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Evaluation of AODV Routing Protocol under MANETS with Various Density Nodes

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Abstract

A mobile ad hoc network is self-configured infrastructure where no of nodes interact with each other via multi-hop wireless links. Mobile nodes interact through a wireless medium without any centralized control, also nodes can move randomly. The basic strategies involved are reactive, proactive and hybrid. Unpredictable changes in the network topology are there due to the mobility of nodes which leads to the regular route change. Nodes involved in the MANET results in the frequent network topology changes which make the routing a challenging task. This paper involves the performance measures of AODV reactive protocol by calculating the metrics such as throughput, packet delivery ratio and delay under various nodes density condition in terms of QOS using OPNET MODELLER 14.5.

Keywords

MANET, AODV, METRICS, OPNET MODELLER

1. Introduction

Mobile devices have gained communication of various nodes, computation and memory resources interconnection due to the advancement in the mobile computing and wireless communication technology. MANET means a wireless adhoc networks with self-configuring network of mobile routers connected by the wireless links [3]. These are easy to deploy because MANET's are totally infrastructure-less, so it require less cost and preparation time [2].

Mobile Adhoc is a multi-hop self configured network which does not require fixed infrastructure of wireless devices involved (computer nodes, laptop, mobile phones, personal digital assistance) connected by various wireless links. For the initiation of communication both the source and the destination node should lie between the radio ranges. Path between the nodes may be changed due to the mobility of the nodes, which is creating the most studied problem in the mobile Ad-hoc networks. Nodes are free to move anywhere in the network because in MANET breaking of communication links are very common. There are various applications of mobile Ad-hoc network protocol, the most significant application is military communication networks in: battle field, emergency rescue operations, monitoring different environmental changes and effects. Each node in the network work as a router because devices involved need to forward traffic that is not related to its own use. While communication of nodes with each other they can move freely. Due to the different resources such as bandwidth, battery power and latency the objectives of how routing should take place is often unclear.

Remainder of this paper is organized as follows: Section II introduces the routing protocols. Section III provides the overview of routing protocol used in the study. Section IV presents the simulation and results. Finally the conclusions are presented in Section V.

2. Routing Protocols

Routing basically perform the function of maintaining routes between source and destination in highly dynamic environment.[4] IP routing protocols are developed under Internet Engineering task Force which has MANET working group (WG). Mobile Ad-hoc routing protocols are divided into two sub-

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types unicast routing and multicast routing [1]. In unicast routing protocol, forwarding means that one source node transmit data and control packets to a single destination node. In multicast routing protocol source node can send the same data and control to more than one node. Unicast protocols are further categorized into proactive, reactive and hybrid routing protocols. A proactive protocol constantly maintains the updating of topology in the network [8].Every node is known to all others nodes making that network. In reactive protocols routes are developed as and when required rather than continuously maintaining the topology of network. Hybrid protocols are the combination of both proactive and reactive routing protocols[7]. Based on the up to date information received from neighboring nodes, a link state table is maintained in the network.

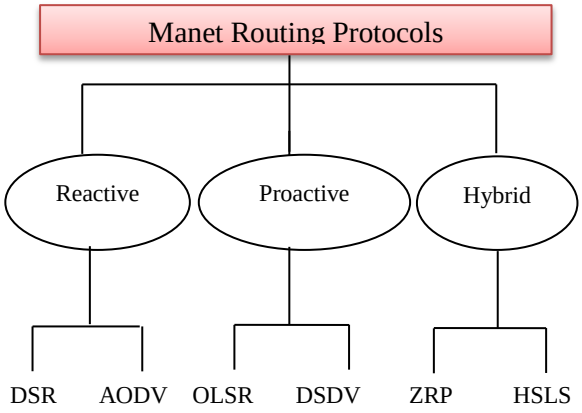

Figure 1: MANET Routing Protocol [6]

A. Reactive Protocol

Reactive routing protocol is also known as "On-Demand based" routing protocols [6]. In the network route is established only when the source node requests to find a route to send packets to the destination node. Distance vector routing algorithm is used in the reactive routing protocol. Reactive routing protocol will establish a route when anode wants to communicate with another node in the network, but source does not have a route to send information to the destination node [5]. Most commonly used protocols of reactive routing are AODV and DSR.

Basically reactive protocols

- Find route when demanded by source.
- Uses flooding technique to find the destination on" On Demand ".
- Consumes bandwidth only when source node starts transmitting the data to destination node.

3. Overview of Protocol

A. Adhoc On-Demand Distance vector Routing Protocol (AODV)

Ad-hoc on-demand vector routing (AODV) is on demand routing protocol, whenever a route from source to destination is required then only it develops a route. AODV is an enhancement protocol of Destination Sequenced Distance-Vector (DSDV) outing protocol [9]. It is created with the combination of Dynamic source routing (DSR) and Destination Sequenced Distance-Vector (DSDV); AODV use properties of route request (RREQ) and also route maintenance procedure from DSR and some features like sequence number, periodic updates, hop by hop count from DSDV routing protocol. Following information of the packet header is in the route request

- Source node IP address
- Broadcast ID
- Current sequence number for the destination

After the demand source node receives route reply (RREP) from destination node. When the RREP is sent from destination to source, all the nodes along the path keep records of route to the destination node, via this packet. If failure occurs in active route, then for source node the upstream mobile nodes generate a RREP message, informing that this link is no more available for transmission.

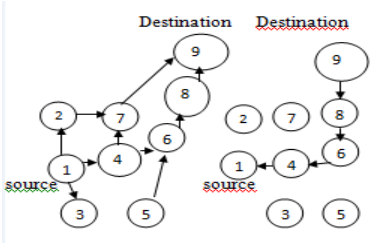

Figure 2: Route Discovery [3]

4. Simulation and Results

Simulation is carried out on OPNET MODELLER 14.5 and various parameters are taken for performance evaluation of AODV routing protocol with various density of nodes. The performance of

routing protocol is calculated on the basis of following -

- Delay
- Load
- Network Load
- Throughput

In this simulation different network sizes are involved with 20, 40, 60, and 80 nodes. Protocol used is AODV with Random Way Point mobility model and simulation time is 5 minutes.

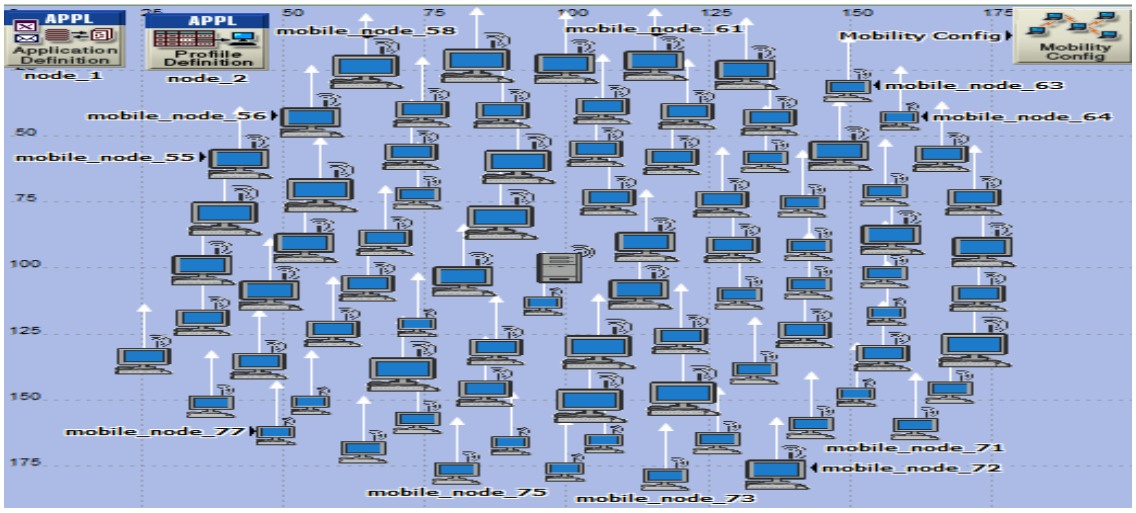

Figure 3: Environment Scenario of 80 nodes

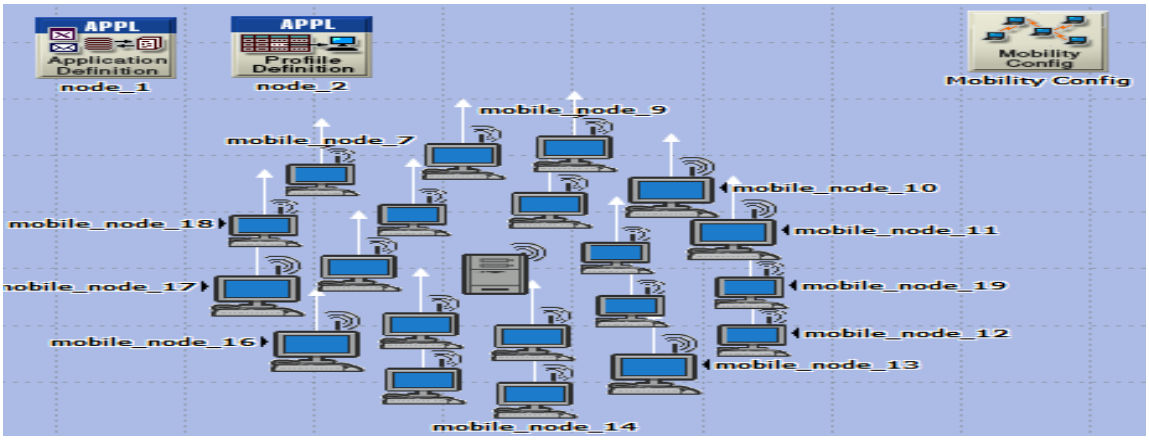

Figure 4: Scenario of 20 nodes

Table 1: Simulation Parameters

Simulation parameters	Value
Simulator	Opnet Modeler 14.5
Network size	20,40,60,80 nodes
Protocol	AODV
Mobility Model	Random Way Point
Simulation Time	5 min

Below are the graphical results of ADOV routing protocol with above mentioned metrics. Figure 5 shows with increase in no of nodes there is increase in delay. Figure 6 represents with increase in nodes from 20- 80 there is increase in load. Figure 7 and 8 shows that with increasing no of nodes network load also increases in network and throughput also get increased.

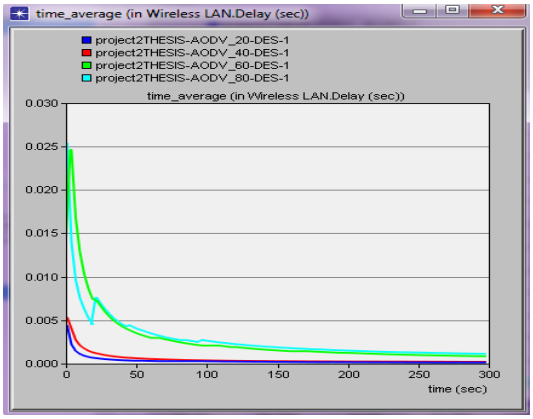

Figure 5: Measurement of delay under MANET with different nodes

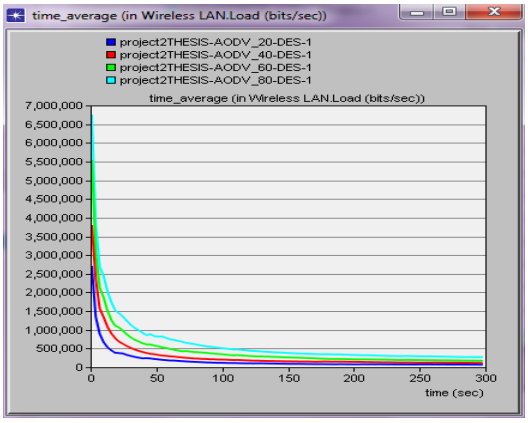

Figure 6: Measurement of load under MANET with different nodes.

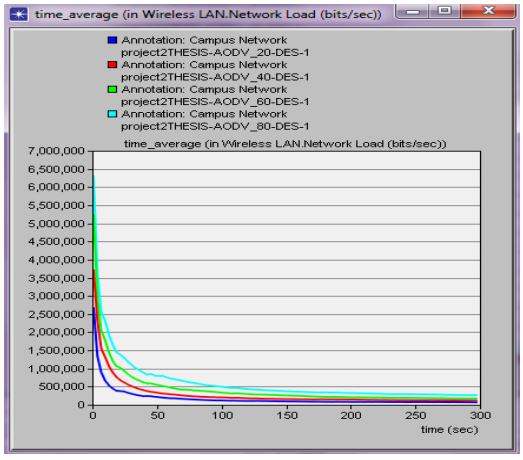

Figure 7: Measurement of Network load under MANET with different nodes

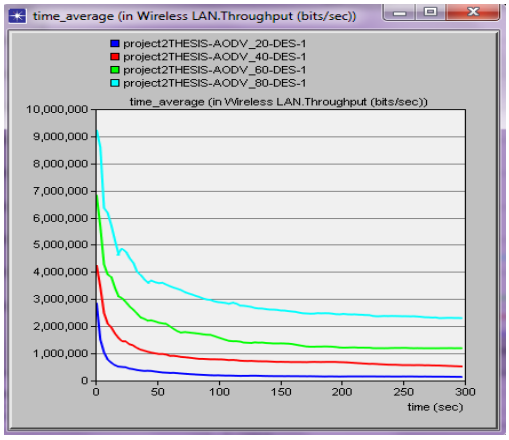

Figure 8: Measurement of throughput under MANET with different nodes

Table 2: Average Delay of different nodes

No of Nodes	Average Delay
	ADOV
20	0.329
40	0.525
60	2.775
80	2.853

Table 3: Average Load of different nodes

No. of Nodes	Average Load
	ADOV
20	177.30
40	299.82
60	455.31
80	640.60

Table 4: Average Network load of different nodes

No. of Nodes	Average Network Load
	ADOV
20	176.68
40	295.78
60	439.34
80	616.90

Table 5: Average throughput of different nodes

No of Nodes	Average Throughput
	ADOV
20	257.69
40	847.97
60	1669.97
80	2989.96

5. Conclusions

This paper shows the results of AODV routing protocol on different parameters. The simulation is done in terms of throughput, load, network load and delay. Results are shown in tabular as well as in graphical form by using OPNET modeler 14.5. The results show that with the gradual increase in density there is increase in average delay, average network load, average throughput, and average load. In future this can be analyzed or implemented using other network software. The other wireless protocols can also be virtually analyzed for deep understanding of this research work.

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