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ADAPTIVE ROUTING IN DELAY TOLARANT NETWORK

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ABSTRACT: *WITH THE PROGRESSION OF COMPUTER NETWORKS EXTENDING BOUNDARIES, MOBILE AD HOC NETWORK (MANET) HAS EMERGED AS A NEW FRONTIER OF TECHNOLOGY TO PROVIDE ANYWHERE, ANYTIME COMMUNICATION. DUE TO ITS DEPLOYMENT NATURE, MANETS ARE MORE VULNERABLE TO MALICIOUS ATTACK. THE ABSOLUTE SECURITY IN THE MOBILE AD HOC NETWORK IS VERY HARD TO ACHIEVE BECAUSE OF ITS FUNDAMENTAL CHARACTERISTICS, SUCH AS DYNAMIC TOPOLOGY, OPEN MEDIUM, LIMITED POWER AND LIMITED BANDWIDTH. IF THERE ARE NO ATTACKS, THERE IS NO NEED FOR SECURITY. MAJOR ATTACKS ON MOBILE AD HOC NETWORKS ARE FLOODING, SELECTIVE FORWARDING, SINKHOLE, WORMHOLE ETC. IN A BLACK HOLE ATTACK, A MALICIOUS NODE ATTRACTS TRAFFIC TOWARDS IT AND DROPS ALL PACKETS WITHOUT FORWARDING TO THE DESTINATION. THE SECURITY OF THE AODV PROTOCOL IS COMPROMISED BY A PARTICULAR TYPE OF ATTACK CALLED BLACK HOLE ATTACK. WE HAVE PRESENTED SEVERAL EXISTING METHODS TO DETECT BLACK HOLE ATTACK IN MOBILE AD HOC NETWORK. IN OUR PROPOSED METHOD EVERY NEIGHBOUR NODE MONITORS THE FORWARDING NODE. SO IN A DENSE NETWORK THE DETECTION RATIO BECOMES HIGH. BECAUSE IN A DENSE NETWORK THERE ARE MANY NODES TO MONITOR THE FORWARDING NODE. OUR PROPOSED METHOD CAN EFFECTIVELY DETECT MALICIOUS NODE IN A MOBILE AD HOC NETWORK.*

Keywords—*Wireless Computer Network, Routing Mechanisms*

I: INTRODUCTION

Even after a rapid increase in Internet and a huge development in communication networks in the world, there still exist many environments where there is not enough network connectivity or end to end paths for the nodes. These areas include extra terrestrial environments, planned networks in space or remote areas in villages, deserts or forests. The entrance of wireless communications provided a major change in the development of many mobile networks in such areas. Nonetheless there still exists certain characteristics like intermittent connectivity between mobile nodes, low bandwidth and channel capacity, high end to end delay, sparsely of mobile nodes, low radio ranges etc. The networks that exhibit these characteristics came to be known as 'Challenged Environments'. In 2002 Fall et al [1] in a seminal work of Inter Planetary Internet [IPN] initiated the concept of Delay Tolerant Networks which later also came to be known as Disruption Tolerant Networks (called DTN).

A DTN is a network of nodes that has the ability of dealing with intermittent connections and also dealing with high end to end delays. They work with a mechanism called Store and Forward where nodes store messages or packets in its local buffer and when a connection activates with other nodes, they transfer the messages across the network towards the destination. These networks were also termed as **"Opportunistic Networks"** since the communication between nodes is opportunistic and not continuous. They make use of any possible connection may it be radio frequency communication or WiFi communication whenever they become available to transfer data between nodes. Since then DTN has grown to become one of the most intriguing research areas and there have been many challenges at the Routing layer, Mac layer, Application layer etc. which have been studied.

II: ROUTING IN DTN

In DTN routing is the process of select next hop towards the destination in such a way to minimize both delay and number of Hops.

DTN has been an active area of research for a number of years now and there has been many DTN routing algorithms that have been proposed. Most of these algorithms can be classified into various categories which are

Forwarding versus replication. No network knowledge versus local knowledge versus entire global time state graph

1. **Forwarding algorithm**

Forwarding strategy uses only single copy in the network so the delivery ratio of the forwarding algorithm is low. T. Spyropoulos et al. [9] introduces various forwarding algorithms. First is the Direct Transmission algorithm. In direct transmission Node sends message to another node if it is the destination of the message.

The other forwarding algorithm is Randomized Routing Algorithm. In randomized Routing [9] Algorithm, The current message custodian hands over the message to another node it encounters with probability $P \in (0,1]$ Further, in order to avoid a message constantly jumping back and forth between two nodes within range, we assume that, when a node receives a message, it is not allowed to send the message back to the node it received it from, for a given amount of time.

Another routing protocol is Utility based routing [9] In Utility based routing every node i maintains the utility function Ui for all node in the network then if the utility value of node A sends message to node B if the utility value of the node B is greater than the utility value of node A. And the last protocol discussed in [9] is seeking and focus. In seek and focus If the utility of the current node is below a predefined threshold Uth, perform randomized forwarding with Parameter p to quickly search nearby nodes Focus. If the utility of received node is greater than the threshold value then it performs utility based forwarding.

The other routing protocol are, First Contact (FC) [10] was trivial where node forwards packet to first node available and hence was completely ine_cient and delivers least throughput and high delays. Next one, Minimum Expected Delay (MED) [10] was a time invariant algorithm where cost of an edge is the average waiting time.

1. **2. Replication strategy**

So with the assumption of having no a-priori information came the birth of a lot of replication algorithms like Epidemic [5], MaxProp [11], Spray and Wait [7], RAPID [12]. These algorithms have a basic notion of fooding the network with copies of the packets, in order to achieve minimum delay and all these algorithms are per-contact routing algorithms.

The simplest of them was Epidemic [5] which sends a copy to every new contact that does not have a copy thereby hoping that at least one copy will reach the destination and hence achieving minimum delay. As it is easy to see that this algorithm would lead to a number of problems. i) There exists many copies of packets in network thereby having a huge wastage of resources. ii) Contact durations may not be long enough to transmit all the packets in one contact.

To minimize the number of packets, algorithms like Spray and Wait [7] were put forward where each node only forwards limited copies in the network. There were many favours of spray and wait most favourable being the Binary Spray and Wait which forwards half of the copies to the node it meets (called the spray phase) and this process goes on until a node has 1 copy in which case it will wait (called the wait phase) to forward it to destination. Although this gives small delay when it comes to delivering packets and reduces the number of copies in the network by some factor, it still is large enough to have unnecessary wastage of resources which can be avoided if intelligent path planning could be done.

3. Probabilistic Algorithms

Because of the drawbacks of the above algorithms of extensive replication consuming many resources and no utilization of node mobility, gave the rise for a new set of algorithms called probabilistic algorithms like PRoPHET [13], Predict and Relay [14], DTN routing with trajectory Planning [15] etc.

The simplest of these was PRoPHET [13] which calculates a delivery redictability for every node via three formulas and the frequency of meeting that makes the decision on which node to forward the packet to. It has lot of advantages like it makes use of predictable movement of nodes and tries to reduce communication over head by forwarding instead of replication and yet achieve high delivery ratio and low delay, decisions are made per contact and not at source and it doesn't require any global knowledge of the system. It still has a few drawbacks that the correctness of predictability relies heavily on its three fundamental probability constants alpha, beta and gamma and no particular good value for those constants is proved.

III: EXISTING WORK

Li Ding et al. [2] propose a mixture model of routing in the hybrid network. An observation on the character of the network in question is that it can be separated to several subnets which have high local connectivity. In those subnets, some nodes contact with other subnets intermittently. The graph contains several *strongly connected components* and several *articulation points* which is known as *articulation nodes* in DTN. The *articulation nodes* have higher probability to deliver the message outside the local strongly connected sub-graph. Unlike the computation of *articulation points* in graph theory, the *articulation nodes* are locally computed without the knowledge of the entire graph. The articulation nodes are discovered when two nodes meet each other and exchange the routing information stored in their routing table. They may not be actual *articulation points* because their removal does not necessarily disconnect the entire graph, but instead their removal disconnects the graph in a local sense.

Authors compared the ANBR with the Simbet routing and epidemic routing protocol. ANBR has high delivery rate and low network overhead.

IV: PROPOSED SYSTEM

In delay tolerant network there are two types of routing protocol, one is the forwarding packets and other is replicating packets .Forwarding uses only single copy of message in the network so it achieves low delivery ratio and high delay rate. Replication generates multiple copies so it increases the delivery ratio but it also increase network traffic and waste resources.

It is being observed during literature survey need of dynamic routing strategy. We proposes dynamic routing strategy which make a decision whether forwarding or replication

Decide the Threshold value T
For each node n
If Free Buffer size > T
Use Encounter based for Routing (Replication Strategy)
Else
Use First Contact Routing (Forwarding Strategy)

V: RESULTS

Simulation can be defined as "Imitating or estimating how events might occur in a real situation." It can involve complex mathematical modelling, role-playing without the aid of technology, or combinations. The value lies in the placing you under realistic conditions that change as a result of behaviour of others involved so you cannot anticipate the sequence of events or the final outcome.

Visualization

ONE is able to visualize results of the simulation in two ways. If the user wishes, the whole simulation is shown in real-time within the GUI as shown in figure. Node locations, current paths, connections among nodes, number of messages carried by a node, etc. are visualized in the main window.

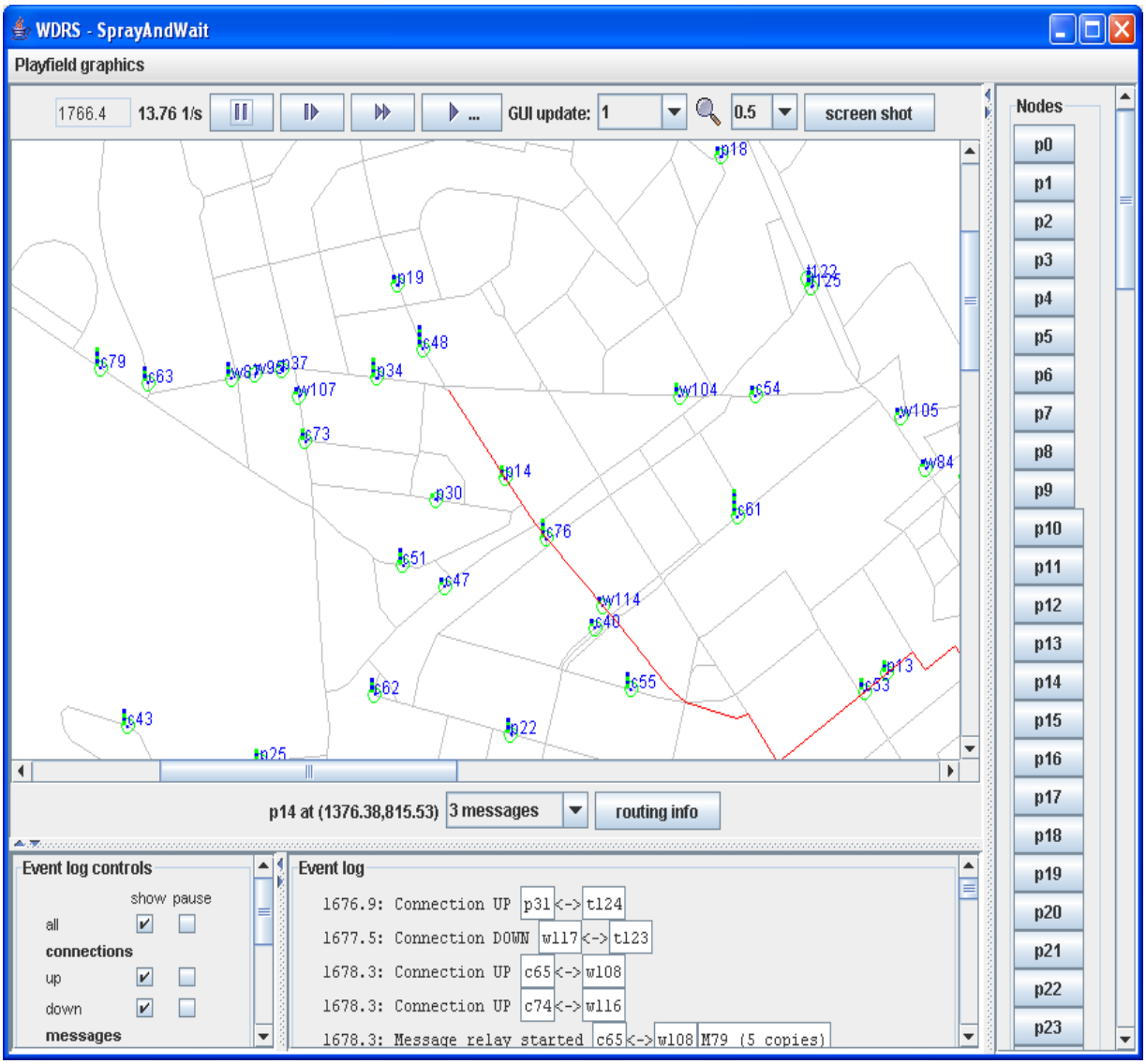

Fig. 1 Visualized Window

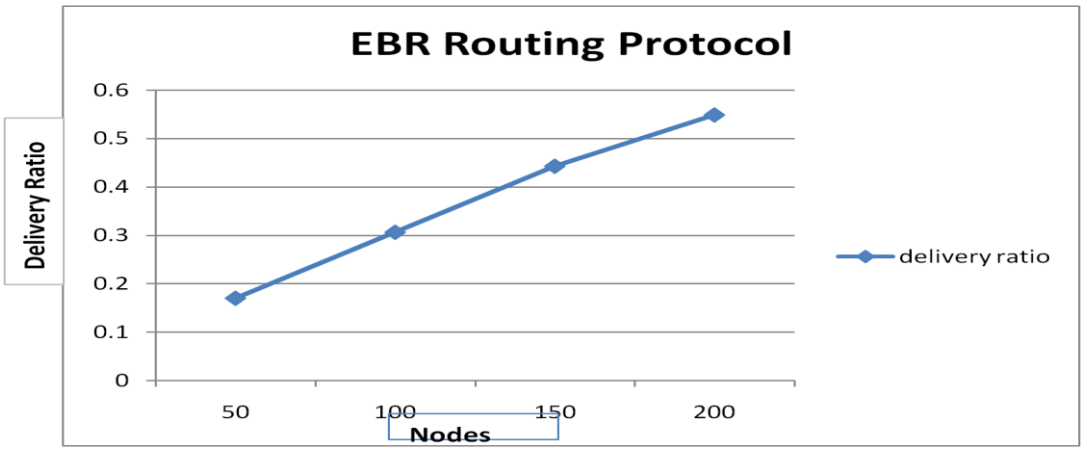

Fig. 2 Delivery Ratio of EBR Protocol

Adaptive Routing For T=0.25 vs Adaptive Routing For T=0.30

Comparison of Adaptive Routing for T=0.25 with Adaptive Routing for T=0.30

Network Parameters

Network size:	4500×3400
Number of nodes:	50,100,150,200
Simulation Time:	10000
Routing Protocol	Epidemic,Adaptive Routing
Buffer Size	5MB

Table.1 Network Parameter

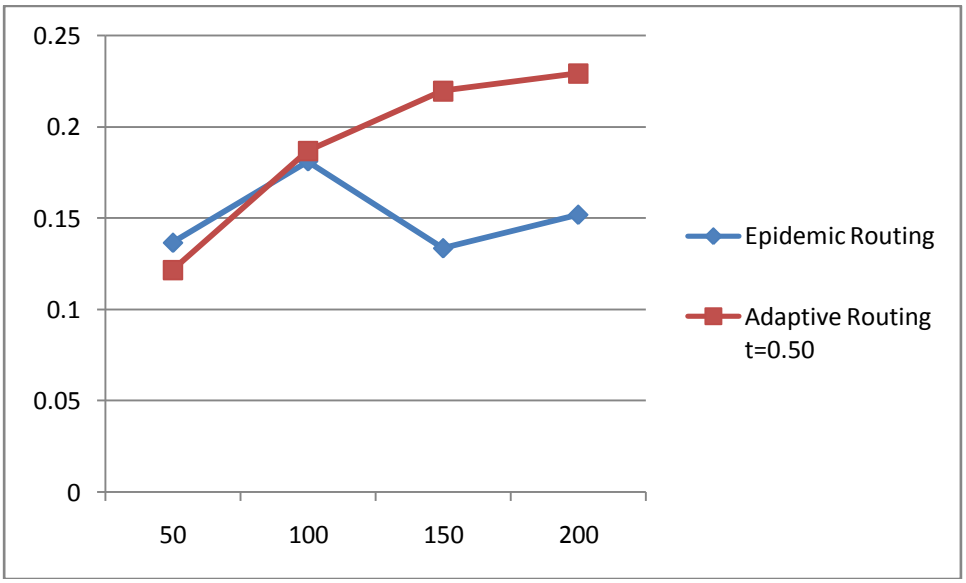

Fig.3 As shown in graph the Delivery Ratio of Adaptive Routing Protocol for T=0.25 and T=.30 are almost same.

Epidemic Routing vs. Adaptive Routing for T=0.40

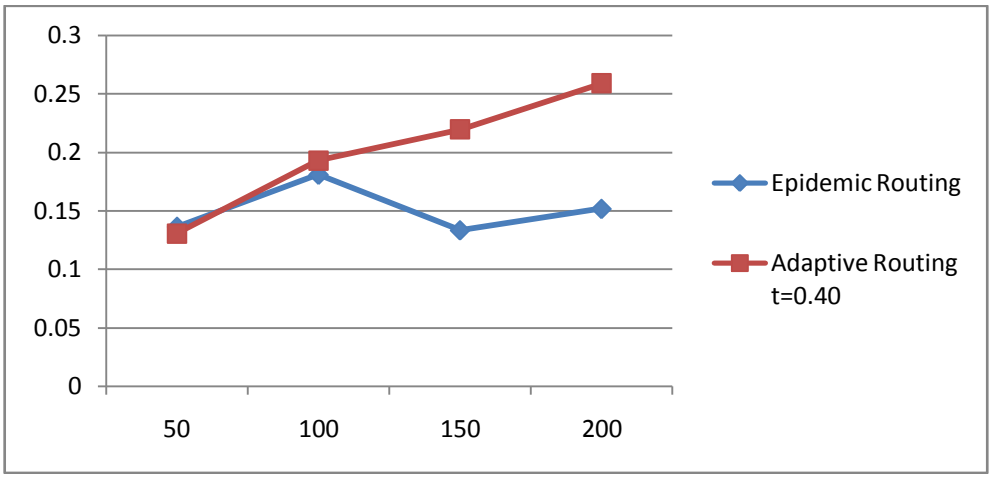

FIG. 4 EPIDEMIC ROUTING VS. ADAPTIVE ROUTING FOR T=0.40

VI: CONCLUSION

Delay and disruption tolerant networks (DTNs) transport application data by creating a "store and forward" network where no infrastructure exists. Although end-to-end connectivity may not be available between two nodes, DTN routing protocols instead take advantage of temporal paths created in the network as nodes encounter their neighbours and exchange messages they have been asked to forward.

So, we conclude that the routing in DTN is challenge, since there are no guarantees that a route will ever be available, many current DTN routing protocols apply epidemic-style techniques, leveraging the fact that an increased number of copies of a particular message in the network should improve the probability that the message will reach its intended destination. However, such techniques come at a high price in terms of network resources, resulting in the rapid depletion of buffer space and energy on resource limited devices, the rapid depletion of available bandwidth, and the potential to greatly increase end-to-end delay.

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