Comparison of Random Based Mobility Model using TCP Traffic for AODV and DSDV MANET's Routing Protocols

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Abstract:-In Mobile Ad hoc network (MANETS), no fixed infrastructure is available. Different wireless hosts are free to move from one location to another without any centralized administration, so, the topology changes rapidly or unpredictably. Every node operates as router as well as an end system. Routing in MANETs has been a challenging task ever since the wireless networks came into existence. The major reason for this is continues changes in network topology because of high degree of node mobility. The MANET routing protocols have mainly two classes: Proactive routing (or table-driven routing) protocols and Reactive routing (or on-demand routing) protocols. In this paper, we have analyzed various Random based mobility models: Random Waypoint model, Random Walk model, Random Direction model and Probabilistic Random Walk model using AODV and DSDV protocols in Network Simulator (NS 2.35). The performance comparison of MANET mobility models have been analyzed by varying number of nodes using traffic TCP and maximum speed of nodes. The comparative conclusions are drawn on the basis of various performance metrics such as: Routing Overhead (packets), Packet Delivery Fraction (%), Normalized Routing Load, Average End-to-End Delay (milliseconds) and Packet Loss (%).

Keywords: *Mobile Ad hoc, AODV, DSDV, TCP, CBR, routing overhead, packet delivery fraction, End-to-End delay, normalized routing load.*

1. Introduction

Wireless technology came into existence since the 1970s and is getting more advancement every day. Because of unlimited use of internet at present, the wireless technology has reached new heights. Today we see two kinds of wireless networks. The first one which is a wireless network built on-top of a wired network and thus creates a reliable infrastructure wireless network. The wireless nodes also connected to the wired network and these nodes are connected to base stations. An example of this is the cellular phone networks where a phone connects to the base-station with the best signal quality.

The second type of wireless technology is where no infrastructure [1] exists at all except the participating mobile nodes. This is called an infrastructure less wireless network or an Ad hoc network. The word Ad hoc means something which is not fixed or not organized i.e. dynamic. Recent advancements such as Bluetooth introduced a fresh type of wireless systems which is frequently known as mobile Ad-hoc networks.

A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time because the nodes are mobile. The network is decentralized where all network activity; including discovering the topology and delivering messages must be executed by the nodes themselves. Hence routing functionality will have to be incorporated into the mobile nodes. Mobile ad hoc network is a collection of independent mobile nodes that can communicate to each other via radio waves. The mobile nodes can directly communicate to those nodes that are in radio range of each other, whereas others nodes need the help of intermediate nodes to route their packets. These networks are fully distributed, and can work at any place without the aid of any infrastructure. This property makes these networks highly robust.

In late 1980, within the Internet [1] Engineering Task Force (IETF) a Mobile Ad hoc Networking (MANET) Working Group was formed to standardize the protocols, functional specification, and to develop a routing framework for IP-based protocols in ad hoc networks. There are a number of protocols that have been developed since then, basically classified as Proactive/Table Driven and Reactive/On- demand Driven routing protocols, with their respective advantages and disadvantages, but currently there does not exist any standard for ad hoc network routing protocol and the work is still in progress. Therefore, routing is one of the most important issues for an ad hoc network to make their existence in the present world and prove to be divine for generations to come. The area of ad hoc networking has been receiving increasing attention among researchers in recent years. The work presented in this thesis is expected to provide useful input to the routing mechanism in ad hoc Networks.

2. Protocol Descriptions

2.1 Ad hoc On Demand Distance Vector (AODV)

AODV routing algorithm is a source initiated, on demand driven, routing protocol. Since the routing is "on demand", a route is only traced when a source node wants to establish communication with a specific destination. The route remains established as long as it is needed for further communication. Furthermore, another feature of AODV is its use of a "destination sequence number" for every route entry. This number is included in the RREQ (Route Request) of any node that desires to send data. These numbers are used to ensure the "freshness" of routing information. For instance, a requesting node always chooses the route with the greatest sequence number to communicate with its destination node. Once a fresh path is found, a RREP (Route Reply) is sent back to the requesting node. AODV also has the necessary mechanism to inform network nodes of any possible link break that might have occurred in the network.

2.2 Destination Sequenced Distance Vector (DSDV)

The Destination Sequenced distance vector routing protocol is a proactive routing protocol which is a medications of conventional Bellman-Ford routing algorithm. This protocol adds a new attribute, sequence number, to each route table entry at each node. Routing table is maintained at each node and with this table; node transmits the packets to other nodes in the network. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station.

3. Simulation

Both routing techniques were simulated in the same environment using Network Simulator (ns-2). Both AODV and DSDV were tested by the traffic i.e. TCP. The algorithms were tested using 50 nodes. The simulation area is 1000m by 1000m where the nodes location changes randomly. The connection used at a time is 30. Speed of nodes varies from 1m/s to 10m/s. by using TCP traffic we calculate performance of these two protocols for different random based mobility model. i.e.:

- Random Waypoint (RWP)
- Random walk (RW)
- Random direction (RD)
- Prob. Random Walk (PRW)

3.3 Performance Metrics

The key performance metrics chosen for comparing the protocols are throughput, packet delivery fraction, routing overheads, Average end-to-end delay and packets lost. Throughput is a measure of effectiveness of a protocol. Packet delivery fraction is a measure of efficiency of the protocol. To achieve a given level of data routing performance, two different protocols can use differing amounts of overhead, depending on their internal efficiency. Delay is an important metric which is very significant with multimedia and real-time traffic.

4. Simulation Results

The results of our simulation will be presented in this section. First we will discuss the results of both AODV & DSDV protocol for different matrices and after that we make the comparison between the two protocols.

4.1 AODV Result

4.1.1 Routing Overhead (packets)

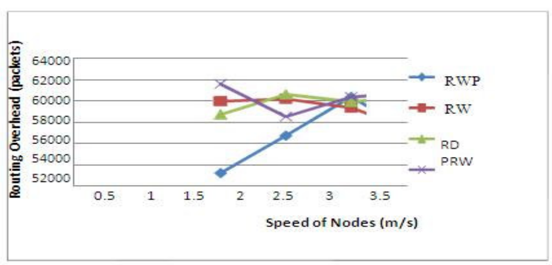

Fig 1 Routing Overhead vs. Speed of Nodes

From fig. 1 we conclude that every mobility model is suffering from more variations in routing overhead with increase in mobility. Random Waypoint model is generating minimum overhead packets for every type of mobility while Prob. Random Walk is generating highest routing load during transfer of data packets from source node to destination node.

4.1.2 Packet Delivery Fraction (%)

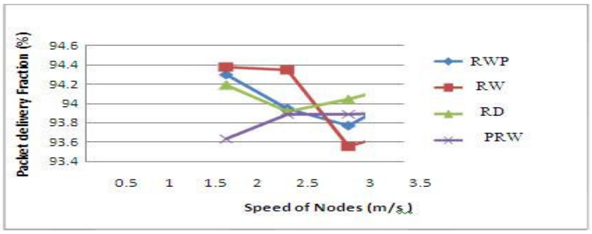

Fig 2 Packet Delivery Fraction vs. Speed of Nodes

Fig. 2 shows that for AODV protocol and TCP traffic, Random Walk model is giving better performance at low speed. At high speed, Random Direction model is better from other models.

4.1.3 Normalized Routing Load

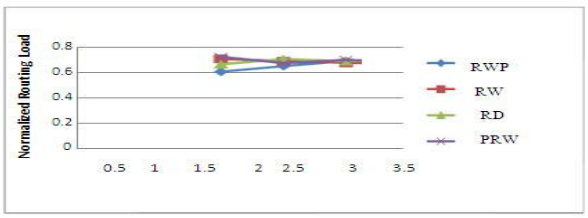

Fig 3 Normalized Routing Load vs. Speed of Nodes

Fig. 3 indicates that for AODV protocol with TCP traffic, Random Waypoint model is generating minimum routing packets for transmission of data packets at all speeds. Random Direction is generating higher routing loads.

4.1.4 Average End-to-End Delay

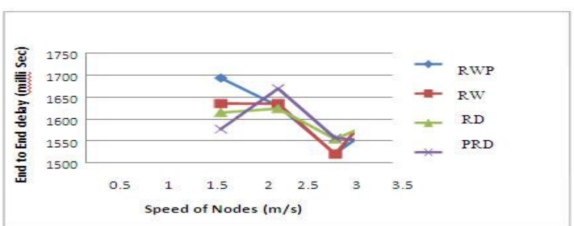

Fig 4 End-to-End Delay vs. Speed of Nodes

Fig. 4 for AODV protocol with TCP traffic, Prob. Random Walk model is giving better performance by taking minimum time to transmit the data packets up to destination for high and lower speeds. As the speed increases, Random Walk model performance degrades very much and suffers from highest delay.

4.1.5 Packet Loss (%)

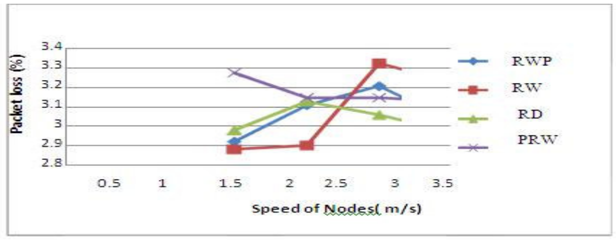

Fig 5 Packet Loss (%) vs. Speed of Nodes

Fig. 5 for AODV protocol, TCP traffic Random Walk model is performing better at low speeds. At higher speed, Random Direction model is having minimum packet loss as compared to another mobility models. While Random Walk model is performing poor with increase in speed.

4.2 DSDV Result

4.2.1 Routing Overhead (packets)

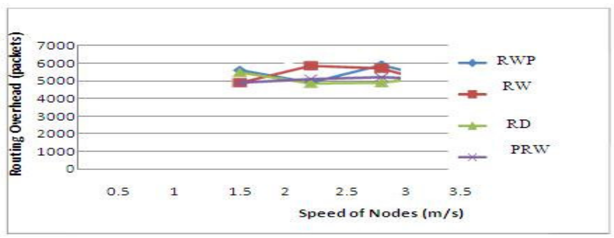

Fig 6 Routing Overhead vs. Speed of Nodes

Fig. 6 indicates that there are fewer variations in routing overhead for DSDV with the change in the mobility of nodes for all models as compared to AODV protocol. Random Walk is showing minimum overhead at 1.5 m/s and 3 m/s speeds. Random direction is giving better performance at 2 m/s and 2.5 m/s.

4.2.2 Packet Delivery Fraction (%)

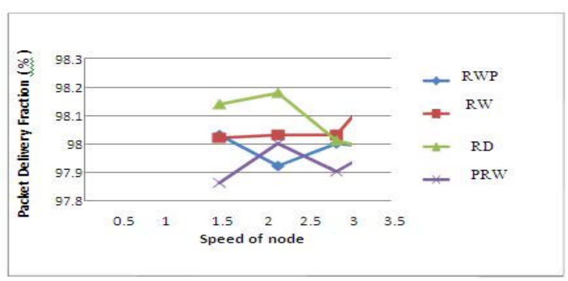

Fig 7 Packet Delivery Fraction vs. Speed of Nodes

Fig. 7 shows that for DSDV protocol with TCP traffic Random Direction model is performing better at low speed with maximum packet delivery. Random Walk is good for high speeds.

4.2.3 Normalized Routing Load

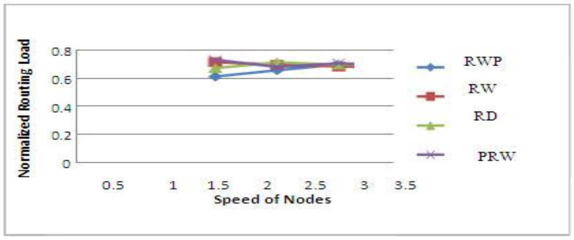

Fig 8 Normalized Routing Load vs. Speed of Nodes

Fig. 8 shows that for DSDV protocol with TCP traffic, at speed 1.5 m/s and 3 m/s, Random Walk is generating minimum routing load. Random Direction model is performing better at the speed of 2 m/s and 2.5 m/s with generating minimum routing packets.

4.2.4 Average End-to-End Delay

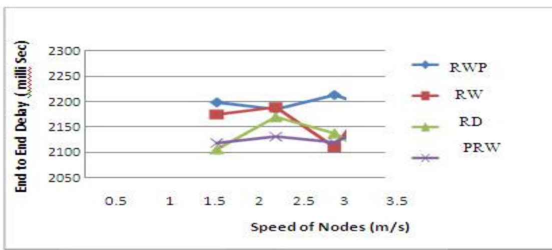

Fig 9 End-to-End Delay vs. Speed of Nodes

Fig. 9 for DSDV protocol, TCP traffic, end-to-end delay is more for every model as compared to above protocol. Here, Random Direction model is performing better for low and high speeds. Here also, Random Walk model is performing very poor. It takes highest time to send data packets from one end to another end.

4.2.5 Packet Loss (%)

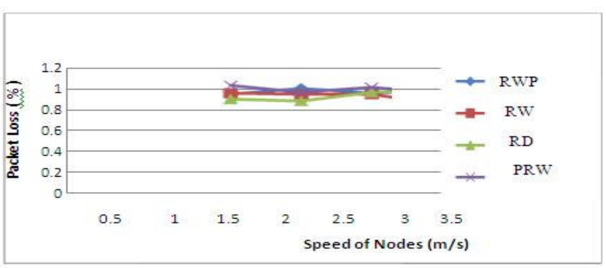

Fig 10 Packet Loss vs Speed of nodes

Fig. 10 for DSDV protocol, TCP traffic; we have less packet loss as compared to AODV. Random Direction is having minimum packet loss at low speed while at high speed; Random Walk is performing better by minimum packet losses.

5. Comparison & Conclusions

The comparison of both Protocols for different random access method is shown in following of table:

Table 1 Simulation conclusions for TCP traffic (scenario 1)

			AODV					DSDV			
Traffic	N/W load	Metrics	RWP	RW	RD	PRW		RWP	RW	RD	PRW
TCP	Low	RO		v				v			
		PDF		v					v		
		NRL	v						v		
		DELAY			v						v
		PL		v					v		
	High	RO	v						v		
		PDF		v						v	
		NRL	v						v		
		DELAY				v				v	
		PL		v						v	

In both Protocol i.e. AODV & DSDV Random Walk model have the best performance as the Random Walk model have better result shown in table.

6. Future Work

In this paper four Random mobility models have been compared using AODV and DSDV protocols. This work can be extended on the following aspects:

- Investigation of other MANET mobility models using different protocols under different types of traffic like CBR.
- Different number of nodes and different node speeds.

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