Throughput Performance Comparison of AODV, OLSR, TORA Mobile Ad Hoc Network Protocols Under the Random Walk Mobility and Random Way Point Model

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Abstract---Mobile ad hoc Network consists of mobile networks which create an underlying architecture for communication without the help of traditional fixed-position routers. MANET is group of mobile nodes which uses multi hop transmission for communication. Routing in MANET is challenging task, moreover presence of malicious nodes make the overall network very insecure furthermore dynamic nature of moving nodes adds to the complexity. Mobility of the nodes has substantial influence on the network performance. Present Paper reports the performance comparison of throughput in between Proactive routing protocol by focusing on Optimized Link State Routing (OLSR), Reactive Routing Protocol by focusing on Ad Hoc on Demand Distance Vector (AODV) and Temporally Ordered Routing Algorithm (TORA). The performance analysis of three Mobile Ad Hoc Network (MANET) routing protocols has been done under the two mobility models i.e. Random Walk Mobility Model and Random Way Point.

Keywords : MANET, AODV, OLSR, TORA, OPNET 14.5, Random Walk Mobility Model, Random Way Point Mobility Model.

I. INTRODUCTION

MANET stands for Mobile Ad hoc Network. It is a decentralized autonomous wireless system which consists of free nodes. MANET sometimes called mobile mesh network, is a self configurable wireless network. A MANET consists of mobile nodes, a router with multiple hosts and wireless communication devices. The wireless communication devices are transmitters, receivers and smart antennas. These antennas can be of any kind and nodes can be fixed or mobile. The term node referred to as, which are free to move arbitrarily in every direction. These nodes can be a mobile phone, laptop, personal digital assistance, MP3 player and personal computer. These nodes can be located in cars, ships, airplanes or with people having small electronic devices [1]. Nodes can connect each other randomly and forming arbitrary topologies. Nodes communicate to each other and also forward packets to neighbour nodes as a router. The ability of self configuration of these nodes makes them more suitable for urgently required network connection.

A. Ad-Hoc Routing Protocols

This section describes the main features of three protocols AODV (Ad hoc On-demand Distance Vector), OLSR (Optimized Link State Routing) and Temporally Ordered Routing Protocols Algorithm (TORA)deeply studied using OPNET 14.5.

1) AODV (Ad hoc On-demand Distance Vector)

AODV is an on-demand routing protocol. The AODV algorithm gives an easy way to get change in the link situation. For example if a link fails notifications are sent only to the affected nodes in the network. This notification cancels all the routes through this affected node. It builds unicast routes from source to destination and that's why the network usage is least. Since the routes are build on demand so the network traffic is minimum. AODV does not allow keeping extra routing which is not in use. If two nodes wish to establish a connection in an ad hoc network then AODV is responsible to enable them to build a multi-hop route. AODV uses Destination Sequence Numbers (DSN) to avoid counting to infinity that is why it is loop free. This is the characteristic of this algorithm. When a node send request to a destination, it sends its DSNs together with all routing information. It also selects the most favorable route based on the sequence number [2-4].

2) OLSR (Optimized Link State Routing)

It is a proactive routing protocol and is also called as table driven protocol because it permanently stores and updates its routing table. OLSR keeps track of routing table in order to provide a route if needed. OLSR can be implemented in any ad hoc network. Due to its nature OLSR is called as proactive routing protocol. All the nodes in the network do not broadcast the route packets. Just Multipoint Relay (MPR) nodes broadcast route packets. These MPR nodes can be selected in the neighbor of source node. Each node in the network keeps a list of MPR nodes. This MPR selector is obtained from HELLO packets sending between in neighbor nodes. These routes are built before any source node intends to send a message to a specified destination. Each and every node in the network keeps a routing table. This is the reason the routing overhead for OLSR is minimum than other reactive routing protocols and it provide a shortest route to the destination in the network. There is no need to build the new routes, as the existing in use route does not increase enough routing overhead. It reduces the route discovery delay [5].

3) TORA (Temporally Ordered Routing Algorithm)

TORA is a routing algorithm. It is mainly used in MANETs to enhance scalability. TORA is an adaptive routing protocol. It is therefore used in multi-hop networks. A destination node and a source node are set. TORA establishes scaled routes between the source and the destination using the Directed Acyclic Graph (DAG) built in the destination node. This algorithm does not use "shortest path" theory, it is considered secondary. TORA builds optimized routes using four messages. Its starts with a Query message followed by an Update message then clear

message and finally Optimizations message. This operation is performed by each node to send various parameters between the source and destination node. The parameters include time to break the link (t), the originator id (oid), Reflection indication bit (r), frequency sequence (d) and the nodes id (i). The first three parameters are called the reference level and last two are offset for the respective reference level. Links built in TORA are referred to as "heights", and the flow is from high to low. At the beginning, the height of all the nodes is set to NULL i.e. (-,-,-,-, i) and that of the destination is set to (0, 0, 0, 0, dest). The heights are adjusted whenever there is a change in the topology. A node that needs a route to a destination sends a query message with its route required flag. A query packet has a node id of the intended destination. [6]When a query packet reaches a node with information about the destination node, a response known as an Update is sent on the reverse path.

II. Simulation Setup

We have analyzed and observed the performance of MANET network under two scenarios with varying number of nodes and specific performance parameters. Parametric representation of both scenarios has been shown in Table. 1.

Parameter	Value
Simulator	Opnet 14.5
Area	3.5×3.5 Km
Wireless MAC	802.11
Number Of Nodes	50, 100
Mobility Model	Random Walk, Random Waypoint Mobility
Data Rate	11 Mbps
Routing Protocols	AODV,OLSR and TORA
Simulation Time	5 minutes
Traffic	CBR, VBR, TCP

Table. 1: Simulation parameters

III. Previous Work

In 2012, Vishal Sharma et. al [3] have evaluated the performance of AODV and DSR reactive routing protocols in MANET network using GSM quality voice traffic by calculating matrices such as voice end-to-end delay, network load, throughput and number of hops per route, route discovery time, and voice traffic-sent and -received using OPNET Modeler 14.5. From this paper it is concluded that AODV routing protocol has lowest end-to-end and lower network load as compare to DSR. Also, AODV has maximum average throughput and traffic received as compare to DSR. The DSR routing protocol does not scale well with large sized networks. Simulation results also showed that AODV reactive routing protocol is the best suited for MANET networks in dense population of nodes, whereas, DSR has very poor QoS in high populated node networks with GSM voice traffic data. In 2009, Liu Tie-yuanetal et. al [7] have presented a comparative study on entity mobility models. Firstly, both the advantages and disadvantages of four typical entity mobility models are summarized; these models include the Random Walk model (RW), the Random Way Point model (RWP), the Random Direction model (RD)and the Markov Random Path model (MRP). Secondly, focus on primary parameters of these models, effects of both the speed and the pause time on the performance metric of MANET routing protocols are analyzed. Finally, with the help of the NS-2 simulator, the effect of different entity mobility models on the performance of MANET routing protocols is analyzed.

IV. Results And Discussion

- **Throughput:** it is the time that the total size of useful packets that received at all the destination nodes. It is the total number of bits (in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

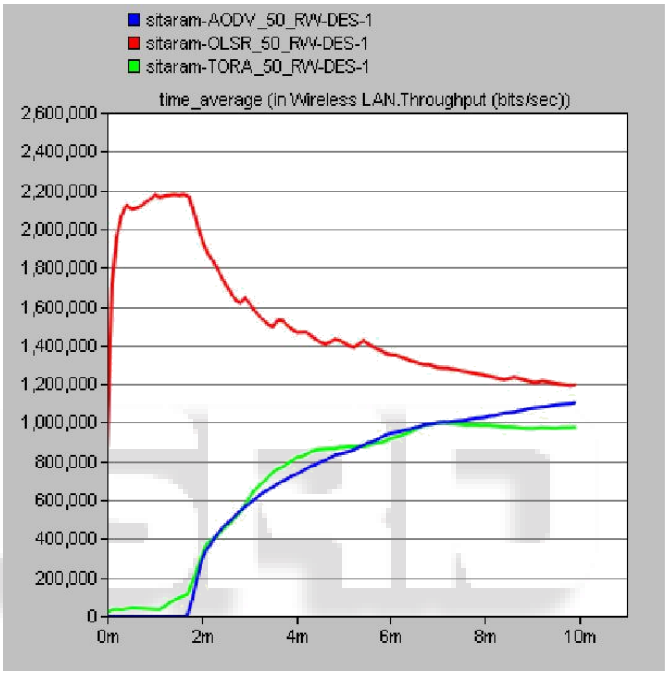

Fig. 1: Throughput (50 Nodes Random Walk)

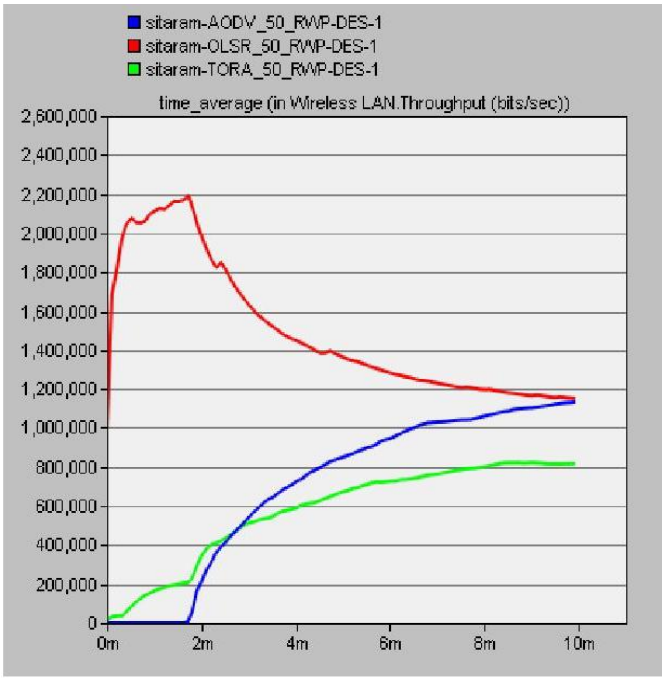

Fig .2: Throughput (50 Nodes Random Way Point)

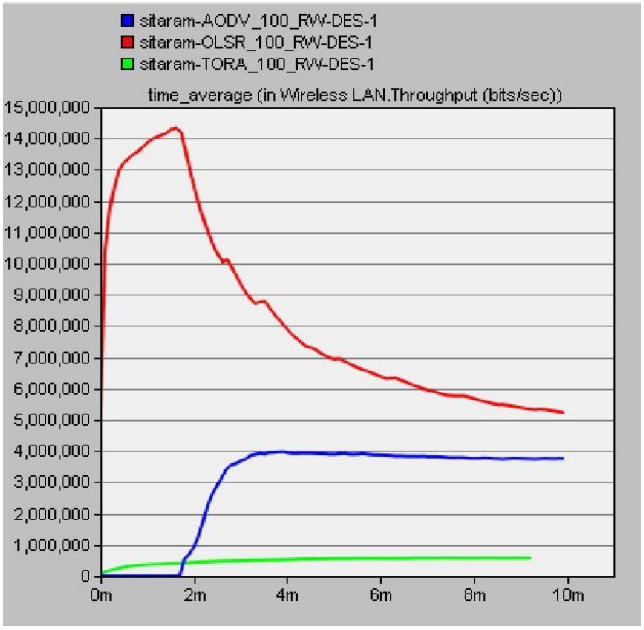

Fig. 3: Throughput (100 Nodes Random Walk)

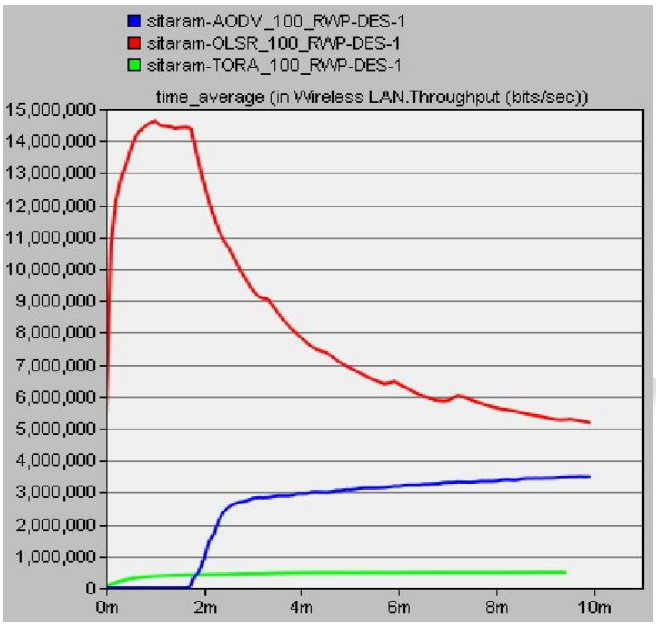

Fig. 4: Throughput (100 Nodes Random Way Point)

On the basis of above figures a comparisons table I.2 been made which is given below:

Throughput	AODV		OLSR		TORA	
	Random Walk	Random Way Point	Random Walk	Random Way Point	**Random Walk**	**Random Way Point**
50 Nodes	1,100,020	1,152,120	2,199,231	2,200,000	1,100,000	810,000
100 Nodes	4,000,000	4,000,050	14,223,652	14,754,326	810,231	721,326

Table. 2: Comparison of Various protocols' results

1) OLSR protocol outperforms both AODV and TORA protocol in 50 and 100 nodes simulation setup and is able to handle both Constant and variable traffic perfectly.
2) OLSR under Random Walk Mobility model gives slightly better results than random Way Point Model for 50 node setup. But for 100 nodes set up random Way Point plays slightly better.
3) On the other hand for TORA performance degrades in Random Way Point Mobility model than Random Walk in both 50 and 100 node simulation setup.

V. CONCLUSION

Present paper reports the performance of Throughput with two different mobility models i.e. Random Walk model and Random Way point Mobility model and TCP, CBR and VBR as traffic type while taking 50 and 100 as the node density.

A comparison of above has been made in between three Ad-Hoc Routing Protocols AODV (Ad hoc On-demand Distance Vector), OLSR (Optimized Link State Routing) and Temporally Ordered Routing Protocols Algorithm (TORA) deeply studied using OPNET 14.5.

From the extensive simulation results, it is found that OLSR shows the best throughput performance. Moreover, Random Way Point Model outperforms Random Walk Model for all three routing protocols i.e. AODV, OLSR and TORA in terms of throughput.

In future, the node density can be varied to study its impact on the performance of the routing protocols and thus check their efficiency as the nodes increase. Doing so would bring out the contrast between the two mobility models and thus help in making reaching accurate conclusions.

REFERENCES

[1] EM Royer, PM Melliar-Smith, and LE Moser. An analysis of the optimum node density for ad hoc mobile networks. In Proceedings of IEEE International Conference on Communications (ICC 2001), vol. 3, pages 857–861, Helsinki, Finland, June 2001.
[2] S. R. Biradar, Hiren H D Sarma, Kalpana Sharma, Subir Kumar Sarkar, Puttamadappa "Performance Comparison of Reactive Routing Protocols of MANETs using Group Mobility Model" IEEE (2009).
[3] Vishal Sharma, Harsukhpreet Singh "Performance evaluation of reactive routing protocol in MANET networks using GSM based voice traffic applications" Optik - Int. J. Light Electron Opt Elsevier pp. 201-204 June 2012.
[4] Vasudha Arora et. al. "Performance Evaluation of Routing Protocol for MANETs under different traffic conditions" IEEE 2nd International Conference on Computer Engineering and Technology vol. 6, pp.79 - 84, 2010.
[5] Ying Ge,"Quality of Service Routing in Ad-Hoc Networks Using OLSR" Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS"03)0-7695-1874-5/03 $17.00 © 2002 IEEE.
[6] Priti Garg, et. al. "Comparative Performance Analysis of Two Ad-hoc Routing Protocols", International Conference on Network and Electronics Engineering IPCSIT vol.11, pp 99-104, 2011.
[7] Liu Tie-yuan CHANG Liang, Gu Tian-long "Analyzing the Impact of Entity Mobility Models on the Performance of Routing Protocols in the MANET". IEEE (2009).

