Reality based mobility model Analyzed over reactive and proactive routing protocols in natural Disaster areas

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Abstract— In MANET a mobility model of the mobile nodes is an important and unique feature that differentiates this network with other wired and wireless networks. Network topology changes dynamically due to high mobility. Therefore to analyze any routing protocol performance in the realistic scenarios mobility models plays an influential role. In our paper the impact of reality based mobility models on reactive routing protocols (AODV, DSR) and proactive routing protocol (DSDV) are analyzed in the natural disaster scenarios. Performance matrices which analyze the performance of routing protocols are end to end delay, Throughput, Packet delivery Ratio. Mobility model scenarios are generated in bonnmotion and get implemented on NS2 network simulator. Our research work recommended to understand better use of routing protocols, reality based mobility models in real world application such as rescue and relief operation, tracking and surveillance operation in disaster areas.

Key words: bonnmotion, MANET, mobility model, routing protocols, tracking

I. INTRODUCTION

On Rapid growth and development in the mobile communication, nature of computing changes widely. Need of portable devices like smart phones, laptops etc increases from last few years. Now personal computing is move to ubiquitous computing. In a decentralized manner group of mobile nodes are communicating with each other without any permanent network structure in a MANET [1,3]. Due to decentralize and infrastructure less adhoc networks are considered for flexible applications used in communication these applications are disaster aid, police operations in particular areas, group conference, rescue operation, military deployment etc [4]. As unpredictable making and breaking of links caused by node mobility, routing protocol need to quickly adapt to these network changes. But this became challenge due to constraint like limited battery power and less bandwidth in MANET [2]. So to choice a suitable routing protocol is a big challenge for the reality based scenarios.

The related work on real time observation of mobility nodes in a health care environment, a realistic mobility model has been developed .Here DSDV and AODV routing protocol are evaluated with realistic mobility models shown in [1].Work done on reactive and proactive routing protocols including AODV, DSR, DSDV, OLSR and DYMO are compare on various mobility models in terms of end to end delay, PDR and NRL in [2]. In a realistic scenario performance of a group mobility models are evaluated and examined over the on-demand routing protocol DSR show in [3]. Motivation behind the paper in [4] is to discover and study the pause time effect on AODV routing protocol by using reference model. Routing strategies of three routing protocols AODV, OLSR , SRMP under two different mobility models based on parameter metrics such as node mobility and network size are analyzed in [5]. AODV and DSR are analyzed in various mobility models like RPGM, Manhattan and RWP under different square dimensional areas and network density shown in [6]. Simulation and comparison of the performance between types of routing protocols table- driven ,On-demand routing protocol in three mobility models like Gauss Markov , Manhattan Grid model and RPGM in terms of end to end delay ,NRL and energy consumption is done in [7].

II. METHODOLOGY AND SYSTEM DESIGN

A. Experimental setup

Main aim of our research work is to evaluate the performance of one proactive routing protocol (DSDV) as well as two On demand routing protocols (AODV,DSR) under the two different realistic mobility models in the disaster conditions. Realistic environment scenarios are generated on Bonn motion where as for simulation Network Simulator (NS2) version -2.27 is used. Two different realistic environments carried out using mobility model Manhattan Grid mobility model and Reference point group mobility model.

1) A fire broke out in a four story commercial building in suburban city area with node 30.
2) Road accident due to heavy windstorm in the hilly area with node 70.

The Wireless physical MAC layer IEEE 802.11b was taken with an Omni directional antenna. Cbrgrn.tcl script is used to generate constant bit rate (CBR) traffic. Two ray ground model was employed for radio propagation. Fig 1 shows the flowchart of the procedure for simulation carried out in NS-2 environment

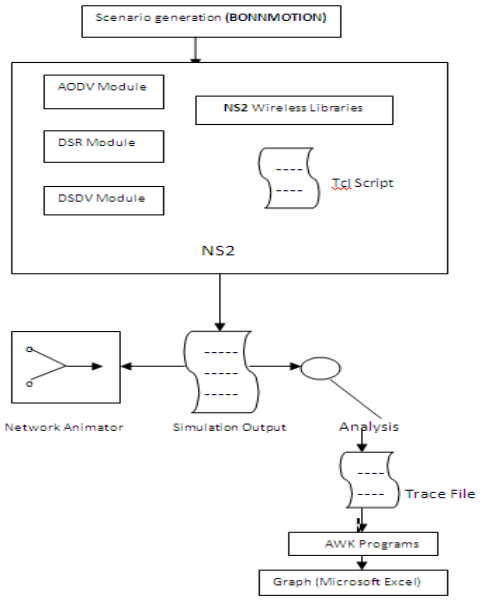

Fig. 1

B. Performance Matrices

- *Average End to end delay (AD):* it is define as a time taken to travel from source to reach destination. It also included the delay or waiting time taken for route discovery when routes are not available.
- *Throughput:* it is define as the total number of packets received by the destination (Data Packet correctly delivered to the destination).
- *Packet delivery ratio (PDR):* it is define as the ratio of total number of packet received by the destination node to the packets sent by the source node. It measured in percentage.

Table.1 shows the simulation parameters given below.

Parameters	**Values**
Simulation Time	200sec
Minimum speed	5 m/sec
Maximum speed	10m/sec
Pause Time	10 sec, 50-100 sec
Nodes	30,70
Boundaries	250-1000m^2, 500m^2
Mobility Models	MG,RPGM
Maximum connection	18,45
Protocol Used	AODV,DSR,DSDV

Table: 1

III. REALISTIC ENVIORMENT SCENARIOS

A. A fire broke out in a four story commercial building in suburban city area.

In the first case study a real rescue operation environment of the fire brooked out building in the suburban area is modeled and analyzed by using Manhattan grid mobility model. The dimension of the accidental area is bounded by 250*250m^2 to 500 *500 m^2 .Number of peoples that are affected is 75 (mobile nodes). They are move from the accident area to the safe area in between them they travel from the market place of (500* 500m^2 to 750 * 750 m^2) area range and reached to safe area of (750*750m^2 to 1000*1000 m^2) area range. Rescue activity is restricted to mobility speed 5-20m/s with a constant pause time 20s. Each area range is divided into blocks of 5 in (x-axis) and 5 in (y-axis) with a turning probability of 0.5.

B. Road accident due to heavy windstorm in the hilly area.

In this case we study a rescue operation of road accident due to windstorm affected in hilly area .This scenario is modeled and examine by using RPGM mobility model. Rescue operation was performed after a heavy windstorm which causing trees fall down on the road and result in tragic road accident. Disaster area is of 1000*1000m^2. Rescue unit taken part in Disaster zone is 75 in numbers with a variable pause time 50-300sec. Rescue activity is affected up to 1-2m/s mobility speed due to sharp turns and narrow passage in the hilly area. The number of rescue group is taken part are 1 and 5 in the present scenario.

IV. RESULTS AND DISSCUSIONS

A. Scenario1: A fire broke out in a four story commercial building in suburban city area.

1) Impact of end to end delay (AD):

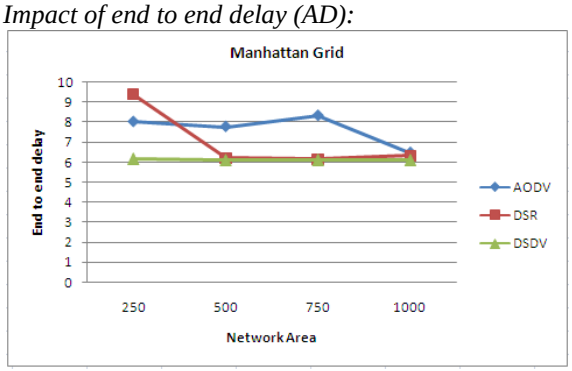

Fig. 2

In fig.2 we observed that on the accidental point DSR show large delay but as move into the accidental range delay decreases and became equally constant with DSDV in the market and safer area ranges. AODV show large end to end delay in accidental and market area ranges but decreases in the safe area zone. DSDV performing good by showing low and stable average delay in all area ranges .This is due to DSDV use periodic updates and the movement pattern of a mobile node may be influenced by and correlated with nodes in its neighborhood means having high spatial dependence.

2) Impact of throughput:

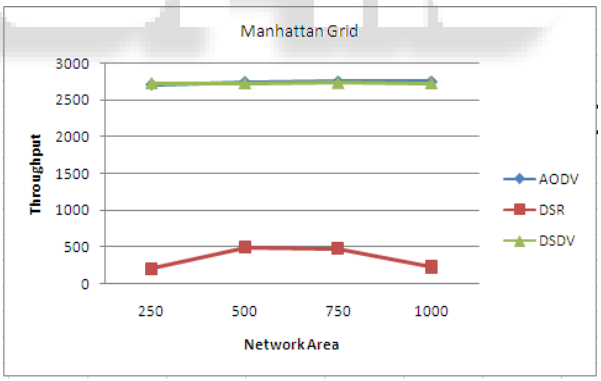

Fig. 3

Fig 3 Indicate that AODV and DSDV outperforming in all the network area ranges because with high temporal dependence AODV supporting uni-directional links between nodes. Both the routing protocol has equal and constant throughput values. But DSR shows worst performance because this routing protocol uses source routing and caching which makes difficult many of the route caching and other Route Discovery optimizations.

3) Impact of Packet Delivery Ratio

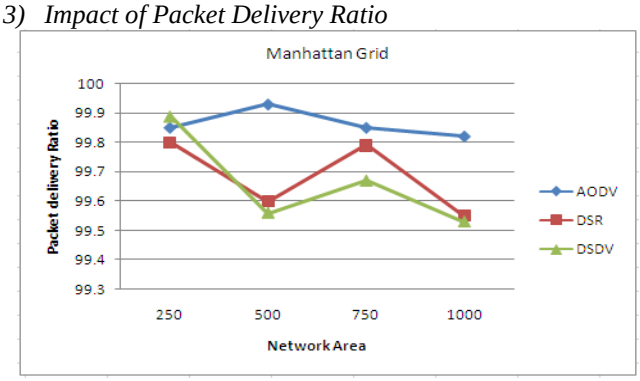

Fig. 4

On taken analyzing factor PDR fig. 4 Results shows that AODV again show good performance in accidental, market and safer area zones as compare to DSR and DSDV. Packet delivery ratio increase to 99.9% and with the slow fall down it maintained a constant PDR up to 99.8% as we move to large areas. This is due to the factor that nodes having highly temporal dependence and by use of sequence numbers in AODV source nodes are always able to find new valid routes.

B. Scenario 2: Road accident due to heavy windstorm in the hilly area

1) Impact of End to end delay (A.D):

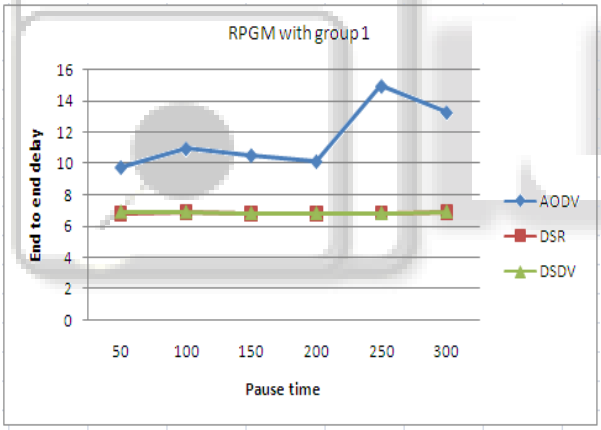

Fig 5

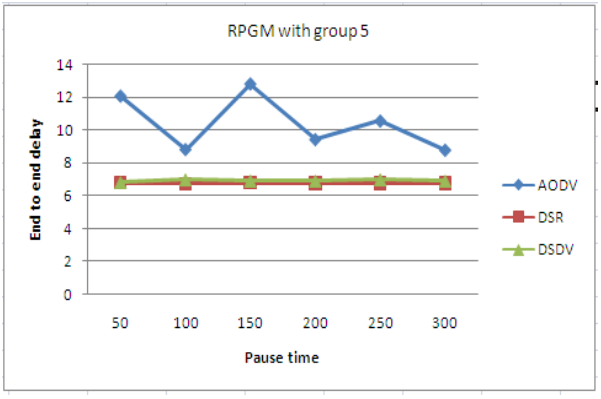

Fig 6

Fig 5 and fig 6 indicate the results that AODV show large delay in case of group 1 DSR and DSDV end to end delay became stable and constant because there is low packet drop in the single group as it is having a full node density. In case of group 5 again these both routing protocol show less delay because DSDV have low latency for route discovery.

2) Impact of throughput:

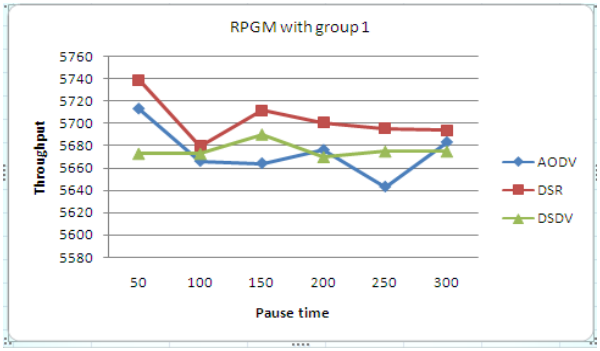

Fig 7

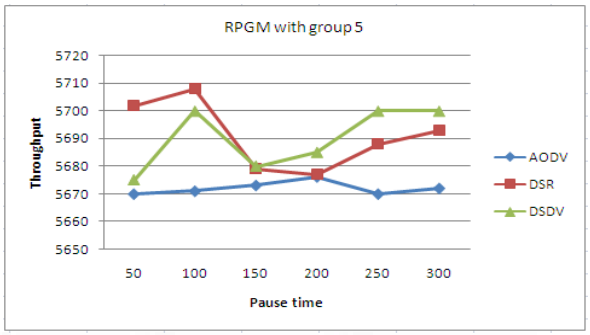

Fig 8

On observing the fig 7 we find out that DSR performing better while having an optimal throughput values as compare to AODV and DSDV. The reason behind that intra group communication in between the nodes and here each hop is registered. Fig 8 depicts that DSR show good optimal throughput value with the less pause time but when the pause time increases from 150sec to 300 sec DSDV performing best as compare to other routing protocol this is due to on long pause time interval DSDV protocol respond by propagating updates throughout the network so that maximum packets are received when network topology change.

3). Impact of Packet delivery Ratio:

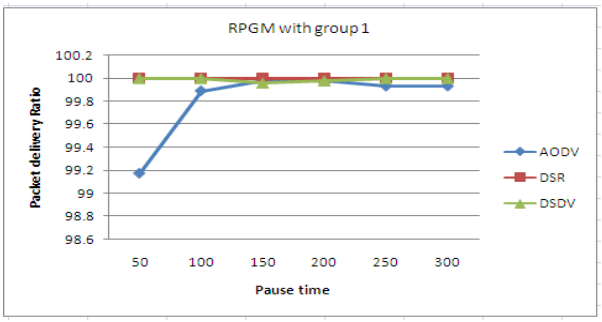

Fig 9

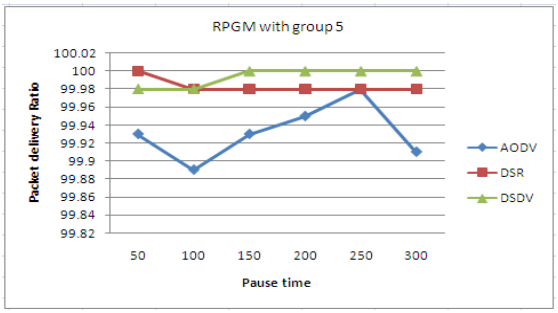

Fig 10

Fig 9 demonstrate the Impact of packet delivery ratio with a single group on the routing protocols in this case we observed that DSR and than DSDV having highest and constant PDR this is because all node lies in the single group and both routing protocols guarantees a loop–free path .While we see in fig 10 with group of 5 at the less pause time DSR performing good but on increasing the pause time DSDV performing better this is due to on increasing in the number of groups nodes in each group is decrease. AODV perform worst on varying pause time due to temporary routing routes and large delay.

V. Conclusion and Future Work

As we examined the result and discussion in the previous section performance of routing protocol greatly affected the mobility model. Outcome of our research works illustrate that in the rescue operation for the first scenario, with increasing in the network area DSDV performing well in terms of End to end delay while AODV performing good as compare to DSR in terms of Throughput and PDR. In case of rescue operation took place in hilly area scenario DSR and DSDV show excellent in terms of End to end delay.DSR performing better with a single group in terms of throughput and PDR. On increasing the group and the pause time DSR and DSDV show slightly fluctuation but performing well in terms of Throughput and PDR.

In future various works on many more improved routing protocols like RAODV, TORA and OLSR etc are taken for deployment of different realistic scenarios such as Military operation, Mesh network etc.

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