COMPARATIVE STUDY OF DIRECT DELIVERY, FIRST CONTACT AND EPIDEMIC ROUTING PROTOCOLS IN DTN

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Abstract: Delay-tolerant Networking (DTN) does successful communication in sparse mobile ad-hoc networks and other challenged environments where there is no source to destination path is setup unlike a traditional networking. Many DTN routing protocols use variety of mechanisms including packet replication, flooding mechanism to transfer message between nodes. Through the evolution of all routing protocol with various numbers of nodes and with different interval time using simulation tool, a comparative study can be done. This paper focus on the performance of Direct Delivery, Epidemic and First Contact Routing protocol in random way point mobility model and 300s message lifetime.

IndexTerms – Direct Delivery Router, Epidemic Router, First Contact Router, Delay Tolerant Network, routing in 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 will provide necessary facility for data transfer.

Many DTN routing protocols use a variety of mechanisms, including discovering the meeting probabilities among nodes, packet replication, and network coding [6]. The main difference between Internet and DTN communication is absence of end to end communication path which leads disconnection, variable delay, and high error rate in communication. DTN uses store, carry 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]. The new routing scheme, called Spray and Wait, in which works in two phases "Spray" phase number copies of message are generated and spread into network "Wait" phase will wait until the message meets to its destination node [3]. 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]. Binary Spray and Wait improves Spray and Wait with dividing initial number of copies [4].

II. ROUTING PROTOCOLS IN DTN

A. Direct Delivery Routing

This routing is very simple and basic. It uses a single copy routing protocol which 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.

B. First Contact Routing

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. This routing also employs single copy routing strategy.

C. Epidemic Routing

Epidemic routing [6] is flooding-based in nature, as nodes continuously replicate and transmit messages to newly discovered contacts that do not already possess a copy of the message. In the simplest case, epidemic routing is flooding; however, more sophisticated techniques can be used to limit the number of message transfers. Epidemic routing has its roots in ensuring distributed databases remain synchronized, and many of these techniques, such as rumor mongering, can be directly applied to routing.

III. Simulation Environment

The ONE simulator is used for simulation. The simulation configuration parameters are shown Table 1

Table 1: Simulation Configuration

SIMULATION CONFIGURATION	
Parameter	**Value**
Simulation Time	2000s
Buffer Size	5 MB
Number of Nodes	10 ~ 50
Message Size	50k ~ 100k
Message Generation (Event Interval)	1 – 5, 5-10
Message Lifetime	300s
Mobility Model	Random Way Point

IV. Result Evaluation

The metrics used to compare the performance of the protocols are described in the following:

• Delivery ratio is the ratio between the delivered messages over the generated ones.

• Overhead is the ratio between the total numbers of transmissions over the number of delivered messages.
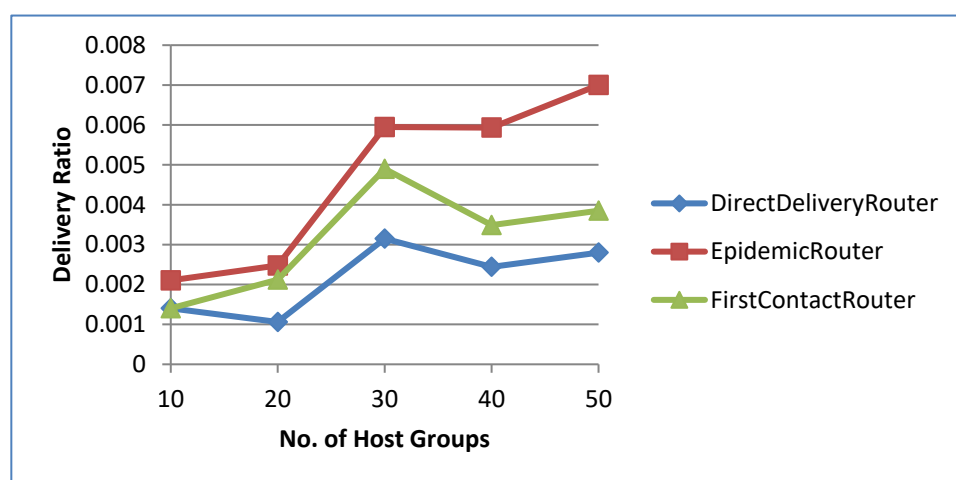

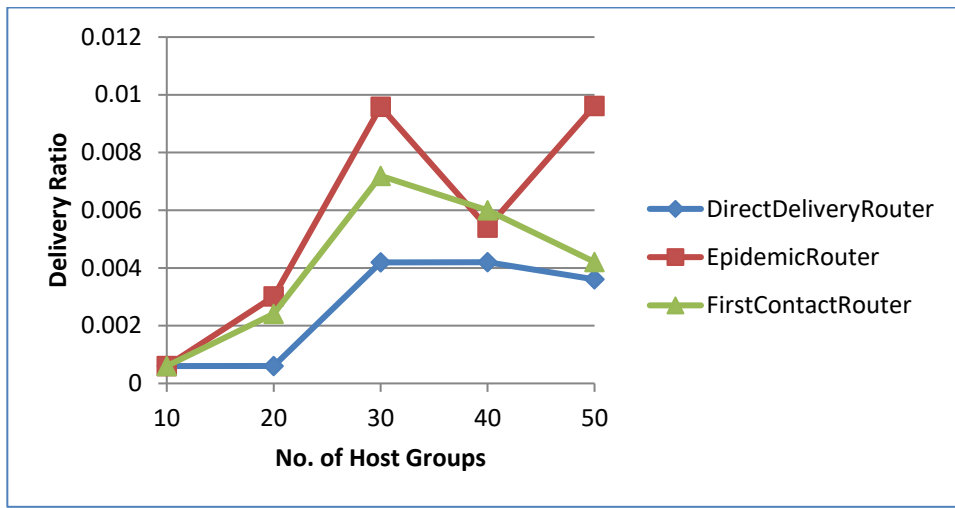Fig. 1 Comparison of Delivery Ratio for interval 5-10

Fig. 2 Comparison of Delivery Ratio for interval 10-15

Fig. 1 and 2 shows the comparison of Delivery Ratio of Direct Delivery, First Contact and Epidemic Routing. The result shows that the delivery ratio of Epidemic routing is higher than First Contact and Direct Delivery as epidemic router uses replication and forwarding mechanism. Delivery ratio of direct delivery is very low due to absence of replication of message. Direct delivery router delivers message direct source to destination. First contact creates one copy and forwards the copy to its immediate first contact node which increases the delivery ration than direct delivery routing.
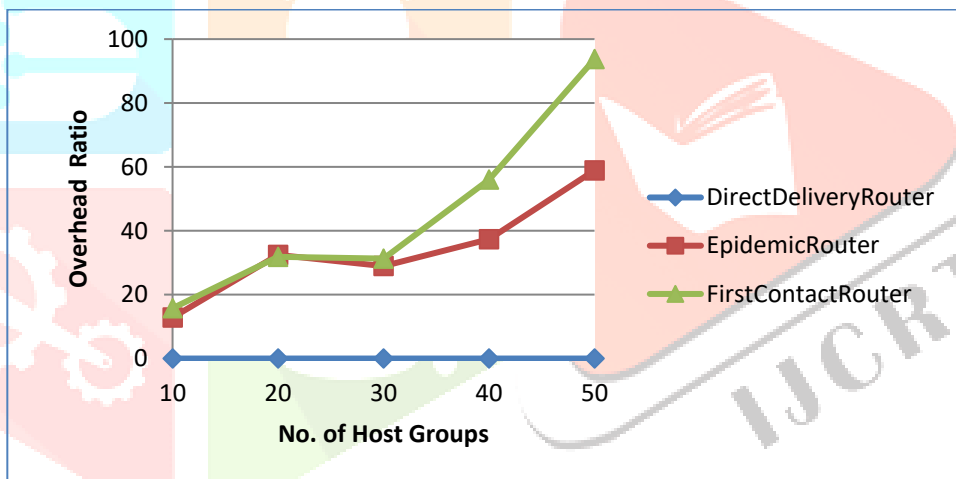

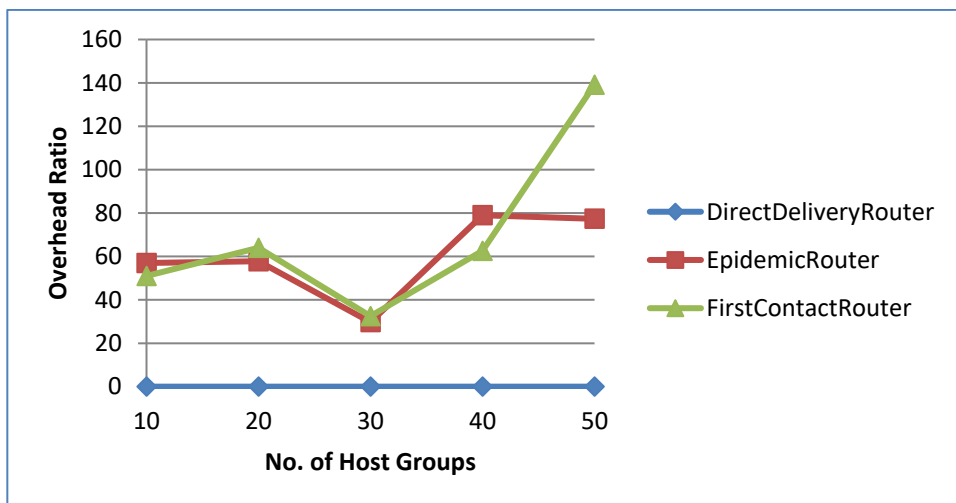
Fig. 3 Comparison of Overhead Ratio for interval 5-10

Fig. 4 Comparison of Overhead Ratio for interval 10-15

Fig. 3 & 4 shows the comparison of Overhead Ratio of Direct Delivery, First Contact and Epidemic Routing. The result shows that the Direct Delivery Router has almost zero overhead ratios as it never creates message copy. First contact and epidemic router creates message copy which leads towards overhead ratio.

V. Conclusion / Acknowledgment

In this paper, the result from simulation is analyzed and compared on Direct Delivery, First Contact and Epidemic Router protocols for interval of 5-10 and 10-15. It shows that delivery ratio of Epidemic Router is very good compared to Direct Delivery and First Contact because it uses replication and forwarding mechanism. In this scheme, when a node receives a message, it forwards a copy of it to all nodes it comes in contact. Thus, the unlimited message copies are spread throughout the network. This scheme uses best effort approach to increase delivery probability. It also proves that the overhead ratio is very low in Direct Delivery than First Contact and Epidemic, because Direct Delivery routing never creates a message copy and hence it generates no or very less overhead ratio.

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