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A Survey on Improved PROPHET Routing Protocol in DTN

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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. To examine the Delay Tolerant Network, path should be defined over multiple unreliable, intermittently-connected components. The performance and efficiency of routing protocols in DTN depends on various mobility models in which node travels and node characteristics. PRoPHET routing protocol in DTN uses its delivery predictability of node encounters and transitivity to select and forward bundles to its neighbor node regardless of their distance. Routing in such network is very difficult and for that different routing protocols are developed. In this Survey paper we discuss about various routing Strategy and at the end compared the different routing protocol with their various performance metrics.***

Keywords*: Disruption Tolerant Network (DTN), Routing Protocol, Probabilistic Routing Protocol using History of Encounters and Transitivity (PRoPHET)*

1. INTRODUCTION

DELAY-TOLERANT networks (DTNs) have the ability to connect the nodes/devices and have the potential to serve areas of the world that are being serviced by traditional networks.
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.
DTN uses store, carry and forward approach. Node should carry the message until proper custodian is not found. 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.

Knowledge obtained from past encounters with other nodes is used to optimize the packet delivery and its delivery performance for forecasting the future contacts to determine the next suitable hops for a given packet However, there are drawbacks in PRoPHET causing its delivery ratio and delay to the messages to reach the destination.

2. 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.

Majority of forwarding and routing techniques uses asynchronous message passing (also referred to as store-carry-forward) scheme [1].

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 [3].

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 [3].

C. Epidemic Routing and n-Epidemic Routing

Epidemic Routing [4] 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 [5] 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.

E. Prophet++

The PRoPHET++ routing protocol [5] 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 [6] 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).

3. DTN Routing Protocol Strategy [9]

Many challenges affect the routing in dtn such as the changing network topology, low delivery ratio and high delay. The problem can be mitigated by using different routing strategy. Many research interests focus on developing new approaches for routing in delay tolerant network environment.

DTN Routing Protocol Strategy can be classified into Three Broad Categories and they are Flooding, Replication and Forwarding and send towards the source using the reverse of the list of the nodes in RREQ. When the source node receives RREP, it first stores the route in its Route Cache and then sends data packets through that route.

3.1 Flooding

Flooding families are extended the number of copies of each message to a group of nodes, this node works like relays. The relays stock up the message pending they connect with the target, at which the message is deliver.

The basic concept of Epidemic routing is when two nodes encounter, they exchange messages each other and message will be propagated to the destination. It is based on Flooding delivery and the data delivery results in inefficient use of the network resources such as bandwidth, power and buffer space at each node. Fig: 1 in which the all nodes of network have the packet, where A and G are source and destination.

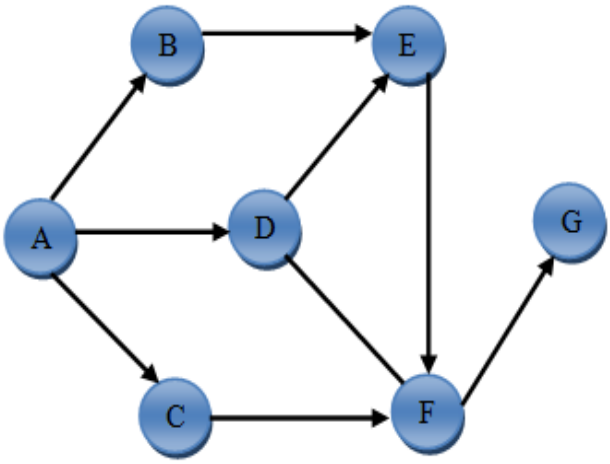

Fig: 1- Flooding strategy[9]

3.2 Replication

Replication scheme insert multiple copies, or replicas of message into the network in order to increase the probability of message delivery that one of them will finds its way to the destination. This scheme further separated into two classes based on the no. of replicas created: Quota based and flooding based.
In first phase it spread the sufficient no. of message copies. The nodes transport a message copy does direct show in the wait phase if the destination is not reach in the spray stage. In fig: 2 all nodes of network have message except E.

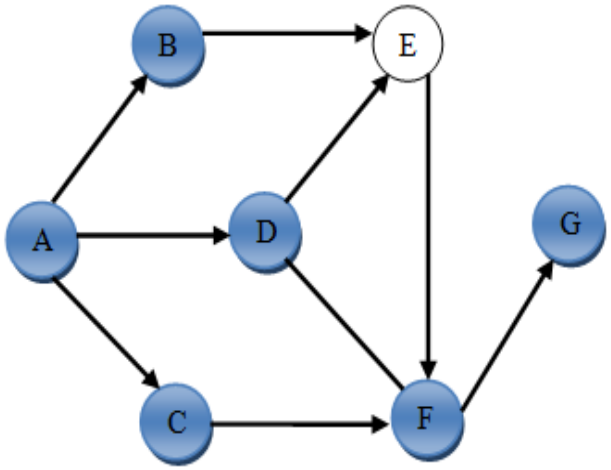

Fig: 2 Replication Strategies[9]

3.2 Forwarding

In the Forwarding routing strategy, keep a single-copy message in the network and attempt to forward that copy through successive intermediate node to the destination. It takes more traditional approach on the basis of network topology knowledge to routing data in a DTN.
Fig: 3 represent the forwarding strategy in which A, D, F and G node have messaged.

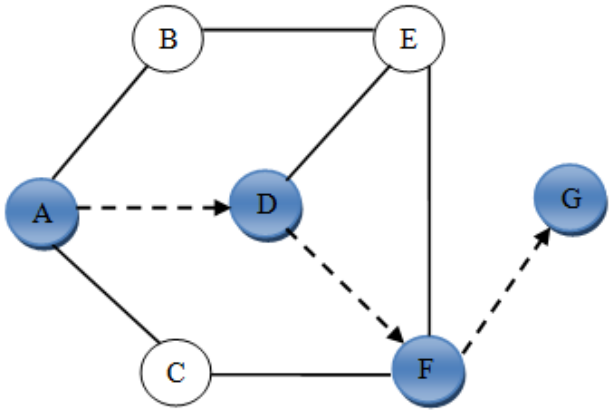

Fig: 3 Forwarding Strategy[9]

4. PROPHET [7],[8]

Prophet routing protocol called as Probabilistic routing protocol provides parameters based on non-randomness of mobility which gives advantage in mobile applications to improve routing performance. Instead of delivering blind epidemic replicas of messages in the form of bundles in the network, it applies "probabilistic routing".

PRoPHET [10] is a prediction-based scheme, and it is one of the few DTN routing protocols that have an IETF draft. It implements a quality metric called encounter predictability to measure the capability of the encountering nodes whether or not it can transmit the message to the destination.

Denoted as P(a,b) [0,1], the delivery predictability is established at every node A for each known destination B. As the metric is calculated, a node with higher value is considered a better candidate for delivering bundles to a certain destination.

For instance, if P(a,b) is greater than P(c,b), bundles for destination B are likely to forward to A rather than C. Thus, the delivery predictability is used for forwarding decisions.

In PRoPHET mechanism, a two-part Information Exchange Phase (IEP) is initiated when a communication opportunity exists between two PRoPHET nodes. In the first part of IEP,the encountered nodes exchange their summary vector (using a Hello message) including delivery predictability values to update the internal delivery predictability vector of each node, and later they exchange bundle information including destination and size of the bundle combined with the updated delivery predictability.

In PRoPHET as shown in Fig. 4 (sequentially from subfigure 1.a to subfigure 1.d),

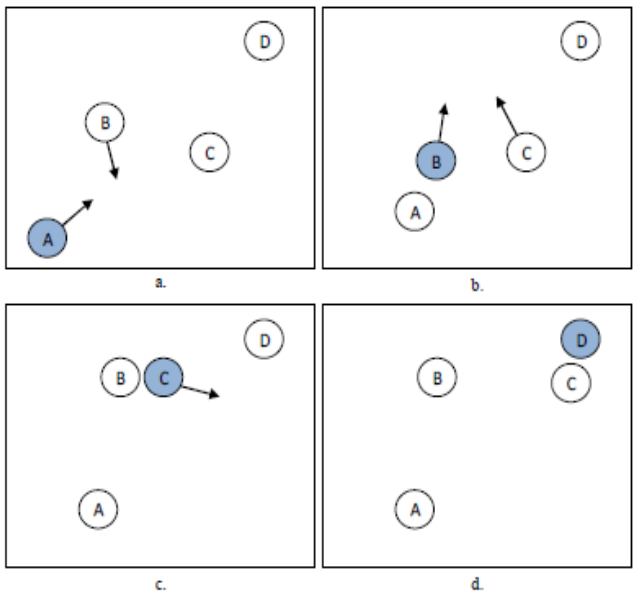

Fig 4. Node Encounters in PRoPHET[8]

There are three parts of the delivery predictability calculation. First, the delivery predictability metric is

updated whenever nodes encounters, so that nodes that are often encountered have high delivery predictability.

The **delivery predictability** must age since a pair of nodes does not encounter each other for a moment of time.

Transitivity is also applied in PRoPHET. Based on the observation that if node A frequently encounters node B, and node B frequently encounters node C, hence node C probably is a good node to forward messages destined for node A.

5. CONCLUSION

In this paper, we have looked at the applications and routing protocols of the Disruption Tolerant Network (DTN). One of the popular DTN routing protocols is PRoPHET, which uses history of node encounters and transitivity to enhance performance over previously existing Epidemic protocol.
And to assure that Prophet routing protocol is better in all respects than epidemic routing.

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