A Review of ADHOC Routing Protocols in Different Mobility Models

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Abstract— **Adhoc Networks are multi hop wireless networks with dynamically changing network connectivity because of mobility. The protocol suite having many routing protocols designed for adhoc routing. The widely used adhoc routing protocol are Adhoc On Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Temporally - Ordered Routing Algorithm (TORA) and Destination Sequenced Distance Vector (DSDV). In this paper, the three random based mobility models such as Random walk, Random waypoint, and Random Directions were implemented. The two differ parametric conditions like End-to- end packet delivery delay and packet-delivery fraction are compared with respect to mobility speed, network size and traffic. The AODV protocols in Random Waypoint mobility model performs better than DSR, DSDV and TORA in Random walk and random Direction mobility model shows in simulation result. Depend on the observations, it is to suggest that AODV routing protocol can be used under high mobility since it do better than DSDV, TORA and DSR protocols.**

Keywords
AODV, DSDV, TORA, Mobility models, Ad hoc Networks.

I. Introduction

A mobile ad hoc network (MANET) is an autonomous system of mobile hosts connected by wireless links. An adho c network is the cooperative engagement of a collection of mobile nodes without the required intervention of any centralized access point or existing infrastructure. The various adhoc routing protocols have their unique properties. So in order to find out the most serving and enhance routing protocol for the highly dynamic topology in adhoc network, the routing protocols behavior has to be analyses using different node traffic, mobility speed and network size. Thus, the aim is to carry out a structural performance comparison of ad hoc routing protocols under mobility models.

The main aim of this paper is:

- Track the detailed analyses of ad hoc routing protocols
- Implement the Mobility models
- Analyses the accomplishment differentials of routing protocols under mobility.

The structure of the paper is as follows. Section 2 discusses the Adhoc routing protocols used in this evaluation study. Section 3 presents the Random mobility models used in this analysis. The simulation results, followed by their interpretations are presented in section 4.

II. Mobile Ad-hoc Networking Protocols

In ad-hoc networking there is no direct link from one to another node so this is main problem during sending data. The nodes in the network are moving around unpredictable, and it is very difficult which nodes that are directly linked together. The topology of an ad-hoc network is continuously changing and it is very difficult for routing process. Mainly there are two approaches for routing process in adhoc networks. The first approach is reactive, source initiated or on-demand. In this every time a message is sent it first has to find a path by searching the whole network. There are many different protocols that are in act of granting. The second approach is a proactive approach which is table driven and uses periodic protocols. In this means that all nodes have tables with routing information which are updated at intervals. The AODV, TORA and DSR are source-initiated or on-demand routing protocols and DSDV is a table driven protocol. The ad hoc routing protocols acknowledge in this study are explained below.

A. Destination Sequenced Distance Vector(DSDV)

This protocol is based on the classical Bell- man-Ford routing algorithm [2] to apply to mobile ad hoc networks.DSDV [2] belongs to the class of proactive routing protocols. DSDV also has the feature of the distance-vector protocol [3] in that every node having a routing table including the next-hop information for every possible destination. Every entry has a sequence number. If a new entry is achieved, the protocol favors to select the entry having the immense sequence number. If their sequence number is the same, then protocol selects the metric with the lowest value. Routing information is send by broadcast and when any changes are occurs in topology updates have to be send immediately Packets are transmitted between the stations of the network by using routing tables which are stored at each station of the network. Each routing table having lists of all available destinations, and the number of hops to each node. Each route table entry is tagged with a sequence number which is defined by the destination station. Routing information is advertised by broadcasting or multicasting the packets which are transmitted periodically and incrementally as topological changes are detected - for illustration, when stations moved within the network. Data is also kept about the total time between arrival of the first and the arrival of best route for each destination. Depend on this data, a decision may be made to delay advertising routes which are about to vary soon.

B. Temporally Ordered Routing Algorithm(TORA)

TORA protocol [10] is reactive protocol. The protocol is efficient, highly able to adapt and it is used to build the "temporal order" of topological change events which is used to organize the reaction to topological changes. The protocol is design to minimal reaction to topological changes. The protocol is scatter in that nodes need only maintain information about adjacent nodes. The protocol is "source initiated" and quickly creates a set of routes to a given destination only when needed. The protocol performs three functions through the use of three distinct control packets [8] such as query (QRY), update (UPD) and clear (CLR).

C. Ad-hoc On Demand Distance Vector Routing(AODV)

Adhoc Networks are multi hop wireless networks with dynamically changing network connectivity owed to mobility. The protocol suite having several routing protocols specifically designed for ad-hoc routing. AODV is a reactive protocol depends on the distance vector algorithm. The algorithm uses not identical messages to discover and maintain links. Whenever a node wants and finds a route to another node it broadcasts a Route Request (RREQ) to all its neighbors. The RREQ spread through the network until it reaches the destination or the node with a fresh enough route to the destination. Then the route is made available by to make known a RREP back to the source. The algorithm uses hello messages (a special RREP) that are broadcasted periodically to the immediate consideration neighbors. These hello messages are local advertisements for the continued company of the node, and neighbors using path through the broadcasting node will continue to mark the routes as valid. If hello messages stop coming from a particular node, the neighbor can pretend that the node has moved and marked that link to the node as broken and declare the affected set of nodes by sending a link failure indication to that set of nodes.

D. Dynamic Source Routing(DSR)

Dynamic Source Routing (DSR) [5], belongs to the class of Reactive protocols and allows to dynamically discovering a route across multiple network hops to any destination. Source routing means that each packet in its header carries the complete ordered list of nodes through which the pack- et must pass. DSR uses no periodic routing of messages. Thereby reducing network bandwidth overhead, conserving battery power and avoiding large routing updates throughout the ad-hoc network. Instead DSR relies on support from the MAC layer.

III. Random Mobility Model

The mobility model [8] plays a very important role in determining the protocol performance in mobile Ad Hoc Network. Hence, this work is done using the random mobility models like Random Waypoint, Random Walk and Random Direction. These models with various parameters reflect the realistic traveling pattern of the mobile nodes. The following are the three models with the traveling pattern of the mobile nodes during the simulation time.

A. Random Way point

The Random Way Point Mobility Model includes pauses between changes in direction and/or speed. A Mobile node begins by staying in one location for a certain period of time (i.e. pause). Once this time expires, the mobile node chooses a random destination in the simulation area and a speed that is uniformly distributed between speeds. . The random waypoint model is a commonly used mobility model in the simulation of ad hoc networks. It is known that the spatial distribution of network nodes moving according to this model is non uniform. However, a closed-form expression of this distribution and an in-depth investigation is still missing. This fact impairs the accuracy of the current simulation methodology of ad hoc networks and makes it impossible to relate simulation-based performance results to corresponding analytical results. To overcome these problems, it is presented a detailed analytical study of the spatial node distribution generated by random waypoint mobility. The movement trace of a mobile node using the Random Way-point model is shown in figure 1. It is considered that a generalization of the model in which the pause time of the mobile nodes is chosen arbitrarily in each waypoint and a fraction of nodes may remain static for the entire simulation time.

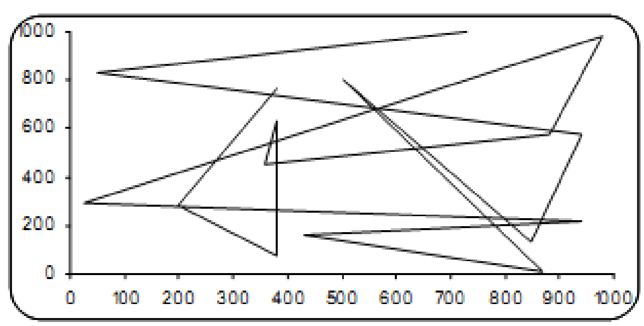

Figure 1 .Random Way Point

B. Random Walk

In this mobility model, a mobile node moves from its current location to a new location by randomly choosing a direction and speed in which to travel. The new speed and direction are both chosen from pre-defined ranges, [min- speed, max-speed] and [0, 2*pi] respectively. Each movement in the Random Walk Mobility Model occurs in either a constant time interval 't' or a constant traveled 'd' distance, at the end of which a new direction and speed are calculated. The movement trace of a mobile node using the Random Walk model is shown in figure 2

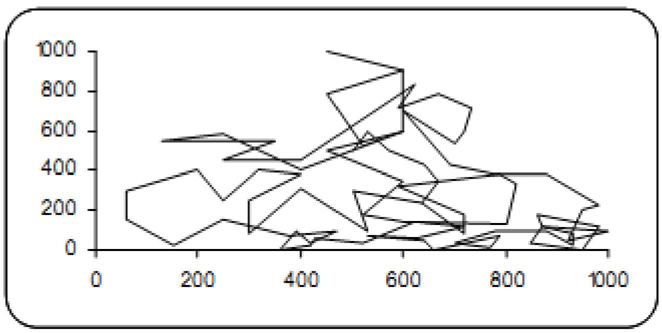

Figure 2.Random walk

Since many entities in nature move in extremely unpredictable ways, the Random Walk Mobility Model was developed to mimic this erratic movement. An MN moves from its current location to a new location by randomly choosing a direction and speed in which to travel. The new speed and direction are both chosen from pre-defined ranges, [speedmin, speedmax] and [0, 2*pi] respectively. Each movement in the Random Walk Mobility Model occurs in either a constant time interval 't' or a constant distance traveled 'd', at the end of which a new direction and speed are calculated. If an MN which moves according to this model reaches a simulation boundary, it bounces off the simulation border with an angle deter- mined by the incoming direction. The MN then continues along this new path random walk on a one or two- dimensional surface returns to the origin with complete certainty, i.e., a probability of 1.0. This characteristic ensures that the random walk represents a mobility model that tests the movements of entities around their starting points, without worry of the entities wandering away never to return. Random Walk is a memory-less mobility pattern. This characteristic can generate unrealistic movements such as sudden stops and sharp turns.

C. Random Direction

A mobile node chooses a random direction in which to travel similar to the Random Walk Mobility Model. The node then travels to the border of the simulation area in that direction. Once the simulation boundary is reached, the node pauses for a specified time, chooses another angular direction (between 0 and 180 degrees) and continues the process. The Random Direction Mobility Model was created to overcome clustering of nodes in one part of the simulation area produced by the Random Waypoint Mobility Model. In the case of the Random Waypoint Mobility Model, this clustering occurs near the center of the simulation area. In the Random Waypoint Mobility Model, the probability of an MN choosing a new destination that is located in the center of the simulation area, or a destination which re- quires travel through the middle of the simulation area, is high. In this model, MNs choose a random direction in which to travel similar to the Random Walk Mobility Model. An MN then travels to the border of the simulation area in that direction. Once the simulation boundary is reached, the MN pauses for a specified time, chooses another angular direction [0, 180] and continues the process. In a slightly modified version MNs continue to choose random directions but they are no longer forced to travel to the simulation boundary before stopping to change direction. Instead, an MN chooses a random direction and selects a destination anywhere along that direction of travel. The movement trace of a mobile node using the Random Direction model is shown in figure 3.

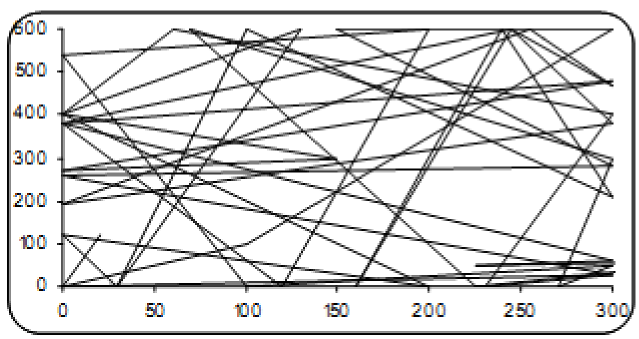

Figure 3.Random Direction

IV. Performance Results

This section discusses the various predominance metrics used and the Performance differentials analyzed. The performance metrics analyzed are the fraction of packets delivered at the destination and the packet delivery ratio for various speeds of mobility, Traffic and Network Size. The simulation is done with different nodes in wireless sensor networks with respect to the random-based mobility model: Random Waypoint, Random Walk and Random direction models. In Random

Waypoint model, most of the times the nodes choose destination closer to the centre of the simulation area and thus producing a dense wave near the centre and stays back there for the specified pause time, also having more neighbors to the nodes in the centre. This will give minimal hop distance between the source-destination pairs. When the network becomes sparse or the traffic load be- comes high the performance produced by DSR and TORA decreases sharply.. DSDV protocol's performance is nearer to AODV under network size metric. TORA protocol's performance was not so good under this mobility model. The Random Walk model creates a high mobility scenario with larger travel time the nodes will travel almost too all the areas. Since there is no pause time between change. The protocols considered for analysis are AODV, DSDV, TORA and DSR of speed and direction, the need for a protocol that updates the routing information quickly as uses the fresh information about the routing becomes mandatory. The simulation results show that the AODV performs better than DSR, TORA and DSDV. One of the reason here is the average hop distance between the source-destination becomes high, and this will increase packet overhead. The usage of the fresh route information and quickly adapting nature of AODV are reasons for better results produced by the AODV. DSDV produces better results than TORA and can be used as the routing protocol under low mobility conditions. The Random Direction Model is an unrealistic model because it is unlikely that people would spread them- selves evenly throughout an area. The nodes choose pause times only at the boundaries and no change of speed and direction before reaching the boundary. This will create a topography in which most of the times most of the nodes are in the boundary and the centre of the area be- comes very sparse. Here the average number of hop distance becomes higher and gives lesser number of alternative paths. AODV protocol produces better results than DSDV, TORA and DSR. When the network size is large, and DSDV produce better result than TORA and DSR.

V. Conclusion

In Random way point model the simulation results shows that when the network becomes sparse or the traffic load becomes high the performance produced by DSR and TO- RA decreases sharply. DSDV protocol's performance is closer to AODV under network size metric. TORA protocol's performance was not so good under this mobility model. Hence, AODV protocol can be chosen as the routing protocol in this type of mobility conditions. In random walk model, AODV performs better than DSR, TORA and DSDV because the average hop distance between the source-destination becomes high in AODV and this will increase packet overhead. So AODV protocols perform better under low and high mobility conditions. The Random Direction Model produces better results than DSDV, TORA and DSR. When the network size is large, DSDV produces better results than TORA and DSR. This shows that AODV is the suitable choice under this mobility model. In this paper, only four ad-hoc routing protocols were considered and their performance were analyzed only under the Random based mobility models. In future, this paper can be enhanced by analyzing the other ad-hoc routing protocols under real-world scenarios such as Group-mobility models.

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