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Performance Evaluation with Throughput and Packet Delivery Ratio for Mobile Ad-hoc Networks

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Abstract: Protocols are used to maintain data integrity, delivery, throughput and packet drop ratio in mobile ad-hoc network. It is most important to study performance metrics factors like throughput and packet drop ratio of proactive and reactive protocols in mobile ad-hoc network. In this paper, a comparative performance analysis is based on protocols like the Dynamic Source Routing, the Ad-hoc On-demand Distance Vector, the Destination Sequenced Distance Vector and the Optimized Link State Routing protocols using NS2 simulator.

Keywords: Ad-hoc routing protocols, Throughput, Packet Delivery Ratio, AODV, DSDV, DSR, OLSR.

I. INTRODUCTION

Mobile Ad-hoc networking is an emerging technology that allows each node can connect by wireless communication links, without any base station [8]. Mobile Ad-hoc networking have several characteristics bandwidth, energy and physical security are limited and topology dynamics. Therefore the routing protocols used in wired network are not suited for mobile Ad-hoc networking. Many routing protocols have been proposed for mobile Ad-hoc networking can be classification as reactive and proactive protocols [3]. In Reactive are only discovered when they are actually needed. In contrast, in proactive routing each node continuously maintain route between pair of nodes. In this paper focused on Ad-hoc On-demand Distance Vector and Dynamic Source Routing as reactive protocol and Destination Sequenced Distance Vector and Optimized Link State Routing as proactive protocol. Ad-hoc On-demand Distance Vector is an on-demand routing algorithm. When a node needs to send data to a specific destination it creates a Route Request and broadcast. Next nodes create a reverse route for itself for destination. When the request reaches a destination node it creates again a Reply which contains the number of hops that are require to reach the destination. All nodes forwarding this reply to the source node create a forward route to destination [3].

Dynamic Source Routing is a reactive protocol as Ad-hoc On-demand Distance Vector protocol. Difference in Ad-hoc On-demand Distance Vector and Dynamic Source Routing is that Ad-hoc On-demand Distance Vector only stores address of next node to the destination but Dynamic Source Routing stores complete path from source to destination including all the intermediate nodes. Source of the packet discovers the route through which to forward the packets. Sender carries in data packet header the complete ordered list of nodes through which the packet must pass [4][2].Destination Sequenced Distance Vector It is a table-driven routing scheme for Ad-hoc mobile networks based on the Bellman-Ford algorithm [6]. Each node maintains a routing table listing for all destinations and number of hops to reach destination. Routing table contains the sequence number assigned by destination node. The sequence number is used to avoid loop formation and distinguish stale routes from new ones. The stations periodically transmit their routing tables to their immediate neighbors. The routing table updates can be sent in two ways: a “full dump” or an “incremental” update [3].The Optimized Link State Routing is a table-driven, proactive routing protocol developed for Mobile Ad-hoc networks. Optimized Link State Routing uses the concept of Multi point Relays to reduce the effect of flooding messages to all nodes in the network, Optimized Link State Routing selects a subset of nodes to be part of a relaying backbone. Optimized Link State Routing works with a periodic exchange of messages like Hello messages and Topology Control message only through its Multi point Relays. So, contrary to classic link state algorithm, instead of all links, only small subsets of links are declared [6][3].

II. LITERATURE REVIEW

Research experiments are performed using different simulators and mobility models across a number of performance metrics. The literature is high focused on Throughput and packet delivery ratio as shown in the following.

Layuan et al. have discussed throughput with other metric like average delay analysis, jitter analysis, loss ratio analysis, routing load analysis, analysis and Connectivity analysis on performance of protocols like Ad-hoc On-demand Distance Vector, Dynamic Source Routing, Destination sequenced distance vector and Temporally-Ordered Routing Algorithm. The simulator is implemented with the network simulation version 2 for evaluating routing protocols. Using network size with 10, 20, 40, 50, and 100 mobile nodes placed randomly within a 1000 m x 1000 m area. The node mobility speed is varying between

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0 and 40 m/s and the pause time is 0 s. Each simulation executes for 300 s. It is concluded that Temporally-Ordered Routing Algorithm has a lowest routing load and a good scalability. Dynamic Source Routing has a less loss ratio, a large throughput and a long delay, which is suitable to the medium scale network environment without higher delay demand. Because Destination Sequenced Distance Vector must maintain the entire situation information, when topology changes frequently and network size increases, the increment of routing load is very quickly, and it is not fit for large-scale and high-speed moving wireless environment. Ad-hoc On-demand Distance Vector displays the smallest delay and loss ratio and the greatest throughput [1]. Azzedine have studied and compared the performance of Ad-hoc On-demand Distance Vector, preemptive Ad-hoc On-demand Distance Vector, Cluster based routing protocol, Dynamic Source Routing, and Destination Sequenced Distance Vector on throughput and delay using a variety of workload such mobility, load and size of the ad-hoc networks[2]. Asma et al. have used throughput, average end to end delay, routing load and packet received to compare the performance of Destination Sequenced Distance Vector, Ad-hoc On-demand Distance Vector and Dynamic Source Routing protocols when packet size changes, when time interval between packet sending changes, when mobility of nodes changes using network simulator NS2.34. Simulations show that Destination Sequenced Distance Vector protocol is very low throughput and routing load is very high as compared to Ad-hoc On-demand Distance Vector and Dynamic Source Routing protocols. There is no effect on the performance of Destination Sequenced Distance Vector protocol if packet size varies. Ad-hoc On-demand Distance Vector and Dynamic Source Routing protocols perform better at less packet size. Performance of all three protocols decrease as mobility of nodes increases [4].

The delay, throughput, control overhead and packet delivery ratio are the four measures used by Mohapatra et al. for the comparison of the performance of Ad-hoc On-demand Distance Vector, Dynamic Source Routing , Optimized Link State Routing and Destination Sequenced Distance Vector protocols using NS2 simulator[3]. Ramesh et al. have compared reactive and proactive routing protocol for mobile ad-hoc network. Throughput and delay are the measures used for the comparison of the performance of Ad-hoc On-demand Distance Vector and Dynamic Source Routing protocols [7]. Singh et al. Evaluation the performance Ad-hoc On-demand Distance Vector and Dynamic Source Routing and DYMO was done across parameters like Throughput, Total Packet Received, Average Jitter, Packet Drop Ratio and End to End Delay with variations in Pause Time of network [6].
The performance of reactive protocols like Ad-hoc On-demand Distance Vector, Dynamic Source Routing and Temporally-Ordered Routing Algorithm was analyzed by Tamilarasan across parameters like Packet Delivery and Average end to end Delay. The simulations were performed using Network Simulator 2. The mobility model uses 'random waypoint model' in a rectangular filed of 500m x 500m with 50 nodes. Simulations show that Ad-hoc On-demand Distance Vector has the best all round performance. Dynamic Source Routing is suitable for networks with moderate mobility rate. It has low overhead that makes it suitable for low bandwidth and low power network. TORA is suitable for operation in large mobile networks having dense population of nodes. [8].

III. SIMULATION SETUP

The simulations were carried out with NS-2 simulator. In order to understand the effect of varying pause time on the various efficiency parameters, especially Packet Delivery Ratio and Throughput of the ad-hoc routing protocols, we using pause time scenario of 0, 10, 20, 30, 40, 50 seconds with each 25 and 50 nodes for Ad-hoc On-demand Distance Vector,, Destination Sequenced Distance Vector, Optimized Link State Routing and Dynamic Source Routing protocols.

The following metrics were employed for the purpose of performance analysis of protocols:

Throughput: It is the number of packets/bytes received by source per unit time. It is an important metric for analysing network protocols.

Packet Delivery Ratio (PDR): It is the ratio of actual packet delivered to total packets sent.
The following table shows the values of the various parameters used during simulation of these protocols.

Table1
Values for Simulation Parameters

Parameters	Values
Routing protocols	AODV, DSDV, DSR, OLSR
No. of Mobile Nodes	25,50
Simulation Period (s)	150
MAC type	802.11
Avg speed (m/s)	11.40
Pause Time (s)	0, 10, 20, 30 , 40 , 50
Initial node energy (J)	1000
Max Connections	10
Connection Type	CBR
Simulation area	500 x 500

IV. SIMULATION RESULTS

The following tables show the results obtained under different simulations performed for these protocols.

Table 2
PDR for 25 Nodes

Pause time	AODV	DSDV	DSR	OLSR
0	99.85	97.78	100	100
10	99	88.48	98.6	98.77
20	99.46	76.08	99.4	99.56
30	99.55	89.58	100	99.01
40	98.76	74.68	99.3	99.02
50	99.16	82.8	99.4	99.95

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Table 2 and Figure 1 show the results of packets delivery ratio for all protocols. Most of these protocols maintain a high packet delivery ratio except Destination Sequenced Distance Vector which shows a major difference in PDR values as compared to the other protocols. The best PDR results for Destination Sequenced Distance Vector are observed for 0 pause time scenario only and for higher values of pause time its PDR is reasonably lesser against other protocols. The Optimized Link State Routing protocol maintains a consistent high PDR for all cases of pause time values.

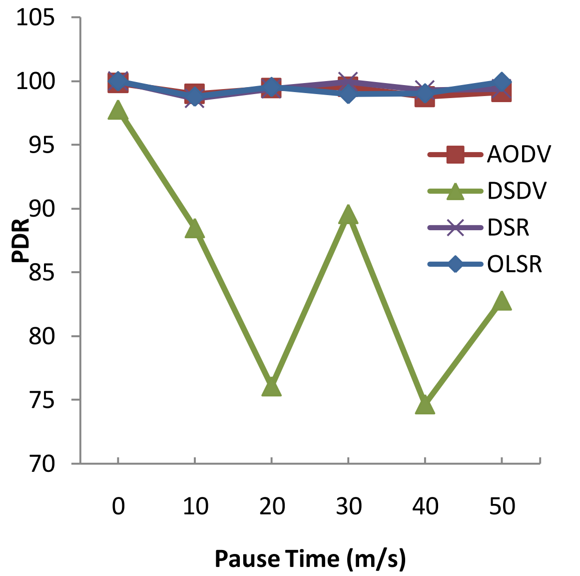

Figure 1: PDR vs. Pause Time for 25 Nodes

Table 3
PDR for 50 Nodes

Pause time	AODV	DSDV	DSR	OLSR
0	99.21	86.46	100	99.7
10	99.3	81.23	97.7	99.55
20	99.66	92.2	99.8	100
30	99.31	86.72	99.1	99.55
40	98.83	82.26	98.4	99.06
50	99.31	89.38	99.9	100

By increasing the number of nodes to 50, a similar pattern is observed in almost all the protocols as show in Table 3. Here we observe a similar sharp declining trend of delay in case Destination Sequenced Distance Vector as show in Figure 2. This low packet delivery ratio is consistently there for all scenarios of pause time. However, here again Optimized Link State Routing outperforms other protocols in terms of PDR by maintaining its high values for all cases of pause time. In fact it is been observed that the packet delivery ratio of Optimized Link State Routing improves by some margin when the number of nodes are increased to 50. Even for some scenarios of pause time Optimized Link State Routing achieves 100% PDRs.

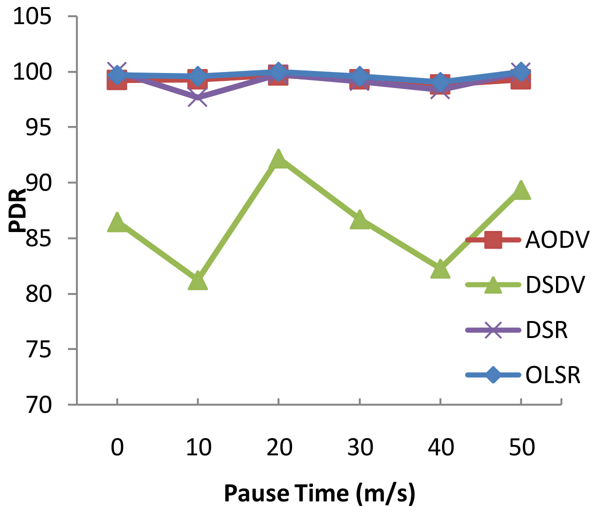

Figure 2: PDR vs. Pause Time for 50 Nodes

Table 4, 5 and Figure 3, 4 show the performance of the protocols under consideration in terms of throughput (kbps) with 25 & 50 being the values of number of nodes respectively.

Table 4
Throughput for 25 Nodes

Pause time	AODV	DSDV	DSR	OLSR
0	56.58	55.92	54.54	57.96
10	55.9	50.45	54.68	56.68
20	57.34	45.33	55.19	58.78
30	56.35	59.03	54.75	56.86
40	56.16	44.2	54.68	56.91
50	57.68	50.26	54.27	56.49

The throughput results of Destination Sequenced Distance Vector again show major variations for different pause time values starting with an initial descent followed by some corrections in later scenarios. However consistency in results is observed for Optimized Link State Routing, Dynamic Source Routing and Ad-hoc On-demand Distance Vector,. In fact we observe a significant improvement for in throughput results for Ad-hoc On-demand Distance Vector, for 50 pause time scenario. We observe efficient Optimized Link State Routing throughput results which on an average are the best for 25 nodes case among all the other protocols. But when the number of nodes is increased to 50 we observe major changes in the results. The throughput performance of Ad-hoc On-demand Distance Vector, improves significantly with increase in number of nodes.

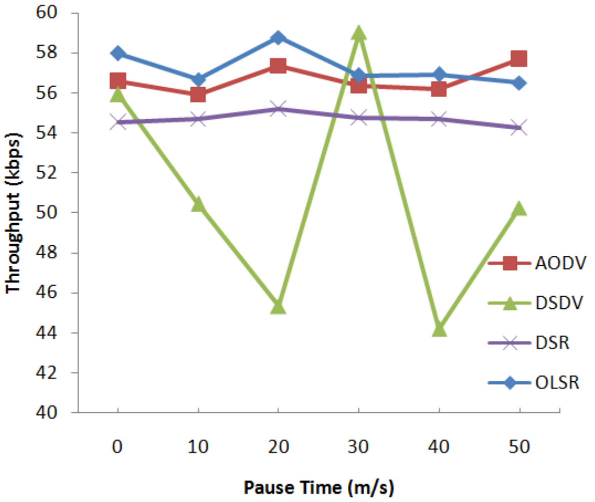

Figure 3: Throughput vs. Pause Time for 25 Nodes

Table 5
Throughput for 50 Nodes

Pause time	AODV	DSDV	DSR	OLSR
0	56.88	51.1	54.58	57.15
10	58.35	48.45	53.65	56.6
20	57.03	53.35	54.84	56.64
30	56.86	52.37	54.97	56.69
40	59.58	50.16	53.824	56.65
50	56.64	55.11	54.55	57.07

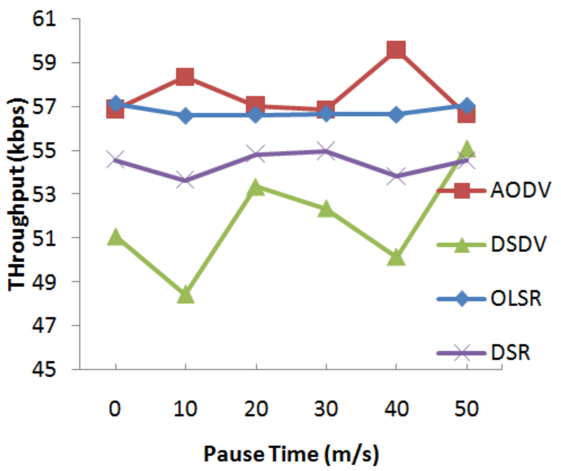

Figure 4: Throughput vs. Pause Time for 50 Nodes

In fact it achieves the individual best among all protocol even when its throughput declines for higher pause time scenario. Next best throughput results can be observed for Optimized Link State Routing which once again maintains consistency in its throughput. Dynamic Source Routing exhibits the next better throughput while even in t his case the throughput for Destination Sequenced Distance Vector is recorded to be minimum.

V. CONCLUSION

In this paper analysed that performance of Ad-hoc On-demand Distance Vector, Destination Sequenced Distance Vector, and Dynamic Source Routing & results Optimized Link State Routing on the basis metrics like of throughput and packet delivery ratio. These analyses were made while varying the value of pause time parameter. As per the analysis, the throughput results Optimized Link State Routing were the best for both cases of number of nodes. Hence they performed better than reactive protocols in these respects. These protocols show consistency in their throughput values, especially Optimized Link State Routing, which was rarely effected by changes in pause time or number of nodes. Another observation that can be made on the basis of these simulation data is that the maximum effect of change in pause time was seen on Destination Sequenced Distance Vector. The value for its metrics Packet Delivery Ratio and throughput showed deep variations as compared to other protocols.

REFERENCES

[1] Li Layuan, Li Chunlin and Yaun Peiyan, "Performance evaluation and simulations of routing protocols in ad hoc networks", Computer Communications, Elsevier, vol.30, pp.1890–1898, 2007.
[2] Azzedine Boukerche, "Performance Evaluation of Routing Protocols for Ad Hoc Wireless Networks", Mobile Networks and Applications, vol.9, pp. 333–342, 2004.
[3] S. Mohapatra and P.Kanungo, "Performance analysis of AODV, DSR, OLSR and DSDV Routing Protocols using NS2 Simulator", in proc. International Conference on Communication Technology and System Design, pp. 69-76, 2011.
[4] Asma Tuteja, Rajneesh Gujral and Sunil Thalia, "Comparative Performance Analysis of DSDV, AODV and DSR Routing Protocols in MANET using NS2", in proc. International Conference on Advances in Computer Engineering, pp. 330-334,2010.
[5] M. Shobana and Dr. S. Karthik, "A Performance Analysis and Comparison of various Routing Protocols in MANET", in proc. International Conference on Pattern Recognition, Informatics and Mobile Engineering (PRIME), pp 391-392, 2013.
[6] Gurpinder Singh and Jaswinder Singh "MANET: Issues and Behavior Analysis of Routing Protocols", International Journal of Advanced Research in Computer Science and Software Engineering, vol. 2, Issue 4, pp. 219-227, 2012.
[7] K.Ramesh Reddy,S. Venkata Raju and N.Venkatadri, "Reactive, Proactive MANET Routing Protocol Comparison" , International Journal of Video& Image Processing and Network Security , vol.12, pp. 22-27,2012.
[8] Tamilarasan-Santhamurthy, "A Comparative Study of Multi-Hop Wireless Ad-Hoc Network Routing Protocols in MANET", IJCSI International Journal of Computer Science Issues, vol. 8, Issue 5, pp. 176-184, 2011.