Analysis of AODV in Grid Environment

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ABSTRACT
Routing Issues in MANET is one of the key areas of researches in Mobile Computing. This paper is mainly focused on evaluating AODV routing protocol in Grid Environment using Random Direction mobility model. We evaluate various QOS metrics such Average Throughput, End to End Delay, Jitter and Packet Loss. Random Direction Mobility is the mobility model proposed for movement of various MANET nodes in Grid Environment. The performance analysis was conducted by using NS2 Simulator. Since MANETs are not currently deployed on a large scale, research in this area is mostly simulation based. The result shows that AODV routing protocol can performance well in grid environment.

Keywords: Grid Environment, MANET, AODV

1. INTRODUCTION
One of the most critical things for understanding and realizing *Mobile Grid computing* is to have a consistent and accurate definition, or at least determination of what a Mobile Grid is. There are many attempts for the accurate definition of the Grid. However the various approaches that have been made address in a high degree of accuracy the term Grid. Mobile Grid, in relevance to both Grid and Mobile Computing, is a full inheritor of Grid with the additional feature of supporting mobile users and resources in a seamless, transparent, secure and efficient way.

It has the ability to deploy underlying ad-hoc networks and provide a self-configuring Grid system of mobile resources (hosts and users) connected by wireless links and forming arbitrary and unpredictable [7] [8].

A mobile ad hoc network (MANET), sometimes called a mobile mesh network, is a self-configuring network of mobile devices connected by wireless links. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic [8].

2. PROTOCOL DESCRIPTION

2.1 Ad hoc On Demand Distance Vector (AODV)

The Ad hoc On Demand Distance Vector (AODV) routing algorithm is a routing protocol designed for adhoc mobile networks . AODV is capable of both unicast and multicast routing. It is an on demand algorithm, meaning that it builds routes between nodes only as desired by source nodes. It maintains these routes as long as they are needed by the sources. Additionally, AODV forms trees which connect multicast group to ensure the freshness of routes. It is loop-free, self-starting, and scales to large numbers of mobile nodes [4].

AODV builds routes using a route request / route reply query cycle. When a source node S desires a route to a destination D for which it does not already have a route, it broadcasts a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node S and set up backwards pointers to the source node S in the route tables. In addition to the source node's IP address, current sequence number, and broadcast ID, the RREQ also contains the most recent sequence number for the destination of which the source node is aware. A node receiving the RREQ may send a route reply (RREP) if it is either the destination or if it has a route to the destination with corresponding sequence number greater than or equal to that contained in the RREQ. If this is the case, it unicasts a RREP back to the source. Otherwise, it rebroadcasts the RREQ. Nodes keep track of the RREQ's source IP address and broadcast ID. If they receive a RREQ which they have already processed, they discard the RREQ and do not forward it. As the RREP propagates back to the source, nodes set up forward pointers to the destination. Once the source node receives the RREP, it may begin to forward data packets to the destination. If the source later receives a RREP containing a greater sequence number or contains the same sequence number with a smaller hop count, it may update its routing information for that destination and begin using the better route [7].

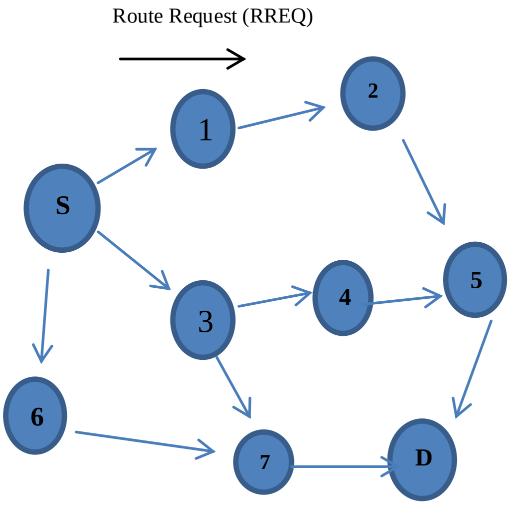

Figure 1.0: Route Request (RREQ)

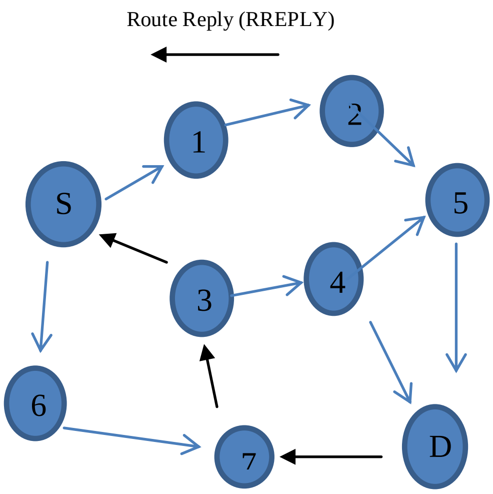

Figure 1.1 : Route Reply (RREPLY)

3. PROPOSED ALGORITHM FOR AODV

3.1 Route Request

Route Request is responsible for generating route between source and destination. If a route is not available for the destination, a route request packet (RREQ) is flooded throughout the network. The RREQ contains the following fields :

Source Address	Request ID	Source Seq No	Destination Address	Destination Seq No	Hop Count

The request ID is incremented each time the source node sends a new RREQ, so the pair (source address, request ID) identifies a RREQ uniquely. On receiving a RREQ message each node checks the source address and the request ID. If the node has already received a RREQ with the same pair of parameters the new RREQ packet will be discarded. Otherwise the RREQ will be either forwarded (broadcast) or replied (unicast) with a RREP message:

• If the node has no route entry for the destination or it has one but this is no more an up-to-date route, the RREQ will be rebroadcasted with incremented hop count.

• If the node has a route with a sequence number greater than or equal to that of RREQ, a RREP message will be generated and sent back to the source.

Working of this RREQ module is as follows:
if current addr = dest_addr
{
construct the RREPLY packet and RREQ packet, send RREPLY packet to node prevHop from which it has received RREQ
}
else
{
add the current node address into the trail field & forward the RR EQ packet to the neighbour nodes }

• At any node, when it receives RREPLY it does the following
if current addr = dest_addr
{
update the routing table according to the hop count and retrieve the packet from the data queue and insert into normal queue.
}
Else
{
update the routing table according to the hop count and forward the packet to neighbour following the trail content
}

3.2 Route Reply

Route Reply is responsible for the maintenance of the path generated during the discovery phase.If a node is the destination, or has a valid route to the destination, it unicasts a route reply message (RREP) back to the source. This message has the following format.

Source Address	Destination Address	Destination Seq No	Hop Count	Life time

• At each node, when it receives data packet, it does the following
if current addr = dest_addr
{
extract data and set type=ack in data packet , remove the data content and send acknowledge packet to prev_id
}
Else
{
Get pheromone values of all links using neighbor table, compute probability for all nodes in neighbor table and send packets to that link which has highest probability
}
Decay the table whenever accessed. If the pheromone value = 0.1 for any destination then delete the destination entry from the routing table.

3.3 Route Error

All nodes monitor their own neighborhood. When a node in an active route gets lost, a route error message (RERR) is generated to notify the other nodes on both sides of the link of the loss of this link.

4. MOBILITY MODEL

Mobility models are widely used in the simulation-based performance analysis of mobile networks. Some of the Mobility models are:

1. Random Way Point Mobility Model
2. Random Walk Mobility Model
3. Random Direction Mobility Model

In this Paper, We have chosen Random Direction Mobility Model to evaluate the performance of AODV in Grid environment.

4.1 Random Direction Mobility Model

The Random Direction Mobility Model was created in order to overcome a flaw discovered in the Random Waypoint Mobility Model. MNs using the Random Waypoint Mobility Model often choose new destinations, and the probability of choosing a new destination that is located in the center of the simulation area, or requires travel through the middle of the simulation area, is high. Royer states that MNs moving with the Random Waypoint Mobility Model appear to converge, disperse, converge again. In order to alleviate this type of behavior and promote a semi-constant number of neighbors, the Random Direction Mobility Model was developed. In this model, MNs choose a random direction in which to travel instead of a random destination. After choosing a random direction, an MN travels to the border of the simulation area in that direction. As soon as the boundary is reached the MN stops for a certain period of time, chooses another angular direction (between 0 and 180 degrees) and continues the process. Figure 1.2 shows an example path of an MN, which begins at the center of the simulation area or (250,250), using the Random Direction Mobility Model.

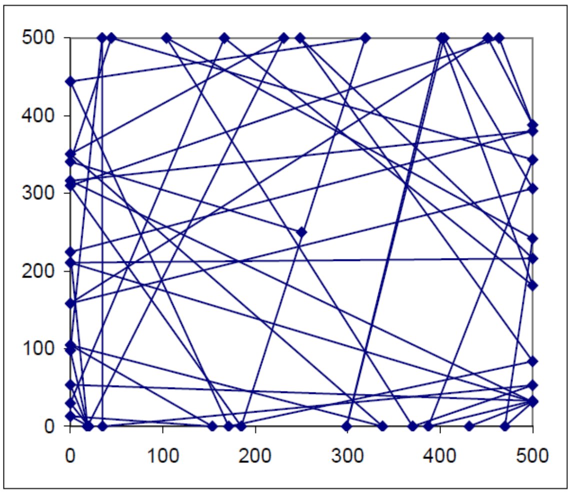

Figure 1.2 :
Traveling pattern of an MN using the Random Direction Mobility Model

5. SIMULATION

This section consists of two parts. The first part introduces the simulation scenario, simulation parameters and the simulation tools. The second displays the simulation results and the explanations.

5.1 Simulation Scenario

To prove the performance of our proposed algorithm, we use the Network Scenario Generator (NSG)to generate the TCL file of routing and grid map, and input the TCL file to the Network Simulation, version 2.34 (NS-2) for simulation. Ns 2 is a discrete event simulator mainly used in MANET research.As for the simulation parameters, we design a grid map of 1000 meters multiplied by 1000 meters.

Table 1: Simulation Parameters

Parameter	Value
Area	1000m X 1000m
Nodes	25
Node placement	Grid
Maximum Speed	50 sec
Mobility Model	Random Direction Model

5.2 Simulation Result and Analysis

To evaluate the performance of routing protocols, the following metrics are considered.

1)Average Jitter: The delay variation between each received data packet. It measures the stability of the algorithm's response to topological changes. The variation of Average jitter with varying the number of mobile nodes is shown in Figure 1.3.

2)Average End-to-end delay: End-to-end delay indicates how long it took for a packet to travel from the source to the application layer of the destination. The variation of Average End-to-End Delay with varying the number of mobile nodes is shown in the Figure 1.5.

3)Throughput: The total amount of data a receiver R actually receives from the sender divided by the time it takes for R to get the last packet. The variation of Throughput with varying the number of mobile nodes is shown in Figure 1.4

4)Dropped Packets: Total number of dropped packets from the sender to the receiver is shown in the figure 1.6

5)Sequence Number of all packets: Sequence numbers of all sent, received ,dropped packets are shown in Figure 1.7

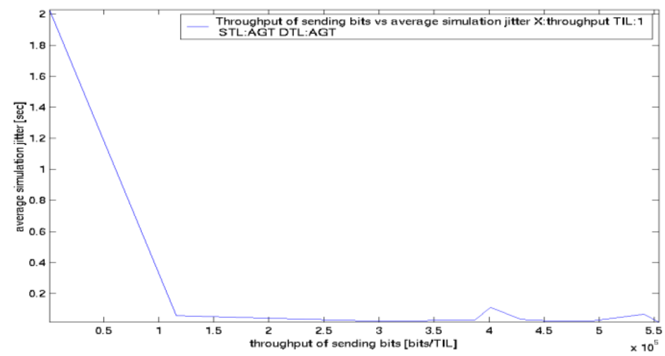

Figure 1.3 : Jitter

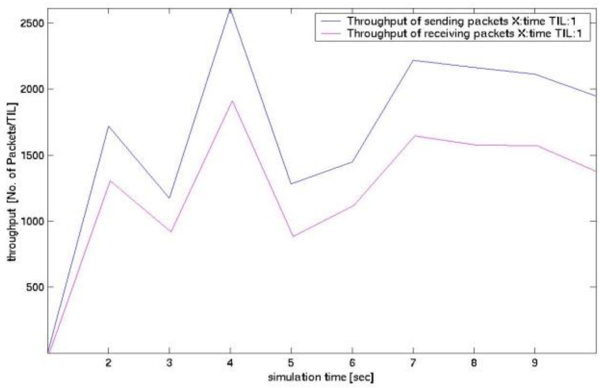

Figure 1.4 : Throughput

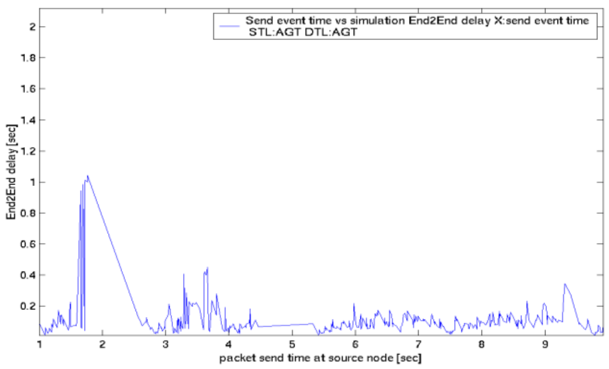

Figure 1.5 : End to End Delay

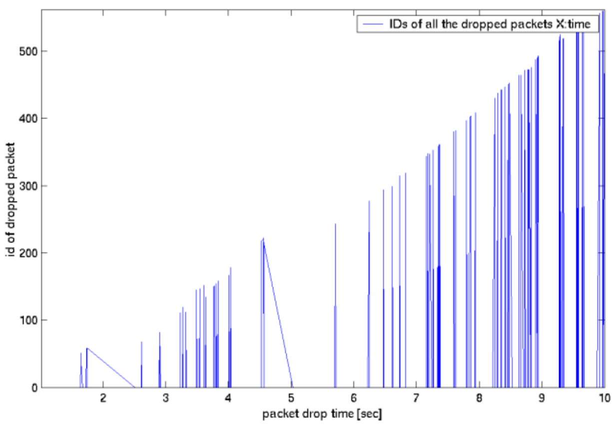

Figure 1.6 : Packet Id of Dropped Packets

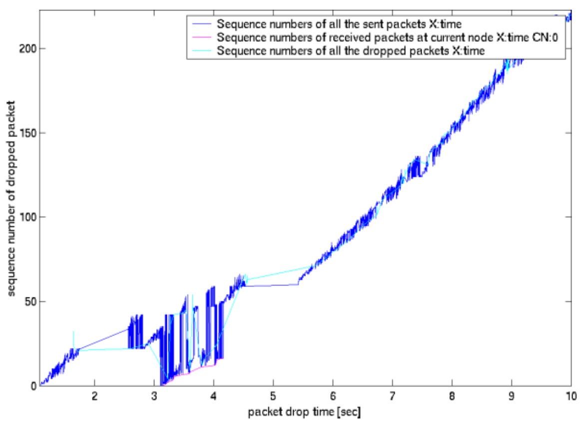

Figure 1.7 : Sequence No of All Packets

6. CONCLUSION

The performance of AODV is studied by placing the nodes in Grid Environment. The simulation results shows that AODV achieves better performance in Grid Environment. One of our future research studies is the study of the behaviour of AODV in various environments with various mobility models.

7. REFERENCE

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