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THOMSON REUTERS
[INIT: January 2017]
ISSN 2348 – 8034
Impact Factor- 4.022
GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

REVIEW OF THE ROUTING PROTOCOLS FOR MOBILE ADHOC NETWORKS USING NS2

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ABSTRACT

The node density is the one of the major factor which has much influence on the performance of any routing protocol of mobile ad hoc network. Several previous works highlighted this fact. In this paper, we will evaluate some of the widely used MANET routing protocols with different network density.

The proposed evaluation will be made on MANET routing protocols DSDV, DSR and AODV which are readily available in network simulator- ns2. The performance of these protocols will be measured with suitable metrics.

Keywords- *Mobile Ad hoc Network(MANET), Routing Overhead, Route Discovery , Mobility Aware Routing, Routing Protocols, DSDV, DSR, AODV.*

I. INTRODUCTION

Wireless networks are emerging as new technology that will allow users to access information and services electronically, regardless of their geographic location. Wireless communication between mobile users is becoming more popular ever than before. This is due to proliferation in laptop computers and wireless data communication services, such as wireless modems and wireless LANs.

A Mobile Ad-Hoc Network (MANET) is a self-configuring network and the nodes are connected through wireless link. It is an infrastructure less network. The wireless network topology may change rapidly. Each node in the network act as router and it communicate other nodes. There is no centralized administration. Nodes in ad hoc networks are differentiated by their limited resources like power ,memory and mobility. Due to the limited transmission range of the nodes, multiple hops may be needed for a node to send data to any other node in the network. Thus each node acts as a host and router. If a node needs to communicate with another that is outside its transmission range, an intermediate node acts as a router to relay or forward packets from the source to the destination. For this purpose, a routing protocol is needed. Routing protocol design[1,2,3,4] is an important and essential issue for Ad Hoc networks due to dynamism of the network. One interesting research area in MANET is routing. Routing in the MANETs is a challenging task and has received a tremendous amount of attention from researches.

Guaranteeing delivery and the capability to handle dynamic connectivity are the most important issues for routing protocols in wireless mobile ad hoc networks. Once there is a path from the source to the destination for a certain period of time, the routing protocol should be able to deliver data via that path. If the connectivity of any two nodes changes and routes are affected by this change, the routing protocol should be able to recover if an alternate path exists.

Types of MANET Routing Protocols

Routing protocols are classified into two types based on their Properties.

- Proactive Routing Protocols.
- Reactive Routing protocols.

Table Driven Routing Protocols (Proactive)

The proactive protocols are principally traditional distributed shortest-path protocols that maintain routes between every pair of nodes at all time by either Bellman-Ford (distance vector) or Dijkstra's algorithm. The routes are based

on periodic updates, which mean that proactive protocols always maintain a valid route by broadcasting routing information. This results in little or no delay for route determination, but on the other hand, it consumes bandwidth to keep routes up-to-date. It also maintains routes that may never be used. Scalability problem is also a disadvantage as it takes longer for updates to traverse the networks, as it gets bigger.

On-Demand routing Protocols* (*Reactive)
With on-demand protocols, if a source node requires a route to the destination for which it does not have route information, it initiates a route discovery process which goes from one node to the other until it reaches to the destination or an intermediate node has a route to the destination. If a node wants to send a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet. The route discovery usually occurs by flooding the route request packets throughout the network.

This Paper examines routing protocols designed for these ad hoc networks by first describing the classification of ad hoc routing protocols The section II describing the properties of each of the protocols and then comparing their different characteristics. The section III, IV&V describes the simulations and results and followed by conclusion.

II. ABOUT THE COMPARED ROUTING PROTOCOLS

Dynamic Source Routing (DSR)
Dynamic source Routing[8] is a on demand routing protocol for Mobile Ad hoc Network and is based on the concept of source routing. The protocols maintains route cache in each node which is updated when new routes are learned. The protocol consist of two phases. Route Discovery and Route maintenance. The source node broadcasts a route request(RREQ) packet consist of the destination node address, source node address and unique request ID. Each node receives the packet checks whether if route is available or not. If does not, it adds its own address to the route record and forwards the packet. Route Maintenance is achieved through the use of route error packet (RERR) and acknowledgements. Route error packets are generated at a node due to the problem of fatal transmission at the data link layer. When a route error packet is received, the hop in error is removed from the node's route cache and all routes containing the truncated at the point

Destination-Sequenced Distance-Vector (DSDV)
The destination sequenced distance vector routing protocol[5] is a proactive routing protocol based on the Bellman-Ford algorithm. Routing table is maintained at each node and with this table, node transmits the packet to other nodes in the network. To guarantee loop-freedom DSDV uses a concept of sequence numbers to indicate the freshness of a route. The Broadcasting mechanism in the dsdv is of two types-Full dump and incremental dump. Full dump will carry all the routing information and the incremental dump will carry only last updation of full dump to improve the efficiency of the system. DSDV is not fit for large networks.

Ad hoc On-demand Distance Vector (AODV) Routing
AODV is a reactive routing protocol [,6,7] implemented for mobile ad hoc networks. AODV is used for unicast, multicast and broadcast communication. AODV is combination of both DSR and DSDV. It adopts the basic on demand mechanism of Route Discovery and Route maintenance from DSR and the use of hop by hop routing sequence number and periodic beacons from DSDV. When a source node desires to sent information to destination node and does not have a route to destination, it starts the route discovery process. It broadcasts RREQ to neighbors and then forward the request to their neighbors on so on up to route for the destination is located .And also send a route reply packet to the neighbors which is the first receives RREQ.RREP is routed along the reverse path. Each node maintains own sequence number and broadcast id. To maintain routes the nodes survey the link status of their next hop neighbor in active routes. If the destination or some intermediate node move, the node upstream of the break remove the routing entry and send route error(RERR) messages to affect the active route upstream neighbors. This continues until source node is reached.

ISSN 2348 – 8034
Impact Factor- 4.022

III. SIMULATIONS AND METRICS

Simulation Environment
The simulations were performed using Network Simulator (Ns-2) [09], particularly popular in the ad hoc networks. The source-destination pairs are spread randomly over the network. The mobility model uses 'random waypoint model' in a rectangular filed of 800m x 800m with 50 nodes.

Mobility
Without mobility scenario **0 m/s**
Mobility Model **Random Waypoint**

Traffic Parameters
Traffic **CBR over UDP**
% of communicating Nodes **50 %**
CBR Packet Size 1024 **Bytes**
CBR Interval **0.5 s**
Maximum Packets 300
We have tested the performance of the three routing protocols with different network size .

Metrics considered for Evaluation
Throughput:

The throughput metric measures how well the network can constantly provide data to the sink. Throughput is the number of packet arriving at the sink per ms/second.

Mac Load:
The ratio of the number of MAC layer messages propagated by every node in the network and the number of data packets successfully delivered to all destination nodes. In other words, the MC load means the average number of MAC messages generated to each data packet successfully delivered to the destination.

Dropped Packets:
The Number of Nodes in the Network vs Agent level Total Dropped Packet is considered as the metric to analyze the performance.

Routing load :
It is the number of routing packets required to be sent per data packet delivered.

IV. RESULT AND ANALYSIS

The Simulation Results
The experimental result of figure1 shows throughput given to three different protocols in different node densities. As shown in the graph, DSR performed well in terms of throughput. Next to DSR, ADOV performed good. DSDV is the poor performer in terms of throughput .

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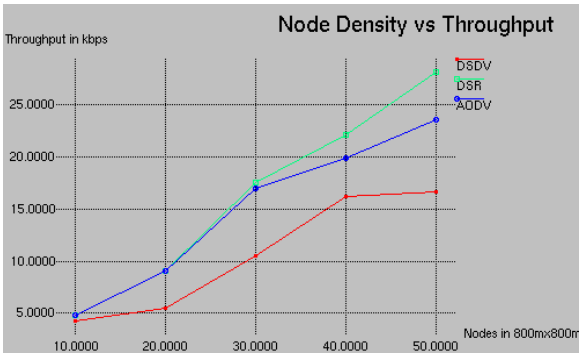

Figure 1 Node density Vs Throughput

The figure2 shows total dropped packet by the three different protocols in different node densities. As shown in the graph, DSDV is performing good. And next is DSR. AODV performed very poor and dropped much packets than all other cases

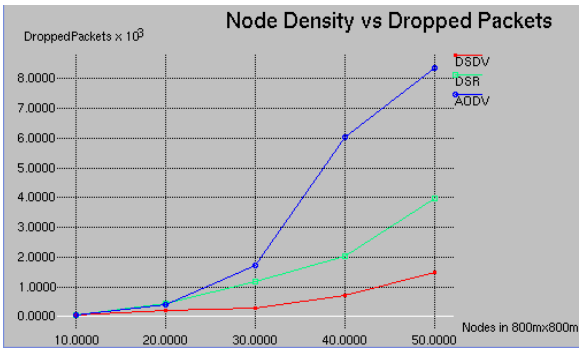

Figure 2 Node density Vs Dropped packets

The figure2 shows total transmitted routing control messages by the three different protocols in different node densities. As shown in the graph DSR ,is performing good. AODV performed very poor and produced too many routing control message packet than all other cases

The figure4 shows MAC load of the three different protocols in different node densities. As shown in the graph, DSR without mobility performed very poor and caused much MAC load. AODV also performed very poor and caused much MAC load .DSDV is performing good.

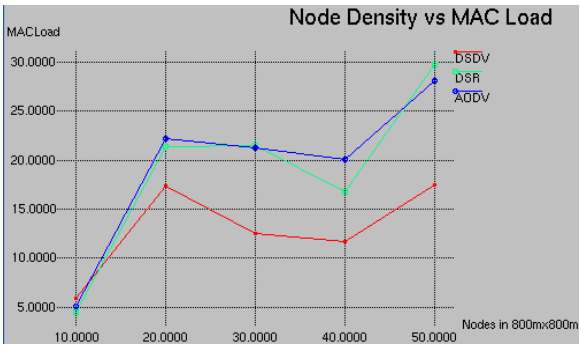

Figure 5 Node density Vs MAC Load

ISSN 2348 – 8034
Impact Factor- 4.022

The figure6 shows routing load of the three different protocols in different node densities. As shown in the graph, AODV without mobility performed very poor and caused much routing load. DSDV is the next protocol which caused much routing load next to AODV

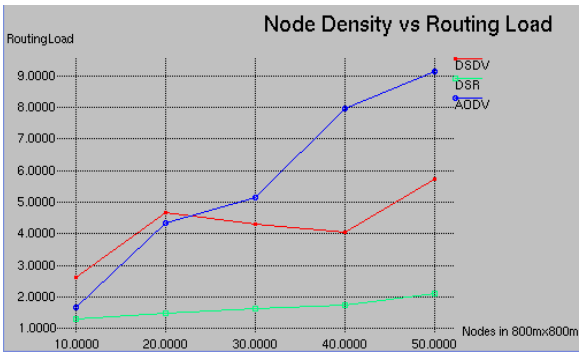

Figure:6 Node Density Vs Routing Load

V. CONCLUSIONS AND FUTURE WORK

We have evaluated three commonly used ad hoc routing protocols DSDV, DSR and AODV with respect to node density. If we carefully examine the graphs presented in previous section it is obvious that AODV was the protocol which was getting affected too much in network density scenario. The reason for such poor behaviors is caused by the way in which its routing mechanism is working.

So future works may investigate the routing mechanism of AODV to improve its performance., it will explore the routing message processing mechanism of AODV and try to reduce the different kinds of overheads involved in routing message processing and improve them to provide better performance. There is much possibility for developing a mobility and node density aware extension to AODV routing protocol. Future works may address these issues.

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