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The impact of Routing Protocols and topologies on IOT Based Systems

The impact of Routing Protocols and topologies on IOT Based Systems

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Abstract. Routing protocols is a mechanism of detecting best route path from single node to multiple nodes or signal node in order to transfer data between network and it specify how routing techniques in routers communicate between routers to accomplish communication tasks. A simulation was done to compare some protocols such as ""RIP"", ""OSPF"" and "EIGRB' to determine the best routing protocol at a specific given network topology for IoT applications. The main problem there is a different routing protocols was developed each has its performance among different IoT applications. As well a simulation was required to detect the perfect routing protocol required for IoT applications. In this project a simulation of "IoT" network that serve the "IoT" applications using different routing protocols such as ""RIP"", ""OSPF"' and "EIGRB" and an evaluation to the performance of each routing technique was to decide which is the best routing for "IoT" applications. Opnet modular was used to implement the simulation and it is found that the ""IGRP"" has the fastest router convergence among the three protocols we are testing.

Keywords. IoT, Routing, Protocols, OSPF, EIGRB, RIP.

1. Introduction

Internet of Things (IoT) has appeared as a Possible Future Scenario of the applicability and effect of technology in human life. Internet of Things spreads the understandable of Internet from a network of rather similar devices such as computers to network of dissimilar devices such as home applications, consumer electronics or wireless sensor networks. As developed from traditional network such as Internet, Internet of Things networks head for to re-use techniques which are advanced for Internet such as routing protocols ,,,THE Internet of Things (IoT) is a recent communication model that imagines a near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet.[1]

Routing protocols are arranged on routers with the objective of replacing routing information there are two types of routing protocols are distance vector include RIP(routing information protocols) and IGRP(Internet Gateway routing protocol) and link state such as OSPF(Open Shortest Path First) and another protocols [2]

Cisco advanced Internet Gateway Routing Protocol as another alternative to RIP. The most recent Enhanced IGRP (EIGRP) made IGRP ancient beginning in the 1990s.[3]

2. Related Works

Ahmed et al, 2008, had been used altered algorithms to illustrate "OSPFWS" problems and discussed each algorithms and explained the advantages/disadvantages of the algorithms. As result each algorithms may be better by comparing with another according to the application of papers, and finally they created new suggestion for determining the "OSPWS" problems[4].

A. Jani et al. 2011, they suggested a new routine to improve the "RIP" efficiency with including an intelligence component. Their planned technique assists preliminary step for creating a network with self-Configured[5].

Karamgeet et al. 2012, found the finest route by using simulation for "OSPF". Their work applied on wired and wireless LANs with performing several sorts of simulations and focused on OPNET. Networks were designed in OPNET to achieve "OSPF" protocol operation and result of simulation assigned OPNET modeler to assess the execution for the wireless network protocol containing "OSPF"[6].

Pankag et al. 2012, here analyzing the execution for the altered routing like "OSPF", "RIP", "IGRP" & "EIGRP" protocols were shown based on transmission cost, delay and router throughput. "OSPF" can transmit a packet better than others[7].

G.C Nwalozie et al. 2012, explained the "OSPF" performance and implementation in addition to the predictable route "RIP" with an improved type. They show "OSPF" used for optimizing the performance metrics for networks with using dijkestra procedure to evaluate the lack path toward the target networks[8].

V. Vetreselvan et al 2014., here, routing protocols had typical challenges and discussed approximation of numerous routing protocol issues were assorted for many routing protocols if they were utilized with actual conditions[9].

Md Samil et al. 2014, had made a comparison between "RIP" and "OSPF" protocols with a theoretical fact. "OSPF" accomplishes a throughput and instant packet delay of "RIP" and its coverage network more quickly than "RIP", so, "RIP" is good with "FS-RIP", and shows a finest performance with respect than "OSPF"[10].

A. Virma and N. Bhardwaj (2016) give a comparative study for the most elective "RIP" and "OSPF" protocols and getting finest route in wired and wireless LANs for them[11].

3. Proposed Solution

To Simulate a network scenario covers three types of routing protocols "RIP", "OSPF" and EIRGB and evaluate the performance of each protocol in term of "QoS" parameters.

4. Aims and Objectives

The goal of this research is to find the best and fastest router and this is done by using three different types of routers and then evaluating the performance of each router. The routers used in the work are RIP, OSPF, EIGRB, and the experimental results show that IGRB is the best of the three tested routers.

5. Methodology

An investigation on many scientific papers done, to gain knowledge "IoT" applications, requirements and protocols, then using simulation software used to simulate network and implement the scenarios of testing the protocols, and three main protocols chosen "RIP", "OSPF" and Eigrb routing protocols.

Moreover the evaluation of these protocols examined regarding “QoS” parameters. A network topology will be used to accomplish the simulation, on the “Opnet-modular-14.5”.

6. *Network* Scenarios

Altered scenarios executed using “Opnet-Modular-14.5”, the scenarios cover small, medium and large networks with altered topologies including SRT, SMT, LMT, and LTT. The simulation of network covers an evaluation of performance on network routing in term of traffic sent capability and the Link time of the router.

6.1. 3rd Network Scenario

Fig. “1” declare a general scenario covers all of the protocols selected for the comparison (“RIP”, “OSPF” and “EIGRP”) so an LAN blocks added into simulation and routers, the routers linked with “1000-Base-T” links and LAN block linked to router through “100-Base-T”.

Moreover, the simulation cover altered type of topologies SRT, SMT and LMT, and LTT. All scenarios cover link failure.

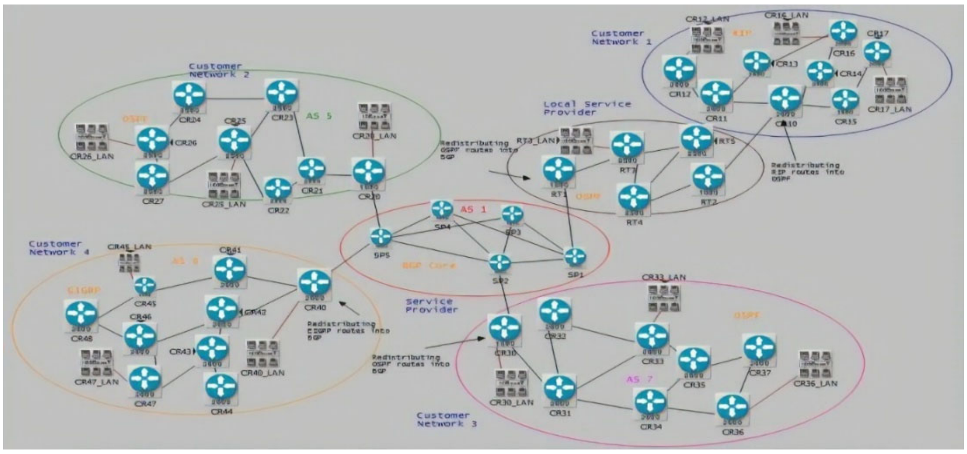

Figure 1. General Scenario Covering “RIP”, “EIGRP” and “OSPF” Protocols

6.2. SRT Scenario

The SRT as exposed in Fig. 2 implemented by using five routers connected through “1000-Base-T” connection so network cover the SRT with linkage failure.

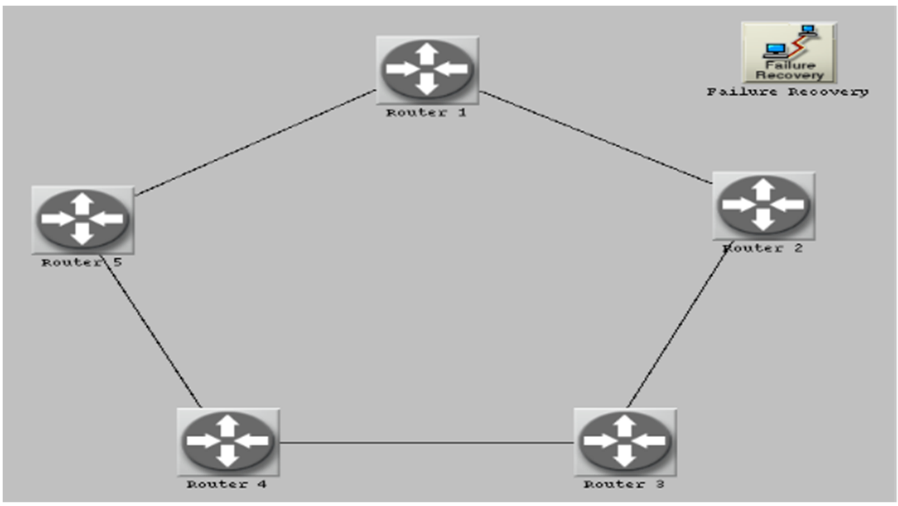

Figure 2. SRT network in Opnet

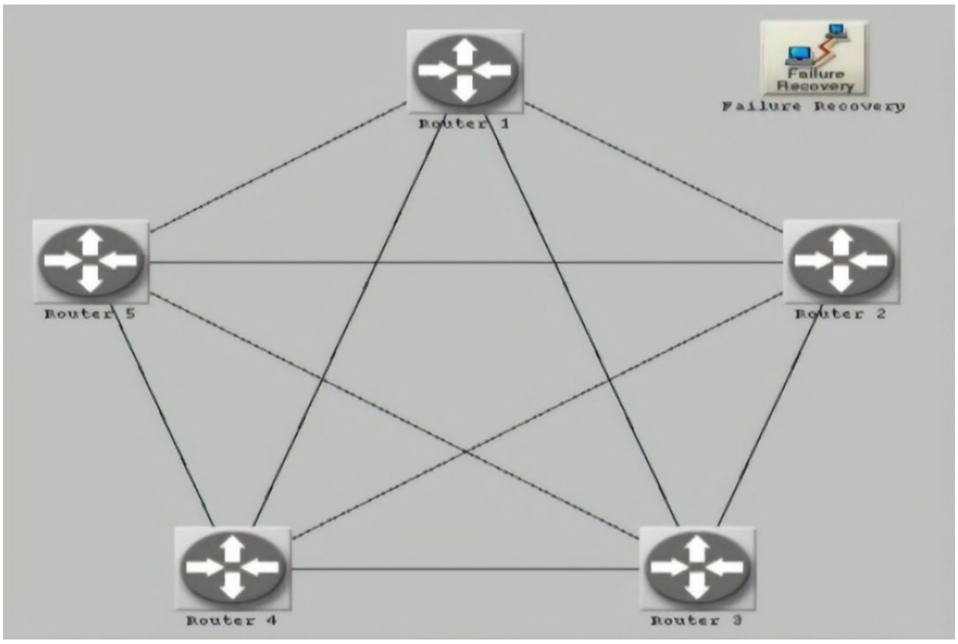

Figure 3. SMT network in Opnet

6.3. SMT Scenario

The SMT as exposed in Fig. 3 implemented by using five routers linked through "1000-Base-T" connection so network cover the RT with a linkage failure the connection state between routers exceeds the two or equal thus it become differ from the RT.

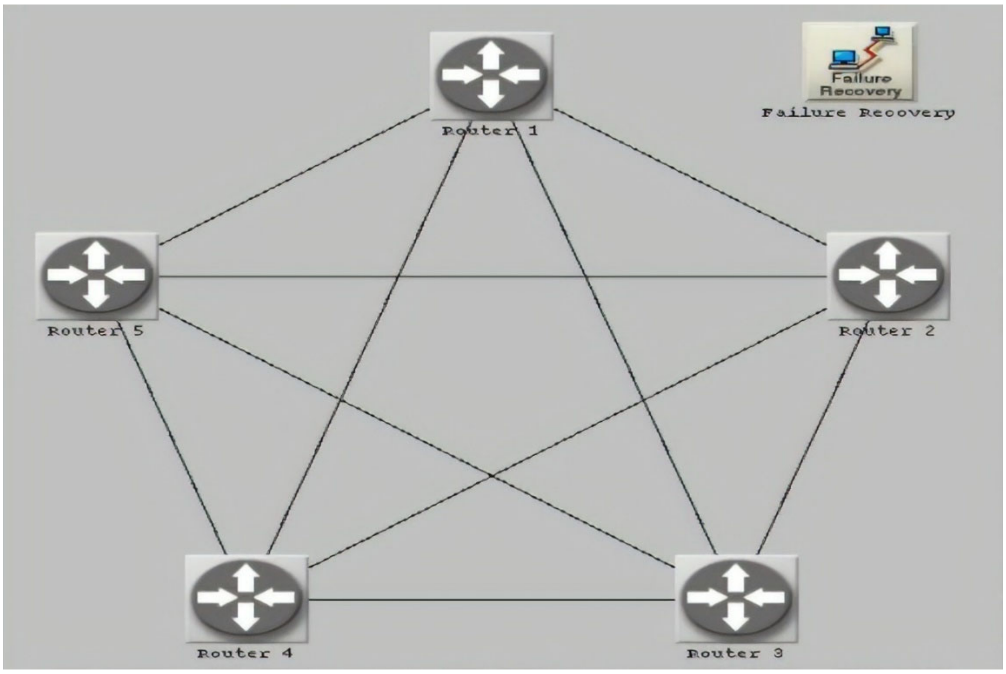

Figure 2. SRT network in Opnet

6.4. LMT Scenario

Using the Opnet modular rapid configuration nth routers can be Configured with the required topology, then the link mode is "1000BaseT" connection and the nth of route links between routers is confide to crease the LMT network exposed in Fig. 4.

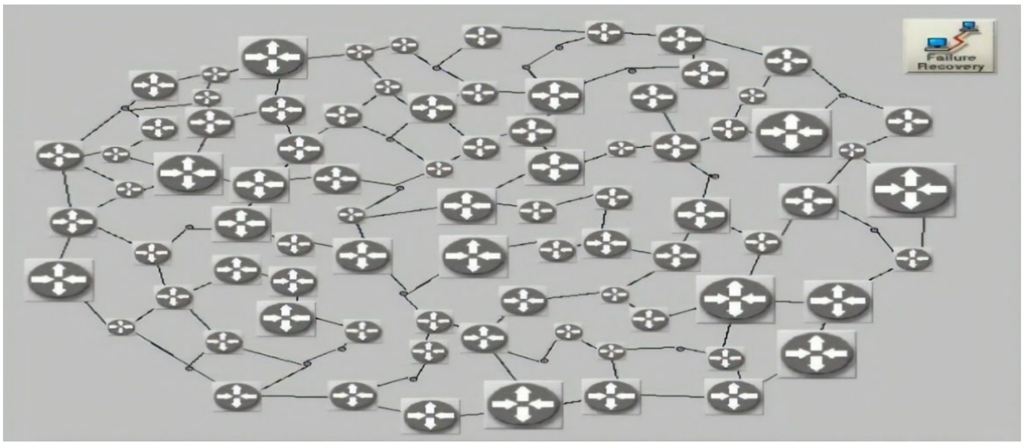

Figure 4. LMT network in Opnet

6.5. LTT Scenario

Using the Opnet modular rapid configuration nth router configured with the required topology "tree selected", then the link mode is "1000BaseT" connection and the nth of route links between routers is configured to crease the LTT network as exposed in Fig. 5.

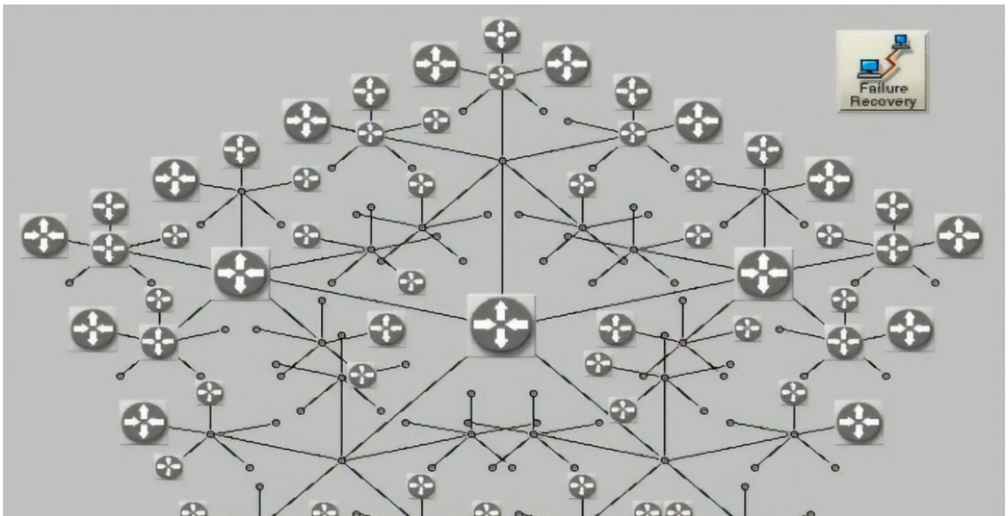

Figure 5. LTT network in Opnet

7. Performance Results

7.1. SRT Scenario

Fig. 6 represent a demonstrations to the router "traffic sent in bits/sec" to three protocols in a SRN. From chart of routing traffic/sent it's found "EIGRP" takes highest efficiency of bandwidth compared to "RIP" a least bandwidth efficiency. Commonly "OSPF" improved bandwidth adeptness compared to "EIGRP" while no new routers added to network. In addition the "OSPF" is highest initial peak is cased by the routers maps 3rd network before selecting the routing path. requires routers to rise a major size of data primarily.

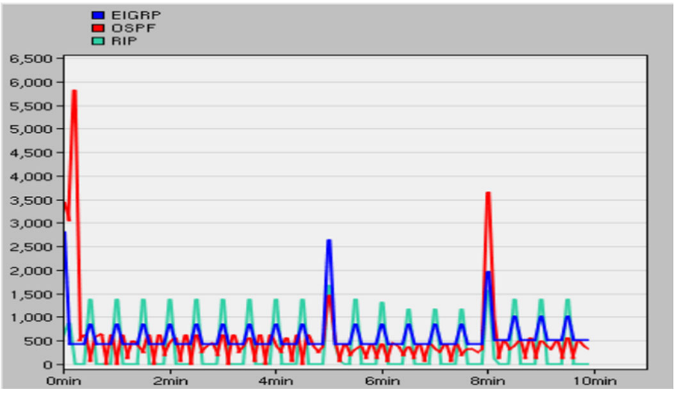

Figure 6. Routing “traffic sent in bits/sec” for SRT

In Fig. 7 demonstrations of link action of protocols. 3rd, (S), and 3rd peaks declare first setup, failure of link, at “300” (S), and recovery of link at “480” (S). Also examine width of each peak declare the Link Period. Longer a protocol acquires to converge, and the peak will be wide. From these results it’s found “EIGRP” is rapid Link in all the steps while “OSPF” is faster time of Link than “RIP” Through failure of link.

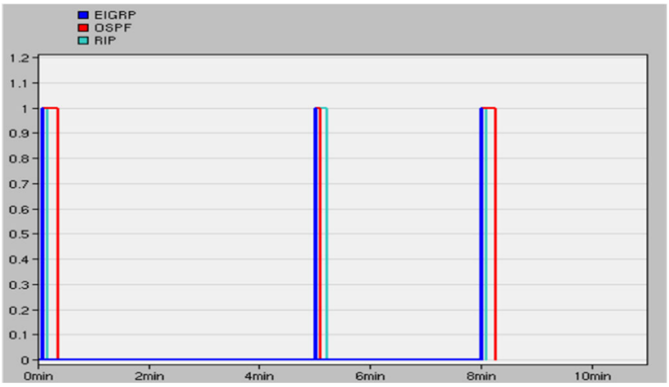

Figure 7. Link Activity for SRT

In Table “1” a representation of initialization, Link and Link time unit in (S), the extreme value with a maximum of “50S” estimating percentage for wholly routing protocol while running the simulation.

Table 1. Link periods (S) of SRT

	“RIP”	“OSPF”	“EIGRP”	“RIP”%	“OSPF”%	“EIGRP”%
Initial	4	15	0.9	8	30	1.8
Link	10	5	0.9	20	10	1.8
Link	5	15	0.9	10	30	1.8

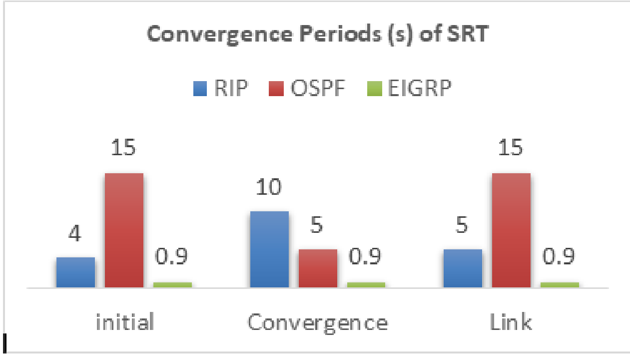

Figure 8. Link period (S) of SRT

7.2. SMT Scenario
During traffic sent Link results of SMT are exposed in Figs. "9" , "10" respectively. Likewise to the outcomes in the SRT, the 3rd, (S), and 3rd peak declare the initial setup, failure of link, and recovery of link in network. Analyzing traffic sent outcomes its found throughput raised for every protocol due rise of neighbor routers, but in comparison to SRT bandwidth efficiency (quantity of routing "traffic-sent" in network topology) not altered.

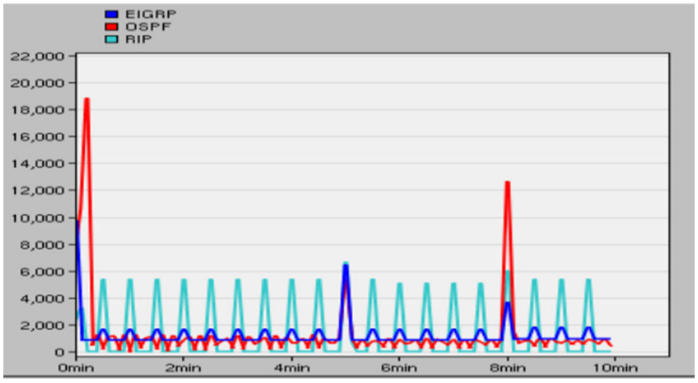

Figure 9. SMT Routing "traffic sent in bits/sec"

The Link results exposed in Fig. 1 are altered; while "EIGRP" is quiet the rapid, "RIP" now rapid Link times than "OSPF" at every three peaks. "RIP" is unnoticed in display as it interfere with "EIGRP" Through the 3rd and 3rd peaks, and "OSPF" Through (S) peaks.

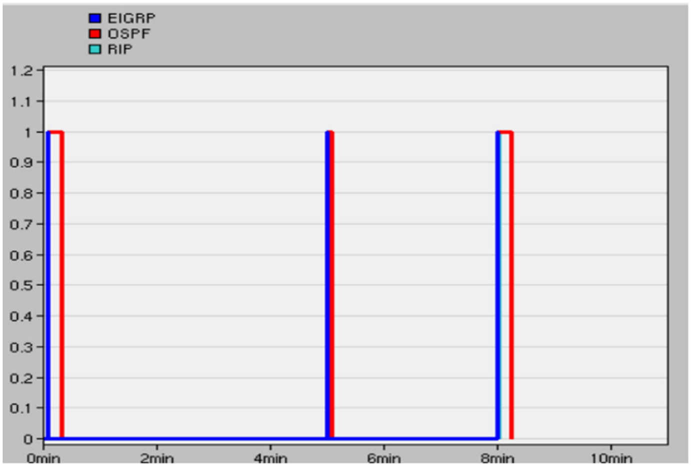

Figure 10. SMT Link Activity

Alteration pointed to the impractical topology of network, and the “OSPF” parameters have not been fixed to optimal for the protocol to implement at its “finest”. In addition every end point is only one hop away in topology, “RIP” is capable to easily obtain its end point. To clear the “OSPF” must 3rd map out entire network even though for topology, it avails to only having information of routers near in network.

In Table 2 a illustration of the initialization, Link and Link time unit in (S)s, the maximum value maximum of “50” (S) estimating the percentage among each routing protocol.

Table 2. Link period (S) of SMT

	“RIP”	“OSPF”	“EIGRP”	“RIP”%	“OSPF”%	“EIGRP”%
Initial	0.9	15	0.9	1.8	30	1.8
Link	4	5	0.9	8	10	1.8
Link	1.5	15	0.9	3	30	1.8

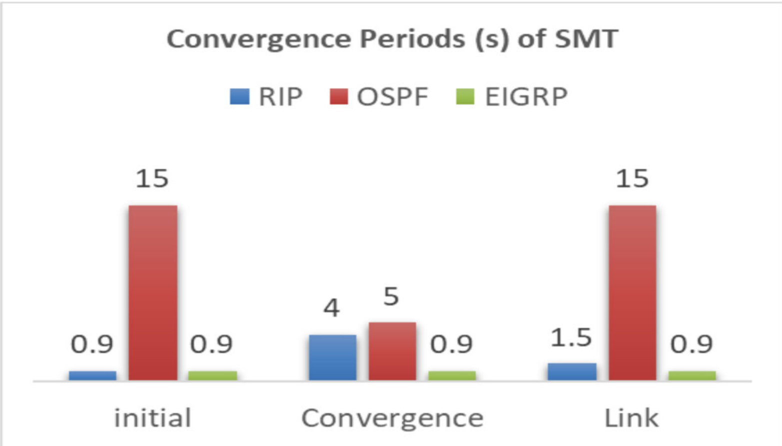

Figure 11. Link period (S) of SMT

7.3. *LMT Scenario*

Fig. “12’ , Fig. “13” demonstrations of traffic sent and link results of LMN. Moreover traffic sent results demonstration all protocols traffic of increasing basically; however, “EIGRPs’ and “OSPFs’ efficiency of bandwidth is considerably superior to of “RIP”, with peaks of “1Mbps” every “30” (S).

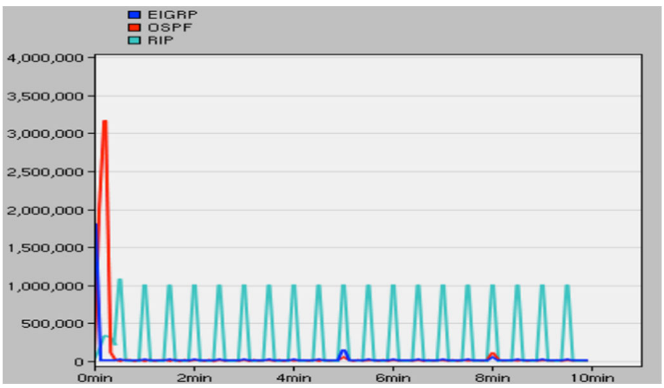

Figure 12. LMT Routing “traffic sent in bits/sec”

It’s found “OSPFs” and “RIPs” Link time rise while “EIGRP” stays the rapid. It should also be stated “OSPF”’s Link time is faster than “RIP”, as predicted in a real topology.

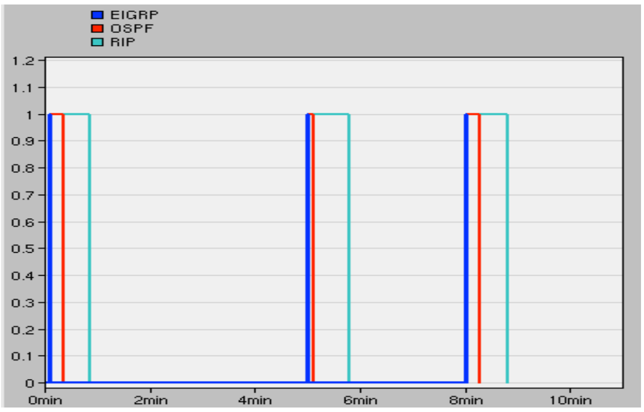

Figure 13. LMT Link Activity

Table 3 illustrate the initialization, Link and Link time unit in (S), with maximum value maximum of “50(S)” estimating the percentage for routing protocol.

Table 3. Link period (S) of LMT

	“RIP”	“OSPF”	“EIGRP”	“RIP”%	“OSPF”%	“EIGRP”%
Initial	5	15	0.9	90	30	1.8
Link	45	5	0.9	90	10	1.8
Link	47	15	0.9	94	30	1.8

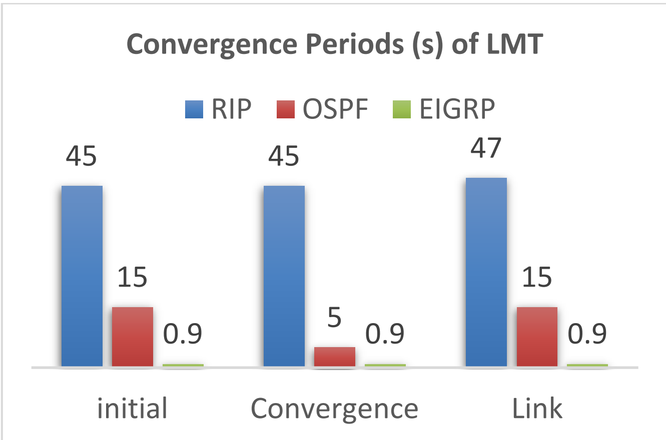

Figure 14. Link period (S) of LMT

7.4. LTT

Traffic of the routing referred for the LTT is presented in Fig. 4.8. Again, it’s found “RIP” tes bandwidth with “1.3 Mbps” peaks of traffic every “30 (S)”. Both “OSPF” and “EIGRP” use the bandwidth more efficiently. However, “OSPF” a much greater initial peak of traffic than “EIGRP”, at nearly “3.5” Mbps related to “1 Mbps”. is suitable to “OSPF” being a link formal algorithm, which needs it to map out the whole network.

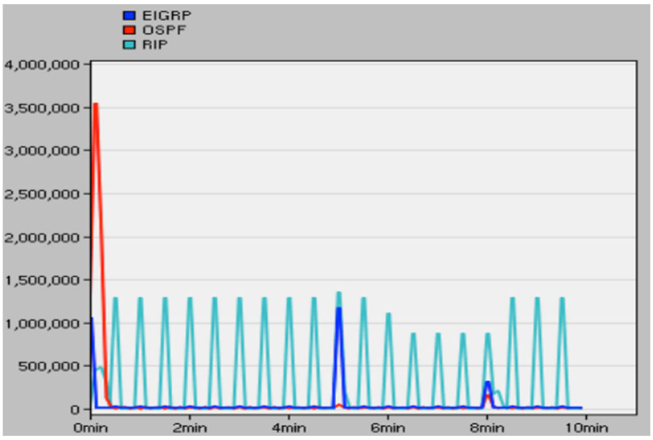

Figure 15. Routing "traffic sent in bits/sec" for LTT

In Fig. 16 it's seen the Link efficiency of each protocol in the LTT structure. In comparison with the LMT, Link happens rapidly in topology with the exemption of "EIGRP", who's Link is fully constant.

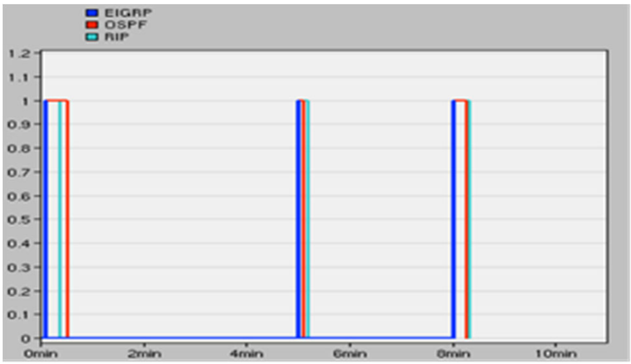

Figure 16. LTT Link Activity

Table 4. Link period (S) of LTT

	"RIP"	"OSPF"	"EIGRP"	"RIP"%	"OSPF"%	"EIGRP"%
Initial	17	25	0.9	34	50	1.8
Link	7.5	5	0.9	15	10	1.8
Link	18	15	0.9	36	30	1.8

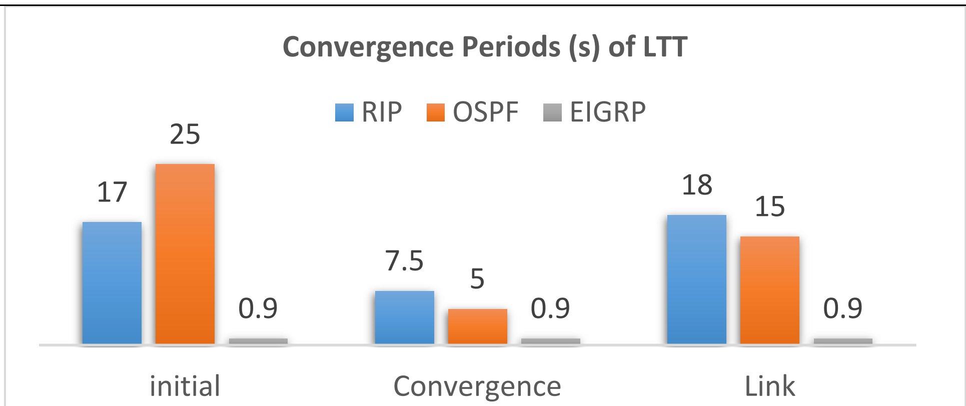

Figure 17. Link period (S) of LTT

8. Discussion

The usage of "EIGRP" serving "IoT" it's found the Link time/bandwidth efficiency for all its scenarios is the finest. Regarding the "RIP", it's found the initial Link performance enhanced than "OSPF" for little topologies, but its efficiency of bandwidth the less for all states. The expectations the "RIP" have a less efficiency of bandwidth, as it needs complete episodic updates while "OSPF" and "EIGRP" doesn't require a periodic updates. Moreover the "OSPF" improved Link time in SRT after linkage failure. In addition the "EIGRP", "OSPF" had an initial detection contrivance for variations in network. "OSPF's" total Link efficiency of time/bandwidth remained constant for little topologies.

In addition LMT is most precise according to predicted results. In state, "EIGRP" continued rapid while "OSPF" converged rather than "RIP" at each Link event. In relationship, our LTT resulted in MT smaller Link period. Also, "RIP" and "OSPF" had very similar Link times, which is not precise in a big topology. In decision, "EIGRP" is the top routing protocol due to finest Link and efficiency of bandwidth in all the states. Comparing "OSPF" and "RIP", the former is improved for big topologies as definite by LMT, while the latter is only suitable for smaller networks.

9. Conclusion

The quality assessment of the "IoT", routing protocols and operation modes affected by the routing techniques and topology. In addition Opnet used for evaluating performance of network with three protocols "RIP", "OSPF" and Eigrb and performance metrics obtained for altered routing protocols like "EIGRP", "RIP" and "OSPF". It's analyzed the delay is enhanced by accumulative the transmission rate. "EIGRP"/"OSPF" is further effectual than the other routing protocols.

In conclusion, our emulation definite "EIGRP" is the finest excellent for all topologies of network executed as it a fast Link, while also effectively operating bandwidth. "OSPF" is the next optimal for big networks, as proven by LMT effects. "RIP" achieves out of sorts in big networks and is so simple, restricted to small networks.

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