



Performance Comparison and Analysis of DSDV and AODV Using Different Performance Matrices

Neelu Kumari*, Rajni Choudhary

Department of Computer Science,
Govt. Mahila Engg. College, Ajmer, Rajasthan, India

Abstract— *Wireless networks are gaining very popularity in current research and application scenario. A mobile adhoc network is consist of self-configuring networking devices it means each device works as host and as a router in network. Each node helps to other nodes for conveying information.*

Routing is important task of MANET that provides better communication in MANETs. Performance of routing protocol evaluated based on different performance metrics such as Routing Overhead, Packet Delivery Ratio, Average Delay, and Packet Loss under different network scenario such as node density, mobility speed, network traffic.

Lots of issues are possible of packet loss in MANETs such as broken links, transmission errors, no route to the destination. AODV routing protocol uses two types parameter such as sequence number and hop count. Sequence number describes the fresh information of the network and hop count shows shortest routes. While DSDV is proactive routing protocol used for MANET applications.

My Objective of this research work is implementing of AODV and DSDV routing protocol for MANET application on NS-3 simulator and calculate performance parameters of quality of services (Packet Delivery Ratio v/s mobility, End to End Delay and Routing Overhead) and analysis in term of Quality of Services parameter for AODV and DSDV routing Protocol for MANET applications.

Keywords— *MANET, DSDV, AODV, QoS, PDR etc.*

I. INTRODUCTION

Mobile Adhoc networks is hot research topic in current research scenario in wireless Network technology and it is very reliable technology to enhance efficiency and to perform multiple applications in the area of communication among mobile nodes. [2]

The most common applications of wireless networks are Group Standard for Mobile communications (GSM) and Wireless Local Area Network (WLAN). Nodes are not arranged in any particular fashion in such networks. So to ensure better communication in between nodes, some routing protocols have been developed for such networks. These protocols also help to utilize the resources optimally.

Wireless networks are playing a major role in the area of communication. Wireless Networks enable the users to communicate and transfer data with each other without any wired medium.

In wired network physical medium exists and does not exist in wireless network. In general, wireless networking devices use of infrared or radio frequency signals to transfer information and resources between devices each other. Today many types of wireless devices are available such as mobile terminals, hand-held PCs, laptops, cellular phone, PDA, wireless sensors and satellite. Wireless networks are two types first is called infrastructure based wireless networks and second is called Infrastructure less network. Infrastructure less network is also called Ad-hoc Network. Ad-hoc networks [1], [15], [17] can be classified in three categories based on applications; Mobile Ad-hoc Networks (MANETs), Wireless Mesh Networks (WMNs), Wireless Sensor Networks (WSN). Wireless networks became very popular due to lots of factors such as ease of installation, reliability, cost, bandwidth, total required Power, security and network performance. Another Research Issues is security from introduces of malicious fictional activity in wireless sensor network. Due to malicious activity, the information among node may be theft or modified and communication may be interrupted.

II. RELATED WORK

A. Routing:

The requirement of ad hoc routing protocol was felt because ad hoc networks are self organizing, decentralized. Also the possibilities of change in topology make the necessity of ad hoc routing protocol more prominent. Pure flooding mechanism, all the nodes retransmit each packet received, which leads to poor resource consumption as available bandwidth is used very badly and the rate of collision is significantly high.

The ad hoc routing protocols are generally classified in two broad categories, the reactive protocols and the proactive protocols.

1) *Ad-Hoc Routing*: The main goal of an ad hoc network routing algorithm is to correctly and efficiently establish a route between a pair of nodes in the network. So that a message can be sent according to the expected Quality of Service (QoS) parameters such as Packet Delivery Ratio (PDR), Routing Overhead and End-to-End Delay. The establishment of a route among the nodes should be done with minimum overhead and bandwidth consumption. The highly dynamic topology changing nature of mobile ad hoc networks creates difficulty and complexity to routing among the mobile nodes within the network [10], [11], [16].

2) *Classification of Routing Protocols*: Routing Protocol is classified into two approaches: proactive routing protocol and reactive routing protocol.[3]

a) *Proactive (Table Driven) Routing Protocol*: Proactive routing protocol aim to keep consistent and up-to-date routing information between every pair of nodes in the network. Each node in the network maintains this routing information in one or more routing tables. So this protocol is called table driven approach. Proactive routing have the advantage that routes are available at all times. But these protocol have more routing overhead due to its periodic update message procedure. Examples of proactive routing are Destination Sequenced Distance Vector(DSDV) [4], [20].

b) *Reactive Routing Protocol*: While Reactive routing protocols have less overhead comparative Proactive routing protocol because it maintains information for active routes only in the network. It means routes are determined on demand. Source node needs to send data packets to some destination first it checks its route table whether it has a route or not. If no route exist it finds a path to the destination by route discovery process. AODV is example of reactive routing protocol [5].

Shima, Hassan, Patel, Razali [3] done research on Routing protocols in MANETs and performed analysis on routing for MANETs to ensure that the protocols provide efficient end-to-end communication because of the diverse nature of the applications which use MANETs. Table-driven and On-demand routing strategies for certain protocols have been compared and it comes out that no particular algorithm is best suited for all scenarios.

Anita et. al.[6] had presented a new security attack and analysis that MANETs are attack prone in nature and Wormhole attack is one the most critical possible attacks. Wormhole attack in a wireless network can be very destructing as a virtual tunnel is created by malicious colluding nodes. These tunnels present shorter links in network. This may impact transmission of packets. The certificate based authentication strategy has been applied on MADOV, Multicast Ad hoc On-demand Distance Vector Protocol and the design for Worm Hole Secure MADOV (WHS-MADOV) has been prepared. The PDR tests show that the mobile network with WHS-MADOV is much more secure than the networks without MADOV.

III. PROBLEM DEFINITION

Though ad hoc networks are very useful at one end, however on the other end there are many problems associated with them.

- Due to vary mobile nature of ad hoc networks, higher movements are possible which cause frequent disconnection of links. Also due to mobility routing becomes the main issue.
- Because of the broadcast environment, interference is high. So the network becomes less reliable.
- As we know that in ad hoc networks bandwidth is low, so transmission rate is generally low.
- As compared to wired networks, the speed in ad hoc networks is slow. This is a reason of degraded quality of service.
- Since bandwidth availability is low, and speed is slow, hence these networks take more time in connection setup.

Due to above challenges and research issues, the problem arises of requirement of best performance technique for Mobile adhoc network applications. The efficient Route discovery of destination node from source node and maintenance of route between source and destination should be required for Manet's application [11].

Performance of Quality of services issues in network communication can decided by calculating of different performance parameters like delivered packets, dropped packets or packet delivery ratio, end to end delay, routing overhead [10], [14]. The calculation of these parameters for mobile adhoc network can help in better understanding of efficient uses and behavior of various routing protocols for different circumstances for MANETs.

IV. PROPOSED WORK

AODV and DSDV are the routing protocols with various performance metrics that are evaluated with NS-3 and then a comparison between the two is made to determine which protocol works best in the required application.

The Ad Hoc On-Demand Distance Vector (AODV) [5] Routing Protocol provides route discovery process on demand in mobile ad hoc networks. This routing protocol uses control message such as Route Request (RREQ), Route Reply (RREP) for route Discovery phase and Route Error (RERR) for route maintenance [8], [18].

DSDV routing protocol is distance vector, table driven based on Bellman ford routing procedure. It provides loop free routes. DSDV protocol also avoids counting to infinity problem by using sequence number. Nodes increment its sequence number when there is change occur in neighborhood like that link addition or removal. Each node maintains a route to every other node in the network because DSDV nature is proactive [9], [10], [19].

V. SIMULATION AND RESULT

For the performance analysis the ns-3 simulator is used. Ns-3 Simulator the Network Simulator (NS-3) is discrete-event in which simulation core and different models are implemented in C++ [7]. ns-3 has built in library which can be

linked statically and dynamically to a C++ program. NS-3 is not supported backward NS-2. All API of Ns-3 are implemented in python programming language.

Ns-3 simulator generates packet capturing file with extension .pcap. Packet capturing file can be read by following tools.

- Wireshark.
- Tcpdump

1) Performance Evaluation of DSDV & AODV: Routing concepts is basically includes two process first determining the optimal path and second is forwarding information. It is difficult to say which routing protocol is efficient and optimal under different network scenario such node density, traffic load and mobility speed. Here I have evaluated the performance of AODV, DSDV by using different performance metrics such as Routing Overhead, Packet Delivery Ratio, Average End-to-End Delay and Packet Loss via simulation [10], [12], [13]. I have created a network with following Simulation parameter for performance evaluation of routing protocol shown.

Table I Experimental Simulation Setup Parameters

Parameter	Value
Simulator	NS – 3
Number Of Nodes	30
Simulation Time	100 Sec
Simulation Area	1000X1000
Packet Size	1000 Bytes
Packet Rate	5 packet/sec
Mobility Model	Random Way Point Mobility Model
Routing Protocol	DSDV, AODV
Speed	10 m/s
Pause	2 sec

2) Result: The results are observed in experimental process of routing protocol in environment of ns3 are shown in following tables.

Table II Simulation Results: Routing Overhead and Avg. End to End Delay for Aodv Routing Protocol

Routing Protocol	Data Packet	Control Packet	Routing Overhead	Average End To End Delay (Sec)
AODV	99	495	83.33	.0013

Table III Simulation Results: Routing Overhead and Avg. End to End Delay for DSDV Routing Protocol

Routing Protocol	Data Packet	Control Packet	Routing Overhead	Average End to End Delay (sec.)
DSDV	99	2574	96.29	.0010

Table IV Simulation Results of PDR (%) for AODV with Speed (m/s)

Mobility Speed (m/s)	AODV (PDR%)
20	100
40	97.92
60	97.76
80	98.38
100	98.93

Table V Simulation Results of PDR (%) for DSDV with Speed (m/s)

Speed(m/s)	PDR (%) for DSDV
20	98.85
40	95.2
60	92.8
80	95.2
100	98.4



Fig. 1 Comparative analysis of PDR for AODV v/s DSDV against speed for MANET

3) Analysis: Performance Evaluation of routing protocol gives applicability and helps to identify which protocol is best suitable for a given scenario. I have calculated Packet Delivery Ratio, Routing Overhead and Average End-to-End Delay for AODV and DSDV via simulation [12], [13].

a) Routing Over Head: AODV routing protocol has less routing overhead comparison to DSDV. Because AODV only maintains active route information in the network [20]. While nature of DSDV is proactive and each node maintains topology information of other nodes in the network. DSDV routing have more control traffic volume. Simulation Result of Routing overhead of AODV and OLSR shown in graph 5.2

b) Average End-to-End Delay: Average End-to-End Delay tells possible Delay in the network b/w source and destination node and also provides quality of communication. DSDV routing are proactive nature it means all routes are available at all times. While in AODV routes are determined when needed. So DSDV has low delay than AODV. Because AODV takes time to decide the route.

c) Packet Delivery Ratio: Packet Delivery Ratio higher represents the better communication reliability. We can see AODV routing has more PDR comparison to DSDV. Because re-routing is less in AODV routing. When we increase mobility speed the lots of links are breaks and affect the packet delivery ratio.

VI. CONCLUSION AND FUTURE WORK

1) Conclusion: Here I have investigated various losses factor in mobile ad-hoc network by using network scenario via simulation. In these simulations for DSDV and AODV Routing protocol, we analyze packet loss problem by mobility factor. And how many packets are lost and received to destination node.

We have examined the performance of AODV and DSDV by varying different simulation parameter and measuring the performance metrics such as Packet Delivery Ratio, Average Delay, and Routing overhead. From this comparison each routing protocol has its own advantage and disadvantage. For proactive routing protocol such as DSDV, each node maintains up-to-date routing information in the network. So connection setup times are fast. But these routing protocols have large amount of routing overhead in the network due to periodic update message. On demand routing protocol such AODV reduces the traffic needed for routing but introduces delay due to route discovery process on demand. AODV routing protocol is highly adaptable in changing network topology.

2) Future Work: Adhoc Networking is a current topic in research area now days and so that mean there are so many issues which are remaining to be solved. Security is an important issue which should be solved as adhoc networks are decentralized, security must be considered at prime. Measurement of complexity can be taken as an issue in research. The performance analysis may be evaluated with other routing protocol like OLSR. There are some attacks possible in Optimized Link State Routing Protocol and Access on Demand Vector routing such as Black Hole attack and Select Forwarding attack and the detection of these attacks is desirable for avoiding loss in Packet Delivery Ratio, end to end delay and other Quality of services factors.

REFERENCES

- [1] A. Boukerche, "Performance Evaluation of routing Protocol for AdHoc Wireless Network", In International Conference on Mobile Network and Application, IEEE, 2004.
- [2] M.N Lima, A.L. Dos, Guy Pujolle, "A Survey of Survivability in Mobile Ad Hoc Networks", In International Conference on Communications Surveys and Tutorials, IEEE, 2009.
- [3] Shima, Hassan, Patel, Razali, "Comparative Review Study of Reactive and Proactive Routing Protocols in MANETs", In International Conference on Digital Ecosystems and Technologies, pp. 304- 309, IEEE, 2010.
- [4] C.E. Perkins and P. Bhagwat, "Highly dynamic destination-sequenced distance vector routing (DSDV) for mobile computers", Proceedings of ACM Sigcomm 94, 1994, pp. 34-244.

- [5] C.E. Perkins and E. M. Royer, "Ad-hoc On-Demand Distance Vector Routing," Proc. Workshop Mobile Computing Systems and Applications (WMCSA '99), Feb. 1999 pp. 90-100.
- [6] Anita, E.A.M. , Vasudevan, V. , "A certificate-based scheme to defend against worm hole attacks in multicast routing protocols for MANETs", in International Conference on Communication Control and Computing Technologies (ICCCCT), pp. 407-412, IEEE, 2010.
- [7] A. Wang and W. Jiang, "Research of Teaching on Network Course Based on NS-3", in proceedings of First International Workshop on Education Technology and Computer Science, 2009, pp 629-632.
- [8] Thriveni H.B., G. Manoj Kumar and Rinki Sharma, "Performance Evaluation of Routing Protocols in Mobile Ad-Hoc Networks with Varying Node Density and Node Mobility", in International Conference on Communication Systems and Network Technologies, pp. 252-256, IEEE 2013.
- [9] R. Rohankar, R. Bhatia and V. Shrivastava, "Performance Analysis of Various Routing Protocols (Proactive and Reactive) for Random Mobility Models of Adhoc Networks", in First International Conference on Recent Advances in Information Technology, IEEE 2012.
- [10] Md. Arafatur, Farhat Anwar "A Simulation Based Performance Comparison of Routing Protocol on Mobile Ad-hoc Network (Proactive, Reactive and Hybrid)", in International Conference on Computer and Communication Engineering, IEEE 2010.
- [11] I. Khahil, S. Bataineh and L. Qubajah, "Distributed Secure Routing Protocol for Mobile Ad-hoc Networks", in fifth International Conference on Computer Science and Information Technology, pp. 106-110, IEEE 2013
- [12] S.K. Gupta, Rohit Sharma and Dr. R. K. Saket, "Simulation and Analysis of Reactive Protocol around default values of route maintenance parameters via NS-3", In International Conference on Information Systems and Computer Networks, pp. 155-160, IEEE 2013.
- [13] A. Lee, C. G. Lavina, J. Caballero, Ilkyeun Ra, "Performance Analysis of Ad Hoc Routing Protocols based on Selective Forwarding Node Algorithms", IEEE 2013
- [14] Neha Gupta, Manish Shrivastava, "An Evaluation of MANET Routing Protocol", in International Journal of Advanced Computer Research, 2013.
- [15] N. Adam, M.Y. Ismail, Abdullah, "Effect of Node Density on Performances of three MANET routing protocol", In International Conference on Electronic Devices, Systems and Applications, pp.321-325, IEEE, 2012.
- [16] A. Suresh, K. Duraiswamy, "Scalable Instant way point routing protocol for MANET", In International Conference on Computing, Communication and Networking Technologies, IEEE, 2010.
- [17] Jabbehdari, Shamaei, "IQos-ODMRP :A Novel routing Protocol Considering Qos Parameter in MANET", In International Symposium on Industrial Electronics and Applications, pp. 126-130, IEEE, 2010.
- [18] Ibrahim, Nesar Ahmad, Salim Beg, "Performance Evaluation of TCP Reno and Vegas over different routing protocols for MANETs", In International Symposium on advanced networks and Telecommunication Systems, pp. 82-84, IEEE, 2010.
- [19] Kassim, M, Rahman, R.A.; "Mobile ad hoc network routing protocols comparison for wireless sensor network", IEEE International Conference on System Engineering and Technology (ICSET), Page(s): 148-152, IEEE, 2011.
- [20] Natarajan Meghanathan, "A MANET Multicast Routing Protocol for StableTrees based on the Inverse of Link Expiration Times", in the 9th Annual IEEE Consumer Communications and Networking Conference - Wireless Consumer Communication and Networking, pp 947-951, IEEE, 2012.