The Efficiency Analysis of Mobility Model using Routing Protocols

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ABSTRACT

In the mobile Ad Hoc networks (MANET) are anticipated to be deployed in different scenarios having the complex mobility of nodes. Generally a variable mobility nature is predictable to have an important impact on the performance of the routing protocols in Ad Hoc networks. In the present work an attempt has been made to give an analysis on the mobility models used in an Ad Hoc network. Using simulation, it further pertains to study the metrics used in support of performance procedures for mobile Ad Hoc network protocols, we have compared the performance of two routing protocol AODV and DSR by using the mobility model and change the node density with varying number of the source node. DSR and AODV both protocol use On-Demand route detection idea but the inner method which they use to find the route is much different for both protocols. We have analyzed the performance of protocols for changeable network load and mobility.

Keywords: Ad-Hoc network, performance, mobility models, routing protocols, AODV, DSR.

1. INTRODUCTION

The Ad Hoc network is an independent system, it implements self-configuration, self-management during its unusual life period, such as deployment, operation and death period [1,2,5] .The wireless nodes freely communicate with each other without any predetermined infrastructure .In the present Ad Hoc Networks is an active area of research. An Effort has been made in achieving capable and reliable routing in Ad Hoc networks. In an Ad Hoc networking each node in the network also acts as a router .The routers are free to move randomly and organize themselves randomly[1,3]. For the design and implementation of communication protocols, the use of simulation tools provides a considerable efficiency and allows near the ideal control in a variety of wireless networks. The routing protocol to be simulated itself, the structural design and the sequence of actions and protocols involved, the mobility models and the broadcasting techniques used and also the metrics serious for evaluating the effectiveness of the protocols. It further pertains to study of the outline information about all the mentioned characteristics. The key role of this paper is that we have accepted a simulation based study of Ad Hoc routing protocols to recognize their behavior when used in an Ad Hoc network environment. The performance of these protocols could be evaluated with the very important mobility model that precisely represents Mobile Nodes (MNs) to give a practical performance measurement. In mobility modeling research, there are two commands of research which could be performed. The first way is towards the design of new models which predicts new era of real world scenario. Second direction is to examine mobility models on account of mobility metrics and the influences of mobility models on routing protocols. This paper is planned as follows. In the part II we discuss the Some mobility model in the Ad Hoc network. In part III, we give brief beginning of AODV and DSR routing protocol [1,3,8] .In part IV, we talk about the random way point mobility model, and in part V agreement the simulation system and outcome obtained in the implementation of simulation. At least we give explanation the conclusion in part VI.

2. MOBILITY MODELS USED IN AD-HOC NETWORK

The mobility of nodes, network topology dynamic characteristics and the self-organization is the difference of Ad Hoc network with new networks. In the Ad Hoc network simulation research, mobility model is used to describe the node's movable pattern, which uses statistical method to simulate the mobile law of nodes in the practical scene [1,3, 4, 5, 6]. When the linear distance of two nodes is within the range of wireless communication, it is probable to set up a wireless link between each other [5,7].Thus, the mobile rule of nodes will explicitly control the connection condition of the wireless link. Mobility models are proposed to focus on individual movement patterns due to point to point communication in cellular networks [4, 5] whereas Ad Hoc networks are designed for group communication. Such models [8] are recommended to retain movement, and efficient transmission among nodes in real life applications. In addition to this, these models mainly focus on the individual motion behavior between mobility era with minimum simulation time in which a mobile node moves with stable speed and direction. These models represent the features of the mobile nodes in an Ad Hoc network like speed, direction, distance and node movement. Mobility models [9] can be categorized based on the following criteria which is based on measurement, scale of mobility, randomness, geological constraints, destination oriented and by varying parameters. Usually, there are two types of mobility models (I) Trace based mobility models and (II) Synthetic mobility models. Trace models provide mobility patterns based on deterministic approach while synthetic models present movements of mobile nodes in a practical manner. At the present an attempt has been made, to address the many mobility models have been bring help for odd applications**.** There are many mobility models have been proposed in the literature [2,6,8,16,18,19,20,24,37]. The a number of mobility models is:

1. Random Way point Model: This Mobility Model includes pause times between changes in direction and speed. Mobile nodes stay in one location for a certain period of pause time [15].

2. Random Walk Mobility Model: an MN (Mobile Nodes) moves from its current location to a new location by randomly choosing a direction and speed in which to travel [17].

3. Probabilistic Random Walk Model: A model that utilizes a set of probabilities to determine the next position of an MN [18,19,20,25].

4. Random Direction Mobility Model: A model that forces MNs to travel to the edge of the simulation area before changing direction and speed, to overcome density waves produced by RWP[19].

5. Column Mobility Model: A group mobility model where the set of MNs forms a line and are uniformly move forward in a particular direction [15].

6. Nomadic Community Mobility Model: A group mobility model where a set of MNs move together from one location to another [23, 24].

7. Manhattan Grid Model: In this model node move only on predefined paths. The arguments and -v set the number of blocks between the paths [25].

8. Reference Point Group Mobility Model: A group mobility model where group movements are based upon the path travelled by a logical center [20].

9. Gauss Markov: A model that uses one tuning parameter to vary the degree of randomness in the mobility pattern. Initially each MN is assigned a current speed and direction [21].

10. Constant Velocity Random Direction Mobility Model: In [27], revised the Random Mobility Model for assigning the same speed to each node for the entire simulation period. A mobile node moves after choosing a random direction in the range 0 to 2 and "bounces" of the simulation border on reaching the grid boundary with an angle determined by incoming direction and further the mobile node continues to move in the new path found.

11. Boundless Simulation Area Mobility Model: By [27,28] showed that there exists a relationship between the previous direction of travel and velocity of a mobile node, with its current direction of travel and velocity.

12. City Area, Area Zone and Street Unit Mobility Models: In [22,24,28], characteristics of mobility models have been explained in detail including critical inputs/outputs and issues that should be consider when designing a specific mobility model. Input parameters include a residents of mobile nodes, geographic area structured into regions and a time period. In output parameters we have a collection of functions that determine the location of a mobile node over the geographical area at a particular time. In combining these input/output parameters with the Transportation Theory, these authors have created three**:** With the help of three different states; State 0 for current location of a given mobile node, state 1 of the mobile node in previous location and State 2 for mobile node's next location when mobile nodes move forward, Chiang's mobility model makes use of probability matrix for determining the position of a particular mobile node in the next time step.

3. PROTOCOLES USED

In this segment, paper investigates the on demand routing protocols. The basic idea is to find and maintain a route only when it is used for communication.

3.1 AODV (AD-HOC On-Demand Distance Vector):

AODV is a routing protocol for mobile Ad Hoc networks and other wireless Ad Hoc networks[25,35,36]. This protocol is capable of both unicast and multicast routing [30, 31]. In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for a link. Other AODV nodes ahead this message, and record the node that they heard it from, creating a blast of provisional routes back to the needy node. When a node receives such a message and previously has a route to the desired node, it sends a message backwards through a temporary route to the requesting node. The needy node then begins using the route that has the least number of hops through other nodes. Unused entries in the routing tables are recycled after a time. When a link fails, a routing error is passed back to a transmitting node, and the process repeats. Each demand for a route has a sequence number. Nodes use this sequence number so that they do not replicate route requests that they have already passed on. AODV requires more time to set up a connection, and the primary communication to set up a route is heavier than some other approaches.

3.2 DSR (Dynamic Source Routing):

DSR is a simple and a capable routing protocol designed specially for use in multi-hop wireless Ad Hoc networks of mobile nodes. The sender knows the complete hop by hop route to the destination. These routes are stored in a route cache [25,34,35,36]. This protocol is composed of the two main mechanisms of "Route Discovery" and "Route Maintenance", which work together to allow nodes to determine and maintain routes to arbitrary destinations in the Ad Hoc network. Other advantages of the DSR protocol include easily guaranteed loop-free routing, support for use in networks containing unidirectional links, use of only "soft state" in routing, and very quick improvement when routes in the network change. The DSR protocol is designed mainly to work well with very high rates of mobility.

4. MOBILITY MODEL USED

In this section, paper investigates which mobility are used for performance analysis. Here, we discuss random waypoint mobility model.

The random way point model is a random based mobility model used in mobility management schemes for mobile communication systems. This proposed to explain the movement pattern of mobile user which consists of how their location, mobility and acceleration change over time. The random way point model, first proposed by Johnson *et al.;* [21], soon became a "benchmark" mobility model to evaluate the because of its straightforwardness and wide convenience. Random Way point mobility model is similar to the Random Walk Mobility Model if pause time is zero. The Radom Way point is the simplest model whose node trace is generated by the stardust tool by CMU Monarch group, included in NS-2 simulator.

The Random Waypoint Model [26] assumes each MN is initially placed on a uniform-randomly chosen coordinate within the network area. The node selects, regularly and randomly, a target location within the network to travel. The velocity to move to this position is also selected homogeneously and randomly from the range [Vmin...Vmax] where Vmin and Vmax characterize the minimum and maximum feasible node velocities. Once the MN moves to the chosen location, it waits at that location for a definite amount of time called the pause-time. The above process of choosing a random target location and random velocity to move is repeated awaiting a predefined simulation time is reached.

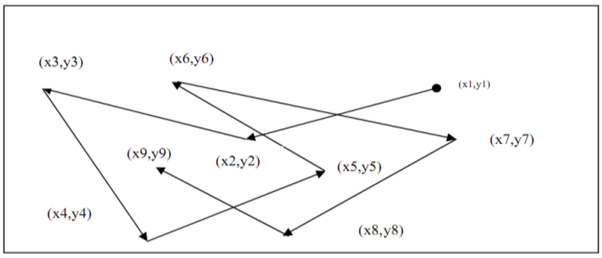

Figure 1: Random Waypoint Model viewing node movement.

5. SIMULATION MODEL

In this paper, an attempt was made to compare the two protocols under the random way mobility scenario.Simulation model based on NS-2 is used in the assessment. The Distributed Coordination Function DCFs of IEEE 802.11 for wireless LANs is used as the MAC layer protocol. In this situation we contain situated 50 and 100 nodes randomly scattered in an area of 500m x 500m. For this study, we have used the random waypoint mobility model for the node associated with 30 Sec. pause time and 0-20 m/sec. Speed. The parameters used for carrying out simulation are summarized in the table 1, which is given below.

Parameters	Value
Routing Protocols	AODV, DSR
MAC Layer	802.11
Packet Size	512 bytes
Terrain Size	500m * 500m
Nodes	50 and 100 nodes.
Mobility Model	Random waypoint Mobility Model
Data Traffic Type	CBR (constant bit rate)
No. of Source	5,7,9,11,13,15
Simulation Time	100 sec.
Maximum Speed 0	0-20 m/sec (30 sec pause time)
CBR Traffic Rate	4 packets/sec

Table 1: Simulation Parameters

5.1 Performance Metrics

The performance of routing protocols AODV & DSR is compared using the following important Quality of Services (QoS) metrics:

5.1.1. Packet Delivery Ratio (PDR): Packet delivery ratio is an important metric as it describes the loss rate that will be seen by the transport protocols, which run on top of the network layer. Thus the packet delivery ratio in turn reflects the maximum throughput that the network can support. It is defined in [33,34] as the ratio between the number of packets originated by the application layer CBR sources and the number of packets received by the CBR sink at the final destination. It is the ratio of data packets delivered to the destination to those generated from the sources. It is calculated by dividing the number of packets received by destination through the number packet originated from the source.

$$PDF = (Pr / Ps)*100$$

Where Pr is total Packet received & Ps is the total Packet sent.

5.1.2. Average Latency: This includes all possible delays caused by buffering during route discovery, queuing delay at the edge, retransmission delays at the MAC, broadcast and transfer times. The lower the packet latency the improved the application performance as the average end-to-end delay is small. According to [25,33], once the time distinction between very CBR packet sent and received was recorded, dividing the total time difference over the total number of CBR packets received gave the delay for the received packets and defined as:

$$\text{Average Latency} = \frac{\sum_{1}^{N}(CBR_{sendTime} - CBR_{recvTime})}{\sum_{1}^{N} CBR_{recv}}$$

where N is the number of data sources.

5.1.3. Average End-to-End Delay: This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and propagation and transfer times. It is defined as the time taken for a data packet to be transmitted across an MANET from source to destination.

D = (Tr –Ts), Where Tr is receive Time and Ts is sent Time

5.2 Packet Delivery Ratio (PDR)

In case of low transfer i.e 5 to 15 source nodes with a lowest node density i.e 50 nodes, AODV protocols deliver more or less all originated data packets (about 90-95%) But the packet delivery portion starts shameful gradually when there is an increase in the number of the source node. DSR performs less competently than AODV when a number of source nodes are low i.e 5 to 15 source nodes with a lowest node density i.e 50 nodes, But when network load increases the packet release ratio of DSR corrupted quicker as compare to AODV. For high node density i.e 100 node and low traffic i.e 5 to 15 source nodes, AOVD perform better than DSR but once traffic is increasing ADOV performance reduce strong i.e 20 source nodes and DSR starts performing better than AODV .

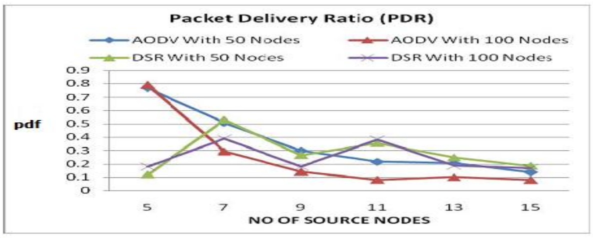

Figure 2: packet deliverance fraction Vs number of source nodes

5.3 Average Latency:

Figure 3 shows that average Latency is always high for both the scenario i.e 50 nodes and 100 nodes for DSR protocol because DSR uses more than one route to transfer data packets from source node to the destination node. This different route reason variation in delay to delivering the data packet from source node to destination node due to this average Latency amplify extensively in the case of DSR. In case of AODV it uses only one route to deliver data packets until this route fails in that situation it starts a new route discovery process for the destination node. Using one route for delivering data packets from source node to destination node causes less variation in delay which will to lead to less Latency. For both the protocol Latency average Latency increases when the number of source node increases

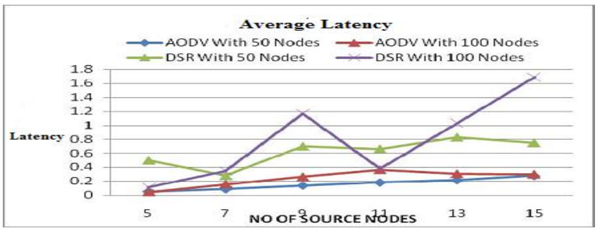

Figure 3: Average latency Vs number of source nodes

5.4 Average End to End delay:

Figure 4 shows that the average end to end delay is low i.e below 10 second, in case of the AODV protocol for both high node solidity i.e 100 node and low node solidity i.e 50 nodes. AODV user only one route that is the shortest path for delivering data from source node to destination node due to this cause average end to end delay for AODV is low as a contrast to DSR. DSR uses more than one route to transmit data packets from source node to destination node which causes more delay as it is not constantly using shortest path for delivering all data packets from source node to the destination node.

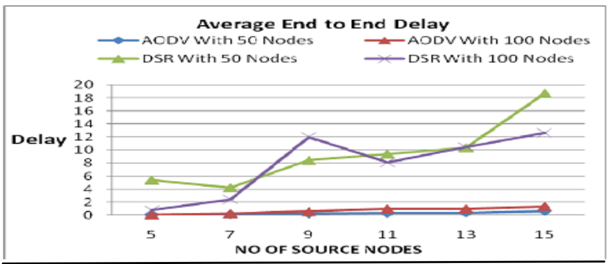

Figure 4: average end to end delay Vs number of source nodes

6. CONCLUSION

It is observed that the network arrange overhead for both AODV and DSR increases with increasing mobility. At lower speed DSR performs better than that of higher speed across the mobility models. In a random way point mobility model with CBR traffic sources, AODV does enhanced than DSR when node solidity is low. In case of high node solidity AODV act is still better in low Traffic load. But in case of high node solidity and high traffic load DSR do better than AODV. AODV forever give low latency irrespective of traffic load and node solidity also AODV gives a improved arrangement than DSR for Average End to End delay. When traffic load increases the Average End to end delay for DSR increases fast. It doesn't affect by the node solidity. Here ,brief comparison the protocols is presented which may help better accepting of these protocols

In this paper, only two routing protocols are used and their performance has been analyzed in the random waypoint mobility model. Also we list the various difficulties we have to face while simulating the routing protocols in an Ad Hoc network paradigm. Our upcoming work includes constructing an energy efficient routing protocol for Ad Hoc Networks. With all these lessons challenges, we positively consider that we have a very stimulating time ahead of Ad Hoc Networks.

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