Analysis 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. 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 (%).

Key words: Mobile Ad hoc, AODV, DSDV, TCP, routing overhead, packet delivery fraction, End-to-End delay, normalized routing load

I. 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.

II. PROTOCOL DESCRIPTIONS

A. 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.

B. 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.

III. SIMULATIONS

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)

IV. SIMULATION RESULT

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.

A. Scenario

In this scenario, we have used AODV and DSDV protocols along with mobility models, named as, Random Waypoint Model, Random Walk Model, Random Direction and Probabilistic Random Walk Model and traffic types as TCP and CBR. The Maximum Speed of the node is fixed at 1.5 m/s. The size of the data packet taken in this simulation is 512 bytes. The size of the simulation area is decided as 200 meter × 200 meter. Simulation process will run for duration of 900 seconds. The pause time for every node before changing direction and speed is taken as 10 seconds. The Number of Nodes is varying from 10 to 50. The limit to the maximum connections between different nodes is fixed up to 60% of total no. of nodes.

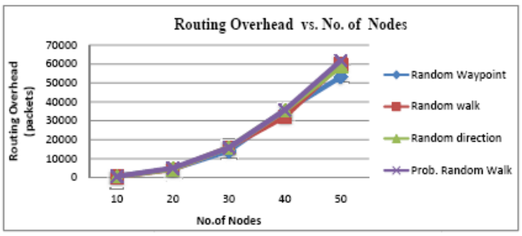

Fig 6.6 Routing Overhead vs. No. of Nodes (AODV, TCP)

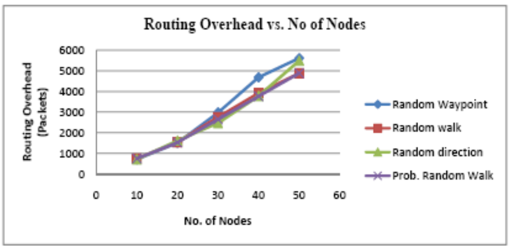

Fig 6.7 Routing Overhead vs. No of Nodes (DSDV, TCP)

Based on Figure 6.6, we concludes that at low network load, Random walk model is having minimum routing overhead while at high network load, Random Waypoint model is generating minimum overhead packets. Probabilistic Random Walk Model is generating highest routing overhead when A model is good for communication. All models show that the Routing Overhead is increased when the number of nodes is increasing. Figure 6.7 indicates that Random Waypoint model is generating minimum routing packets when the number of nodes is less for DSDV protocol whereas Random Walk models is generating lowest routing overhead at high network load. Initially, Prob. Random Walk and Random Walk generates highest number of overhead packets for less no. of nodes.

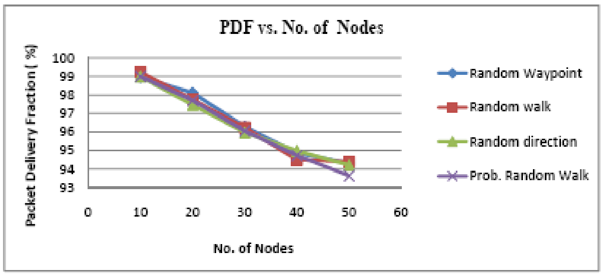

Fig 6.8 Packet Delivery Fraction vs. No. of Nodes (AODV, TCP)

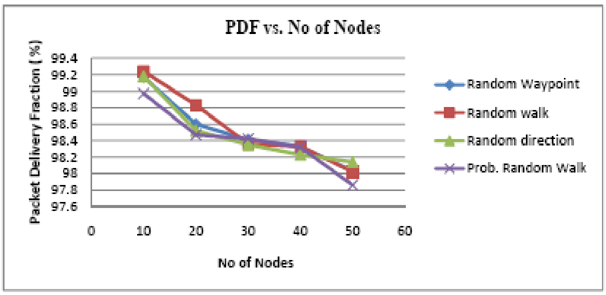

Fig 6.9 Packet Delivery Fraction vs. No. of Nodes (DSDV, TCP)

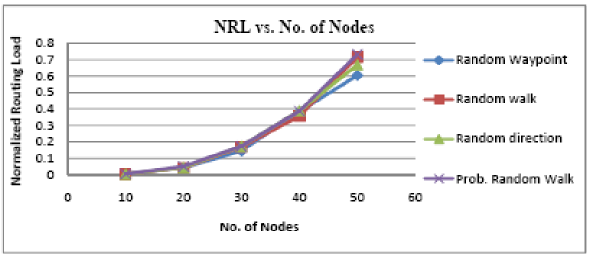

Fig 6.10 Normalized Routing Load vs. No. of Nodes (AODV, TCP)

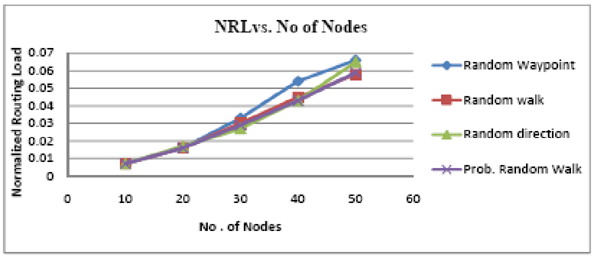

Fig 6.11 Normalized Routing Load vs. No of Nodes (DSDV, TCP)

Figure 6.8 shows that Packet Delivery Fraction is decreasing significantly for every mobility model as the number of nodes are increasing. For AODV protocol, at both network loads i.e. low and high, Random Walk model performs better with highest packet delivery fraction while

Prob. Random Walk is having minimum packet delivery to destination. From figure 6.9 we concludes that for DSDV protocol with TCP traffic, Packet Delivery Fraction is decreasing significantly with the increase in the number of nodes. Random Walk model is better for lesser number of nodes while Random Direction is best for higher number of nodes. Prob. Random Walk model is again showing its poor performance for delivering data packets successfully to the destination.

Figure 6.10 show that initially all the mobility models are generating almost same normalized routing loads at low network load. But for higher number of nodes, Random Waypoint model is generating minimum routing load whereas Random Walk and Prob. Random Walk models are generating highest normalized routing packets.

Figure 6.11 indicates that for DSDV protocol, Random Walk model is generating minimum normalized routing load at low and high network loads. While Random Waypoint model is showing poor performance by generating higher routing load at higher traffic.

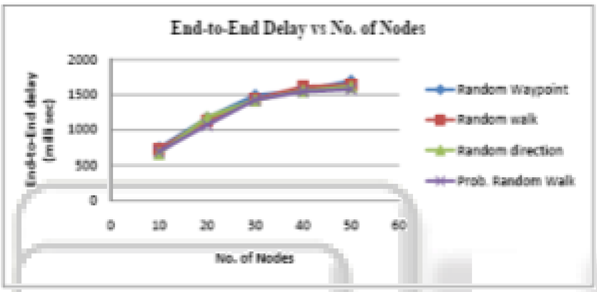

Fig 6.12 End-to-End Delay vs. No. of Nodes (AODV, TCP)

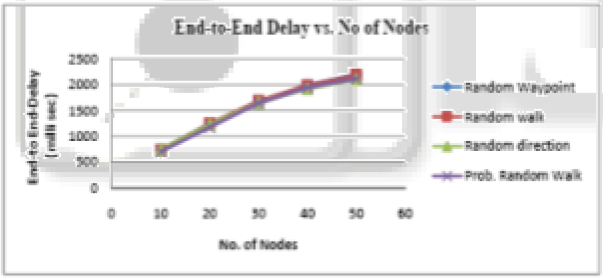

Fig 6.13 End-to-End Delay vs. No. of Nodes (DSDV, TCP)

Figure 6.12 shows that End-to-End Delay is increasing significantly for every mobility models with the increase in number of nodes. For AODV protocol with TCP traffic, Random Direction model is providing minimum delay at low network load while Prob. Random Walk is providing minimum delay for sending data from one node to another at higher network load. Random Waypoint model is providing highest delay.

From figure 6.13, we conclude that Prob. Random Walk model is providing minimum delay at low number of nodes. Random Walk model provide maximum delay up to 40 nodes. If we increase further the number of nodes then Random Waypoint model is taking more time to transfer packets to destination. At this point, Random Direction model is having minimum delay as compared to other models.

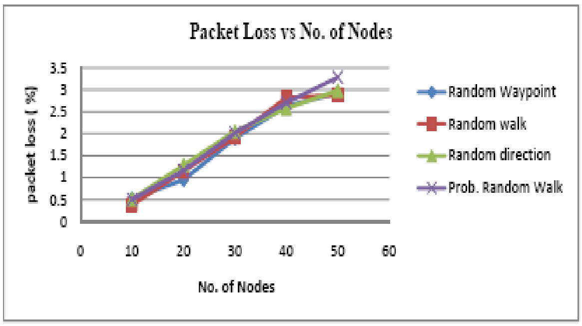

Fig 6.14 Packet Loss vs. No. of Nodes (AODV, TCP)

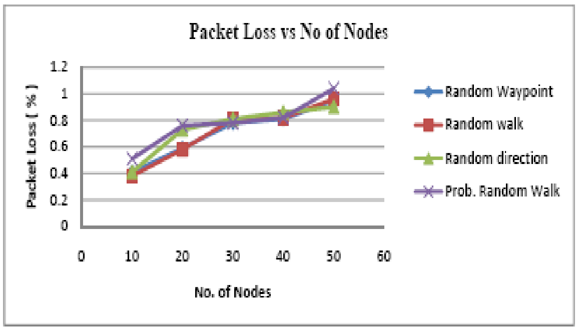

Fig 6.15 Packet Loss vs. No. of Nodes (DSDV, TCP)

Figure 6.14 indicates that Random Walk model is having minimum packet loss at both network loads. Prob. Random Walk has highest packet loss for low and high traffics. Figure 6.15, it shows that for DSDV protocol at low and high traffic conditions, Prob. Random Walk model is having more percentage of packet loss. During 30 nodes to 40 nodes, every model is having almost same packet loss. In this case, Random Walk model is better for low network load while Random Direction model is better at high network loads.

V. COMPARISON & CONCLUSION

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.

VI. 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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