Riverbed Modeler Simulation-Based Performance Analysis of Routing Protocols in Mobile Ad Hoc Networks

Y.Chalapathi Rao, P.Kishore, S.Rajendra Prasad

Abstract— Mobile Ad-Hoc network (MANET) is a highly dynamic network of wireless mobile nodes that transmitted data from one node to other without systemized control or physical infrastructure. In wireless communication, MANETs are gained more significance and nodes are movable can be moved from one position to another and associated with the neighbors. At any time nodes can be added and removed because of mobility and dynamically change the wireless link connections in the network. In the success of communications, routing is a high priority and it characterizes an essential role. This paper focus on four different routing protocols and their functionality in MANETs with the analysis to be observed on Optimized Link State Routing Protocol (OLSR) in Proactive Routing Protocol (PRP), Dynamic Source Routing (DSR) and Ad Hoc On-Demand Distance Vector (AODV) in Reactive Routing Protocol (RRP), and Gathering based Routing Protocol (GRP) in Hybrid Routing Protocol (HRP) which are worn for efficient routing. The performance analysis of foregoing routing protocols are determined with respect to routing overhead(ROH), end-to-end delay (E2E delay), routing traffic sent (RTS), routing traffic received (RTR), network load, data dropped, throughput, retransmission attempts, and media access delay (MA delay) using Riverbed modeler simulator.

Keywords— AODV, DSR, GRP, MANETs, OLSR, Riverbed simulator modeler.

1. INTRODUCTION

A Mobile Ad-Hoc Network (MANET) is also known as Ad-Hoc Wireless Network or Wireless Ad-Hoc Network; it is growing very quickly from the past 10 years. In the area of wireless networks, MANET is one of the most demanding fields. It's created a new set of demands to be implemented and provided efficiently better E2E communication [1]. Node is called a wireless mobile device that receives, sends, or processes data in network. MANETs are the collection of different kind of wireless mobile devices; all devices are mobile nodes which can move freely within the network and outside of the network areas, so this topology is very dynamic in nature. The network topology can dynamically change without turning to any existing systemized administration because of mobility of nodes [2]. These network topologies are self-directed, self-caring, self-sustaining and self-recognized resources, and it is a self-organizing less-infrastructure network associated by wireless communication links. With this communication networks can able to work anywhere and at any time easily for good capability [3].

For the reduction of transmission routing failure by taking consideration of latency, power and communication overhead can find the optimal path using the available hosts to arrive the destination in MANET [4]. It has gained a lot of importance in a nonmilitary public organization, industrial and commercial areas with including applications such as the cooperating industrial robots, rescue missions, educational operations on campus, the traffic management and law enforcement operations. In MANET, several challenges are faced by sender and receiver packets in routing, networks constitute many challenges that are to-be addressed in both technical and research [5].

In MANET, all nodes are movable can move from one position to another within the limited area of each host so in these conditions routing is an essential challenge. So we focus on the main issue of research is the packet routing technology. And also few challenges are facing to develop frequently routing link breakages, open network architecture, fast moving of mobile nodes, shared medium, recognizing misbehaving node routing, finite energy source, and secure routing protocol of the networking topology in dynamic nature [6].

Many routing protocols have been developed from the past few years in MANET; these routing protocols are classified into three categories which are PRP, RRP, and HRP. The most popular routing protocols are RRPs (DSR, and AODV) when they are needed, it finds the routes. PRPs (OLSR) are table-driven protocols they need it before to find routes. And HRPs (GRP) draws on the strengths of other routing protocols which can simultaneously offer an efficient framework [7].

Most of the papers consider the E2E delay, network load, routing overload, throughput, packet delivery ratio, media access delay parameter metrics with below 50 nodes, but here we considered under 80 nodes with include another two parameters like DTS and DTR.

In this paper, mainly we focus on four major MANET routing protocols that are OLSR, GRP, AODV, and DSR. Based on the data rate, the performance evaluation process is file transfer protocol (FTP) in High load data traffic. The performance is analyzed by means of ROH, RTS, RTR, data load, data dropped, throughput, retransmission attempts, E2E delay, and MA delay using Riverbed modeler simulator. The rest of the paper is organized as follows. Section II explained a brief overview of MANETs routing protocols,

Revised Manuscript Received on March 10, 2019.

Dr.Y.Chalapathi Rao, Associate Professor, Deparment of ECE, VNR VJIET, Hyderabad, Telangana, India.(E-mail: chalu.8421@gmail.com)

Dr.P.Kishore, Assistant Professor, Deparment of ECE, VNR VJIET, Hyderabad, Telangana, India.(E-mail: kishore_p@vnrvjiet.in)

Dr.S.Rajendra Prasad, Professor, Deparment of ECE, VNR VJIET, Hyderabad, Telangana, India (E-mail: rajendraprasead_s@vnrvjiet.in)

Section III provides the performance evaluation, the simulation results are discussed in Section IV and Section V conclusion of MANETs routing protocols with the comparative study.

2. A BRIEF OVERVIEW OF ROUTING PROTOCOLS IN MANETS

Topology-based Mobile Ad hoc Networks (MANETs) routing protocols are classified into three categories: Proactive routing protocol (Table-driven), the Reactive routing protocol (On-demand driven) and Geographical routing protocol (Hybrid) in figure 1. This type of protocols are conventionally known as traditional network routing protocols, and the basis of packet receive to the destination from a source node is stored an information of the mobile link's in the routing [8].

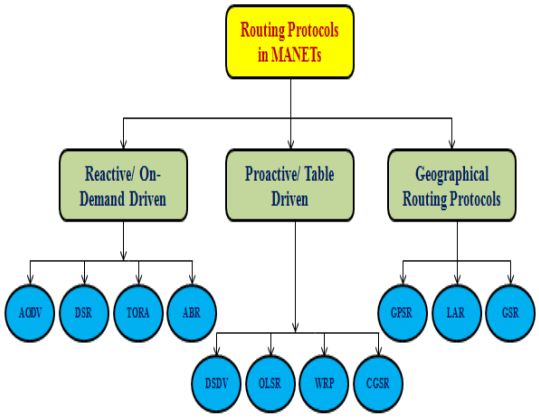

Figure 1: Classification of MANETs routing protocol

AODV:

Adhoc on Demand Distance Vector Routing Protocol (AODV) dispenses the realization of on demand route in MANET; it is unicast RRP that routes are created by only on demand and also reduces the number of a broadcast in the network. The route discovery set about accompanied by route_request_packet broadcasting from the source node to its neighbor's destination. The route_request_packet constitutes the both source and destination addresses and broadcast ID. In this protocol, network overhead is low, which reduces network message flooding. However, the main drawback of AODV is when network size grows with respect to increase in network overhead which leads to packet lost problem and consume extra bandwidth.

DSR:

Dynamic source routing (DSR) is a multi-hop on demand RRP that discovers and maintains routes between nodes, it provides a highly dynamic reactive routing protocol and a very low network overhead. This protocol makes available of three main steps: acknowledgment of wireless mobile link layer, acknowledgment of passive source, and acknowledgment wireless network layer, the original sender in the route maintenance receives the router error packet when a route is broken; failure is detected by one node.

OLSR:

Optimized link state routing protocol (OLSR) is a PRP (table-driven routing protocol). This protocol is an enhanced pure link state algorithm whereas it ensures the availability of the directions or paths when required. OLSR is in proactive nature. When compared with flooding mechanism network overhead of the packet transmission is reduced in this algorithm. During the flooding process in OLSR, multi-point relays (MPRs) are selected and are responsible for the transfer of broadcast packets. Some researchers thought that OLSR is more suitable for warning applications and also working with efficiently in dynamic network topology.

GRP:

Gathering-based routing protocol (GRP) is also called as the HRP for the reason that the strengths of RRP and PRP can be used at the same instant. It is known as source initialized protocol in that the entire routing path is constructed or established from the source node in MANET. This protocol is a position based PRP. And GRP utilizes information derived from a source node location towards the neighbor's destination for the purpose of formulating and optimizing the searching path and it is acquiring rapid data transfer with less ROH of control messages. In this routing protocol, preventing long network-wide searches for the sinks is the principal advantage.

3. SIMULATION ENVIRONMENTS AND PERFORMANCE EVALUATION

Riverbed simulator modeler 17.5 is a tool for analyzing and evaluating the wireless communication networks. It is a commercial network simulation tool; with the help of this simulator modeler we analyzed four different routing protocols that are AODV, DSR, OLSR, and GRP. The topology of this wireless ad-hoc network or MANET which consists of nodes and links, which are graphically specifies from the user of Riverbed modeler. The simulation environment uses a 32-bit/ 64-bit fully parallel simulation kernel as the means of analyzing evaluating system performance, the internal process of nodes and their behavior and protocols has to be defined from fast discrete-event simulation (DES) engine operation [9].

In this paper, we have taken 80 mobile nodes and IEEE 802.11g WLAN Standards are considered to simulate the environment and evaluate and analyze the performance of different MANET routing protocols. Figure 2 shows Riverbed scenario containing 80 WLAN nodes of the simulation environment. We have configured the mobile nodes to work in each scenario with 24Mbps of data rate and 1000* 1000 meters of network area, WLAN server, Application Configuration, Profile Configuration, Mobility Configuration, and other are wlan_wkstn_adv node models after that we assigned a IPV4 addressing to all nodes. Table 1 shows the simulation parameters.

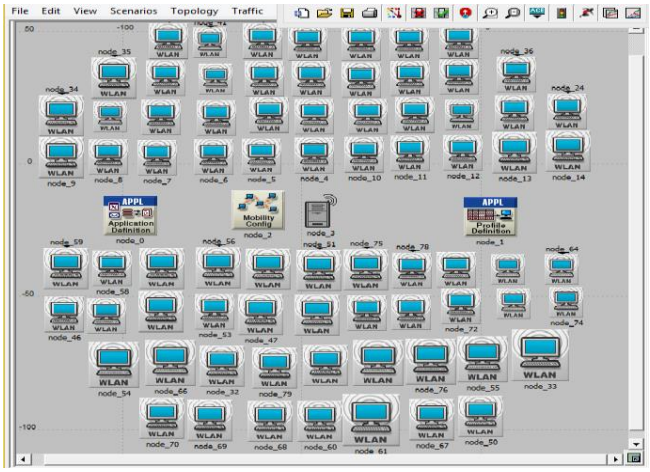

Figure 2: Riverbed environment scenario

Table 1: Simulation Parameters

Simulation Parameters	Values
Simulator	Riverbed Modeler
Simulation Kernel	Based on Kernel-type preferences
Network Area (m)	1000*1000
Number of Nodes	80
Mobility Model	Random way point
Data Rate (Mbps)	24
Standard	IEEE 802.11g
Traffic Type	FTP (High Load)
Simulation Time	10 minutes
Addressing Mode	IPxV4
Transmit power	0.005
MANET Routing Protocols	AODV, DSR, OLSR and GRP
WLAN Parameters	
SRL	7
LRL	4
Seed	128
Buffer size	256,000

The performance assessment of the simulation result is analyzed as stated by various metrics and the analysis of various MANET routing protocols are useful for determining the performance metric quantities of a network. In this experimental study, the performance metrics RTS, RTR, E2E delay, network load, throughput, MA delay, retransmission attempts, and data dropped are employed.

4. COMPARATIVE SIMULATION RESULTS

The comparative simulation results of four different routing protocols scenarios AODV, DSR, OLSR, and GRP are considered with respect to the all performance metrics.

Figure 3 shows the 80 mobile nodes of network E2E delay, based on the results OLSR routing protocol shows very small or minimum delay (0.00011 sec) pursued by other protocols GRP and AODV. And the DSR protocol shows the highest or maximum value of delay which is 0.021 sec.

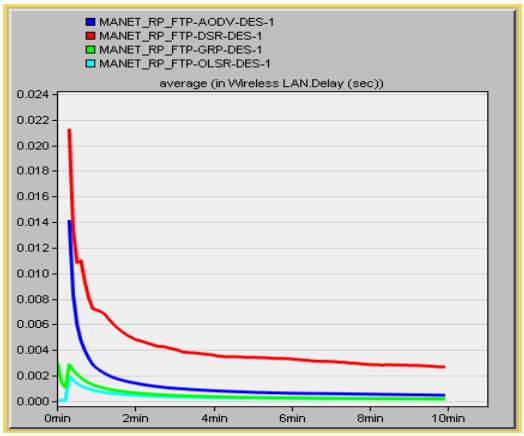

Figure 3: E2E delay of four routing protocols

Figure 4 shows MA delay for entire network, the GRP shows the very small or least MA delay (0.0075 sec) pursued by other protocols OLSR and AODV. And the DSR protocol shows the highest or maximum value of MA delay which is 0.054 sec.

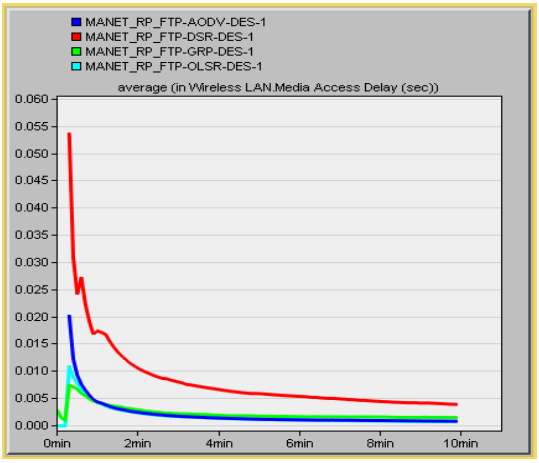

Figure 4: MA delay of four routing protocols

Figure 5 shows the network load for entire network, the AODV routing protocol shows least network load (647009 bits/sec) pursued by other protocols DSR, GRP, and OLSR. At the beginning of time all the protocols has moved with equal values.

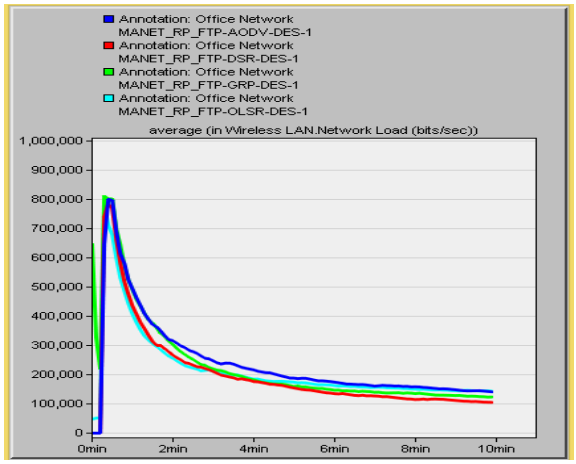

Figure 5: Network Load of four routing protocols

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Figure 6 shows the throughput for the entire network, DSR protocol shows the least or minimum throughput (911887 bits/sec) pursued by other protocols GRP and AODV. And the OLSR protocol shows the highest or maximum value of throughput since it is 4689661 bits/sec.

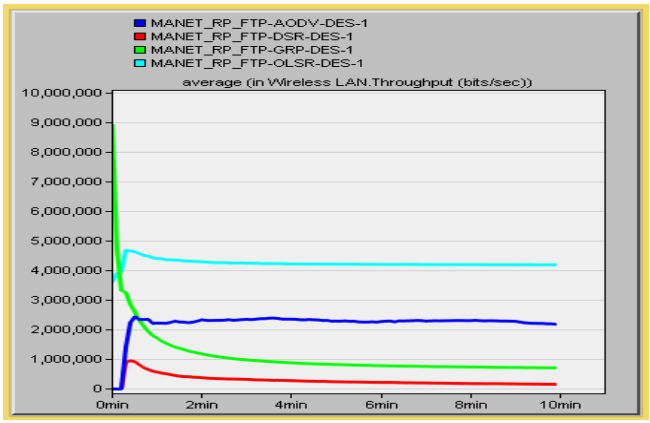

Figure 6: Throughput of four routing protocols

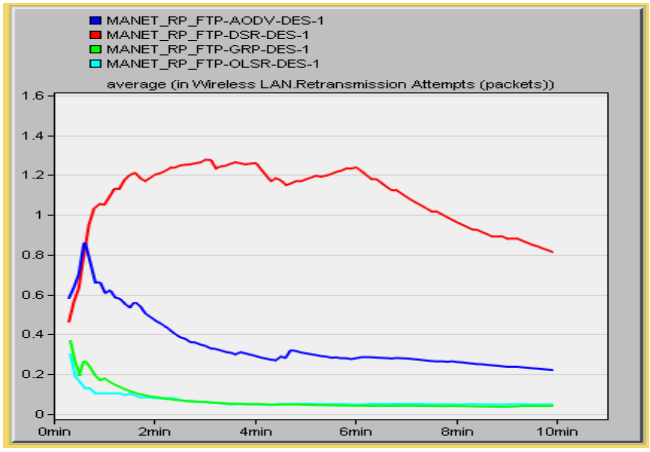

Figure 7: Number of retransmission attempts

Figure 7 shows retransmission attempts for 80 nodes, the OLSR routing protocol shows the least packets (0.104) pursued by GSR and AODV. The DSR protocol shows the highest value which is 1.25 packets.

Figure 8 shows the absolute data dropped for 80 nodes using file transfer protocol. The OLSR protocol shows the least data dropped (43005 bits/sec) whereas the rest of protocols are almost the same.

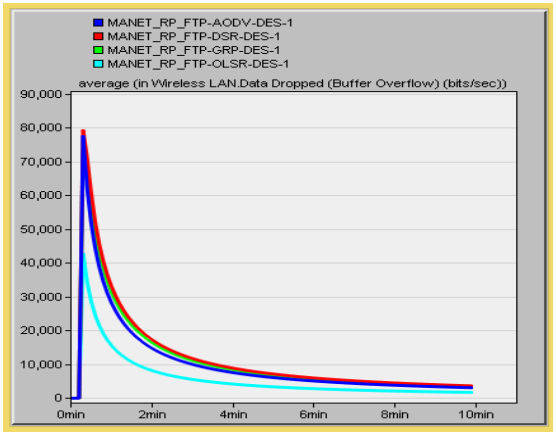

Figure 8: Data Dropped for four routing protocols

Figure 9 and Figure 10 are observed that OLSR protocol shows the highest or maximum amount of RTS and RTR into the network succeed by other protocols GRP, AODV, and DSR. In DSR protocol show the least amount of RTS (42857 bits/sec) and RTR (152340 bits/sec).

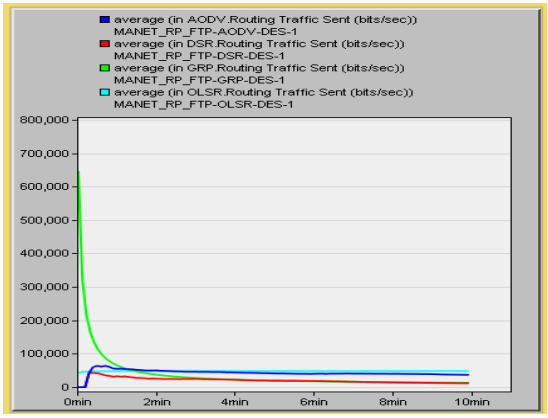

Figure 9: RTS of four routing protocols

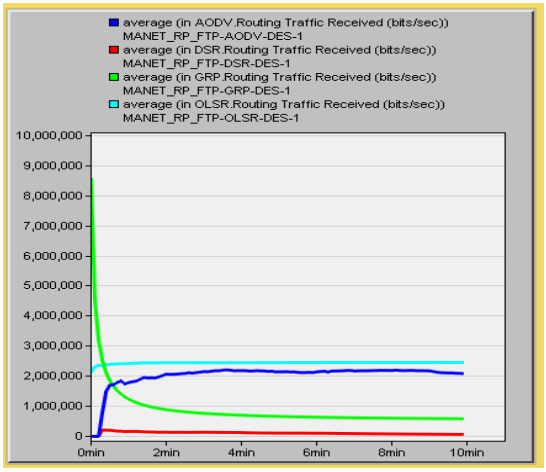

Figure 10: RTR of four routing protocols

The resulting analysis of OLSR, GRP, AODV, and DSR protocols are shown in table 2 with respect to the outputs from Riverbed modeler simulation. In these simulation experimental results, OLSR protocol shows the overall best performance comparatives with DSR, GRP, and AODV routing protocols.

Table 2: Simulation results under 80 nodes using FTP

Metrics	E2E Delay (sec)	Throughput (bits/sec)	Network load (bits/sec)	RTS (bits/sec)	RTR (bits/sec)	Data dropped (bits/sec)
AODV	0.014	1401929	647009	42867	1957214	77669
DSR	0.021	911887	740617	42857	152340	79684
GRP	0.003	3263504	812624	166917	1041098	75817
OLSR	0.001	4689661	784261	46937	2447473	43005

5. CONCLUSIONS

This paper presents the performance analysis and evaluation of mobile ad-hoc networks routing protocols using Riverbed Simulator Modeler. We have analyzed different routing protocols that are AODV, OLSR, GRP and DSR, on that we considered eight performance metrics from a MANET which are RTS(routing traffic sent), RTR(routing traffic received), network load, data dropped, throughput, E2E delay, MA delay, and retransmission attempts. From the simulation results, the OLSR protocol has performed better than the other three protocols AODV, GRP and DSR in terms of E2E delay, data dropped and throughput. OLSR protocol has the highest throughput which is 4689661 bits/sec, minimum data drop almost which is negligible and very low E2E delay (0.0011 sec) whereas DSR protocol shows the least throughput (911887 bits/sec) and high delay (0.021 sec) in all scenarios using FTP. All the performance metrics average values are taken from the graphs.

According to our simulation results, the comparative study of the above mentioned routing protocols shows that the OLSR protocol has performed better in the mobile ad-hoc network in different quality of service parameters.

REFERENCES

1. Gagangeet Singh, Sandeep Singh, “Comparative Analysis of AODV, DSR, GRP, OLSR and TORA by varying Number of Nodes with FTP and HTTP Applications over MANETs”, International Journal of Computer Applications, Vol.65, No.2, March, 2013.
2. Z G Al-Mekhlafi and R Hassan, “Evaluation study on Routing Information Protocol and Dynamic Source Routing in Ad-Hoc Network”, In Proceedings of 7th IEEE Conference on IT in Asia (CITA 2011).
3. P Ranjan, K K Ahirwar, “Comparative study of VANET and MANET routing Protocols”, In Proceedings of the International Conference on Advanced computing and communication Technologies (ACCT 2011).
4. Ashish Shrestha, Firat Tekiner, “On MANET Routing Protocols for Mobility and Scalability”, IEEE International Conference on Parallel and Distributed Computing, Applications and Technologies, December,2009.
5. H Ashtiani, et al., “A survey of MANET routing protocols in large scale and ordinary Networks”. In Global Journal of Computer Science and Technology, Vol. 10, No. 13, October, 2010.
6. Mchian A Ihasan, et,al., “Performance Investigation of three classes of MANET Routing Protocols”, In Proceedings of IEEE Asia Pacific Conference on Communication, Perth Western, Australia, 3rd -5th October, 2005.
7. Qasim Nadia, Said Fatin & Aghvami Hamid, “Mobile Ad Hoc Networking Protocol’s Evaluation through Simulation for Quality of Service”, IAENG International Journal of Computer Science, vol.36, No.1, 17th February, 2009.
8. Padmalaya Nayak et al., “impact of random mobility models for reactive routing protocols over MANET”, International Journal of Simulation Systems, Science & Technology, vol.17, No.34, 2016.
9. P.Manohara Rao, Y.Chalapathi Rao, M.Ashok Kumar, “Performance analysis of zigbee wireless sensor networks using riverbed simulation modeler”, 2nd IEEE International Conference On Inventive Systems And Control (ICISC-2018), January, 2018.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication