Special Issue | August 2017 ISSN: 2320-9984 (Online)

International Journal of Modern Engineering & Management Research

Website: www.ijmemr.org

All India Seminar on

Futuristic Trends in Telecommunication Engineering & Telecom Panorama – Fundamentals and Evolving Technology, with Particular Reference to Smart City on 5th – 6th August 2017

Organized by

The Institution of Engineers (India) Jabalpur Local Centre

Delay Analysis of AODV Protocol with Varying Speed and Maximum Connections

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***Abstract*—*Wireless communication between mobile users is becoming more popular nowadays. This is because of recent technological advances in laptops, computers and wireless communication devices, such as wireless modems and wireless LANs. Quality of service is the biggest issue in this scenario. Mobile Ad hoc Networks are highly dynamic networks so quality of Service (QoS) in such networks is usually limited. The reason behind it is either node mobility or energy depletion of the mobile nodes. The speed of data delivery plays a very important role in quality of service which depends upon the protocol used in the network. A good routing protocol should cause less delay. The delay of a network specifies how long it takes for a bit of data to travel across the network from source to destination. Delay of Ad-hoc network depends upon maximum number of connections in the network, mobility, number of nodes in the network and speed of the mobile nodes. The objective of this paper is to analyze delay of the ad-hoc AODV reactive routing protocol with varying different parameters of the network.*

1. INTRODUCTION

A mobile ad-hoc network (MANET) is a network composed of mobile nodes mainly characterized by the absence of any fixed infrastructure. Mobile routers associated hosts connected by wireless links – the union of which forms an arbitrary topology. The routers are free to move randomly and organize themselves arbitrarily, thus the network's wireless topology changes rapidly and unpredictably. In ad-hoc network mobile nodes are independent, self-organized and they have

the freedom to move any-where any-time and still can communicate with each other if they are present within the transmission range of each other. This freedom in the movement attracts many researchers to develop and work in this field. The requirement for this transmission is that delay should be minimum. Mobility is very important parameter while calculating delay. In this paper delay is calculated in high and low mobility scenario. In Experiments 1 and 2 delay is analyzed in high mobility scenario whereas experiments 3 and 4 are the case of low mobility.

2. AODV (AD-HOC ON DEMAND DISTANCE VECTOR ROUTING PROTOCOL)

AODV protocol is defined by the RFC 3561, it was written by Charles Perkins and Elizabeth [4]. AODV is a reactive routing protocol that is a simple, efficient on-demand MANET routing protocol. It uses hop-by-hop routing. AODV adopts traditional routing tables i.e. one entry per destination. Every node forwards data packets towards a destination node according to its routing table. The routes in the AODV routing table are kept up to date as long as they are needed by the source. AODV maintains a single path per destination. The routing is divided into two basic mechanisms. The first one is the route discovery; It is responsible for finding a route to the destination if no root is currently available in the routing table of the node. The second one is the route maintenance which keeps the routes up-to-date, e.g. removes broken paths. AODV also has other significant features whenever a route is available from source to destination, it does not add any overhead to the packets. However, route discovery process is only initiated when routes are not used or they are expired and consequently discarded. This strategy reduces the effects of stale routes and the need of route maintenance for unused routes.

Performance Metric

Delay is an important parameter to decide efficiency of the routing protocol. delay is defined as the time taken by the network for successful delivery of data packets to the destination. AODV is on depend routing protocol hence time is required in root establishment in this paper delay is measured by varying different parameters in different scenario. The simulation is done for version-1, seed-0, rate-4.0 and a rectangular area of 500x500 has been taken.

Simulation Process

The simulation is performed using network simulator (NS2.35). Below are the important steps-

1. Initially scenario and traffic files are generated by using cbrgen and setdest commands.
2. Write TCL script and use above generated files as input for TCL.
3. Execute TCL script by using ns command. Two files are generated i.e. Trace file and nam files are generated
4. Trace files are analyzed using AWK script to measure performance parameter delay of AODV protocol.
5. plot graphs.

Experiment No. 1

This experiment is performed to examine delay when no. of nodes are increasing in high mobility scenario, by changing maximum speed of the nodes while using AODV protocol. For this purpose 6 random nodes have been taken for the simulation and graph is plotted for the result.

To carry out this simulation pause time is taken zero (p=0), maximum speed is taken 10 and 50, maximum connection is taken 5.

Table 1. Experimental Readings for the Experiment.

No. of Nodes	Max Speed = 10	Max Speed = 50
10	15.25	9.45
20	11.63	18.25
30	10.18	11.31
40	13.03	15
50	17.85	15.70
60	262.39	82.19

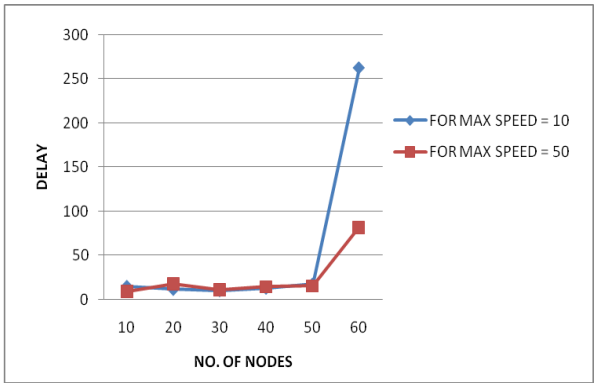

Figure 1 Shows no. of Nodes vs Delay Graph for Different Maximum Speed.

Analysis

It is observed that in starting delay is almost same in both the cases but as the no. of nodes are increased the delay in case of higher value of maximum connection(50) is lesser as compared to the case in which maximum connections are less(10).

This is because AODV is a reactive protocol i.e. it sets up roots whenever needed so when the speed of moving nodes is higher the possibility to get the shortest route increases. It is because more number of nodes comes in the range of transmission.

Experiment No. 2

This experiment is performed to analyze the effect of no. of connections when no. of nodes is increasing in case of high mobility. Six random nodes are taken for the analysis when maximum speed is 50, pause time is zero (for high mobility) and no. of connections is varied to 5 and 10.

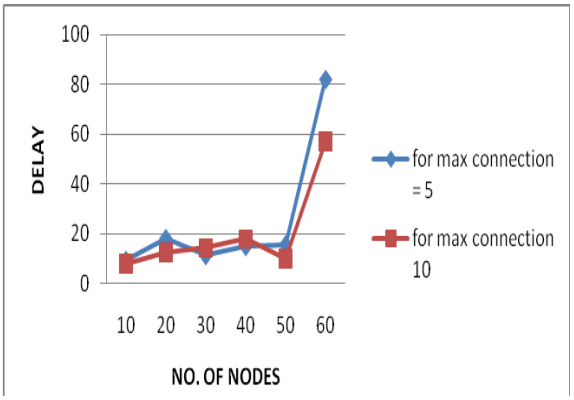

Figure 2. Shows number of Nodes vs Delay Graph for Different number of Connections in High Mobility.

Experiment No. 2

In this experiment it is observed that in case of high mobility when no. of connections are increasing with nodes delay reduces in case of AODV protocol. It is because when connections between the nodes are increasing it will be easier to get shortest path faster and root will be established faster hence delay is reduced. This experiment shows that when AODV protocol is used in the case of high mobility and increasing nodes it will be beneficial to increase the no. of connections which in turn reduces delay.

Experiment No. 3

This experiment is to analyze delay in case of low mobility i.e. pause time is increased to 90. Pause time refers to the time for which a node remains stable in the network. Here pause time is 90 that means mobility is decreased. Graph has been plotted for maximum speed 10 and 50.

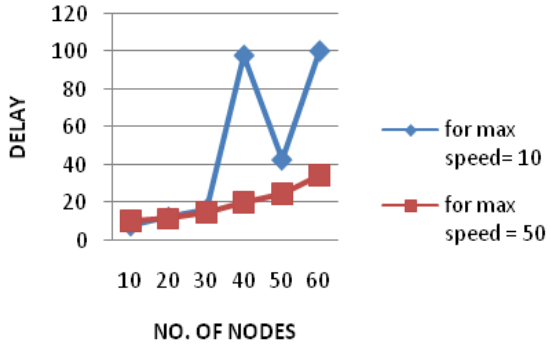

Figure 2. Shows number of Nodes vs Delay Graph for Different number of Connections in Decreased Mobility

Analysis

In this experiment it is observed that in the beginning the delay is almost same for both the case of maximum speed 10 and 50 but as the no. of nodes increased it is observed that delay is slowly increasing in case of higher maximum speed(50ns). In the case of low mobility the delay of higher maximum speed is slightly less than as compared to the lower maximum speed(10 ns).

Experiment No. 4

In this experiment no. of connections are changed to 5 and 10 and rest all the parameters are same i.e. pause time is zero, maximum speed is 50 the effect on delay is analyzed.

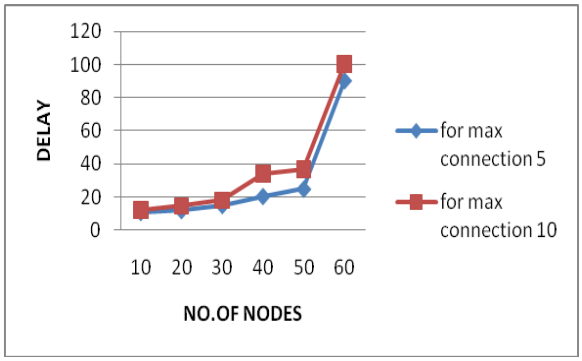

Figure 4 shows no. of nodes vs delay graph for different no. of connections in case of low mobility.

Analysis

Here again we can see that in case of low mobility if no. of connections are increased with nodes it results in lesser delay in case of low mobility delay is reduced very slightly. The reason is again the same by increasing the speed of mobile nodes the possibility of getting the root to destination is increased as the speed increases nodes come in the range of transmission.

4. CONCLUSION

It was the study based on simulation in which delay of AODV protocol was analyzed in high and low mobility scenario. Delay is an important parameter to increase quality of service of the network. It is observed that in case of high mobility and increasing no. of nodes to minimize delay maximum speed and maximum connections of the nodes should be increased. As the speed increases the possibility of nodes to come in the path of source to destination increases hence the chance of getting the shortest path faster increases. By increasing the connections delay is reduced. The reason being is the probability of finding a node for re-route discovery increases as the connections increase. The behavior of AODV is almost same for the lower mobility scenario but in this case delay slightly decreases with increase in speed and maximum connections.

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