ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 5, May 2015

Comparative Study of DTN Routing Protocols

Biren Patel[1], Dr. Vijay Chavda[2]

Assistant Professor, Department of Computer Science, Ganpat University, Ganpat Vidyanagar, Gujarat, India.[1]

Principal, N P Patel College of Computer Studies and Management, Kadi, Gujarat, India.[2]

Abstract: Delay-tolerant Networking (DTN) makes successful communication in sparse mobile ad-hoc networks and other challenged environments where there is no end to end path established unlike traditional networking. The performance and efficiency of routing protocols in DTN depends on various mobility models in which node travels and node characteristics. Through the evolution of various routing protocol in different scenario using simulation tool comparative study can be done. This paper focus on the existing routing protocols techniques and Comparative study of existing routing protocols of Delay-Tolerant Networks based upon the metrics like Delivery Ration and Overhead Ratio.

Keywords*:*Intermediant connectivity; Delay Tolerent Network; routing; DTN

I. INTRODUCTION

Today's communication over Internet is done by TCP/IP where end to end path has been established and then message is transferred from source to destination with high bandwidth and low delay. Also the message delivery probability is very higher with very low error rate. In Challenged Networks (such as Interplanetary Network, Military Battle Field, Sensor Network, Mobile Network) Communication where the destination is not always in direct touch with sender or far away from sender or having no Internet access TCP/IP scenario doesn't work [1]. In this case, Delay Tolerant Network concept will provide necessary facility for data transfer.

The main difference between Internet and DTN communication is absent of end to end communication path which leads disconnection, variable delay, and high error rate in communication. DTN uses store and forward concept to send message or packet from source to destination. DTN has various routing protocol based on knowledge or replication strategy for successful delivery of packet from sender to receiver. Protocols which works on knowledge of nodes or network (such as location based routing, Gradient Routing, Link Metrics) are decrease the delay but delivery probability is very low [2]. On other hand the routing using replication of message (such has in Direct Contact, Two way Hope, Tree Based routing, Epidemic Routing) delivery ration can be increased but resource consumption is high [3]. DTN uses store, carry and forward approach. Node should carry the message until proper custodian is not found. According to resource limitation each node has fixed size buffer to store messages [4]. Node store the message in its buffer until the next custodian is found in the path towards to reach destination. As the buffer size is limited node should follow some policy to decide which message is dropped when the buffer size is full.

II. DTN ROUTING PROTOCOLS

In DTN, the main characteristic of packet delivery is large end-to-end path latency and a DTN routing protocols has to cope with frequent disconnections. Numerous routing and forwarding techniques have been proposed over the past few years. Majority of forwarding and routing techniques uses asynchronous message passing (also referred to as store-carry-forward) scheme [5][6].

A. First Contact

This is simplest strategy to transmit the data from source to destination in DTN.
This transmit message immediately as soon as the source and destination come in contact with each other directly. This is possible when the source and destination are one hop apart or immediately neighbor of each other [7].

B. Direct Delivery

Scheme lets the source hold the data until it comes in contact with the destination. This simple strategy uses one message transmission.
It is a degenerate case of flooding family, requiring no info about network but requires a direct path between source and destination. Hence if no contact occurs, message is not delivered [8].

C. Epidemic Routing and n-Epidemic Routing

Epidemic Routing [11] has been proposed as an approach for routing in sparse and /or highly mobile Networks in which there may not be a contemporaneous path from source to destination.
It adopts a so-called "store, carry-forward" paradigm.

D. Prophet (Probabilistic Routing Protocol using History of Encounters and Transitivity)

Prophet [10] is a DTN routing protocol aiming at using knowledge obtained from past encounters with other nodes to optimize the packet delivery.
Each node keeps a vector of delivery predictability estimates, and uses it to decide whether an encountered node were carrier for a DTN packet.
The predictability estimates are increased every time a node encounters another node, and they are decayed exponentially.

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 5, May 2015

E. Prophet++

The PRoPHET++ routing protocol [12] is a hybrid of Epidemic protocol and PRoPHET protocol. The main idea of the proposed protocol is to accelerate the dissemination of messages in the early phase of message delivery, by employing Epidemic protocol. On the other hand, the proposed protocol restricts dissemination in later phase since it only copies messages to other nodes only when a delivery predictability condition is met.

F. Spray and Wait

Spray and Wait [13] routing consists of the following two phases:

· spray phase: for every message originating at a source node, L message copies are initially spread – forwarded by the source and possibly other nodes receiving a copy – to L distinct "relays". (Details about different spraying methods will be given later.)

· wait phase: if the destination is not found in the spraying phase, each of the L nodes carrying a message copy performs direct transmission (i.e. will forward the message only to its destination).

III. SIMULATION ENVIRONMENT

The ONE simulator is used for simulation of various routing protocol. The simulation process runs for 2000 seconds for each routing protocol and we used Random Waypoint mobility model to observer the node communication. The other parameters are set as per router requirements.

IV. SIMULATION RESULT

The simulation result has been analyzed and compared in three different phases. (i) First Contact v/s Epidemic Router (ii) Prophet v/s Prophet++ and (iii) Prophet++, Spray and wait and Spray and wait with Prophet++.

The performance result is considered based on two parameters Delivery Ratio and Overhead Ration.

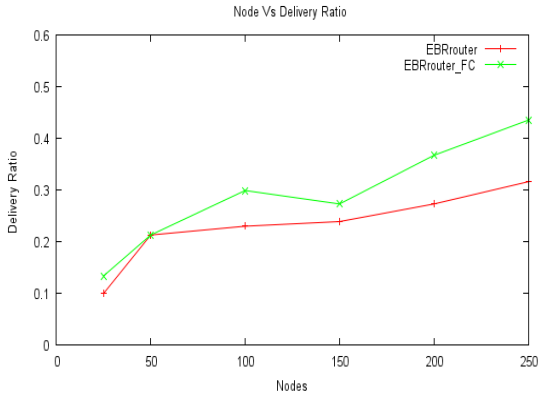

Fig. 1 First Contact and Direct Delivery Router

Fig. 1 shows the analysis of first contact and direct delivery routing protocol comparison. The result shows first contact has better delivery ratio but also when number of nodes increased the overhead ratio also increased.
On another hand the direct delivery has lower delivery ratio but also lower overhead ratio.

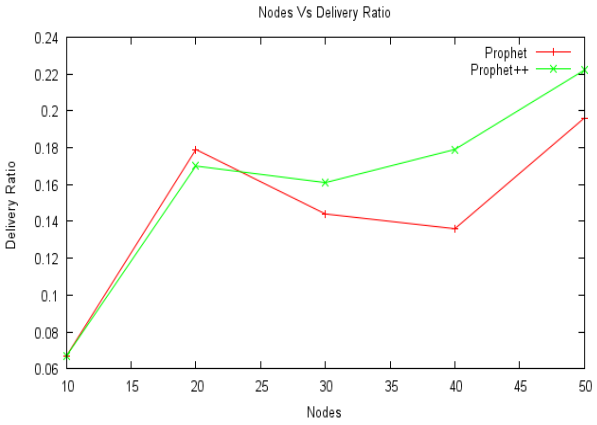

Fig. 2 Prophet and Prophet+ Router Delivery Ratio

Fig.2 and 3 shows the comparison of Prophet and Prophet++. When number of nodes are less then Prophet works very good it provide better delivery ratio but when number of nodes are increased the delivery ration decreased as well as overhead ratio increase very much. Where Prophet++ has best result in both performance parameters when number of nodes are increased. Prophet++ provides better performance when number of nodes is increased.

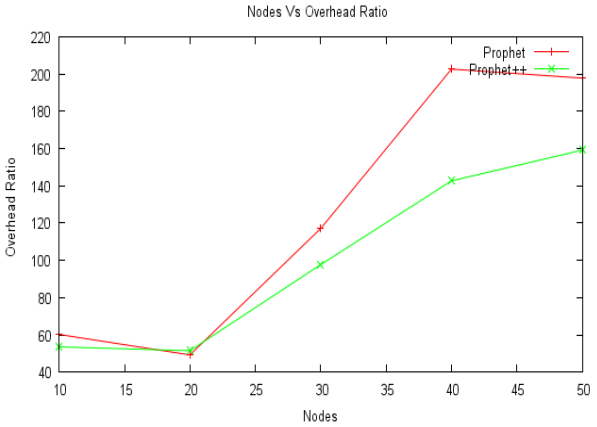

Fig. 3 Prophet and Prophet+ Router Overhead Ratio

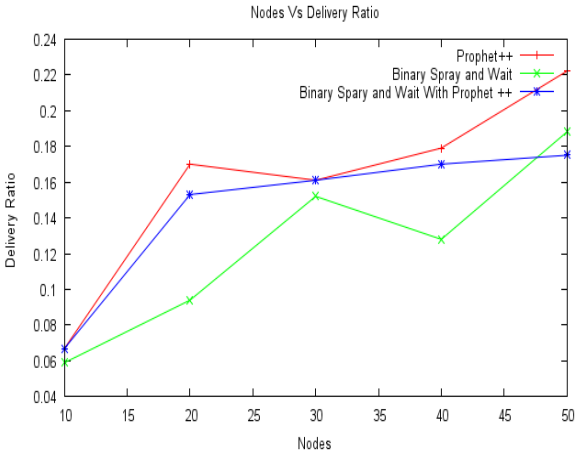

Fig. 4 Prophet++, Spray and wait and Spray and wait with Prophet Router Delivery Ratio

DOI 10.17148/IJARCCE.2015.4506

ISSN (Online) 2278-1021
ISSN (Print) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 4, Issue 5, May 2015

Fig. 4 and fig. 5 shows From above graph we can say Prophet++ has good Delivery Ratio but also the Overhead Ratio increased while on other hand spray and Wait give less Overhead Ration but decreased Delivery Ratio.

When we use Prophet++ with Spray and Wait it give good Delivery Ratio with less Overhead Ration compared to Prophet++ and Spray and Wait stand alone.

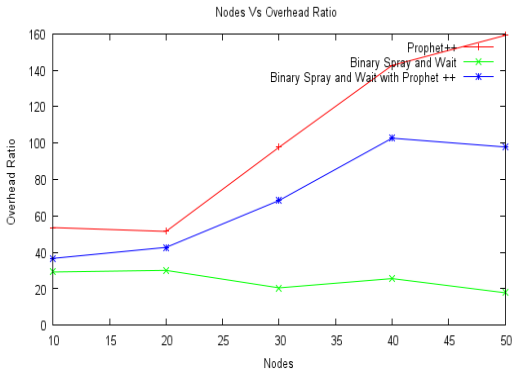

Fig. 5 Fig. 4 Prophet++, Spray and wait and Spray and wait with Prophet Router Overhead Ratio

V. CONCLUSION

In this paper the result from simulation and comparison of various routing protocols such as First Contact and Direct Delivery, Prophet and Prophet++, and Prophet++, Spray and Wait and Spray and Wait with Prophet++ analyzed. The result shows that when we need to achieve higher delivery ratio it will increase the overhead ratio when numbers of nodes are increased. It requires more buffer space to replicate messages copies. When we replicate more copies it will achieve better delivery ratio but also requires much buffer space to store messages.

The only protocol which can be controlled the messages replication is Spray and Wait with Prophet++ Shows that binary Spray and Wait protocol has replication controlled facility.

REFERENCES

[1] Forest Warthman, "Delay Tolerant Networks (DTNs)" Warthman Association Version 1.1

[2] Kevin Fall, "A Delay-Tolerant Network Architecture for Challenged Internets" *SIGCOMM'03*, August 25-29, 2003, Karlsruhe, Germany.

[3] Hemal Shah and Yogeshwar Kosta, "Evolution of Routing Techniques, Routing Protocols and Routing Efficiencies for Delay Tolerant Network", IJCA Special Issue on "Mobile Ad-hoc Networks" MANETs, 2010

[4] Annalisa Socievole, Floriano De Rango, Carmine Coscarella, "Routing Approaches and Performance Evaluation in Delay Tolerant Networks", IEEE 2011

[5] Harminder Singh Bindra and A. L. Sangal, "Performance Comparison of RAPID, Epidemic and Prophet Routing Protocols for Delay Tolerant Networks", International Journal of Computer Theory and Engineering vol. 4, no. 2, pp. 314-317, 2012.

[6] Paritosh Puri and M P Singh "A Survey Paper on Routing in Delay-tolerant Networks" IEEE 2013 "

[7] S. Jain, K.R. Fall, and R.K. Patra, "Routing in a delay tolerant network", 2004

[8] T. Spyropoulos, K. Psounis, and C. S. Raghavendra, "Single-copy routing in intermittently connected mobile networks," in *Proc. IEEE* Sukhbir and Dr. Rishipal Singh, "Effective Routing Protocols for Delay Tolerant Network" International Journal of Morden Engineering Research, July-Aug 2012

[9] Prophet Routing Protocols for Delay Tolerant Networks", International Journal of Computer Theory and Engineering Vol. 4, No. 2, April 2012

[10] A. Lindgren, A. Doria, and O. Schelen, "Probabilistic routing in intermittently connected networks. SIGMOBILE Mob," Comput. Commun. Rev. vol. 7, no. 3, 2003

[11] Seung Deok Hana, Yun Won Chung, "An Improved PRoPHET Routing Protocol in Delay Tolerant Network" Hindawi The Scientific World Journal (First Revision) October 2014

[12] [13] Thrasyvoulos Spyropoulos, Konstantinos Psounis and Cauligi S. Raghavendra, "Spray and Wait: An Efficient Routing Scheme for

[13] Intermittently Connected Mobile Networks" SIGCOMM'05 Workshops, August 22–26, 2005, Philadelphia, PA, USA. Copyright 2005 ACM 1-59593-026-4/05/0008