Modeling an Efficient Cluster Map based Mobility Model for Delay Tolerance Network

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Abstract

This paper study various mobility models in delay tolerance network (DTN) and propose a new mobility model for DTN using Epidemic routing. A number of mobility models have been developed in DTN. DTN is a network technology designed to operate effectively over long distances and in large time delays communications used in an environment where there is no end to end path connectivity. This paper presents a novel clustered map based mobility model for delay tolerance network and the efficiency of proposed model is compared with existing map based mobility model (MBM). It is implemented in ONE Simulator. Map-based mobility models (MBM) constrain the node movement to predefined paths on the map. The results and analysis show that the proposed Clustered map based mobility model reduces average buffer time, increases throughput, increases delivered packets. Hence the proposed Clustered map based mobility model is more efficient.

Keywords: Delay Tolerance Network, Epidemic routing, MBM, Simulation

I. INTRODUCTION

Delay Tolerance Network (DTN) is a network technology which is used in an environment where there is no end to end path connectivity. It operates effectively in large time delays communications such as space communications and through long distances. Messages are delivered using store and forward technique. Messages are buffered inside router and then forwarded to the next router when contact opportunity arrives. requires Hardware that can store large amounts of data is required. In a delay-tolerant network, traffic can be classified in three ways, called expedited, normal and bulk. After that Normal traffic is sent at their intended destination. Until all packets of other classes with expedite and normal have been successfully transmitted and reassembled Bulk traffic is not dealt [1, 2].Mobility models represent the movement of mobile user, and how their velocity or acceleration and location, change over time. Movement of the network nodes is essential for the performance of delay-tolerant networks (DTN). A mobility model that captures the behaviour of the nodes in the real usage scenarios is thus needed for a reliable assessment of a new protocol. Inter-contact times and contact durations are typical parameters. Inter-meeting time is the time interval between contacts of two nodes. In other words we can say it is the time interval a node pair is not in contact with each other. The contact time or contact duration is the time a contact between two mobile nodes lasts. The contact durations limit the amount of data that can be sent and Inter-contact times correspond to how often nodes will have an opportunity to send packets to each other [3].

II. RELATED WORK

In this Section, an overview of mobility model in DTN namely map based mobility model and routing protocol namely Epidemic along with their relative pros and cons have been described.

A. Mobility Models

It is an active area of research. Movement models govern the way nodes move in the simulation. The simplest model is the Random Walk mobility model that relay on random speeds in random directions. Random Waypoint Movement Model add pause times when nodes assume new destination and speed. Map-based movement models constrain the node movement to predefined paths. The simplest random Map-Based Mobility Modal (RMBM) contain all features of random walk model. Nodes move to randomly determined directions on the map following the roads as defined by the map and also it has options to select different node groups that use only certain parts of the map. The ShortestPathMapBasedMovement uses Dijkstra's shortest path algorithm to find its destination. Next is Route based movement model in which nodes follow routes like bus or tram lines. The nodes using that route move from stop to stop using shortest paths and stop on the stops for the configured time [4]. Manhattan Mobility Model (MMM): A model that formulates a grid like structure of horizontal and vertical lines on map to drive nodes with predefined probability. Cluster based Manhattan Mobility Model- All the vehicles moving in the Manhattan Mobility Model are grouped together to form a cluster. The Cluster based Manhattan Mobility Model produces reliable communication [5].

B. Epidemic Routing

It is the first and probably the simplest protocols for data delivery in DTNs. Epidemic algorithms were originally proposed for synchronizing replicated databases. Davisetal improved the basic epidemic scheme with the introduction of adaptive dropping policies. Epidemic algorithms provide a sufficient number of random exchanges of data, all nodes eventually receive all messages. Time-To-Live (TTL) is further introduced by Harrasetal [6].

III. PROPOSED METHODOLOGY

In this simulation we created three clusters p, q, r each having 10 nodes. Each cluster has cluster center and range in meters. Cluster p is a group of 10 p nodes. Similarly Cluster q and cluster r is a group of 10 q nodes and 10 r nodes respectively. Nodes do not move randomly on whole area but can only move within their own clusters. P nodes can only move within cluster p. Similarly q nodes and r nodes can only move within cluster q, cluster r respectively. These nodes do not transfer any data among one another. Fourth group- tram group (group of tram nodes) having five nodes. Tram nodes move among clusters and transfer data between two clusters. Route followed by tram nodes is specified in a route file.

1) Proposed Algorithm:

- Step1. Initialize simulation area with N number of Nodes.
- Step2. Divide the Simulation area into three subareas.
- Step3. Generate Tram Nodes for performing routing between these subareas.

IV. SIMULATION

We extended the Opportunistic Network Environment (ONE) simulator with our new mobility model. ONE is a highly customizable simulator that has several movement models implemented. All map-based movement models obtain their configuration data using file in a Well Known Text (WKT) format. The basic installation contains 4 movement models: random waypoint model, map based movement model, shortest path map based movement, map route movement. We simulated PDM in the ONE system, to compare Performance Metrics obtained under PDM with those predicted under the existing mobility models in ONE. Performance Metrics we evaluate are:

A. Throughput:

Ratio of number of messages delivered to destination and number of messages created by source node is called throughput.

B. Message Delivery Probability:

The probability of the messages that are correctly received by the destination within a given time period

C. Overhead ratio:

$$\frac{\text{Relayed Messages–Delivered Messages}}{\text{Number of Delivered Messages}}$$

D. Average Latency:

It is referred as average message delay from creation to delivery.

E. Average buffer time:

The Average time for which messages stayed in the buffer at each node

F. Varying the number of nodes:

The nodes are increased as: 5->10->15->20->25. The time to live field is set to 300 seconds.

G. Common Parameters for all scenarios:

The simulation parameters are mentioned in the following Table.

Table - 1
Simulation Parameters

Parameter Description	*Value*
Simulation Area	*4500mX3400m*
Simulation Time	*40000s*
Mobility Model	*Map Based Movement*
No. of Groups	*4*
Transmission Range	*10meter*
Node Speed	*2m/s*
Warm-up Period	*1000 seconds*

Time To Live	*60 minutes*
Buffer Size	*5MB*
Routing Scheme	*Epidemic*

V. SIMULATION RESULTS

A. Delivered Packets

Packets Delivered obtained for default map based mobility model and proposed clustered map based mobility model are shown in Figures 1. It is clear that the number of packets delivered in proposed model is more than the delivery of Packet in case of default map based mobility model.

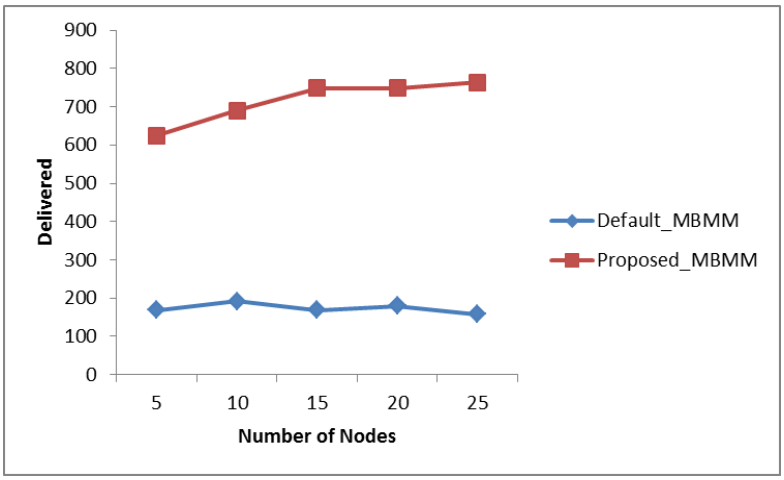

Fig. 1: Number of Nodes v/s Delivered Packets

B. Dropped Packets

Packets Dropped obtained for default map based mobility model and proposed clustered map based mobility model are shown in Figures 2. It is clear that the number of packets dropped in proposed model is less than the Packets dropped in case of default map based mobility model.

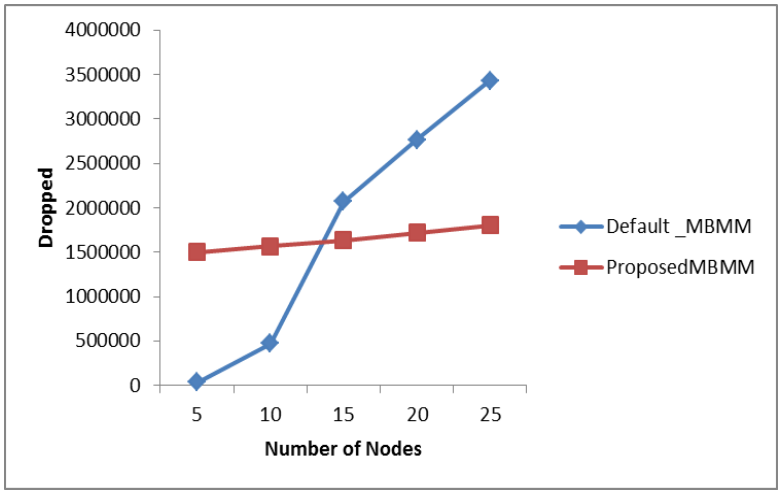

Fig. 2: Number of Nodes v/s Dropped packets

C. Throughput

Throughput obtained for default map based mobility model and proposed clustered map based mobility model are shown in Figures 3. It is clear that the throughput in proposed model is better than the throughput in case of default map based mobility model.

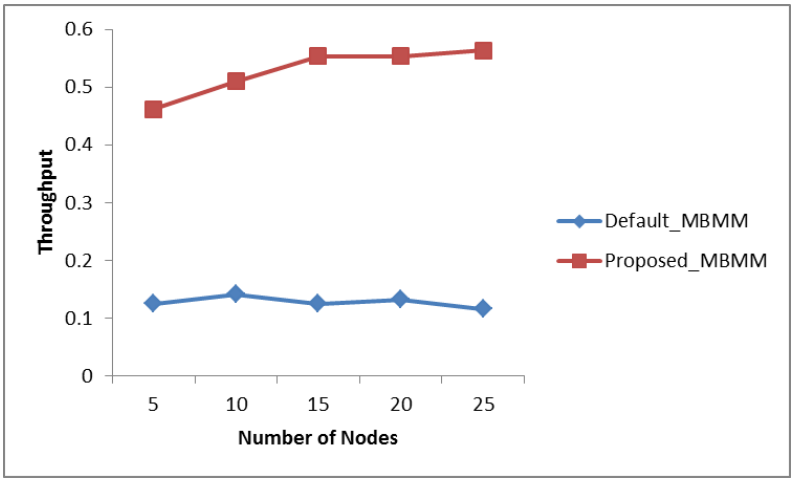

Fig. 3: Number of Nodes v/s Throughput

D. Overhead Ratio

Overhead Ratio obtained for default map based mobility model and proposed clustered map based mobility model are shown in Figures 3. It is clear that the overhead ratio in proposed model is less than the overhead ratio in case of default map based mobility model.

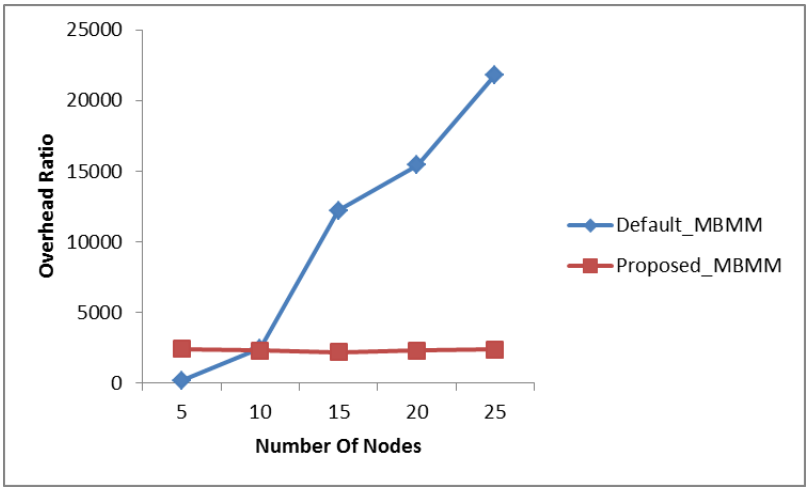

Fig. 4: Number of Nodes v/s Overhead Ratio

E. Average Latency

Average Latency obtained for default map based mobility model and proposed clustered map based mobility model are shown in Figures 5. It is clear that the Average Latency in proposed model is less than the Average Latency in case of default map based mobility model.

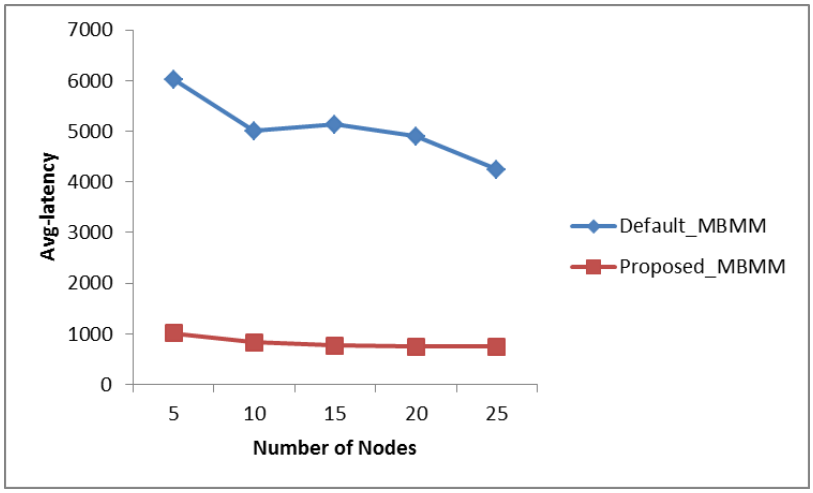

Fig. 5: Number of Nodes v/s Average Latency

VI. CONCLUSION

In the present work, map based mobility models in DTN have been studied and a new map based mobility model has been proposed. From the simulation results, we found that: the proposed clustered map based mobility model is better than the map based mobility model because it has maximum Packet delivered, maximum Throughput, minimum Overhead Ratio, Minimum Average Latency.

REFERENCES

[1] K. Fall, "delay-tolerant network architecture for challenged internets," in Proceedings of ACM SIGCOMM, 2003, pp. 27–34.
[2] https://en.wikipedia.org/wiki/Delay-tolerant_networking.
[3] Frans Ekman, Ari Keränen, Jouni Karvo and Jörg Ott, "Working Day Movement Model," MobilityModels'08, May 26, 2008, Hong Kong SAR, China.
[4] M Shahzamal, M F Pervez, M A U Zaman and M D Hossain, "Mobility Models For Delay Tolerant Network: A Survey," International Journal of Wireless & Mobile Networks (IJWMN) Vol. 6, No. 4, August 2014.
[5] Dr.B. Ramakrishan, M. Milton Joe, R. Bhagavath Nishanth, "Modelling and Simulation of Efficient Cluster Based Manhattan Mobility Model for Vehicular Communication" Journal of emerging technologies in web intelligence, Vol. 6, No. 2, May 2014.
[6] Vinit Kumar, Anita Singhrova, "Movement Models Based Performance Comparison of Routing Protocols in Delay Tolerant Networks" International Journal of Innovative Research in Science, Engineering and Technology Vol. 3, Issue 8, August 2014.
[7] Md Yusuf S. Uddin, David M. Nicol, Tarek F. Abdelzaher Robin H. Kravets, "A Post-Disaster Mobility Model For Delay Tolerant Networking," Proceedings of the 2009 Winter Simulation Conference M. D. Rossetti, R. R. Hill, B. Johansson, A. Dunkin, and R. G. Ingalls.
[8] K.Prasanth, Dr.K.Duraiswamy, K.Jayasudha, Dr.C.Chandrasekar, "Packet Transmission Analysis in Vehicular Ad Hoc Networks using Revival Mobility Model," Int. J. Advanced Networking and Applications 252 Volume: 01 Issue: 01 Pages: 252-257 (2010).
[9] Santosh Kuma , S. C. Sharma, Bhupendra Suman, "Mobility Metrics Based Classification & Analysis of Mobility Model for Tactical Network" International Journal of Next Generation Networks (IJNGN) Vol.2, No.3, September 2010.
[10] Vaishali D. Khairnar, Dr. S.N.Pradhan, "Mobility Models for Vehicular Ad-hoc Network Simulation" International Journal of Computer Applications (0975 – 8887) Volume 11– No.4, December 2010.
[11] Sulma Rashid, Qaisar Ayub, M. Soperi Mohd Zahid, A.Hanan. Abdullah, "Impact of Mobility Models on DLA (Drop Largest) Optimized DTN Epidemic routing protocol" International Journal of Computer Applications (0975 – 8887)Volume 18– No.5, March 2011.
[12] Hemal Shah, Samina Mansuri, Yogeshwar Kosta "Performance Analysis of Drop Policies for Different Mobility Models in DTN" International Journal of Computer Applications (0975 – 8887) Volume 59– No.14, December 2012.
[13] Francisco J. Martinez, Juan-Carlos Cano, Carlos T. Calafate, Pietro Manzoni, "CityMob: a mobility model pattern generator for VANETs" IEEE Communications Society subject matter experts for publication in the ICC 2008 workshop proceedings.