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A Comparative Analysis of Different Movement Models in MANET

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Abstract: Mobile ad-hoc network (MANET) is a group of wireless movable nodes that form a temporary network without any infrastructure. MANET consists of three words i.e. Mobile which means in moving the nature, Ad-hoc which means for this purpose and Networks which means collections of nodes or computers. Nodes in the MANET are free to move. No inner base station exists and therefore each node acts itself as a router in forwarding the traffic to another. MANETs are also characterize by a active, random and rapidly changing topology. The dynamic topology of MANET makes the routing protocol design complex and difficult. In this paper, we studied different queuing strategies, challenges and different routing scheme. Theoretical and simulation result explain the comparative analysis of the routing scheme.

Keywords: Queuing policies, Challenges, Routing schemes, Movement models.

1. INTRODUCTION

MANET is an autonomous collection of mobile nodes connected by wireless links [1]. MANET is self configuring network of moving nodes or routers. Ad hoc network is allowed the devices to create a network on demand without previous coordination or configuration [2]. The term "Ad-hoc" implies "can take different forms". The nodes are free to move in the network therefore it has dynamic topology. Nodes in MANET can join and leave the network at any time instance. In MANETs each node operates not only as an end system but also operate as a router to forward the packets for other nodes[3].

The routing protocol for the MANET can be classified into three different groups: Table driven / proactive routing protocol, On-demand / reactive routing protocol and hybrid routing protocol. In proactive routing protocol, routes to the destination are determined at the start up and maintained using periodic route update process. In this routing information is available regardless of need. In reactive routing, routes are determined when they are required by the process. Here, routing information is available when it is needed. Hybrid routing is the combination of both proactive and reactive routing protocols [4][5].

2. CHALLENGES

There are some security solutions of MANETs which will clearly offer the multi fence security solutions with respect to the network security.

a. The security solution should also execute the many individual components in order to provide the collective protection to secure the whole network.
b. The security solution should also offer the security with respect to the different layers of protocol stack and every layer provides line of defense. It is also not possible that only one single-layer solution can handle all potential attacks.
c. The security solutions should enforce all the three component of security like the anticipation, the recognition and the reply.
d. The security solutions should be reasonable as well as practical in the resource controlled and highly dynamic networking scenario.

3. QUEUING POLICIES

The queuing polices defines which message should be dropped when the buffer is complete There are lots of queuing polices that has been planned for select the mainly vulnerable message. Some of them are describe below:

a. FIFO (First in first out): In this queuing policy, the message that was initially entered into the queue is the first message to be dropped.
b. MOFO (Evict most forwarded first): In this scheme, the message that has been forwarded the most number of times is the first to be dropped.
c. MOPR (Evict most favorably forwarded first): In this, every node maintains a value FP (initialized to zero) for each message in its queue. Every time the message is forward, FP is simplified according to the equation.
d. LEPR (Evict least probable first): Since the node is least likely to deliver a message for which it has a low P-value, fall the message used for which the node has the lowest P-value [6][7].

4. Mobility Models

Spatial dependence is a measure of how the two nodes are dependent in their motion. If the two nodes are moving in the similar direction then they have high spatial dependence. Temporal dependency: Temporal dependency is defined how current velocity (magnitude and direction) are linked to the previous velocity. Nodes having the same velocity have high temporal dependency. Given below are the descriptions of three mobility models with detailed explanation for how they emulate real world scenario [8].

4.1 Random Way Point Movement Model (RWPM)

The Random way point model is the mobility model which is most commonly used in research community. At each instant, a node arbitrarily chooses a target and moves in the direction of it with a velocity chosen randomly from a uniform distribution [0, V_{max}], where V_{max} is the maximum allowable velocity for each mobile node. After reaching on the destination, node stops for the duration defined by 'pause time' parameter. After this duration, it again chooses the random destination and repeats the whole process until the simulation ends.

4.2 Shortest Path Map Based Movement Model (SPMBM)

A more realistic model is the Shortest path map based movement mode l(SPMBM) where, instead of a completed the random walk, the nodes chooses the random point on the map and follow the short route to that point from their current location. The number of map points depends on the construction of the map. An area where the roads have been constructed with many map points more easily attracts nodes.

4.3 Map Based Movement Model (MBM)

In Map based movement model (MBM) nodes having pre-determined routes that they follow. In this movement model, nodes send the data to other nodes in a fixed manner. A map is used to make the routes for nodes and they follow the route, e.g. tram or train routes. This movement model gets as input a map in the WKT (Well Known Text) format. The map consists of map points connected by links. All crossings are map points, and all curves in the roads are constructed by several links and map points [8].

5. APPLICATIONS OF AD-HOC NETWORKS

5.1 Conferencing

Perhaps the ideal application requires the concern of an ad-hoc network is mobile conferencing. When mobile computer users collect outside their standard office environment, the business network communications is repeatedly missing. But the need for collaborative the compute might be even more significant here than in the everyday office environment. Indeed, the entire point of meeting might be to make the some further progress on the particular collaborative project.

5.2 Emergency Services

Ad-hoc networks can be used to overcome network impairment during disaster emergencies. Mobile units will probably hold networking equipment in support of routine operations for the times when the internet is existing and the infrastructure has not been impaired. With the technique and the protocols in this, emergency the mobile units can greatly extend usefulness of their networking equipment during times of lost infrastructure support. For instance, police the squad cars and firefighting tools can remain in touch longer and provide information more quickly if they can cooperate to form an ad-hoc network in places not otherwise offering connectivity to the global Internet [10].

5.3 Personal Area Networks and Bluetooth

The idea of a personal area network (PAN) is to create much contained network populated by some network nodes that are closely associated with an only person. These nodes may be attached to person's belt or carried in the purse. More exotic vision of the future includes the virtual reality devices attached around the head and other devices are more oriented toward the sense of touch. These devices may or may not require having an attachment to the wide area Internet (WAN), but they will almost definitely need to communicate with each other while they are associated with their user's activities [9].

6. SIMULATION SETUP AND RESULTS

6.1 Simulation parameters

ONE (Opportunistic Network Environment) simulator is used to perform the result of our work. ONE simulator is the java based simulator. It can be run on Linux and window operating system.

Table: Simulation Parameters

Parameter	Value
Simulation Area	4500 X 3400
Simulation Time	43200 sec
Mobility Model	Shortest path, Map based, Random way
Routing	Prophet
No. of groups	6
Transmission range	10m
Node speed	2 m/sec
Time to live	100, 200, 300, 400, 500
Buffer size	5, 10, 15, 20, 25
Operating system	Window 7

6.2 Performance Matrices used for analysis

Performance matrices:

a. Packet Delivery Ratio: Packet delivery ratio is the ratio of the data packets delivered to destination to those generated by the sources at the application level.
b. Dropped packets: It describes total number of dropped packets during model.
c. Delivered Packets: It defines the total number of delivered packets.
d. Average Buffer time: It is the time for which the messages stay in the buffer.

7. RESULT AND ANALYSIS

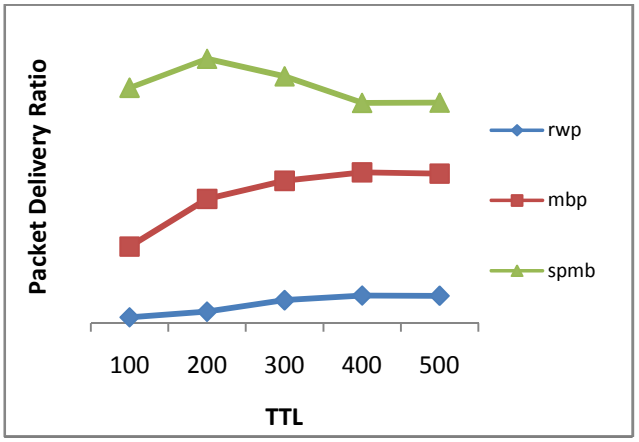

Fig 1: Packet Delivery Ratio V/s Time to Live (TTL)

Fig 1 shows that when time to live varies then packet delivery ratio also varies. In the shortest map based movement model Packet Delivery ratio is high as compare to random way point movement model and map based movement model.

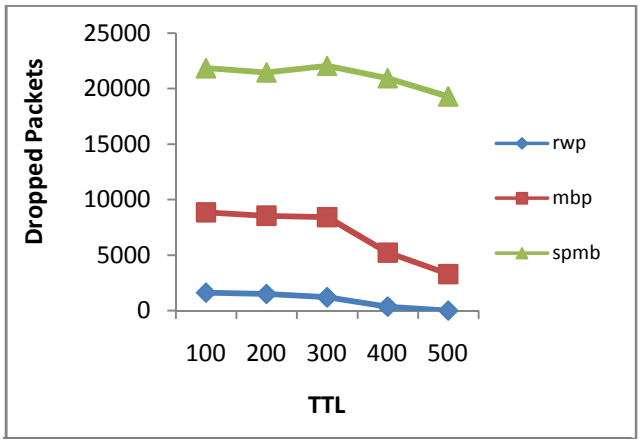

Fig. 2: Dropped Packets V/s Time to Live (TTL)

Fig 2 shows when time to live vary then the effect of dropped packet also varies. In the shortest path map based movement model dropped packets is very high as compare to random way point movement model and map based movement model.

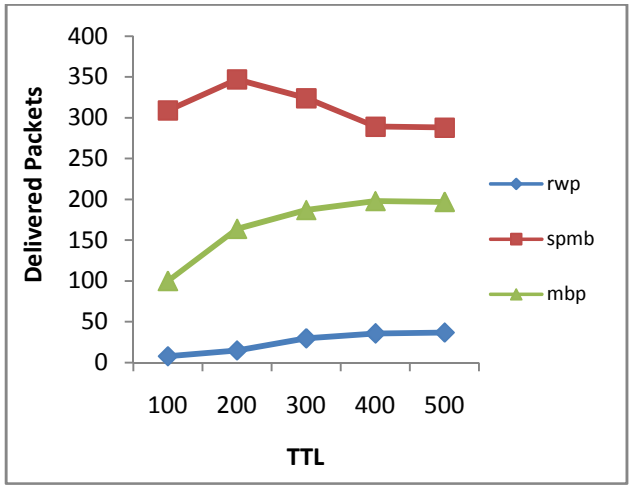

Fig 3: Delivery Packets V/s Time to Live (TTL)

Fig 3 shows when time to live vary then the delivered packets is also vary. In the random way point movement model Delivered packet is very high as compare to shortest path map based movement model and map based movement model.

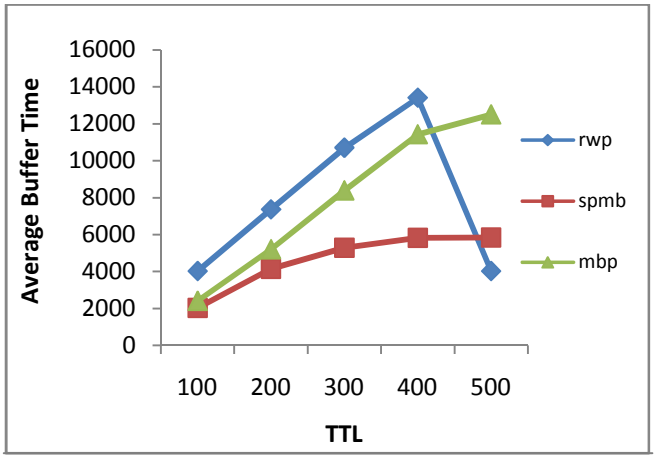

Fig. 4: Average Buffer Time V/s Time to Live (TTL)

Fig 4 shows when time to live very then the average buffer time also very. In the Random way point movement model Average buffer time is very high as compare to shortest path map based movement model, map based movement model.

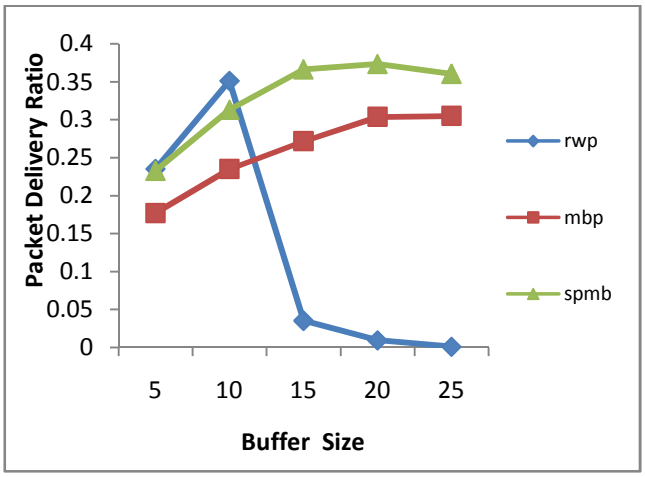

Fig. 5: Packet Delivery Ratio V/s Buffer Size

Fig 5 shows when the buffer size very then the packet delivery ratio also very. In the shortest path map based movement model packet delivery ratio is high as compare to map based movement model and random way point movement model.

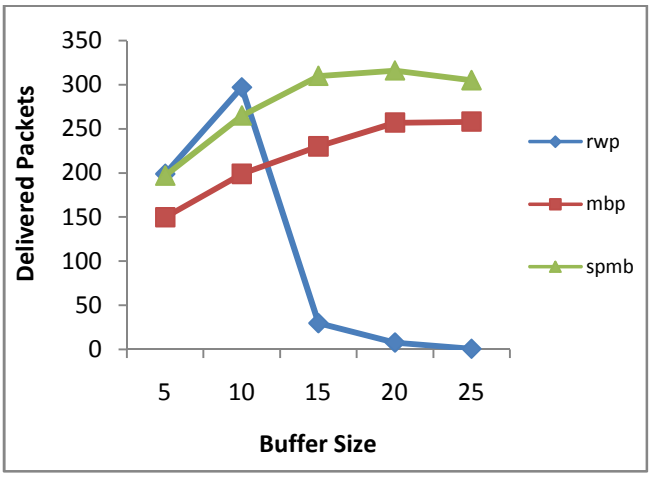

Fig. 7: Delivered Packets V/s Buffer Size

Fig 7 shows when the buffer size very then the delivered packet also very. In shortest path map based movement model delivered packet is very high as compare to map based movement model and random way point movement model.

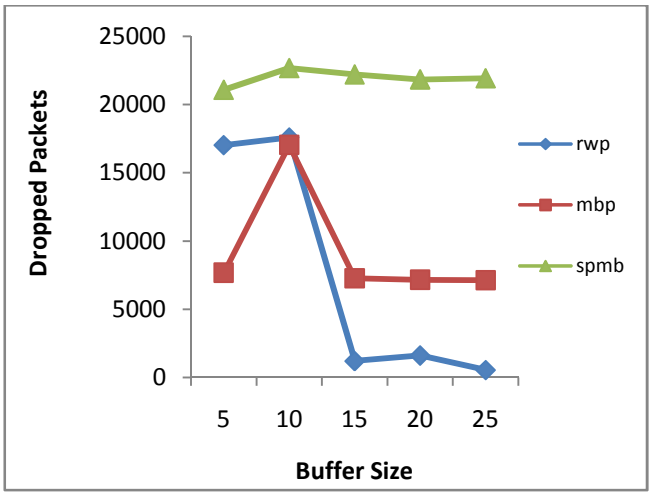

Fig. 6: Dropped Packets V/s Buffer Size

Fig 6 shows when the buffer size very then the dropped packet also very. In shortest path map based movement model dropped packet is very high as compare to map based movement model and random way point movement model.

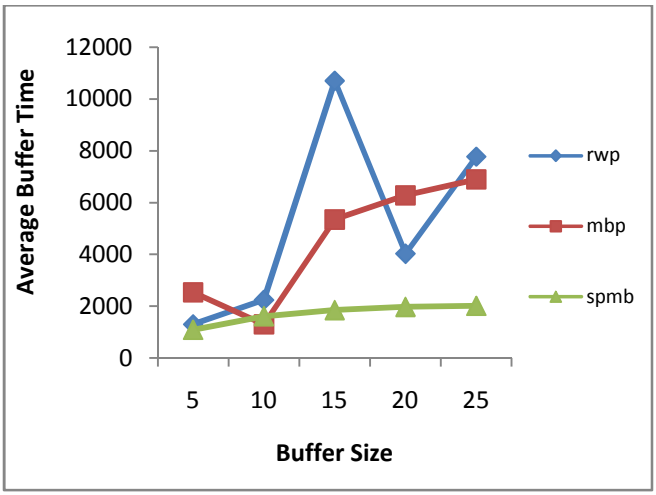

Fig. 8: Average Buffer Time V/s Buffer Size

Fig 8 shows when the buffer size very then the average buffer time also very. In the random way point movement model Average buffer time is very high as compare to map based movement model and shortest path map based movement model.

8. CONCLUSION AND FUTURE SCOPE

Various routing protocols for MANET, the queuing policies for MANET have been covered. We explain different movement model i.e. random way point

movement model, map based movement model and shortest path map based movement model. ONE simulator is used for the simulation of different movement model. After simulation, we get different result for all movement models. In case of shortest path map based movement model packet delivery ratio, dropped packets, delivered packets is very high as compare to map based movement model and random way point movement model.

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