. Therefore, it downgrades the volume of update works which is carried by a router on a fixed interval of time even there is no change in the network topology i.e., static. Chris K. Williams et. al. [4] This paper examines an approach for tuning dynamic routing systems using link metrics and focusing on the RIP dynamic routing protocol to get consistency and expected failover of dynamically routed links in large networks. The architectural issues for designing an enterprise network with redundant links and finally, a metrics system for tuning the routing system where multiply redundant links (redundant groups of redundant links are applied. Ioan Fitigau et. al. [5] this paper examines that when we are using the three routing protocols RIP, OSPF, and EIGRP. then the effectiveness, performance in the network is implemented.

III. EVALUATION METRICS:

Evaluation metrics S. Corson et. al. [6] can be used in evaluating quantitatively routing information protocol. This evaluation study employs the following performance metrics:

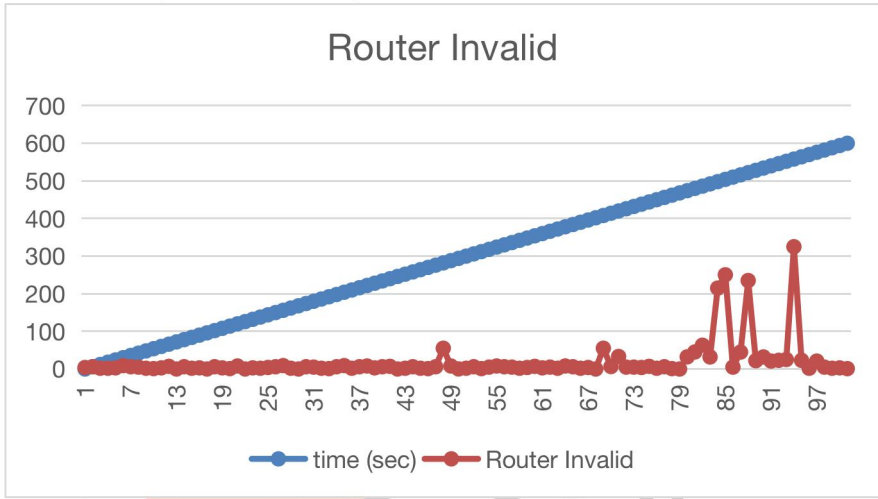
A) Update Interval (Seconds):

This refers to that update interval is the interval that how often a router sends updates to its neighbor nodes. The default update interval time is 30 seconds. This timer controls the intervals between the routing updates.



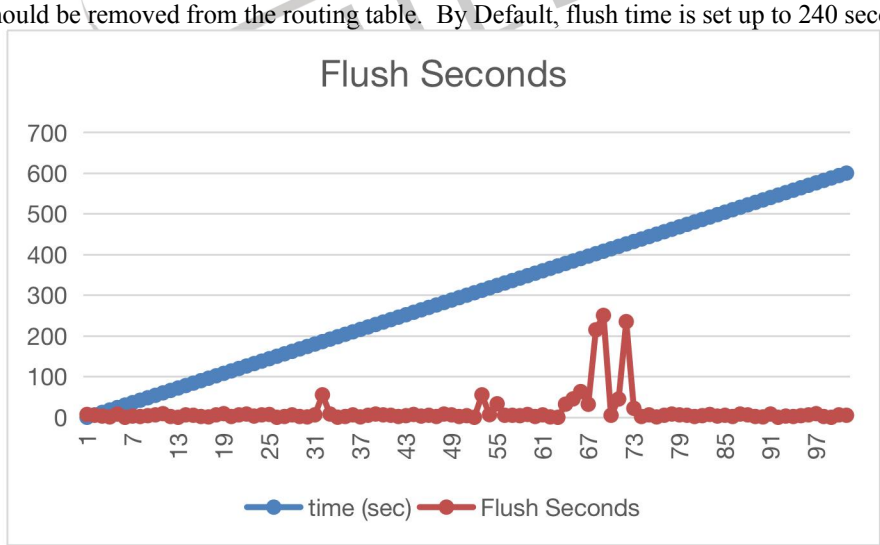
B) Route Invalid (seconds):

This parameter is used to indicate the invalid route which is present in between the source and destination. Whenever the route is inserted into the routing table immediately the timer gets initiated. immediately when it gets expired then the route gets removed. The default route invalid time is set to 180 seconds.



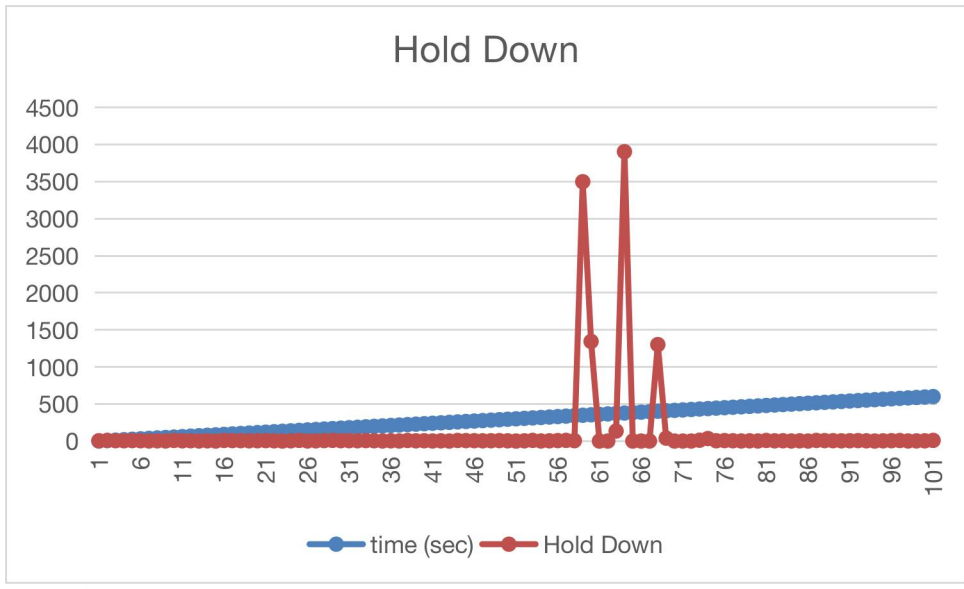
C) Flush (Seconds):

The flush parameter indicates that whenever the flush value is greater than the route invalid parameter. Then it indicates that the route should be removed from the routing table. By Default, flush time is set up to 240 seconds.



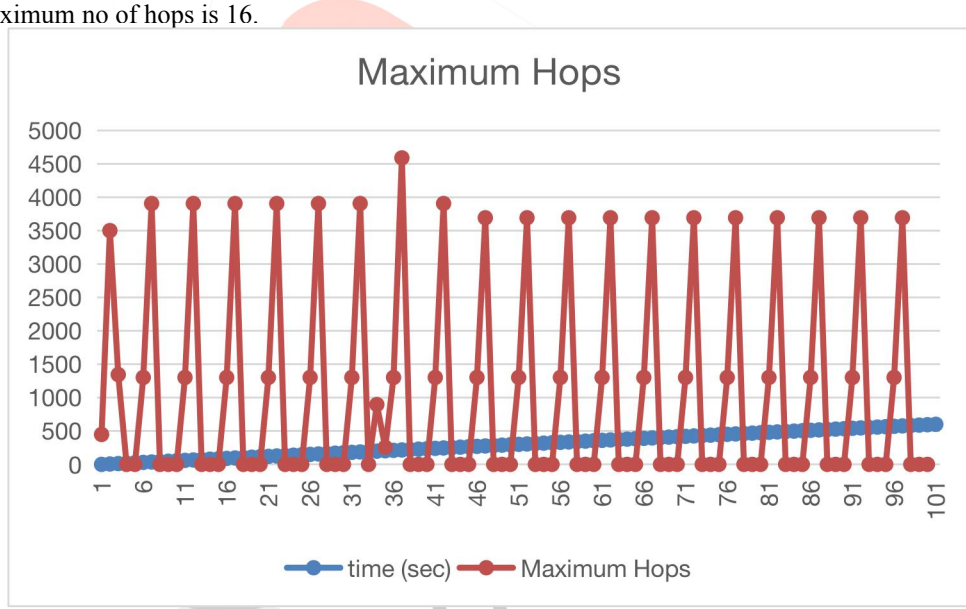
D) Hold-down (Seconds):

This parameter is used for avoiding the route flapping. Route flapping is caused due to Hardware errors, Software errors, Configuration errors within the network. This hold-down timer starts when "Route invalid" expires. during hold-down time updates regarding invalid routes are ignored. By default, the Hold-down timer is set up to 180 seconds.



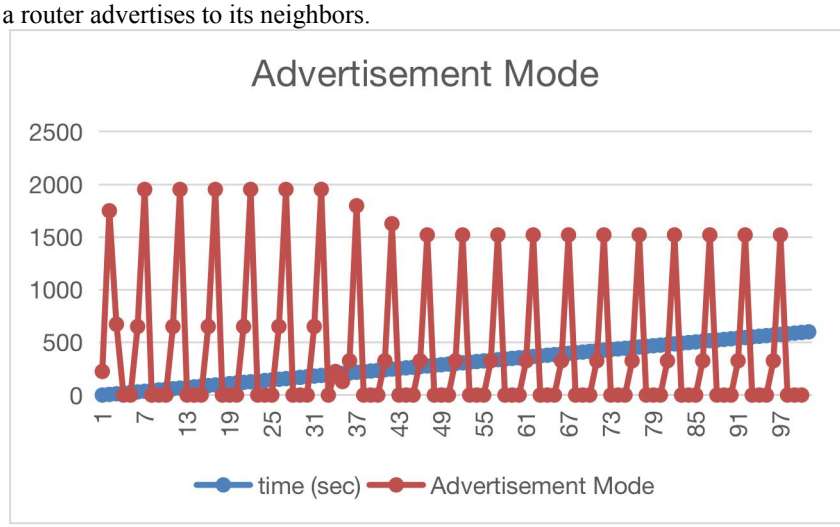
E) Maximum Hops:

This parameter is nothing but a maximum number of hops supported by RIP. It is implemented to prevent endless loops. If the value is maximum then packets may be stuck in loops. If the value is minimum then network size is limited. By default, the maximum no of hops is 16.



F) Advertisement Mode:

It deals with how a router advertises to its neighbors.



G) Throughput: No of delivered packets per unit of time.

H) Delay: how long it takes for a bit of data to travel from source to destination from one endpoint to another endpoint.

Materials and methods:

A) Simulation Tools
B) Simulation Environments

A) Simulation Tools:

"In this objective, we use OPNET Riverbed Modeler Academic edition 17.5 Simulator.

OPNET is the leading commercial event simulator, which is highly used in industry and academic purpose. In OPNET, the network model contains node models, and node models consist of processes, transmitters, and receivers, Links.

The OPNET library contains many predefined network devices and protocols such as routers, switches, fixed and mobile wireless workstations, etc.

OPNET (Optimized Network Engineering Tools) Modeler educational version has the following key differentiating features

1) Systems specified in OPNET Modeler consist of objects, each with configurable sets of attributes.
2) Models are entered via graphical editors
3) Automatic generation of simulations
4) Application-specific statistics that can be collected automatically during simulations.
5) Scalable simulation environment including support for parallel and distributed simulation".

B) Simulation Environment:

In this OPNET simulator, we will generate to implement our work. This result will be obtained after the experiments have been conducted successfully. The aim of this paper is to analyze the performance of RIP protocols in 2 scenarios i.e., Failure, NO_Failure scenario with respect to the effect of a number of nodes. The evaluation metrics considered for Update interval, Route invalid, Throughput, Delay, Maximum Hops.

Parameter	value
No of nodes	4,4
Simulation Time	10 Min (600 sec)
Simulation Area	500X500(Square Area)
Routing Protocols	RIP
Update Interval	8
Route Invalid (Failure Scenario)	8
Hop Count	4
Throughput	103,6.8
Delay	4.0
Scenarios	2

Evaluation Results and Analysis:

Initially, we will Configure the interval at which routes configured by RIP are sent to related nodes. Timers will control the routes between the routing updates. By default, it will be set to 30 sec. according to our experiment we deployed four routers named router1, router2, router3, router4 i.e., router one is connected to Net10, Net11 & router2 is connected to Net20, Net21 & router3 is connected To Net30, Net31 & router4 connected to Net40, Net41.

Router resembles: ethernet4_slip8_gtwy

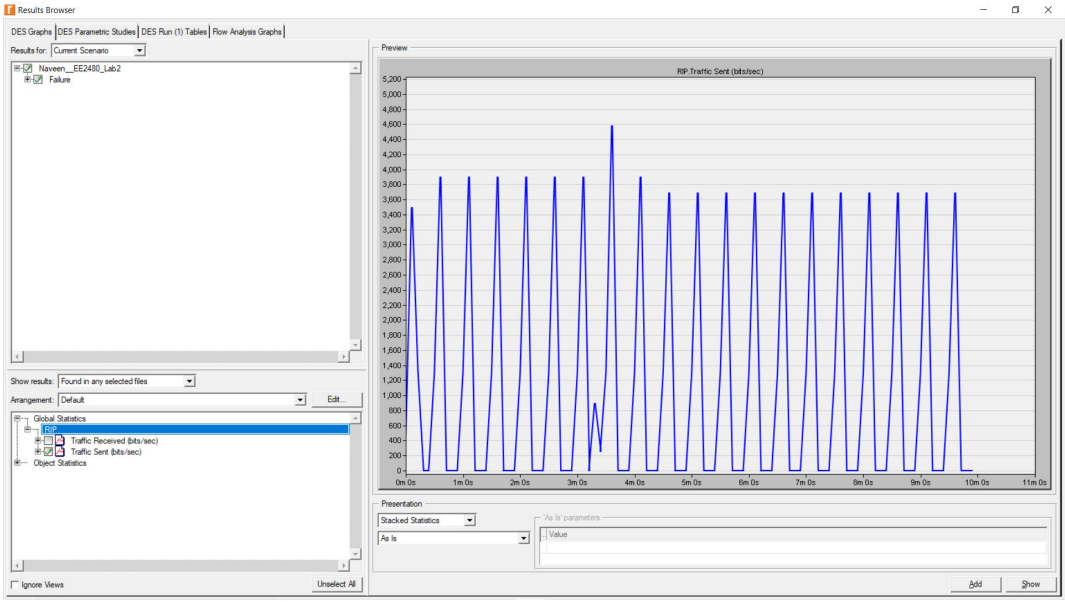
Net x resembles: 100BaseT_LAN

we use bidirectional 100BaseT links to connect the objects among ethernet4_slip8_gtwt and 100BaseT_LAN.

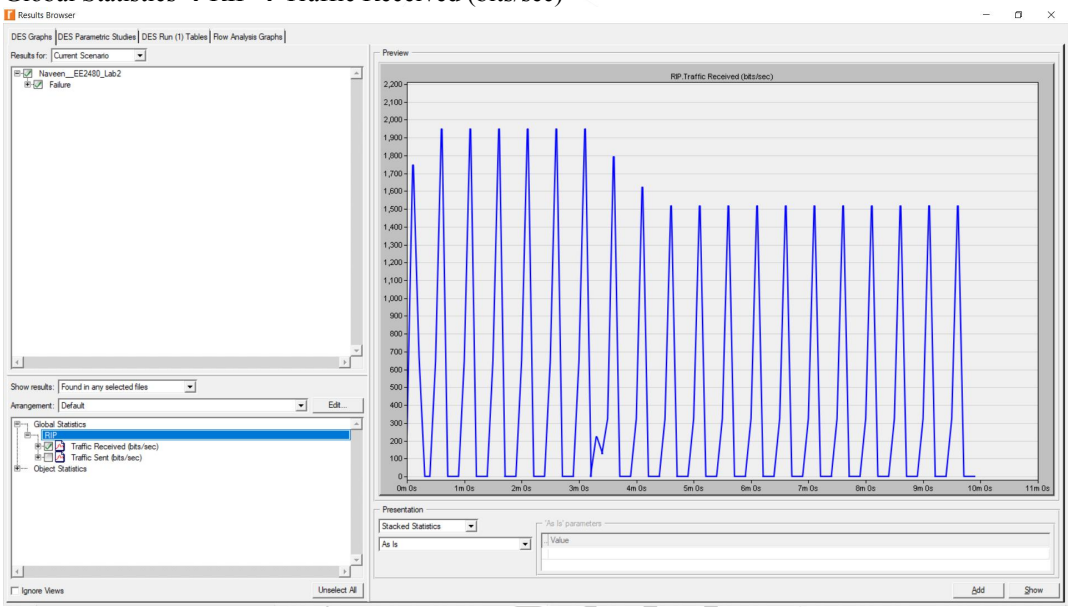
we use PPP_DS3 links to connect among routers.

Now we need to perform the task i.e., choose individual statistics under global statistics we choose RIP under RIP Traffic Sent(bits/sec).

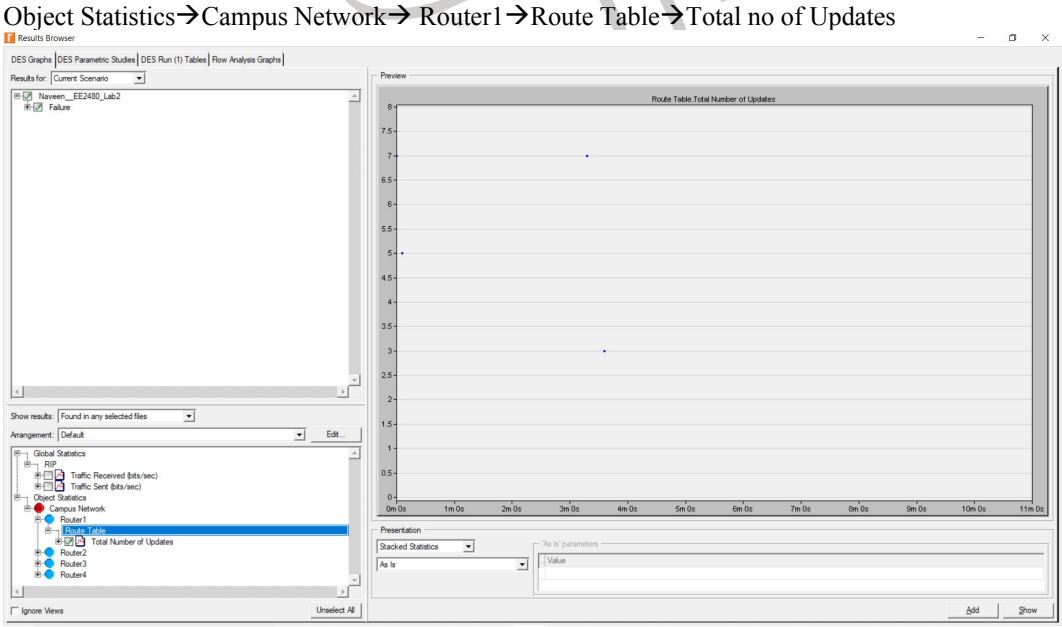
Global Statistics→RIP→Traffic Sent (bits/sec).



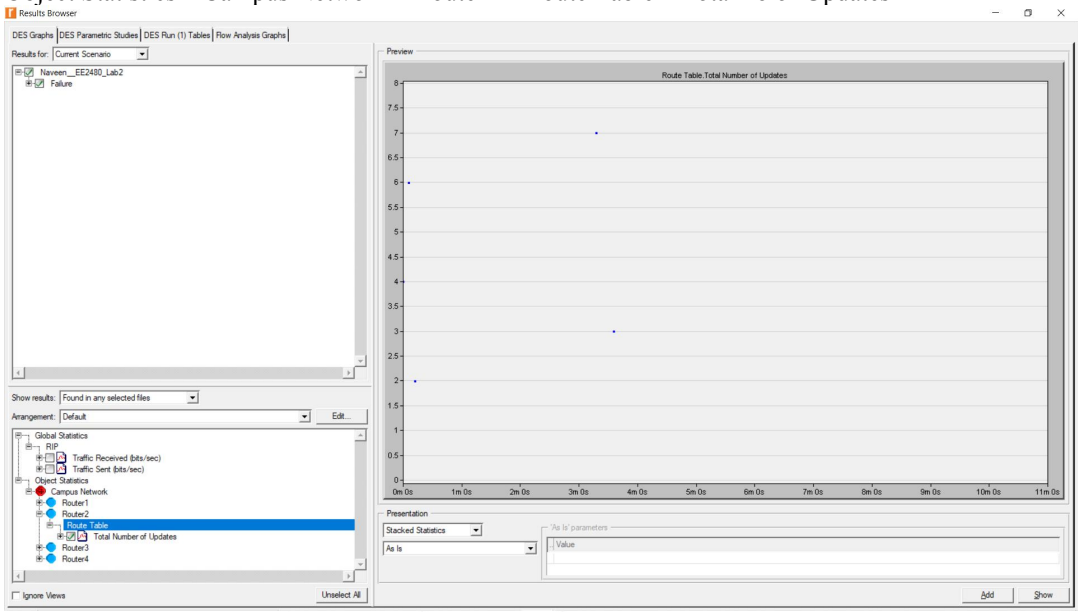
Global Statistics →RIP →Traffic Received (bits/sec)



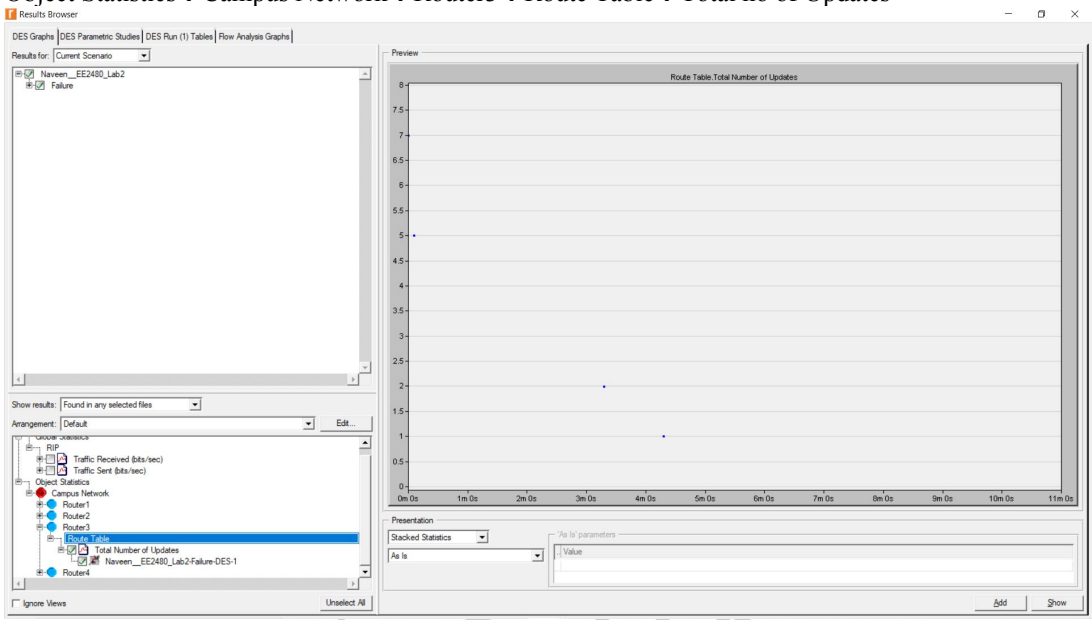
Object Statistics→Campus Network→ Router1→Route Table→Total no of Updates



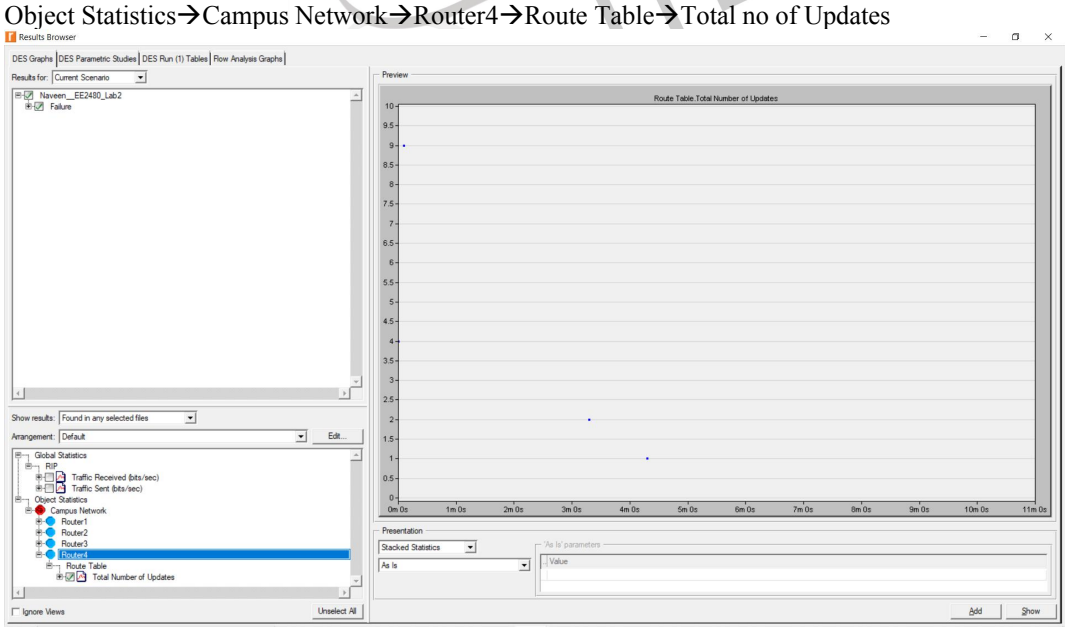
Object Statistics→Campus Network→Router2→Route Table→Total no of Updates



Object Statistics→Campus Network→Router3→Route Table→Total no of Updates

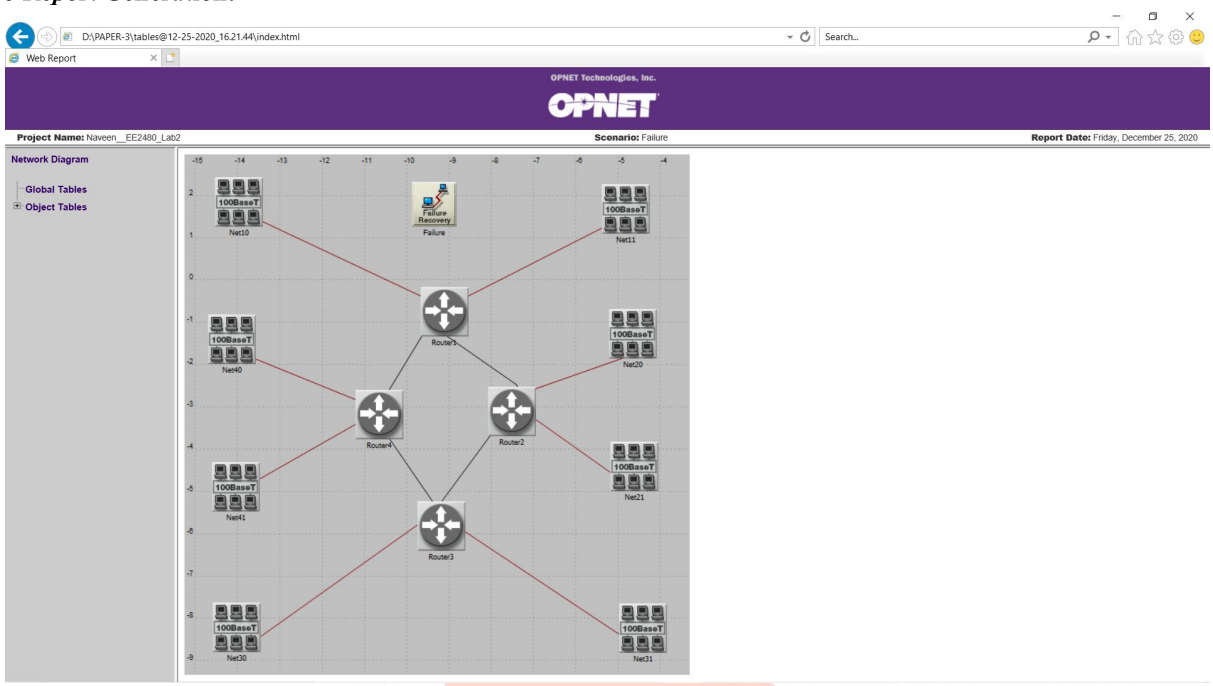


Object Statistics→Campus Network→Router4→Route Table→Total no of Updates

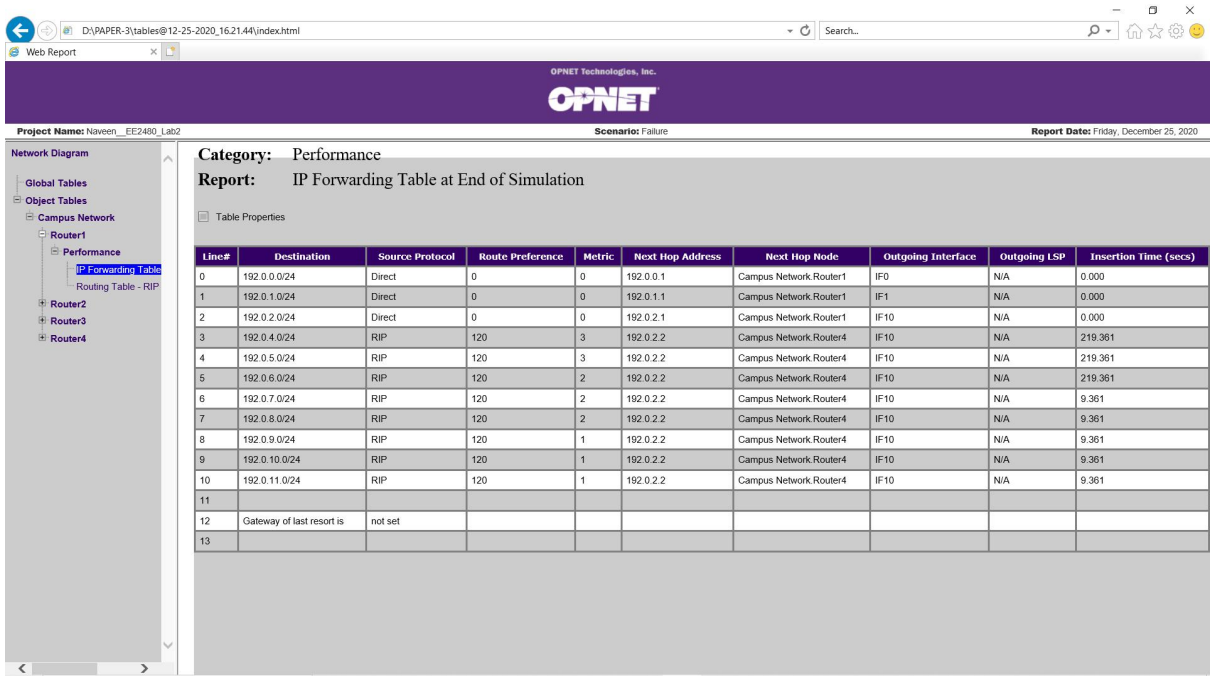


Now click on the simulation window and set the simulation schedule up to 10 min (600 sec). make changes in the global attributes tab i.e., **IP Dynamic Routing Protocol** = **RIP, IP Interface Addressing Mode** = **Auto Addressed/Export, RIP Sim Efficiency** = **Disabled (**This makes routing table gets updated frequently**).**

Web Report Generation:

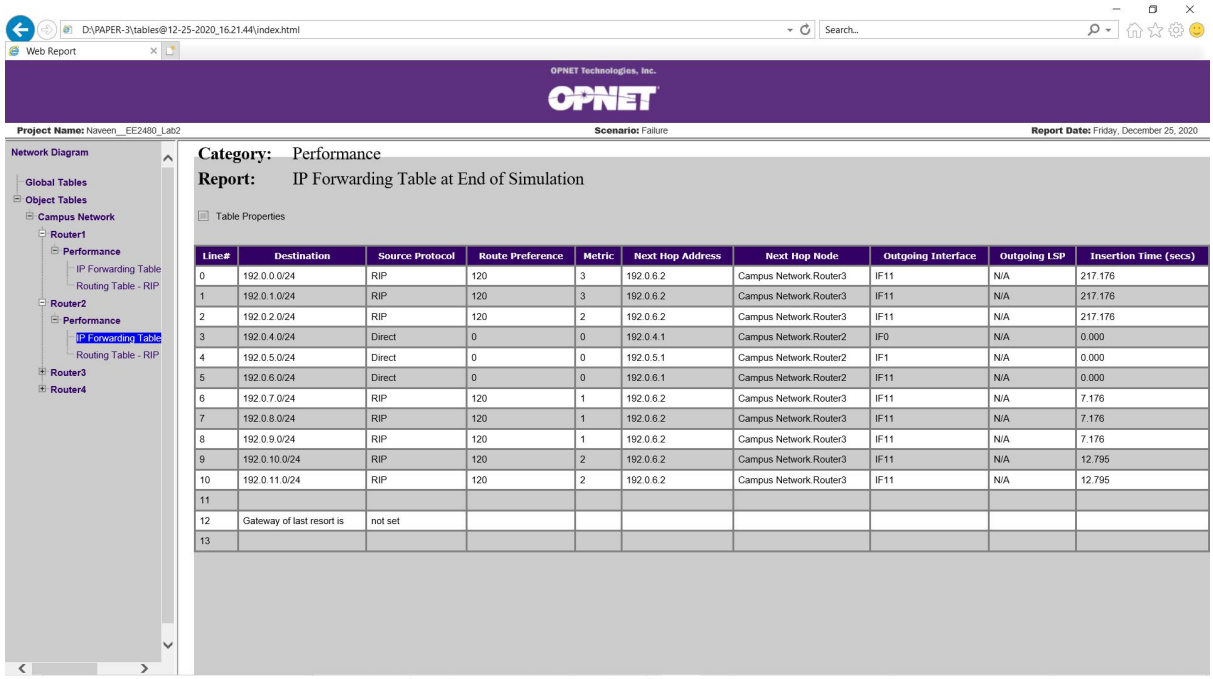


The above describes the Network Diagram of the concerned experiment.



Line#	Destination	Source Protocol	Route Preference	Metric	Next Hop Address	Next Hop Node	Outgoing Interface	Outgoing LSP	Insertion Time (secs)
0	192.0.0.0/24	Direct	0	0	192.0.0.1	Campus Network.Router1	IF0	N/A	0.000
1	192.0.1.0/24	Direct	0	0	192.0.1.1	Campus Network.Router1	IF1	N/A	0.000
2	192.0.2.0/24	Direct	0	0	192.0.2.1	Campus Network.Router1	IF10	N/A	0.000
3	192.0.4.0/24	RIP	120	3	192.0.2.2	Campus Network.Router4	IF10	N/A	219.361
4	192.0.5.0/24	RIP	120	3	192.0.2.2	Campus Network.Router4	IF10	N/A	219.361
5	192.0.6.0/24	RIP	120	2	192.0.2.2	Campus Network.Router4	IF10	N/A	219.361
6	192.0.7.0/24	RIP	120	2	192.0.2.2	Campus Network.Router4	IF10	N/A	9.361
7	192.0.8.0/24	RIP	120	2	192.0.2.2	Campus Network.Router4	IF10	N/A	9.361
8	192.0.9.0/24	RIP	120	1	192.0.2.2	Campus Network.Router4	IF10	N/A	9.361
9	192.0.10.0/24	RIP	120	1	192.0.2.2	Campus Network.Router4	IF10	N/A	9.361
10	192.0.11.0/24	RIP	120	1	192.0.2.2	Campus Network.Router4	IF10	N/A	9.361
11									
12	Gateway of last resort is	not set							
13									

The above figure describes the performance of Router1 under IP Forwarding Table.



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Web Report

OPNET Technologies, Inc.

Project Name: Naveen__EE2480_Lab2 **Scenario:** Failure **Report Date:** Friday, December 25, 2020

Network Diagram
- Global Tables
- Object Tables
- Campus Network
  - Router1
    - Performance
      - IP Forwarding Table
      - Routing Table - RIP
  - Router2
    - Performance
      - IP Forwarding Table
      - Routing Table - RIP
  - Router3
  - Router4

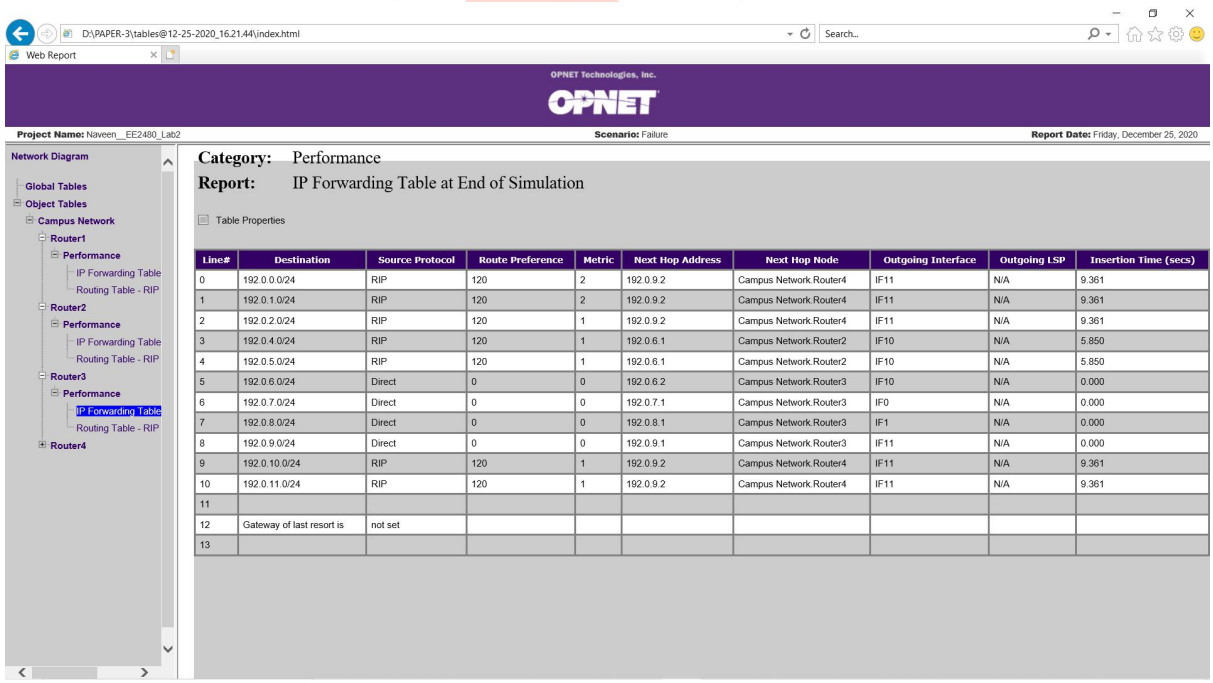
Category: Performance

Report: IP Forwarding Table at End of Simulation

Table Properties

Line#	Destination	Source Protocol	Route Preference	Metric	Next Hop Address	Next Hop Node	Outgoing Interface	Outgoing LSP	Insertion Time (secs)
0	192.0.0.0/24	RIP	120	3	192.0.6.2	Campus Network.Router3	IF11	N/A	217.176
1	192.0.1.0/24	RIP	120	3	192.0.6.2	Campus Network.Router3	IF11	N/A	217.176
2	192.0.2.0/24	RIP	120	2	192.0.6.2	Campus Network.Router3	IF11	N/A	217.176
3	192.0.4.0/24	Direct	0	0	192.0.4.1	Campus Network.Router2	IF0	N/A	0.000
4	192.0.5.0/24	Direct	0	0	192.0.5.1	Campus Network.Router2	IF1	N/A	0.000
5	192.0.6.0/24	Direct	0	0	192.0.6.1	Campus Network.Router2	IF11	N/A	0.000
6	192.0.7.0/24	RIP	120	1	192.0.6.2	Campus Network.Router3	IF11	N/A	7.176
7	192.0.8.0/24	RIP	120	1	192.0.6.2	Campus Network.Router3	IF11	N/A	7.176
8	192.0.9.0/24	RIP	120	1	192.0.6.2	Campus Network.Router3	IF11	N/A	7.176
9	192.0.10.0/24	RIP	120	2	192.0.6.2	Campus Network.Router3	IF11	N/A	12.795
10	192.0.11.0/24	RIP	120	2	192.0.6.2	Campus Network.Router3	IF11	N/A	12.795
11									
12	Gateway of last resort is	not set							
13									

The above figure describes the performance of Router2 under IP Forwarding Table.



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Web Report

OPNET Technologies, Inc.

Project Name: Naveen__EE2480_Lab2 **Scenario:** Failure **Report Date:** Friday, December 25, 2020

Network Diagram
- Global Tables
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  - Router1
    - Performance
      - IP Forwarding Table
      - Routing Table - RIP
  - Router2
    - Performance
      - IP Forwarding Table
      - Routing Table - RIP
  - Router3
    - Performance
      - IP Forwarding Table
      - Routing Table - RIP
  - Router4

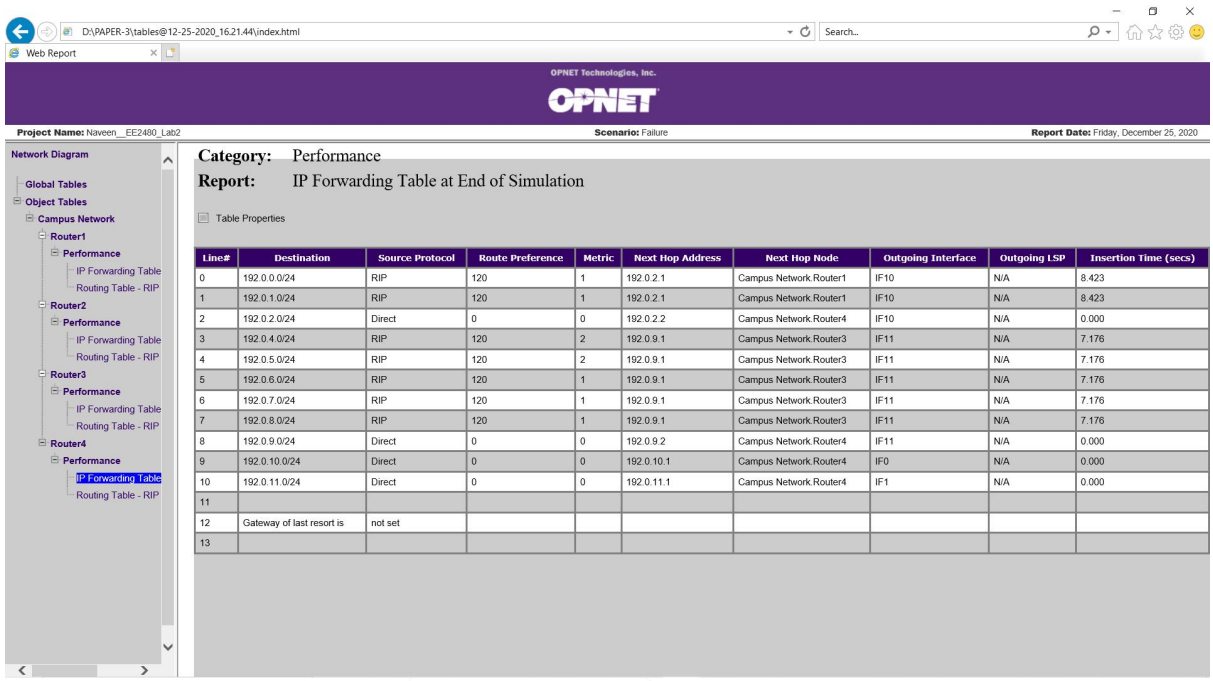
Category: Performance

Report: IP Forwarding Table at End of Simulation

Table Properties

Line#	Destination	Source Protocol	Route Preference	Metric	Next Hop Address	Next Hop Node	Outgoing Interface	Outgoing LSP	Insertion Time (secs)
0	192.0.0.0/24	RIP	120	2	192.0.9.2	Campus Network.Router4	IF11	N/A	9.361
1	192.0.1.0/24	RIP	120	2	192.0.9.2	Campus Network.Router4	IF11	N/A	9.361
2	192.0.2.0/24	RIP	120	1	192.0.9.2	Campus Network.Router4	IF11	N/A	9.361
3	192.0.4.0/24	RIP	120	1	192.0.6.1	Campus Network.Router2	IF10	N/A	5.850
4	192.0.5.0/24	RIP	120	1	192.0.6.1	Campus Network.Router2	IF10	N/A	5.850
5	192.0.6.0/24	Direct	0	0	192.0.6.2	Campus Network.Router3	IF10	N/A	0.000
6	192.0.7.0/24	Direct	0	0	192.0.7.1	Campus Network.Router3	IF0	N/A	0.000
7	192.0.8.0/24	Direct	0	0	192.0.8.1	Campus Network.Router3	IF1	N/A	0.000
8	192.0.9.0/24	Direct	0	0	192.0.9.1	Campus Network.Router3	IF11	N/A	0.000
9	192.0.10.0/24	RIP	120	1	192.0.9.2	Campus Network.Router4	IF11	N/A	9.361
10	192.0.11.0/24	RIP	120	1	192.0.9.2	Campus Network.Router4	IF11	N/A	9.361
11									
12	Gateway of last resort is	not set							
13									

The above figure describes the performance of Router3 under IP Forwarding Table.



Line#	Destination	Source Protocol	Route Preference	Metric	Next Hop Address	Next Hop Node	Outgoing Interface	Outgoing LSP	Insertion Time (secs)
0	192.0.0.0/24	RIP	120	1	192.0.2.1	Campus Network.Router1	IF10	N/A	8.423
1	192.0.1.0/24	RIP	120	1	192.0.2.1	Campus Network.Router1	IF10	N/A	8.423
2	192.0.2.0/24	Direct	0	0	192.0.2.2	Campus Network.Router4	IF10	N/A	0.000
3	192.0.4.0/24	RIP	120	2	192.0.9.1	Campus Network.Router3	IF11	N/A	7.176
4	192.0.5.0/24	RIP	120	2	192.0.9.1	Campus Network.Router3	IF11	N/A	7.176
5	192.0.6.0/24	RIP	120	1	192.0.9.1	Campus Network.Router3	IF11	N/A	7.176
6	192.0.7.0/24	RIP	120	1	192.0.9.1	Campus Network.Router3	IF11	N/A	7.176
7	192.0.8.0/24	RIP	120	1	192.0.9.1	Campus Network.Router3	IF11	N/A	7.176
8	192.0.9.0/24	Direct	0	0	192.0.9.2	Campus Network.Router4	IF11	N/A	0.000
9	192.0.10.0/24	Direct	0	0	192.0.10.1	Campus Network.Router4	IF0	N/A	0.000
10	192.0.11.0/24	Direct	0	0	192.0.11.1	Campus Network.Router4	IF1	N/A	0.000
11									
12	Gateway of last resort is	not set							
13									

The above figure describes the performance of Router3 under IP Forwarding Table.

IV. Conclusion & Future scope:

Defacto values of RIP for route failure mechanism is 180 sec based on RFC 2453 and we obtain approximately 97 sec only. The same can be applied to (RIPng) and we can compare the both.

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[6] S. Corson and J. Macker, "Mobile ad hoc networking (manet): Routing protocol peformance issues and evaluation considerations," 1999.