IOSR Journal of Computer Engineering (IOSR-JCE)
e-ISSN: 2278-0661,p-ISSN: 2278-8727,
PP 48-52
www.iosrjournals.org

Performance Analysis of Various Movement Models in DTN

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Abstract: *In challenging wireless network, where there is no end to end connection between source and destination, delay tolerance network is proposed. In delay tolerance network, dynamic topology is used where nodes are completely mobile and based on the principle of store carry and forward. Delay tolerant network uses various routing schemes and movement models. Mechanism through which message is transmitted from one node to other depends on various routing schemes like first contact, spray and wait and max prophetetc. and node mobility is decided using various movement models like Random way point, Shortest path map based, Map based movement model etc.In this paper, an attempt has been made to compare various existing movement models using different metrics like delivery ratio, average message delay, and overheadratio.*

Keywords: *DTN (Delay Tolerant Network), ONE (Opportunistic Network Environment), Routing protocols, Movement Models.*

I INTRODUCTION

Due to frequent disconnections between the nodes, each node has a buffer space to store message in it. Message transmission between different source destination pairs is done using different intermediate nodes and each intermediate node having its own buffer space temporarily store message in it till it comes in the vicinity of other intermediate node. Buffer size of each node is directly proportional to no of messages in the network. Due to frequent disconnections, there may be high error rates, message crashing possibilities and long message delays and thus network is named as delay tolerant network.

1.1 Characteristics of DTN

1. Discontinuous connectivity: in delay tolerant network, there is no end to end connectivity lies between various nodes so traditional routing protocols doesn't work so other protocols are needed.
2. Dynamic topology: due to high mobility of nodes, network is highly dynamic and network topology changes abruptly.
3. high latency : due to frequent disconnections in the network, there are long message delivery delays in the network which in turn affects the network performance
4. High error rates: DTNpossesses high error rates like message crashing, message dropped due to frequent disconnections.

II RELATED WORK

Routing mechanisms decides the way through which message is transmitted from one node to other, till now we have many routing protocols in the network. Various routing strategies used in DTN are:

1. First contact: In this routing, nodes randomly select nodes from various available nodes and send messages to those nodes. If no node is available, then node waits for the nodes that come in the range of that node.
2. Direct delivery : in this routing scheme, source node wait to come in the vicinity of destination node and it directly send message to destination node
3. Epidemic routing : in this routing scheme , to increase the message delivery rate, source node send multiple copies of message to various nodes in hope that at least from one route message will receive to destination node. In this routing scheme, maximum no of resources are used like high bandwidthetc.
4. Spray and wait : this routing scheme is done in two phases where in phase 1 message is send to various available nodes and in wait phase , it checks that if message is not reached to destination node then it wait for the time to come In range of destination node and directly send the message to destination node
5. Prophet : in this routing scheme source node send the messages to that nodes which are having highest probability of message delivery.
6. Max prophet: in this routing scheme, node having max probability of delivering the message to destination node is selected as an intermediate node.

Due to uncertainty between different nodes in the network, mobility of nodes is a cumbersome task and to decide the movement of nodes, there are various kinds of movement models.

1. Random way point movement model: In this movement model nodes moves randomly in arbitrary direction and there is not any mechanism behind the node mobility.
2. Shortest path map based movement model: here node uses the concept of shortest path as shortest available path is chosen among various available paths in map based environment. here dijkastra algorithm is used to calculate shortest part from all the available paths and different nodes in nodes move on the basis of shortest path
3. Map based movement model: in this movement model, movement of nodes is decided on the basis of predefined maps.

III SIMULATION SETUP AND RESULTS

Table 1. Simulation Parameter Table

Parameter Description	Value
Simulation Area	4500m*3400m
Simulation Time	30000s
Mobility Model	[ShortestPathMapBasedMovement; MapBasedMovement; RandomWaypoint]
Routing	Epidemic
Transmission Range	10m
TTL(Time To Live)	[50;100;150;200]
Buffer Size	5m,10m,15m,20m,25m
Warm Up Period	1000seconds
Buffer	5MB

3.1 One Simulator

ONE (Opportunistic Network Environment) ONE is java based simulator. It can be run on any platform that supports java. Performance Matrices used for Simulation:

- Average delay: It is defined as the average message delay from creation to delivery.
- Overhead Ratio - The overhead ratio shows the amount of network resources needed to deliver a packet to its destination.
- Delivery probability - This is the ratio of total number of packets created to total number of packets delivered to destination.
- Varying the Message TTL: The TTL is varied from 50->100->150->200seconds.

3.2 Simulation Results:

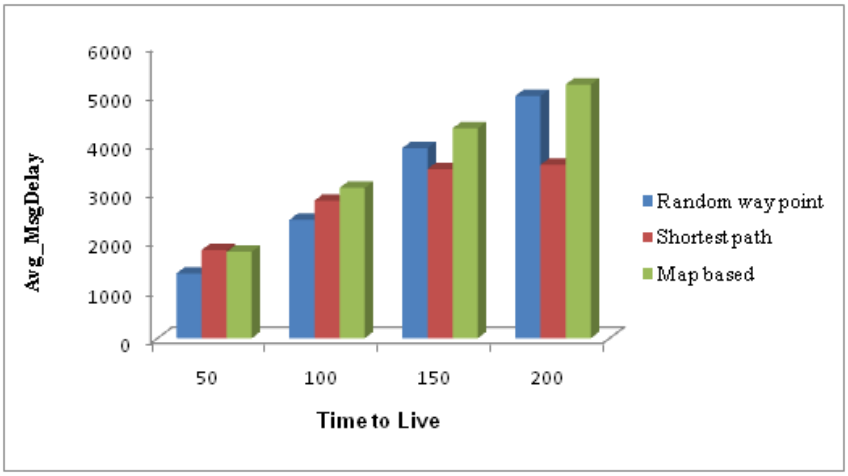

Fig.1. Average Delay V/S Time to Live

Figure 1 depicts the average delay in messages in contrast with time to live for three different movement models i.e. random way point, shortest path map based and map based model. Overall, it can be estimated that in random way point, average delay rate increases continuously with the increment of time to live on the other hand, delay rate decreases continuously with increase in time to live so shortest path and map based movement models should be preferred over random way point.

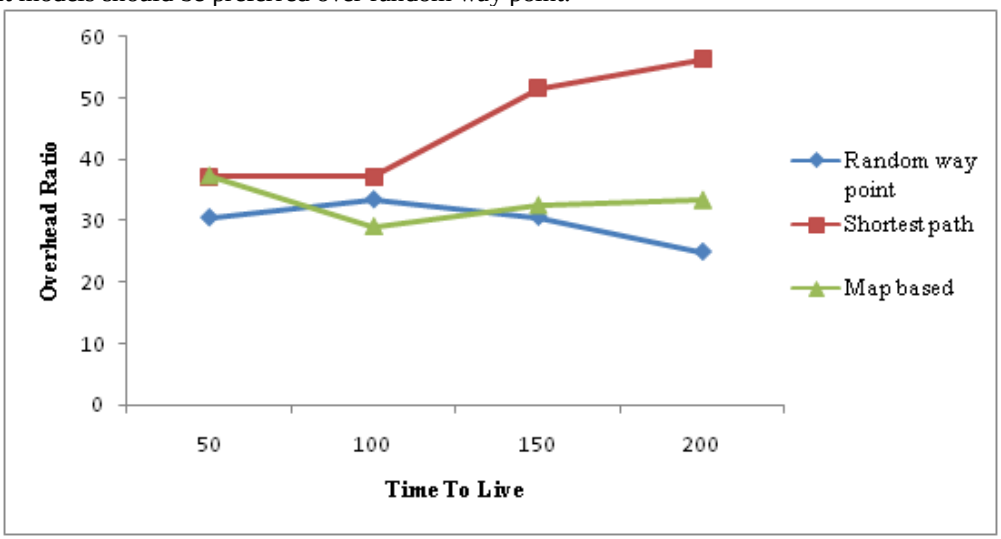

Fig.2. Overhead Ratio v/s Time To Live

Figure 2 depicts the relation between three different movement models on the basis of overhead ratio V/STime toLive. In both random way point and map based, overhead ratio lie between 25 and 35 for any value of Time toLive but in both the cases, there is uncertainty in results. Overhead ratio is highest in shortest path and it always gets increases with increase in Time to Live

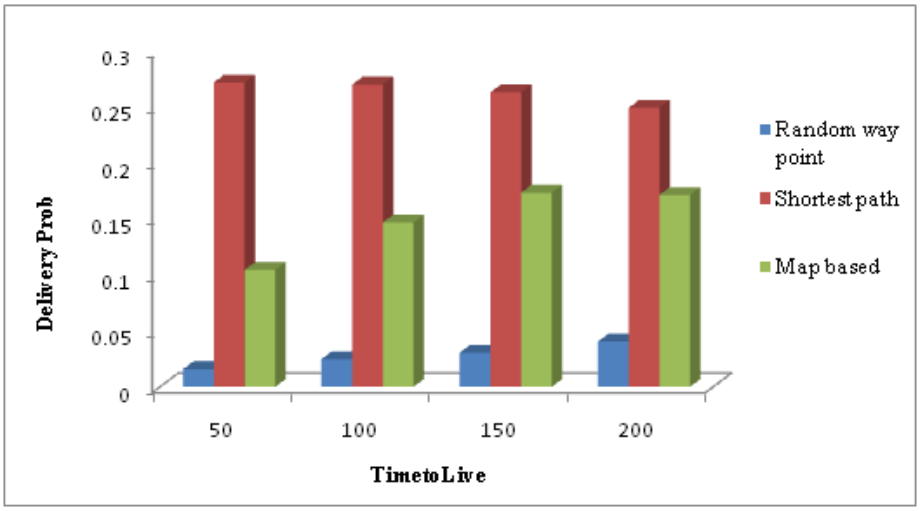

Fig.3. Delivery Probability V/S Time to Live

Figure 3 represents the message delivery probability rate w.r.t. increasing time to live. Overall it is estimated that message delivery probability rate always increases with increase in time to live. Shortest path movement model have highest message delivery probability and message delay while random way point have lowest and in map based message delivery probability lies between both.

IV CONCLUSION AND FUTURE SCOPE

In this paper, first describe different routing schemes and different movement models of DTN. Then using different performance matrices simulate them on ONE simulator Results shows that among these three movement models. In shortest path map based movement model delivery probability is high and message delay is low as compare to other movement models. In future it is intended to propose a new reliable Movement models.

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