International Journal of Technology and Science, ISSN (Online) 2350-1111, (Print) 2350-1103 Volume 3, Issue 4, 2016 pp. 67-69

SIMULATION OF AODV IN WIRELESS AD HOC NETWORKS

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***Abstract*—Vehicular Ad Hoc Networks (VANETs) is a technology that provides communication between moving vehicles. It is a subclass of Mobile Ad Hoc Networks (MANETs). This paper presents simulation of AODV routing protocol in MANET environment. The simulation scenario is prepared using NS2.35 software. The protocol is simulated using mobility models and different characteristics.**

The simulation result shows the performance of AODV in MANET environment in terms of end to end delay, throughput and packet drop ratio.

Index Terms— **AODV, MANETs, Routing Protocols, VANETs.**

I. Introduction

A wireless ad hoc network (WANET) is a decentralized type of wireless network. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, so the determination of which nodes forward data is made dynamically on the basis of network connectivity. Wireless mobile ad hoc networks are self-configuring, dynamic networks in which nodes are free to move. Wireless Ad Hoc networks are further classified based on their applications as Mobile Ad Hoc Networks and Vehicular Ad Hoc Networks.

Vehicular Ad Hoc networks (VANETs) are special type of Mobile Ad Hoc Networks (MANETs) and are important components of Intelligent Transportation System (ITS). Due to high cost of deploying and implementing VANETs in real environment most of the research is based on simulations.

II. Routing Protocol

Routing is a mechanism to establish and to select a specific path in order to send data from source to destination. There are various routing algorithms in ad-hoc routing network. Routing protocols are set of rules which both the source and destination has to follow in order to have communication. They are classified as Topology based and Position based. Topology based routing protocols use links information within the network to send the data packets from source to destination. It is further classified into Proactive, Reactive and Hybrid routing protocols. Proactive routing protocols are table based because they maintain table of connected nodes to transmit data from one node to another and each node share its table with another node. Reactive Routing Protocols are called as on-demand routing protocols because it establishes a route only when a node has something to send. Hybrid routing combines the characteristics of both reactive and proactive routing protocols. In position-based routing protocols, forwarding decisions are made based on the position of destination node and sources one-hop neighbors.

A routing protocol usually has three main functions: [1] route discovery, optimal route selection and route maintenance. Once an optimal route from a source to its destination has been discovered and selected, route maintenance must be carried out, in order to track link failures and perform route re-discovery. Route maintenance and re-discovery are expensive in signaling and computation, and hence it is desirable to choose the optimal route comprising links with maximum possible lifetimes during the optimal route selection phase.

A. AODV

The Ad hoc On-Demand Distance Vector (AODV) [2] is a reactive routing protocol which enables dynamic, self-starting, multi-hop routing between participating mobile nodes wishing to establish and maintain an ad hoc network. It allows the communication between two nodes through intermediated nodes, if those two nodes are not within the range of each other. To establish a route, there is route discovery phase in AODV, along which
Messages can be passed. AODV makes sure these routes do not contain loops and tries to find the shortest route possible. AODV allows mobile nodes to respond quickly to handle changes in route. When links break, AODV causes the affected set of nodes to be notified so that they are able to invalidate the routes using the lost link. Distinguish feature of AODV is that it uses destination sequence number for each route entry, which ensures loop free route. In case there are two routes to a destination, a requesting node selects the one with greatest sequence number. For route discovery and maintenance purposes control messages are defined in AODV.

III. Simulation Scenario And Performance Metrics

A. Simulation scenario

Network Simulator 2 in its version 2.35 (NS-2.35) is used to evaluate performance of AODV routing

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protocol. Simulation area used is 1000x1000m. Simulation parameters are summarized in Table 2.

Table 1. Simulation parameters

Parameters	Specifications
Network simulator	Ns-2, 2.35
Simulation area	1000m X 1000m
Number of nodes	9
Transmission range	250m
Simulation time	10 seconds
Transmission type	TCP/CBR
Data packet size	512 bytes
Propagation model	Two-ray ground
Mobility model	Random Way Point
Channel type	Wireless channel
Antenna model	Omnidirectional

B. Performance metrics

For network simulation, there are several performance metrics:

Throughput:[3] The throughput is defined as the total amount of data a receiver receives from the sender divided by the time it takes for receiver to get the last packet. The throughput is measured in bits per second (bit/s or bps).

Average End-to-End Delay:[3] Average End-to-End Delay includes all possible delays in the network caused by route discovery latency, retransmission by the intermediate nodes, processing delay, queuing delay, and propagation delay. A lower delay means better performance.

Packet Drop Ratio:[3] Packet Drop Ratio is the ratio of the number of packets that never reached the destination to the number of packets originated by the source. Lower the packet drop ratio better the performance.

IV Simulation results

As per the simulation scenario x-graphs are obtained for performance metrics

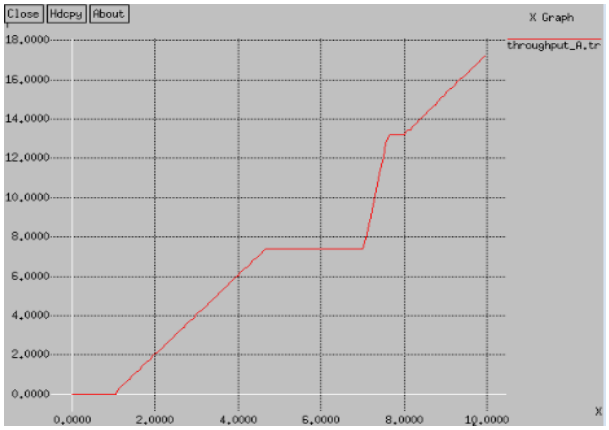

Figure1. Throughput v/s Simulation Time

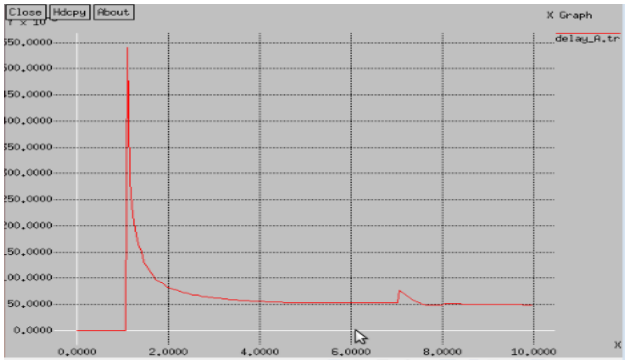

Figure 2. Average End to End Delay v/s Simulation Time

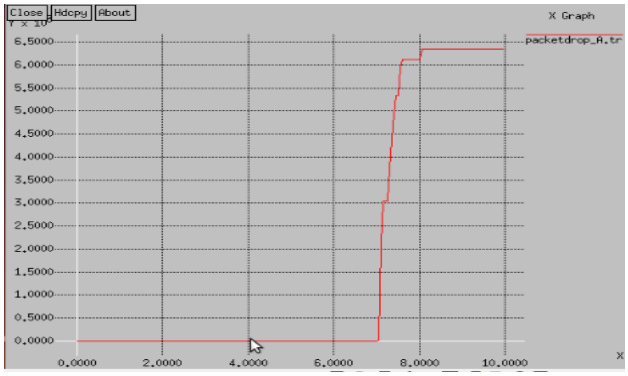

Figure 3. Packet Drop Ratio v/s Simulation Time

V Conclusion

From the x-graphs it can be seen that the performance of AODV in MANET environment is satisfactory as delay is less, packet drop ratio is low and throughput is more. Further AODV will be tested in VANETs environment and the performance will be compared with the graphs obtained in MANET.

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International Journal of Technology and Science, ISSN (Online) 2350-1111, (Print) 2350-1103 Volume 3, Issue 4, 2016 pp. 67-69

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