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Simulation and Performance analysis of AODV by Varying Packet size

Sanjolly Jain, Amit Grover

Abstract— MANET (Mobile Ad-hoc network) is a decentralized and self-organizing network. Because of the security provided by MANET, it becomes one of the most important wireless communication mechanisms among all. In MANET's the Intermediate nodes routes the packets from the source to the destination by using various kind of routing protocols. These routing protocols are AODV, DSR, GRP, OLSR etc. In this article, the effect of varying degree of packet size on AODV (Ad-Hoc on Demand Distance Vector) routing protocol by using two Physical Characteristics(Direct Sequence and Frequency Hopping) has been considered. The given work has been analyzed using OPNET Modeler. The results have been carried out via Delay, Load and Retransmission Attempt. The result shows the enlargement in AODV as per increase in packet size that makes the MANETs more valuable and responsible for a secure communication. Moreover the results show the better performance of AODV with Frequency Hopping.

Index Terms— Ad-hoc on demand distance vector (AODV), Mobile ad-hoc networks (MANET's), Route request message (RERQ), Route reply (RREP), Wireless local area network (WLAN)

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1 Introduction

Now a day, the increasing trends of wireless communication allows the different users to use the different technologies like Bluetooth, WI-FI, Satellite etc for short communication. MANET has been used for long distance communication that provides a peer to peer communication and allows the devices to connect without using any central control authority. As nodes have no central control entity, so they have unrestricted mobility and connectivity to others [9]. In MANET each node provides Routing and network management. It is an autonomous system where each node operates not only as an end system but also as a router to forward packets for other nodes [11]. A MANET is a network which consists of mobile nodes, a router with multiple hosts and wireless communication devices without any centralization authority thus it is an open medium [1]. Due to security provided by MANET it can be used in military battlefields, classrooms and rescue sites. It can also be used in rapid development areas and where there is no wire line network is available [2].

2 Routing Protocols

The communication in between nodes can be carried out by following some set of rules known as protocols. Routing protocol is a standard that controls how nodes decide which way to route packets between computing devices in a mobile ad hoc network. In MANET various types of routing protocols will be used like AODV, GRP, TORA, OSLR etc.

2.1 AODV

AODV is an Ad Hoc On-Demand Distance-Vector Routing Protocol. It is a reactive protocol. The source send the data to the destination by route discovery process and by sending a route request message (RREQ) [14].If neighbor have information about destination it send route reply message to source node, otherwise it sends a message to all of its neighbors. This process will remain continue until the information about destination will not found. It sends a Route Reply (RREP) after finding the destination. When the source node receives route reply message then route becomes ready for communication through intermediate nodes in between source and destination. So, to make a communication in network AODV deals with three important messages that are RREQ, RREP and RERR [15].

3 Related work

In 2012, Kuldeep vats *et al,* [5] simulated and analyzed the performance of routing protocols OLSR, GRP, DSR for mobile ad hoc network .The implementation using network simulator OPNET was carried out to measure the performance analysis of these three network protocols for delay, load, traffic sent and received, retransmission (data dropped or throughput) using 150 mobile nodes. It has been concluded that the performance of OLSR protocol through different networks size carried out had better performance in all aspects in a network. According to the simulation results OLSR presents the best performance and GRP gives low performance to that of OLSR and high performance to that of DSR protocol.

In 2012, AMAR NATH MURAW *et al* [6] had analyzed the performance of three most popular MANET routing protocols GRP, DSR and AODV under different parameters like throughput, network delay and network load. The entire analysis based on packet size was considered to study the behavior of these protocols under different test measures using OPNET. They concluded that in terms of throughput, performance of AODV and DSR is directly proportional to increase or decrease in packet size up to the medium size packets but shows unsatisfactory performance in case of larger packet size. In case of Network load, the performance of AODV is slightly higher than DSR and GRP and for the larger size packets greater than 2048 bytes DSR and GRP show unsatisfactory results. In case of delay, GRP shows better results compare to AODV and DSR but most of the time change is negligible.

4 Experimental Setup

In this experiment, the performance of AODV has been analyzed by varying the packet size for eight different scenarios. Direct sequence physical characteristics are used in the first four scenarios and the frequency hopping in the others. Packet size of 4352 has been considered in the first and fifth scenarios. Packet size of 4608 has been considered in the second and sixth scenarios. Packet size of 4864 has been considered in the third and seventh scenarios. Packet size of 5120 has been considered in the fourth and eighth scenarios. The scenario of this network is show in fig. 1. The placement of each node is random and the mobility network is random way point. The speed of each node is 15 m/s.

OPNET Simulator 14.5 [7] has been used to analyze the performance of AODV protocol, as it provides a comprehensive development environment supporting the modeling of communication network

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and distributed systems [8].The Simulation parameters has been shown in Table 1.

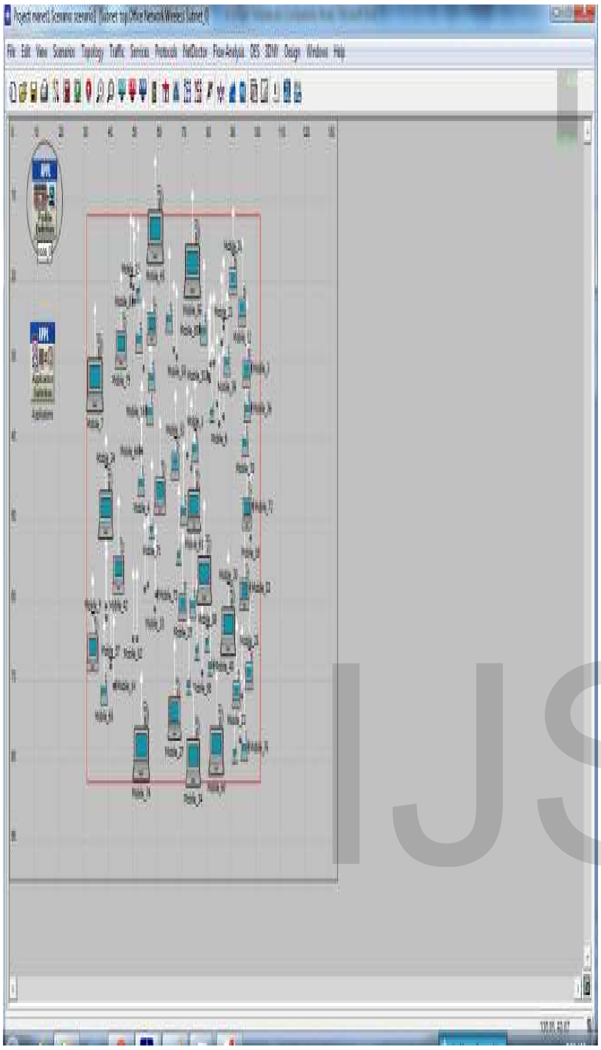

Figure 1: AODV scenario

Table 1: Simulation Parameters

Network parameters	Values
Network size	1000*1000
Nodes	80
Packet size	Constant(4352,4608,4864,5120)
Transmit power	0.01
Data rate	18mbps
Speed(meter/sec)	15
Mobility model	Random way point
IP addressing	IPv4
Duration	240 sec
Physical characteristics	Direct sequence, Frequency hopping

In this article, the analysis has been considered with different parameters like Delay, Load, Retransmission attempt and media access delay.

5 Results

The results have been calculated by varying packet size using direct sequence and the frequency hopping characteristics.

5.1 Delay

It is the time elapsed between the creation of the MANET packet at its source node and destruction at its destination node. Fig 2 shows the delay of AODV for Direct Sequence and Frequency Hopping at different packet size. Fig 2 shows that as the packet size increases the Delay also increases, moreover it shows lesser delay for frequency hopping as compare to direct sequence. Table 2 shows the amount of delay for different packet size for direct sequence and frequency hopping.

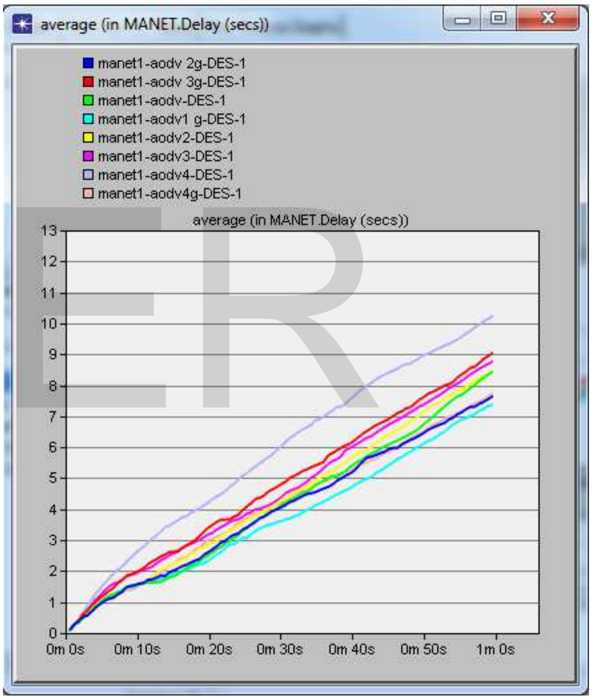

Figure 2: Delay for packet size (4352, 4608, 4864, and 5120)

Table 2: Delay

Packet Size	4352	4608	4864	5120
Direct Sequence	8.4	8.4	8.7	10.2
Frequency Hopping	7.3	7.6	9	7.7

5.2 Load

The total load submitted to wireless LAN layers by all higher layers in all WLAN nodes of the network. Fig 3 shows the result of load of

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AODV for direct sequence and frequency hopping at different packet sizes. It has been clear from the figure 3 and Table 3 that as the packet size increases, the load decreases.

The results also show that frequency hopping has more load than direct sequence in starting but as packet size increases, both have same load. Figure 3 also shows that there is slight change in load with increase in packet size.

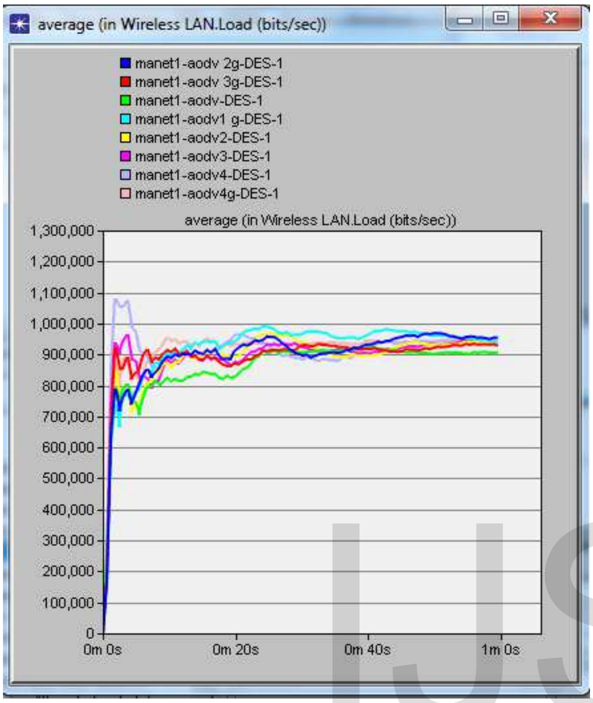

Figure 3: Load for packet size (4352, 4608, 4864, and 5120)

Table 3: Load

Packet Size	4352	4608	4864	5120
Direct Se-quence	906123	954096	930110	928505
Frequency Hopping	938936	954141	930110	928505

5.3 Retransmission Attempt

Total number of retransmission attempts by all WLAN MACs in the network until either packet is successfully transmitted or discarded as a result of reaching short or long retry limit.

For 802.11e-capable MACs, the retransmission attempts counts have been recorded under the statistics that also include retry count increments due to internal collisions. Additionally, if any 11e-capable MACs use Block-ACK mechanism, this statistics will furthermore record retransmitted Block-ACK requests, delayed Block-ACKs and block MPDUs which are not acknowledged in received Block-ACKs.

Figure 4 represents the retransmission Attempt of AODV for direct sequence and frequency hopping. It has been cleared from figure 4 that the frequency hopping has high retransmission attempt than direct sequence

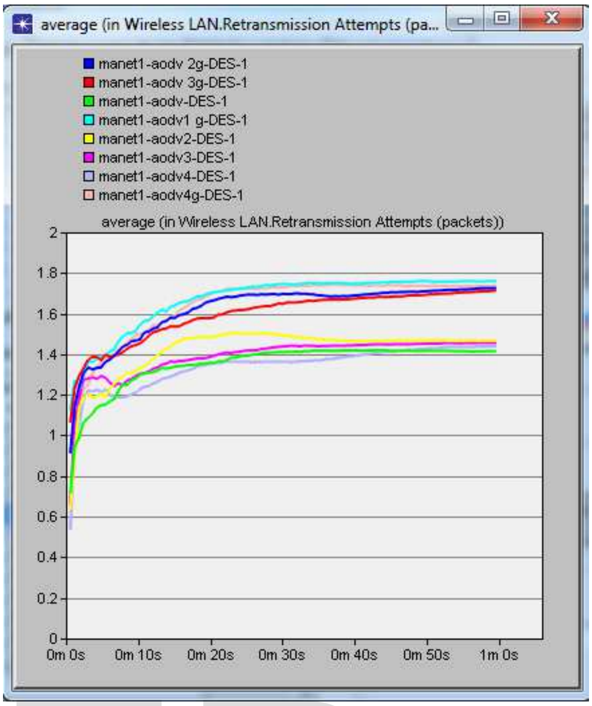

Figure 4: Retransmission Attempt for packet size (4352, 4608, 4864, and 5120)

Table 4 : Retransmission Attempt

Packet Size	4352	4608	4864	5120
Direct Se-quence	1.46	1.46	1.45	1.43
Frequency Hopping	1.71	1.72	1.71	1.73

5.4 Media Access Delay

This represents the global statistic for the total of queuing and contention delays of the data management, delayed Block-ACK and Block-ACK request frames transmitted by all WLAN MACs in the network. For each frame, this delay is calculated as the duration from the time when it is inserted into the transmission queue, which is arrival time for higher layer data packets and creation time for all other frames types, until the time when the frame is sent to the physical layer for the first time. Hence, it also includes the period for the successful RTS/CTS exchange, if this exchange is used prior to the transmission of that frame. Similarly, it may also include multiple numbers of back off periods, if the MAC is 802.11e-capable and the initial transmission of the frame is delayed due to one or more internal collisions. Fig. 5 shows the result of Media Access Delay of AODV for Direct Sequence and Frequency Hopping at different packet size. It has been clear from figure 5 that as the packet size increases the media access delay also increases.

It has been clear from figure 5 and table 5 that, the direct sequence has more media access delay than frequency hopping. From table 5 it

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is clear that at packet size 5120, the media access delay for frequency hopping again decreases.

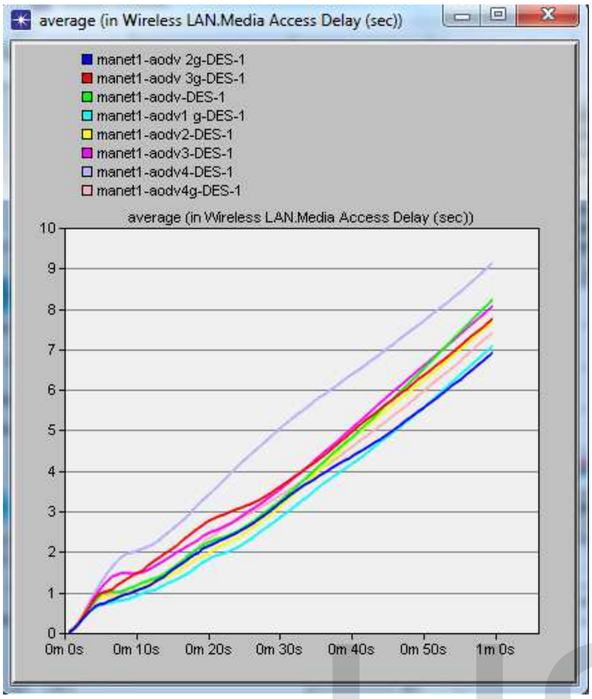

Figure 5: Media Access Delay for packet size (4352, 4608, 4864, and 5120)

Table 5: Media Access Delay

Packet Size	**4352**	**4608**	**4864**	**5120**
Direct Sequence	8.2	7.6	8	9
Frequency Hopping	7	6.8	7.7	7.3

6 Conclusions

In this article, the performance of AODV using direct sequence and frequency hopping has been carried out in terms of delay, load, retransmission attempts and the media access delay by varying packet size and by considering the random placement of nodes. In this analysis, each node is moving with the speed of 15 m/s in an area of within the network range 10, 00,000 sq m. The results show that the increase in the packet size for delay and retransmission attempts provides the better performance of frequency hopping than direct sequence. Further the result shows that the increase in the packet size for delay and media access delay, the performance of frequency hopping is better than direct sequence but both have same load with the change in packet size. It has been concluded that the performance of AODV is better by using the physical characteristics of frequency hopping as compare to direct sequence.

7 Future Scope

The work can be extended by considering some other important parameters like network size and number of nodes, which can further be useful to conduct the study of these protocols under different network scenarios and configurations.

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AUTHOR'S PROFILE

Sanjolly Jain received her B. Tech degree in Electronics and Communication Engineering in 2012 from North West Institute of Engineering and Technology, Affiliated to Punjab Technical University, Kapurthjala, Punjab, India. Her place of birth is Ferozepur, Punjab, India on 22nd December 1990. At present she has been doing her research work under the guidance of Mr. Amit Grover, Assistant Professor, Department of ECE, Shaheed Bhagat Singh State Technical Campus, Moga road, Ferozepur-152004, Punjab, India.

Amit Grover became a Member (M) of Association ISTE in 2006, a Senior Member (SM) of society SELCOME in September 2009, and a Project-In charge (PI) in august 2011 and in September 2012. The author place of birth is Ferozepur, Punjab, India on 27th, September 1980.The author received his M. Tech degree in Electronics and Communication Engineering from Punjab Technical University, Kapurthla, Punjab, India in 2008 and received his B. Tech degree in Electronics and Communication Engineering from Punjab Technical University, Kapurthala, Punjab, India in 2001. Currently, he is working as an Assistant Professor in Shaheed Bhagat Singh State Technical Campus, Ferozepur, Punjab, India. The author is a Reviewer of many Reputed International Journals. His area of interest includes signal processing, MIMO systems, Wireless mobile communication, High speed digital communications and 4G Wireless Communications.

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