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Analysis on Influence of Mobility Models on the Performance of Routing protocols in Wireless Mobile Ad-hoc Networks

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ABSTRACT: Mobile Ad hoc Network is a collection of wireless mobile nodes dynamically forming a temporary network without the aid of any established infrastructure or centralized administration. Many routing protocols are proposed in Mobile Ad-hoc Network. There is a necessity to investigate the performance of MANETs under a number of different protocols with various mobility models. In this paper we were considered the performance evaluation of different routing protocols(AODV, DSR, DSDV, ZRP) in the presence of different network loads and differing mobility models. In this paper we have done the study of Reactive, Proactive and Hybrid protocols with various mobility models. This paper focuses on the evaluation of performance with respect to various parameters such as packet delivery ratio, average end to end delay, jitter and throughput. In this our finding show that the Influence of Mobility Models on the Performance of Routing Protocols in Wireless Mobile Ad-hoc Networks using NS-2 simulator.

KEYWORDS: MANET, routing protocols, mobility model, NS-2.

I. INTRODUCTION

This paper focuses on the analysis of different routing protocol under different mobility models in mobile ad hoc networks. A MANET is characterized by a self configuring infrastructureless architecture, which can handle the communications in a highly dynamic network topology. In MANETs nodes are free to move randomly and join or leave the network when at their will. Since the medium of the communication is wireless, only limited bandwidth is available. Another important constraint is energy due to the mobility of the nodes in nature.

In MANETs, mobile nodes (MNs) operate as routers and end-system connecting points in order to forward packets while moving about, change location frequently and also organize them into a temporary 'ad-hoc' network. Because of this, MANETs can offer a larger degree of freedom at a considerably lower cost than other networking solutions. The main objective of this paper is that, we have created a solid attempt to study the performance of DSR, AODV, DSDV routing protocols over different types of mobility model such as RWM, RPGM, GMV, CMM with respect to various parameters such as packet delivery, average end to end delay, jitter and throughput. In this paper our finding show that the influence of mobility models on the performance of routing protocols in wireless mobile ad-hoc network using NS-2 simulator.

Keeping mobility feature of the nodes it is essential to decide a suitable routing protocol based on the network environment [1]. Here nodes are mobile and are moving with random direction and random speed so to get a route between a source and destination node is an important issue. The prediction of path duration for a selected path is not easy, as it depends on several parameters such as the position and number of relay nodes, their velocity, direction of movement etc. Whenever a route becomes invalid, a mobile node has to find a new route to the destination. This affects the ongoing communication and increases the overhead (for example, control traffic) created by the routing protocol. The following figure1 shows the different types of routing protocols, in which three types of routing protocols such as proactive, reactive and hybrid routing protocols and also their subtypes. In this we are going to analysis on DSR, AODV, DSDV and ZRP routing protocol with different mobility models[2].

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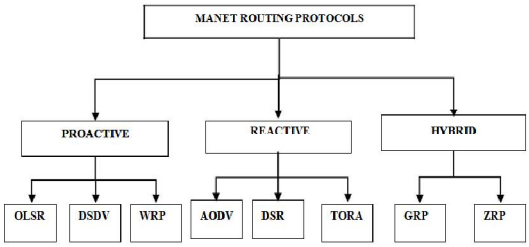

Fig.1: Types of MANET routing protocols

III. MANET CHALLENGES

The following list of challenges shows the inefficiencies and limitations that have to be overcome in a MANET environment:

1. Limited wireless transmission range: In wireless networks the radio band will be limited and hence data rates it can offer are much lesser than what a wired network can offer. This requires the routing protocols in wireless networks to use the bandwidth always in an optimal manner by keeping the overhead as low as possible. The limited transmission range also imposes a constraint on routing protocols in maintaining the topological information. Especially in MANETS due to frequent changes in topology, maintaining the topological information at all nodes involves more control overhead which, in turn, results in more bandwidth wastage.
2. Time-varying wireless link characteristics: The wireless channel is susceptible to variety of transmission impediments such as path loss, fading, interference and blockage. These factors resist the range, data rate, and the reliability wireless transmission.
3. Broadcasting nature of the wireless medium: The broadcasting nature of the radio channel, that is, transmissions made by a node are received by all nodes within its direct transmission range. When a node is receiving data, no other node in its neighborhood, apart from the sender, should transmit. The hidden terminal problem refers to the collision of packets at a receiving node due to the simultaneous transmission of those nodes that are not within the direct transmission range of the sender, but are within the transmission range of the receiver [3].
4. Packet losses due to transmission errors: Ad hoc wireless networks experience a much higher packet loss due to factors such as high bit error rate (BER) in the wireless channel, increased collisions due to the presence of hidden terminals, presence of interference, location dependent contention, uni-directional links, frequent path breaks due to mobility of nodes, and the inherent fading properties of the wireless channel.
5. Mobility-induced route changes: The network topology in an ad hoc wireless network is highly dynamic due to the movement of nodes; hence an on-going session suffers frequent path breaks. This situation often leads to frequent route changes. Therefore mobility management itself is very vast research topic in ad hoc networks.
6. Mobility-induced packet losses: Communication links in an ad hoc network are unstable such that running conventional protocols for MANETS over a high loss rate will suffer from severe performance degradation. However, with high error rate, it is very much difficult to deliver a packet to its destination .
7. Battery constraints: This is one of the limited resources that form a major constraint for the nodes in an ad hoc network. Devices used in these networks have restrictions on the power source in order to maintain portability, size and weight of the device. By increasing the power and processing ability makes the nodes bulky and less portable. So only MANET nodes has to optimally use this resource.

IV. RELATED WORK

Abdul Hadi Abd Rahman and Zuriati Ahmad Zukarnain analysed on three protocols AODV, DSDV and I-DSDV were simulated using NS-2 package and were compared in terms of packet delivery ratio, end to end delay and routing overhead in different environment; varying number of nodes, speed and pause time. Simulation results show that I-DSDV compared with DSDV, it reduces the number of dropped data packets with little increased overhead at higher rates of node mobility but still can't compete with AODV in higher node speed and number of node[1].

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In [3], Mittal and Pinki compared AODV, DSR, and DSDV single path routing protocols using the Random Waypoint Mobility Model (RWPM). Their simulations showed that DSR is able to achieve remarkable packet delivery fraction and the same for the throughput. They compared for 20, 30, and 75 nodes only. They considered performance evaluation of routing protocol and they shows that TORA and DSR shows the better result as compared to AODV and DSDV routing protocol.

Adam Macintosh, Ming FeiSiyau and Mohammed Ghavami suggested examining through simulation the fundamental factors, mobility models and transmission power which have a major impacts on the performance of position based routing protocols. He analyses the effect of the transmission power of on the performance of protocols under two different mobility models. Using NS-2 simulation tool, results show the evaluation and performance of the proposed protocol under a unified simulation environment for different scenarios[4].

Santosh Kumar, S.C.Sharma, Bhupendra Suman evaluated the impact of mobility models with different scalability of networks on MANET routing protocols. This paper evaluates the impact of three mobility models i.e. File Mobility model (FM), RWPM model and RPGM model on proactive routing protocols only. FM model and RWPM are in the same group of routing protocols. The performance of any routing protocol depends on the duration of interconnection among the nodes in the networks. This interconnections results an average connected path for whole network [5].

In recent studies , Samir M. Said, Ibrahiem M. M. El Emary and Shatha Kadim have compared AODV and DSDV with only RWPM model under different parameters. They concluded that the AODV gives less fluctuation results and better performance as compared with DSDV, with respect to some identified parameters like routing overhead, throughput, end-to-end delay. In this, performance evaluation of both proactive wireless routing protocol destination sequenced distance vector (DSDV) and reactive protocols ad-hoc on demand distance vector (AODV) with continuous bit rate (CBR) traffic is executed using NS-2 simulator. The research work mainly focuses on the protocols behaviour on different mobility. The performance differentials are analyzed with varying network load and mobility. Random waypoint model is used to create mobility model for this research work.Two types of simulation work on mobility are done under same simulation environment, which make it more closely to evaluate the performance of routing protocols. In total five performance metrics are measured to conclude this paper. It demonstrates that even though both protocols share distance vector characteristics, the individuality of protocol's mechanism draw considerable performance differentials with mobility.[6]

Vivek Thapar, Bindiya Jain, Varsha Sahni investigated simulation based study of ad-hoc routing protocols in wireless sensor networks. In this paper they have compared the performance of two routing protocol AODV and DSR by using random waypoint mobility model and changing the node density with varying number of source node. DSR and AODV both protocol use On-Demand route discovery concept but internal mechanism which they use to find the route is significantly different for both protocol. They have analyzed the performance of protocols for varying network load and mobility. Simulation with random waypoint mobility model has been carried out by using qualnet 5.0.2 Simulator. The metrics used for performance evaluation are packet Delivery fraction, Average end-to-end Delay, Average jitter. [7].

In scenario based performance evaluation of proactive, reactive and hybrid routing protocols in Manet using random waypoint model [8], B.S.Gouda, D.Patro and R.K.Shital examine the different performance ofAOMDV,RAODV,AODV,DSR,DYMO,OLSR and ZRP routing protocol for mobile ad-hoc networks in various pause time. Their simulation result shows DSR is the best scheme in terms of total bytes receive ZRP is the best performance total packet receive, last packet receive and first packet receive but ZRP shows worst performance in terms of end to end delay, RAODV is the highest packet deliver ratio and ZRP is the highest normalized routing load. While RAODV best shows end to end delay and average jitter but in case of First Packet Receive, Last Packet Receive, Total Bytes Receive.

V. ROUTING PROTOCOLS

There are three types of Routing Protocols in Mobile Ad Hoc Networks: Reactive Routing Protocols, Proactive Routing Protocols and Hybrid Routing Protocols.

A) Reactive Routing Protocols: Reactive protocols also known as On-demand routing protocols which takes the passive approach or lazy to routing which is different with proactive routing protocols. Router are identified and maintained for nodes that require sending data to destination this is done by routing discovery mechanism to find the

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path to the destination. The reactive protocols discovered when needed. In this source nodes initiate route discover broadcasting route request into the network [3]. The discovered route maintained in the routing table however valid and kept and the old one are deleted after active route timeout. AODV, DSR are the example of reactive routing protocols.

B) Proactive Routing Protocols: Proactive protocols are table-driven protocols when each nodes maintain a route to old destination in its routing table. Proactive protocols also determine the route for various nodes in the network in advance, so that the route is already present whenever needed. Route overhead are larger in such schemes in compare to reactive protocols. DSDV, WRP, OLSR are some of example of proactive protocols.

C) Hybrid Routing Protocols: Hybrid protocols depending on how the source finds a route to the destination, It uses combination of both Reactive and Proactive Routing protocols. For ex: GRP, ZRP.

VI. SYSTEM IMPLEMENTATION

In this paper, we use NS-2 simulator for simulating different routing protocols. NS-2 simulator uses a visual tool called NAM. NAM is a Tcl/TK based animation tool for viewing network simulation traces and real world packet trace data. We are using the topology of 500x500 m2 with 25, 50, 75,100 nodes we are increasing only total number of nodes with keeping the total area constant i.e. 500x500 m2, speed 20 ± 3 m/s, pause time 15 ± 3 s, packet size 512 B, simulation time is 100 ms. We discuss the effect of mobility on the Packet delivery Ratio, Average End-to-End delay, Jitter and Throughput of the mobile ad-hoc network.

The simulations carried out, Mobility models were created for the simulations using 10, 30 and 50 nodes, with pause times of 0, 20, 40, 60, 80 and 100 seconds, minimum speed of 5m/s and maximum speed of 75 m/s, topology boundary of 500x500 and simulation time of 100 msec. The following table2 shows the simulation parameters.

Parameter	Value
Simulator	NS-2
Channel type	Wired or Wireless
Protocol studied	DSR, AODV, DSDV, ZRP
Transmission range	250 m
Simulation area	500x500 m2
Number of nodes	25,50,75,100
Movement Model	CMM,GMV,RPGM, RWM
Maximum speed	75 m/s
Minimum speed	5 m/s
Packet Size	512 B
Simulation Time	50 ms

Table 2: Simulation Parameters

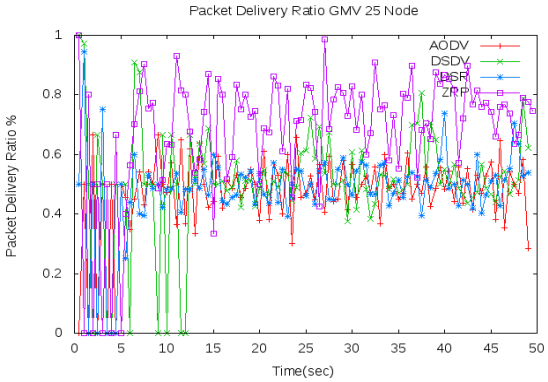

Fig.2: Packet Delivery Ratio for GMV model on 25 node

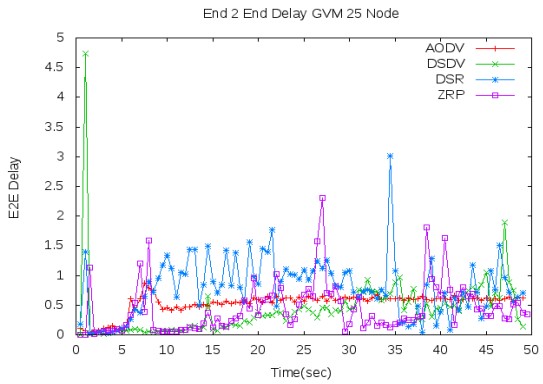

Fig.3: : End to End Delay for GMV model on 25 node

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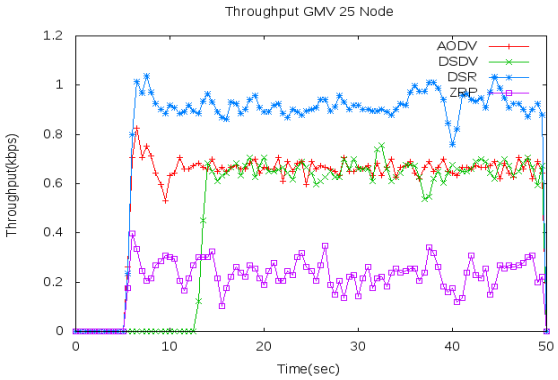

Fig.4: Throughput for GMV model on 25 node

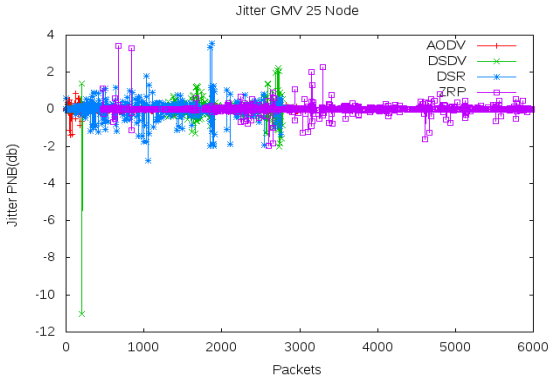

Fig.5: Jitter for GMV model on 25 node

VII. RESULTS AND DISCUSSION

To perform comparison of the protocols examine in second – AODV, DSR, DSDV and ZRP the following sections compare them in terms of rate of packet delivery ratio, end to end delay, jitter and throughput with various number of nodes such as 25, 50, 75 and 100.

No. of Nodes	CMM	GMV	RPGM	RWM
25	0.576	0.582	0.583	0.581
50	0.576	0.583	0.558	0.556
75	0.175	0.576	0.578	0.579
100	0.198	0.58	0.559	0.572

Table 2: Comparison of models based on throughputs AODV

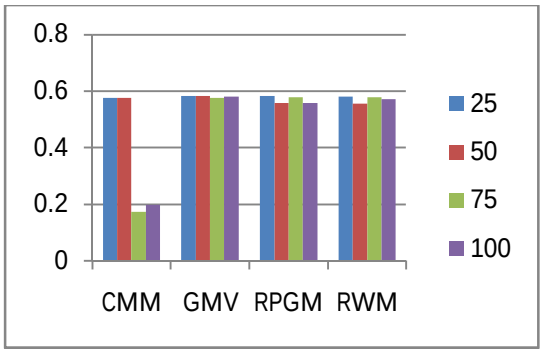

Fig.6: AODV Throughput against Mobility

From the above graph we can say that the GMV model perform better than other mobility model for nodes 25, 50, 75, 100. It shows better performance for all protocols. The CMM model gives better result for node 25 and 50 but it is poor for 75 and 100 nodes.

No. of nodes	AODV	DSDV	DSR	ZRP
25	0.576	0.561	1.133	0.304
50	0.574	0.552	1.129	0.047
75	0.175	0.543	1.131	0.001
100	0.198	0.549	1.142	0.003

Table 3: Comparison of protocols based on throughputs

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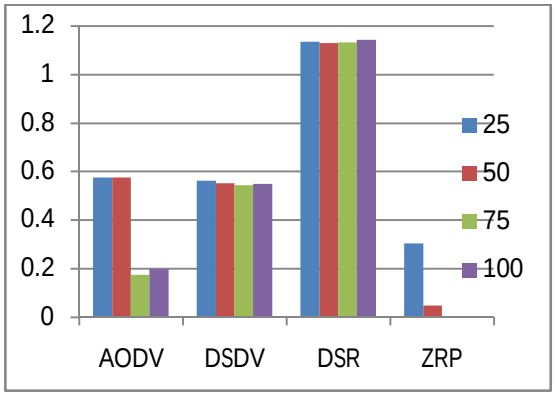

Fig.7: CMM Throughput against Protocols

The above graph shows the throughput performance for CMM model against routing protocols. From the above graph we can say that DSR protocol gives better performance in CMM model for all nodes

VIII. CONCLUSION AND FUTURE WORK

A comparison has been made between the protocols on the basis of their efficiency; the results of simulation show the impact of number of nodes in a MANET on the achievable End-to-End Delay, Throughput, Jitter and Packet Delivery Ratio in the mobile ad hoc networks. From the simulation results, it is clear that the MANETs are not scalable i.e. when the size of a MANET, in terms of number of nodes, grows; it produces poor performance due to large data throughput generated while repairing route breaks. Specifically speaking, consider the reactive protocols (DSDV, AODV) works better for network with more than 30 nodes. AODV has better performance in CMM with more than 50 nodes but DSDV have poor performance with more than 50 nodes but it has good performance up to 25 nodes.

Different results were given by changing the selected parameters. Based on these results, the proactive protocols (DSR) have shown better performance than the reactive protocols. DSR has fixed behavior in all scenarios due to its on-demand specification. There are many equations in case maintaining Quality of Service and adaptive is most crucial during the communication process in the mobile ad-hoc networks which are new optimization technique or energy efficient routing protocol that address Quality of Service and adaptability need to be develop.

Future work will be to evaluate the performance of these protocols by varying the speed, packet size, dimensions and pause time.

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BIOGRAPHY

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