Impact of Varying Node Density and Pause Time in AODV

Biswaraj Sen[1], Achute Sharma[2], Varsha Mintri[3], Kalpana Sharma[4], M K Ghose[5]

[1, 2, 3, 4, 5]*(CSE Department, Sikkim Manipal Institute of Technology, India)*

ABSTRACT: *Unstable topology and varying node density has a bearing effect on route establishment and route maintenance of Reactive Routing Protocols of Mobile Ad hoc Networks (MANETs). This paper makes an attempt to study the impact of varying node density on one of the most popular and widely accepted reactive routing protocol for MANETs called Ad hoc On-Demand Distance Vector Routing Protocol. This study will give an insight about the robustness of AODV in highly dynamic environment.*

Keywords -*MANETs, AODV*

INTRODUCTION

MANETs [1, 3] or Mobile Ad-hoc network is a collection of mobile nodes that communicate by forming a network dynamically that lacks fixed infrastructure and centralized control. Each node in the network moves randomly and can communicate with any other node. Due to this dynamic nature of MANET traditional routing protocols cannot be applied. MANETs find its use in various fields such as PAN (personal area networking), meeting rooms, disaster management, search and rescue management.

There exists many routing protocols for wired networks but these cannot be applied to MANETs for the above mentioned reasons. Hence specialized routing protocols were developed and implemented to facilitate routing in MANETs due to their mobile nature. These specialized unicast [3] routing protocol were divided into three main categories -Proactive [3], Reactive [3] and Hybrid [3] routing protocol.

Here an attempt has been made to get an insight on the behavior of one of the popular reactive routing protocol called as Ad-hoc on Demand Distance Vector (AODV) routing protocol.A simulation based study was made to understand the PDR and NRL in a highly dynamic environment where the node density along with the stability of the network was varied.

I. RELATED WORK

There are numerous papers published on AODV and MANETs.Some lacked experiments and some dynamicity. This paper attempts to overcome these.Few of the related work are as follows:

Rakesh Kumar et.al. (2010)[1] presents a review on various routing protocol for MANETs. This work attempted to compare performance of few routing protocols for MANETs but considered a fixed pause time thus making the topology stable.

Hongbo Zhou (2003)[2] presents a paper on MANET and different routing protocols in MANET.This was a theoretical paper and no experimental work was done.

Charles E. Perkins et.al.(2001)[3] presents an analysis of the performance of AODV and DSR.This study considered a static environment with fixed number of nodes.

Mangesh Ghonge et.al(Feb 2012) presents a paper on Simulation ofBlackhole Attack in AODV.However, the pause time was not taken into consideration.

II. OVERVIEW OF AODV

AODV or Ad-hoc on Demand Distance Vector routing is a reactive routing protocol used in MANET and uses traditional routing. A reactive routing protocol is one that discovers path from sender to receiver only on demand and does not maintain any routing information. AODV maintains destination sequence number as done by DSDV [3] in order to determine the freshness of a route. In order to communicate with the destination node the source node broadcasts a route request packet (RREQ) to its neighboring nodes if no prior information is available. If the neighboring node is the destination node, it replies with a route reply (RREP) packet else it rebroadcasts the RREQ packet to its neighboring nodes. This process continues till the destination node is found. All the

intermediate node keep track of the routing information. The intermediate nodes forwards the packet only after increasing the hop count field. If a node leaves the topology or there is a break in a link, a route error (REER)packet is send to all and a route discovery is initiated once again.

III. PERFORMANCE METRIC

The performance of routing protocol can be analyzed based on the following metrics:

Pause time: Pause time is a time in which all nodes in network are motionless but transmission is continued. Lower pause time means highly dynamic environment i.e. the nodes are in continuous motion. Higher pause time indicate higher stability of the environment i.e. the nodes are motionless and at same position.

Node density: Node density is defined by the number of nodes in a given area.

Packet Delivery Ratio (PDR): Packet delivery ratio is the ratio between the number of AGT packets send by the source to the number of AGT packets received by the destination (We have considered the packets only in the application layer).

Normalized Routing Load (NRL): It is the number of routing packets transmitted per data packet delivered to the destination.

IV. SIMULATIONS

Simulation using NS-2(Network simulator version 2.35) has been used in order to measure the performance of AODV under varying node(25,50,100) scenario as well as considering the pause time to vary from 0 to 20 s, It has been considered that there will be only one node acting as source and one node as destination in the entire network.The mobility pattern for nodes will follow Random waypoint model where each node is permitted to move randomly in its own desired direction and speed and independent of the movement of other nodes. Thus, this environment is realistic to practical scenario.Table1 summarizes all the simulation parameters.

Table1: Simulation Parameters

PARAMETER	VALUE
Traffic Type	CBR
Number of nodes	25,50,100(considering 25 to be low node density and 100 to be high node density)
Transmission Range	250m
Simulator	Ns2 (version 2.35)
Simulation time	100s
Area of network	1000 *1000 m^2
Pause time	0,5,10,15,20 s
Maximum speed of nodes	20 m/s
Mobility model	Random waypoint

V. SIMULATIONS METHODOLOGY

In order to start the simulation the number of nodes is kept constant (i.e., 25, 50 or 100) and the pause time is varied as 0, 5,10,15,20 s. The three figures given below shows the simulation of AODV with the specified simulation parameter as given in Table1.These figures are the snapshot taken from the running NAM (network animator) file. The small circles depict the different mobile nodes present in the given area. The yellow colored nodes are the source and the destination nodes, represented by S and D. The larger circles shows the transmission range of a particular node. The small lines that are in between nodes depict the packets that are being transferred from source to destination. The square boxes are the packets being dropped by the source node.

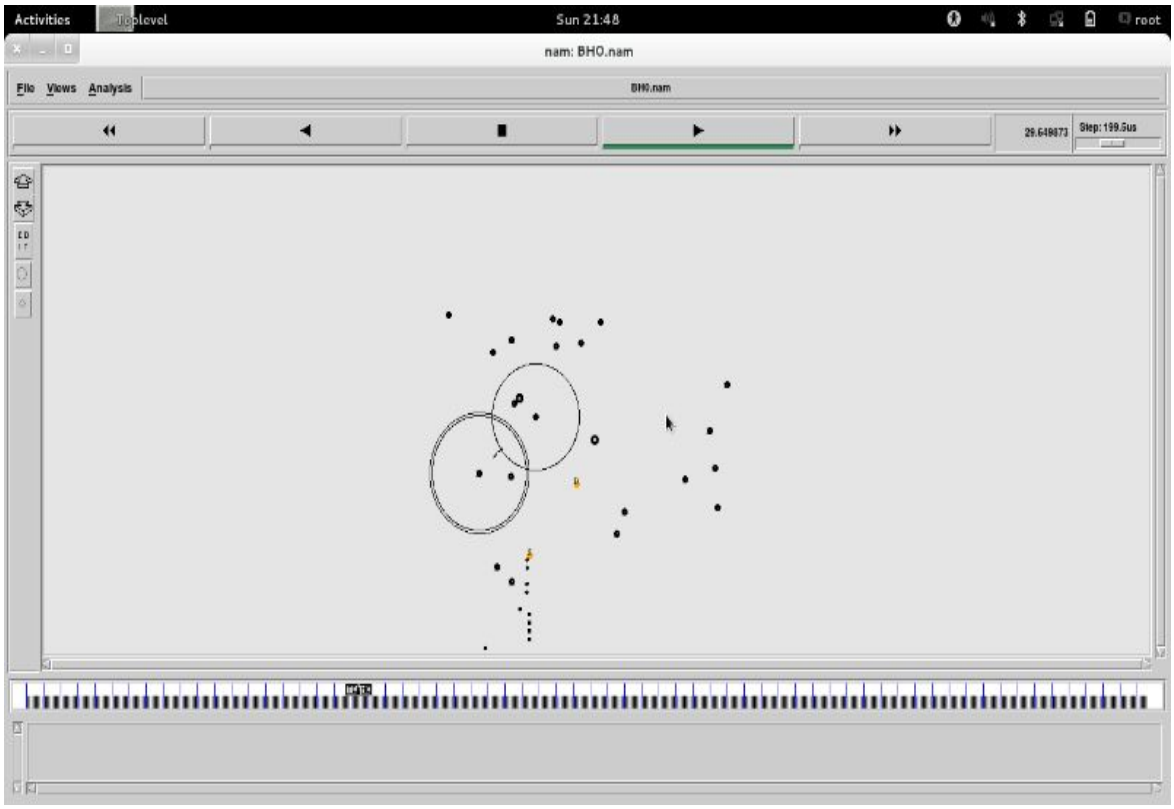

Figure 1: Simulation of 25 nodes

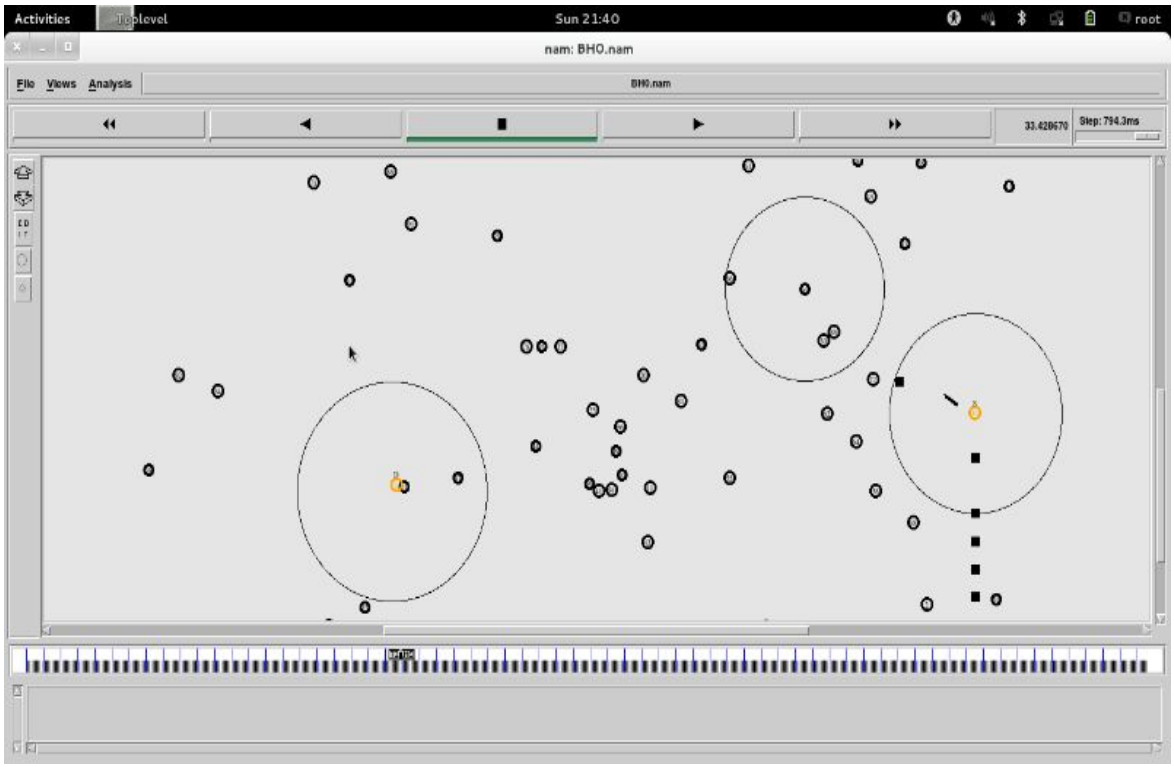

Figure 2: Simulation of 50 nodes

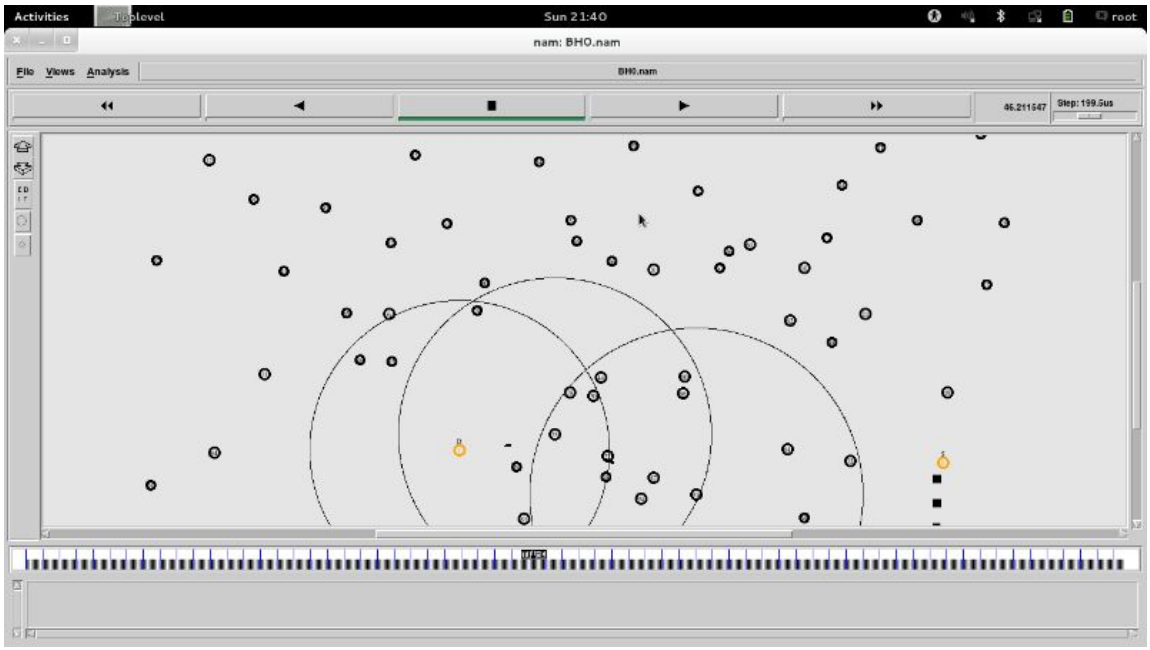

Figure 3: Simulation of 100 nodes

VI. RESULTS

PACKET DELIVERY RATIO: The following graph shows the result for packet delivery ratio.

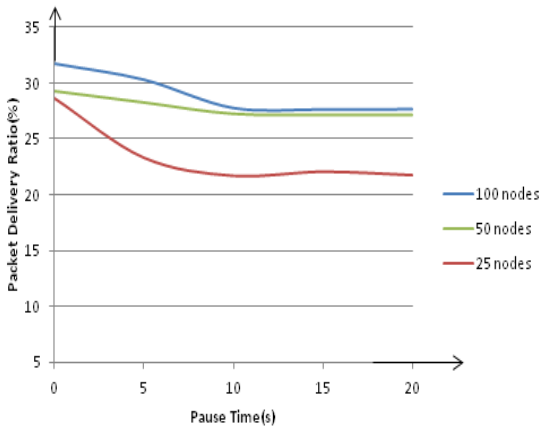

Figure 4: Pause time vs Packet delivery ratio

From the above graph it is observed that as the node density increases there is a slight increase in the PDR. A probable reason for this is since the area is constant and the density increases there is more likelihood of the source and destination nodes coming in transmission range of each other or the intermediate nodes that lie on the routing path. It is also seen that after a certain pause time the PDR attains a stability. This happens since we have taken only one source destination pair into consideration and as the pause time increases the topology becomes more stable and newer routing paths need not be found.

NORMALIZED ROUTING LOAD:The graph given below shows the result for normalized routing load.

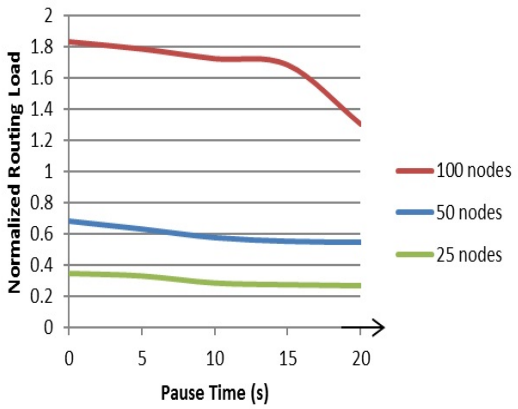

Figure 5: Pause time vs normalized routing load.

The above result shows that as the pause time increases, that is, as the environment acquires stability there is a decrease in routing load. The decrease in routing load can be accounted for the increased stability and lesser number of routing packets to be exchanged.

It has also been seen that with the increase in number of nodes the routing load increases .This increase in NRL is because more number of routing packets are exchanged between more number of nodes for the establishment of connection.

VII. CONCLUSION

The results obtained by this simulation lead us to the following conclusions:

1. Considering a fixed area of 1000 * 1000 m^2, as the node density increases from low density to high density there is a slight increase in PDR and NRL.

2. Keeping the area and number of nodes as constant, as the pause time increases both the NRL and PDR decreases.However, after a certain time interval PDR attains stability i.e. more dynamic the environment more is the PDR.

3. For the given simulation parameter it is observed that if the pause time is 10% of the given simulation time or higher, the PDR attains stability.

4. The results also conclude that as the number of mobile node doubles there is a 40% increase in NRL.

REFERENCES

[1] Rakesh Kumar, Vijay Joshi, Vijay Dhir, "Performance Comparison of Routing Protocols in Mobile Ad Hoc Networks", *International Journal of Engineering Science and Technology, Vol. 2(8),pp 3494-3502, 2010*

[2]Charles E. Perkins,Elizabeth M. Royer,Samir R. Das and Mahesh K. Marina(2001): "Performance Comparison of Two On-Demand Routing Protocols for Ad Hoc Networks" *IEEE Personal Communications, February 2001*

[3]Hongbo Zhou (2003):"A Survey on Routing Protocols in MANETs",*Technical Report: MSU-CSE-03-08Mar 28, 2003*

[4]Mangesh Ghonge, Prof. S. U. Nimbhorkar(2012):"Simulation of AODV under Blackhole Attack in MANET *"International Journal of Advanced Research in Computer Science and Software Engineering, Volume 2, Issue 2, February 2012.*