



Performance Evaluation of Reactive Routing Protocols with Malicious Behavior in MANET

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Mobile ad hoc network is one of the most promising fields for research and development as nodes may move in the network freely and can communicate or interchange information with some another nodes without any central control. As nodes are mobile in MANET and will have limited resources, it may be possible that they will not cooperate in the network after some time for saving their resources for their own use. Such type of nodes refers to misleading nodes.

The main objective of this paper is to analyse performances of two reactive routing protocols: AODV and AOMDV routing protocol with malicious behavior using various performance matrices. This paper also shows the impact of varying parameters on performances of both routing protocols.

Keywords: MANET, Misleading Nodes, Reactive Routing Protocols

I. INTRODUCTION

The current century is considered to be a new era in the field of technology. In the contemporary world, communication technology is becoming larger in which mobile ad-hoc network is one of the most promising fields for research and development. The concept of ad-hoc networking is gaining more popularity among the mobile users than ever before. Now a person can communicate and interchange information with any other person without using any infrastructure. All of this is possible due to technological development in wireless communication devices like mobiles, tab, laptops and notebook etc. MANET refers to a network in which nodes can move anywhere and interchange information with another mobile node without any administration.

Routing protocols play a very significant role in the network to find out valid routes and maintain them between any pair of node. For mobile networks, routing algorithms can be classified as Proactive, Reactive and Hybrid routing protocol. Proactive routing protocol is also known as Table Driven routing protocol which offers up to date information of routing and maintain consistency. Reactive routing is also known as On-Demand routing algorithm which offers communication between any pair of nodes when required using route discovery procedure and route maintenance mechanism. Third routing algorithm is a combination of both the routing protocols and provides advantages of both routing.

In this paper, reactive routing protocols such as AODV and AOMDV are analyzed with malicious behavior and for simulation work, NS 2.35 simulator is used. In this paper malicious nodes are fixed in the network and various performance matrices like PDR, Number of Dropped Packets and End to End Delay are used to evaluate performances of both routing protocols. Rest paper is organized as: Part 2 presents an overview of misleading nodes; Part 3 involves detail of both routing algorithms that are analyzed with malicious behavior. Part4 shows implementation and result while Part 5 contains conclusion and future work.

II. MISLEADING NODES

In MANET nodes are mobile and have dynamic topology means nodes may move anywhere freely in the network without any central control.

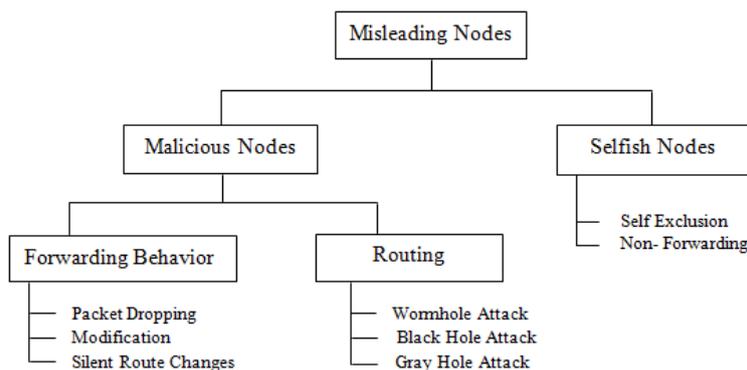


Fig 2.1: Types of Misleading Nodes

For the optimum performance, it is necessary that all the nodes in the network cooperate with others because these nodes has limited resources like limited memory and battery power, it may be possible that after some time node will not cooperate in the network for saving its resources for its own use. Given figure shows the classification of misleading nodes-

III. REACTIVE ROUTING PROTOCOLS

Main focus of this paper is on two reactive routing algorithms. These are -

- **AODV Routing Protocol:** AODV routing protocol refers to Ad Hoc on Demand Distance Vector routing protocol which is one of the example of reactive routing protocol. In this protocol nodes are free to move and may connect or disconnect to the network at any time. It involves route discovery procedure first then route maintenance process.

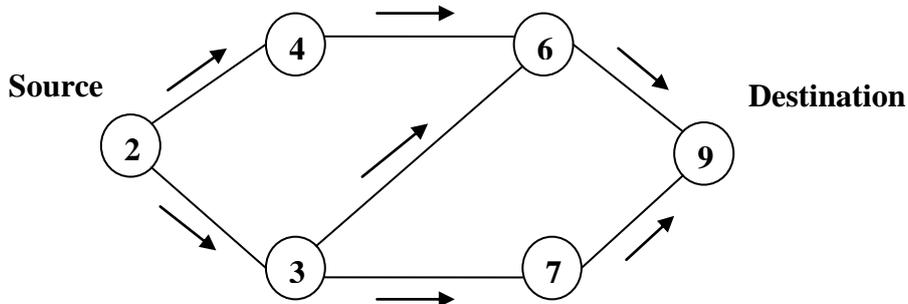


Fig 3.1: RREQ message broadcasting in AODV

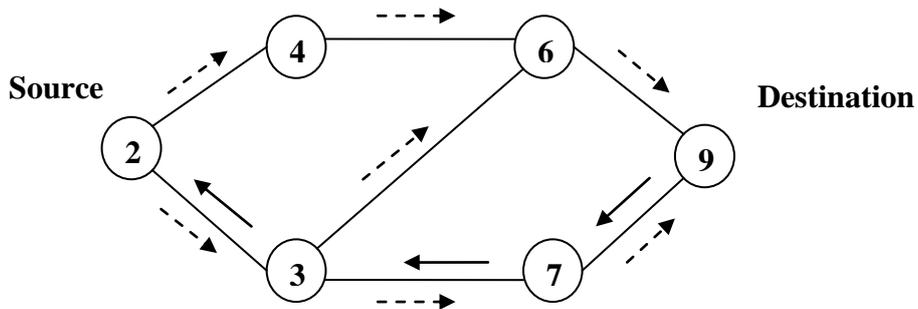


Fig 3.2: RREP message forwarding in AODV

Sequence numbers are used by AODV algorithm to know the freshness of routing information and these are maintained at every destination node.

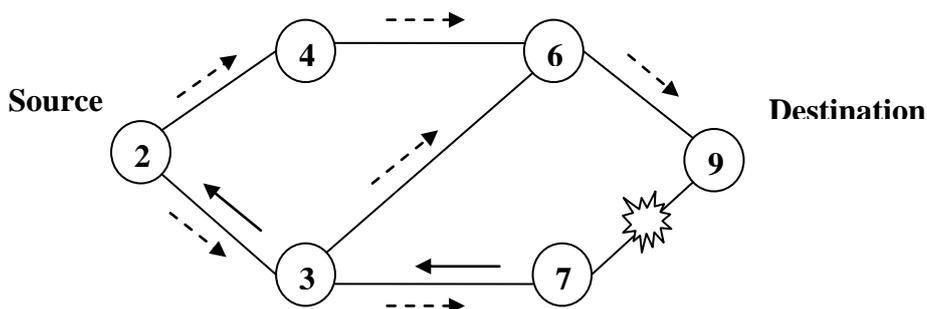


Fig 3.3: Route Maintenance in AODV

- **AOMDV Routing Protocol:** AOMDV refers to Ad Hoc on Demand Multipath Distance Vector routing protocol. It is also known as Multi path routing protocol. Because this protocol is an extension of ad hoc on demand distance vector routing protocol, it involves a route discovery procedure and maintenance mechanism. In a single route discovery process, AOMDV protocol offers more than one path because each RREP message is being considered by the source.

IV. IMPLEMENTATION & RESULT

NS 2 simulator is developed as a part of VINT (Virtual Inter Network Testbed) project at California University, Berkeley. NS 2.35 simulator is used for implementation work. Simulation setup table shows various parameters used for evaluating performances and their comparison.

TABLE 4.1 PARAMETERS FOR SIMULATION SETUP

Mobility Model	Random Waypoint
Simulation Area	1000 * 900
Simulation Time	400 Seconds
Number of Nodes	35, 45, 55, 65
Packet Size	512 bits
Speed	10, 20, 30, 40 m/s
Total Number of Malicious nodes	5
Packet Rate	4, 8, 12, 16 packet/second
MAC Protocol	802.11
Traffic Type	CBR
Pause Time	20, 40, 60, 80
Routing Protocol	AODV/ AOMDV

The main objective of this paper is to evaluate performances of both routing algorithms with malicious behavior using Packet Delivery Ratio, Number of Dropped Packets and End to End Delay matrices at varying parameters such as different – different speed, pause time, packet rate and number of nodes.

- **Packet Delivery Ratio:** It can be defined as the ratio of the packets received by the destination node to the number of packets sent by the source node. It can be calculated as

$$\text{Packet Delivery Ratio} = \frac{\text{Total number of Packets delivered to Destination}}{\text{Sent Packets}}$$
- **Number of Dropped Packets:** Number of Dropped packets is one of the important parameter for checking performance of protocol. It shows that how much packets are not received by the receiver. It can be calculated as-

$$\text{No. of Dropped packets} = \text{Number of Send Packets} - \text{Number of Received Packet}$$
- **End to End Delay:** It is the average time between packets sent and packets delivered to the destination which also includes queuing time, retransmission, and processing time. It can be calculated as-

$$\text{Average End to End Delay} = \frac{\text{Total Delay}}{\text{Received Packets at Destination}}$$

Above table for simulation setup shows that malicious nodes are fixed in the network while speed of the nodes, packets rate, pause time and number of nodes are varying. Except number of nodes, all the parameters are implemented on 54 nodes. There are 5 malicious nodes in the network. Impact of these parameters on performances of both AODV and AOMDV protocol with malicious behavior is shown in the result-

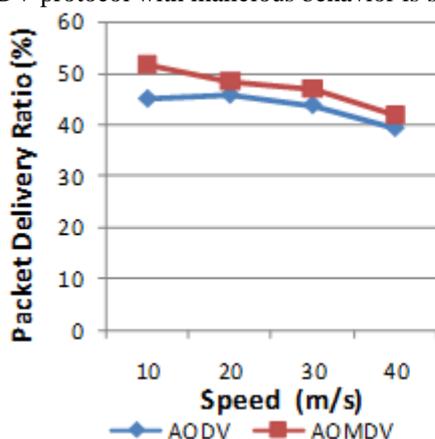


Fig 4.1: PDR vs. Speed

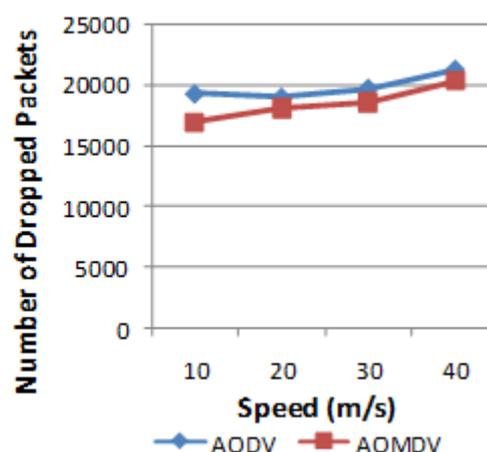


Fig 4.2: No. of Dropped Packets vs. Speed

Fig 4.1 shows that AOMDV reactive routing protocol offers better packet delivery ratio (PDR) than AODV routing protocol and also shows the impact of mobility on performances of both routing algorithms. Fig 4.2 shows that the number of dropped packets is higher in case of AODV than AOMDV and number of dropped packets increases as the speed of nodes increases. Fig 4.3 shows that End to End Delay is higher at mobility 10 m/s for both routing algorithms while at 40 m/s AOMDV provides less end to end delay as compare to AODV. Fig 4.4 shows impact of varying pause time on performances of both AODV and AOMDV.

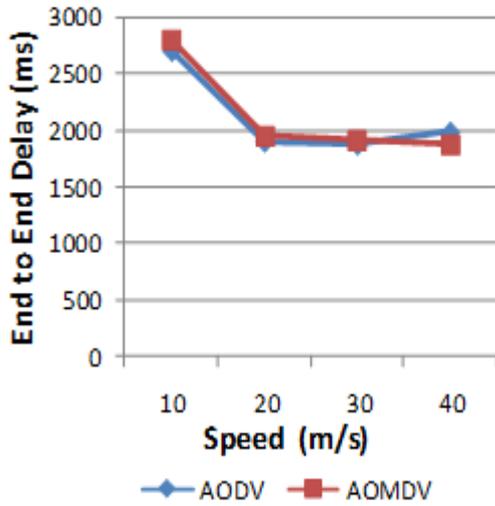


Fig 4.3: End to End Delay vs. Speed

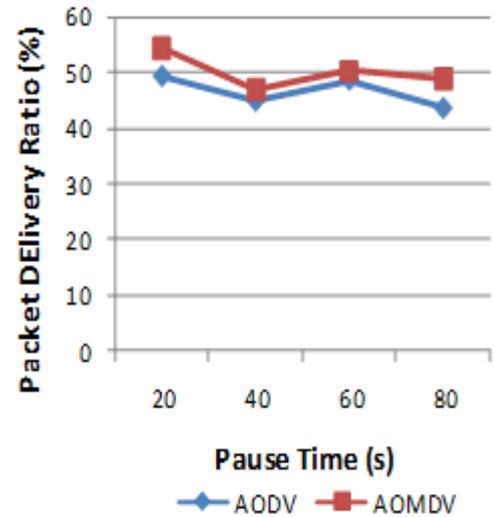


Fig 4.4: PDR vs. Pause Time

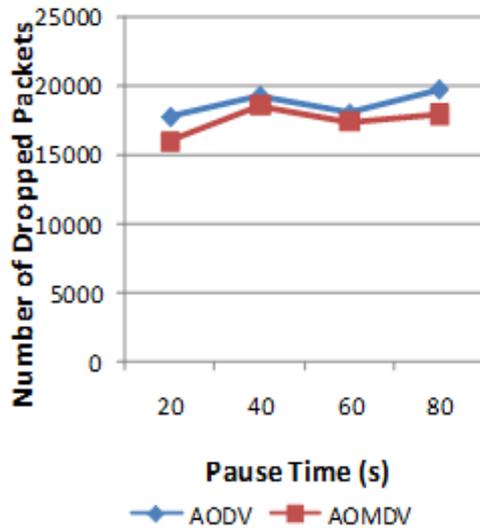


Fig 4.5: Number of Dropped Packets vs. Pause Time

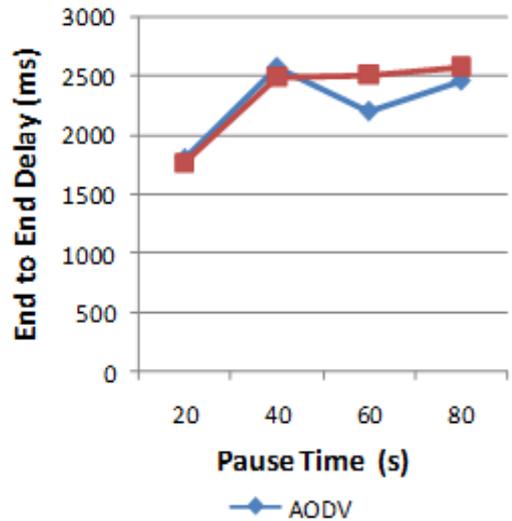


Fig 4.6: End to End Delay vs. Pause Time

Fig 4.5 evaluates the impact of varying pause time on both algorithms and compares that AODV gives higher number of dropped packets than AOMDV. Fig 4.6 shows that end to end delay for both routing algorithms is almost same between 20 to 40 pause times but after 40 AODV performs better and offer less end to end delay. Fig 4.7 and Fig 4.8 shows when there are 35 nodes in the network then AODV performs better in terms of packet delivery ratio and number of dropped packets but as the nodes increased the performance of AODV decreased.

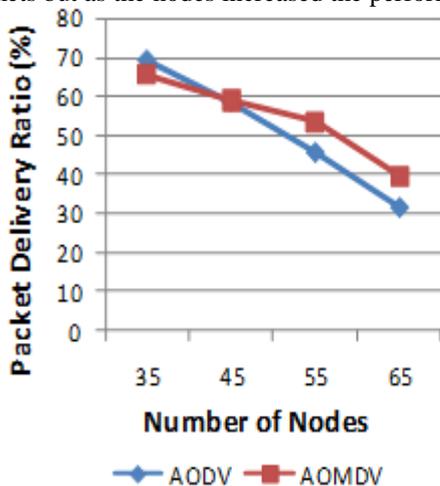


Fig 4.7: PDR vs. Number of nodes

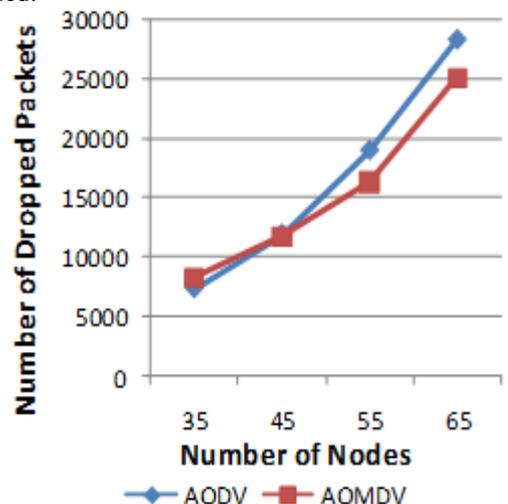


Fig 4.8: Number of Dropped Packets vs. Number of nodes

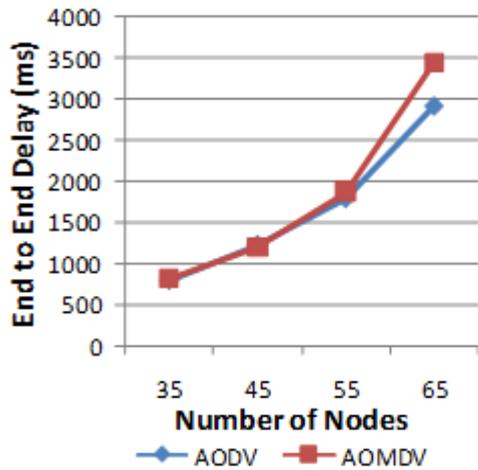


Fig 4.9: End to End Delay vs. Number of Nodes

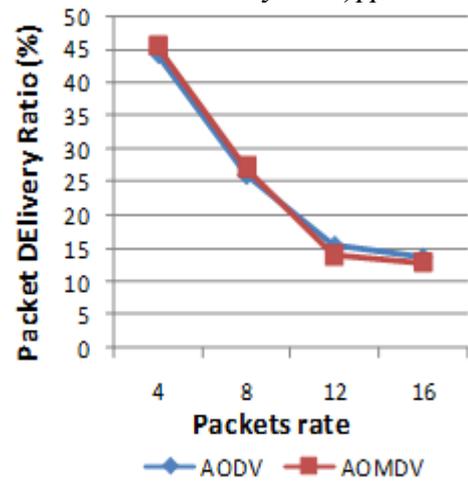


Fig 4.10: PDR vs. Packet rate

Fig 4.9 shows that when nodes are between 35 to 55, both routing protocols perform almost same in terms of end to end delay but after 55 nodes AOMDV performs poorer than AODV protocol. Fig 4.10 shows the PDR vs. packets rate and anyone can see the impact of varying packet rates on AODV and on AOMDV protocol. Performances of both algorithms are decreasing but AOMDV performs better as compare to AODV. Fig 4.11 and Fig 4.12 shows that when packets rate are changing than AOMDV performs better in terms of number of dropped packets while in case of end to end delay AODV performs better.

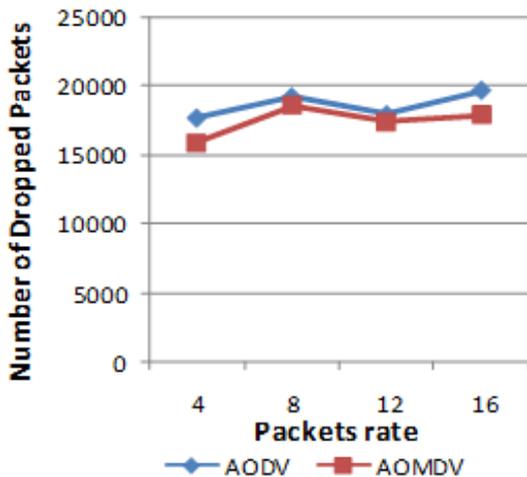


Fig 4.11: No. of Dropped Packets vs. Packet Rate

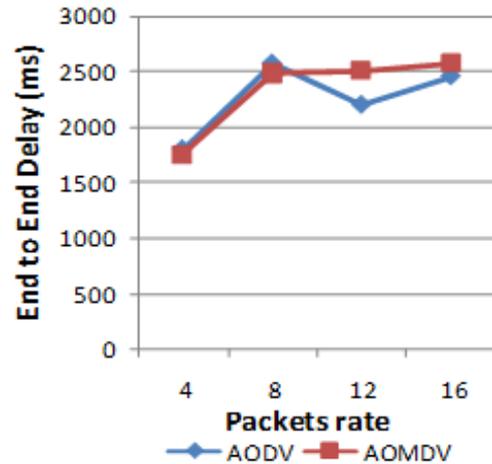


Fig 4.12: End to End Delay vs. Packet Rate

V. CONCLUSION & FUTURE WORK

Two reactive routing protocols AODV and AOMDV with malicious behavior are analysed with different – different parameters in this paper. Above simulation shows that when mobility of nodes is increased then performance of both routing algorithms decreases while number of dropped packets increases. AOMDV performs better than AODV protocol at varying pause time. When number of nodes was 35 in the network, AODV with malicious behavior offers better PDR, less number of dropped packets and end to end delay but as the number of nodes increases in the network like $45 \leq n \leq 65$, further, AOMDV performs better. In case of varying packets rate / second, AOMDV offers higher PDR and less number of dropped packets compare to AODV while AODV performs better for end to end delay.

Simulation work shows that AOMDV performs better than AODV in case of malicious behavior but sometimes AODV also performs better. A new mechanism can be developed that will be the combination of both routing algorithms and provide better result for above parameters.

REFERENCES

- [1] Geetha Jayakumar and Gopinath Ganapathy, "Performance Comparison of Mobile Ad-hoc Network Routing Protocol," International Journal of Computer Science and Network Security (IJCSNS), Vol. 7, No. 11, November 2007.
- [2] T.V.P. Sundararajan and Dr. A. Shanmugam, "Performance Analysis of Selfish Node Aware Routing Protocol for Mobile Ad Hoc Networks," ICGST-CNIR Journal, Volume 9, Issue 1, July 2009.
- [3] Abdur Rashid Sangi, Jianwei Liu and Zhiping Liu, "Performance Comparison of Single and Multipath Routing Protocol in MANET with Selfish Behaviours," World Academy of Science, Engineering and Technology 41, 2010

- [4] Yan Zhang, Chor Ping Low and Jim Mee Ng, "Performance Evaluation of Routing Protocols on the Reference Region Group Mobility Model for MANET," *Wireless Sensor Network*, 2011, 3, 92-105.
- [5] Humaria Nishat, Sake Pothalaiah and Dr. D. Srinivasa Rao, "Performance Evaluation of Routing Protocols in MANETS," *International Journal of Wireless & Mobile Networks (IJWMN)* Vol.3, No.2, April 2011.
- [6] K. Natarajan and Dr. G. Mahadevan, "A Comparative Analysis and Performance Evaluation of TCP over MANET Routing Protocols," *International Journal of Advanced Computer Engineering and Architecture* Vol.1, No. 1, June 2011.
- [7] Ekta Saxena and Rohit Kumar, "Performance Evaluation of Routing Protocols in MANET", *International Journal of Latest Trends in Engineering and Technology (IJLTET)* Vol.3, Issue 4, March 2014.
- [8] A. Rama Rao, N. Murali Vishnu, K.V. Swathi, K. Hanisha and N. Anand, "Performance Evaluation of DSR, AOMDV and ZRP Routing Protocols in MANET by using NS2", *International Journal of Computer Science and Information Technologies*, Vol. 5(1), 2014, 711-714, ISSN:0975-9646.
- [9] Pooja, Sandeep Jaglan and Reema Gupta, "Comparative Analysis of AODV and AOMDV Reactive Routing Protocols", *International Journal of Advanced Research in Computer Science and Software Engineering*, Vol.4, Issue 8, August 2014.
- [10] Surinder Singh, Dr. B S Dhaliwal and Dr. Rahul Malhotra, "Comparative Appraise and Future Perspectives of Reactive and Proactive Routing Protocols in Manets", *International Journal of Research Studies in Computer Science and Engineering (IJRSCSE)*, Vol.1, Issue 1, May 2014, PP 36-41.