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Abstract **-** Intermittently connected mobile Network systems represent a challenging environment for networking research, due to the problems of ensuring messages delivery in spite of frequent disconnections and random meeting patterns. These networks fall into general category of Delay Tolerant Networks. There are many real networks that follow this model, for example, wildlife tracking sensor networks, military networks, vehicular ad hoc networks, etc. In this context, traditional routing schemes fail, because they try to establish complete end-to-end paths, before any packet is sent. To deal with such networks, researches introduced flooding based routing schemes which leads to high probability of delivery. But the flooding based routing schemes suffered with contention and large delays. Here the proposed protocol "Spraying with performed by a node upon reception of an Acknowledgment message", sprays a few message copies into the network, neighbors receives a copy and by that relay nodes we are choosing the shortest route and then route that copy towards the destination, if packets reach its destination which that node diffuse Acknowledment with Autonomic behaviour and discard messages. Previous works assumption is that there is no contention and unreachable nodes. But we argue that contention and unreachable nodes must be considered for finding efficiency in routing. So we are including a network which has contention and unreachable nodes and we applied the proposed protocol. So, we introduce new routing mechanism for Diffusion Based Efficient Spray Routing in Intemittently Connected Mobile Networks with Multiple Copies.

Keywords **-** *Adhoc; evolving protocols; contention; Routing; Space; Unreachable nodes.*

I. INTRODUCTION

Routing efficiently in intermittently mobile connected network does not have end to end path from the source to the destination. The concept of connected, stable network over which data can be routed reliably rarely holds there. In case of wireless signals are subject to multi-path propagation, fading and interference making wireless links unstable and lossy [1]. Additionally, [6] frequent node mobility significantly reduces the time a good link exists and constantly changes the network connectivity graph. As a result wireless connectivity is volatile and usually intermittent and complete end-to-end paths will not exist [1]. Tactical networks may also choose to operate in an intermittent fashion for Low probability of interception and low probability of detection. Deep space networks and underwater networks often have to deal with parameters such as long propagation delays and or intermittent connectivity, as well [8] [9]. These networks are referred to as Delay tolerant networks [10].

These networks can neither make any assumptions about the existence of a contemporaneous path to the destination nor assume accurate knowledge of the destination's location or even addresses.

Under such intermittent connectivity or networks conditions many traditional protocols fail. The biggest challenge is that to enable networking in intermittently connected or mobile network environment is routing. Conventional internet routing protocols as well as routing schemes for mobile ad hoc networks assume that a complete path exists between a source and a destination and try to discover these paths before any useful data is sent. Thus if no end-to-end paths exist most of the time, these protocols fail to deliver any data to all but the few connected nodes.

However this does not mean that packets can never be delivered in these networks. In mobility assisted routing [6] a message could be sent over an existing link, get buffered at the next hop until the next link in the path comes up and so on and so forth, until it reaches its destination. The utility-based flooding scheme is quite fast in some scenarios, the overhead involved in terms of bandwidth, buffer space, and energy dissipation is often prohibitive for small wireless devices. In multi-copy scheme, more than one copy per message was used and in single-copy scheme only route one copy per message can considerably reduce resource waste. So no routing scheme for intermittently connected environments currently exists that can achieve both small delays and prudent usage of the network and node resources.

The problem of contention in the network and dead ends are not concentrated in the previous works. But we say that contention and dead ends are important factors to be considered. Ignoring contention and unreachable nodes will give inaccurate results [9]. For this reason the implementation of multi-copy protocols called Binary Spray routing with performed by a node upon reception of an Acknowledgment message is introduced [2] by considering contention and unreachable nodes in the network. In order to deal with these issues, various adaptive techniques for message Acknowledgement forwarding can be envisaged. Conventional approaches are limited in that they require an a priori definition of the actions to be taken to optimize the mechanism for some specific situation. In this paper, we propose a novel approach, based on the inclusion of autonomic features (in the form of self-optimization capabilities) in the forwarding service itself. [12]

II. RELATED WORKS AND MOTIVATION

Intermittently connected wireless systems represent a challenging environment for networking research, due to the problems of ensuring messages delivery in spite of frequent disconnections and random meeting patterns. Due to the mobility of the nodes, protocols such as Ad-hoc On-demand Distance Vector routing (AODV),Dynamic Source Routing (DSR) or Optimized Link State Routing (OLSR), continuously update routes when users require them (AODV and DSR) or in a proactive way (OLSR). These routes commonly time out after a few seconds. When a path between two nodes does not exist through the network, no route can be created. Needless to say that these protocols can hardly run over Delay Tolerant Networks (DTNs) and will fail to deliver data most of the time, because the assumption on the existence at a given time of a complete path between a source and a destination is simply not met. Many solutions have been proposed for use in such environments over the last few years. The common basis of these solutions is the observation that end-to-end routes may exist over time due to nodes mobility: leveraging their mobility, nodes can exchange and carry other node messages upon meetings, and deliver them afterward to their destinations. This novel routing paradigm is referred to as store carry forward.

Each node in a network serves then as a relay for all other nodes. Different approaches have been proposed depending if contacts among nodes can be planned, predicted, or are unknown in advance. We want to provide a solution for the third case, without relying on any infrastructure or special mobile nodes. We will then briefly review other solutions present in literature for such a scenario.

A new family of routing protocols is proposed in [12] by Spyropoulos, Psounis and Raghavendra. This family, called Spray routing, can be viewed as a trade-off between single and multiple copies techniques. Spray routing consists of two phases: the first is called *spray*, and the second is either *wait* (spray-and-wait protocol) or *focus* (spray-and-focus protocol). In the spray phase, a carefully chosen number of copies of the message are generated and disseminated in the network to the same number of relay nodes. In the wait phase, relays simply wait to meet the destination in order to deliver the message. In the focus phase, each copy of the message is routed according to a utility-based single-copy routing algorithm. The authors show that, if carefully designed, spray routing incurs significantly fewer transmissions per message than epidemic routing, and achieves a trade-off between efficient message delivery and low overhead.

Another related work with a routing scheme called Binary Spray and Wait routing algorithm [10] works as, the source of a message initially starts with L copies; any node A that has n>1 message copies, encounters another node B with no copies, hands over to B, n/2 and keeps n/2 for itself; when it is left with only one copy, it switches to direct transmission. This algorithm performs well in both message delivery and transmissions rate. The next scheme is similar to the single copy routing scheme which scheme uses only one copy per message. Seek and Focus (hybrid) routing algorithm [2] is used. Here each node maintains a timer for every other node. Nodes emit beacon signal, which advertise their presence. Other nodes which sense this beacon signal and establish a relationship by exchange id, called encounter. A node holding the single message copy, will handover to another node it encounters. The above algorithm has bad transmission rate when the single copy get lost.

Epidemic schemes may be combined with a so-called “recovery process” that deletes copies of a message at infected nodes, following the successful delivery of the message to the destination. Different recovery schemes have been proposed: some are simply based on timers, others actively spread in the network the information that a copy has been delivered to the destination [6].

In this work, we focus on data dissemination techniques which do not require nodes to exchange any a priori knowledge/estimation of their meeting patterns and/or location. We are interested in epidemic-style forwarding policies due to their simplicity, inherent robustness with respect to node failures and unpredictable system conditions, as well as totally distributed nature. The major drawback of these schemes is that they can potentially harvest the network resources. Also, epidemic style forwarding is highly sensitive to the setting of some protocol parameters (e.g., the forwarding probability), which in turn should be set according to the current operating conditions. This motivates us to develop an evolutionary forwarding service that will adapt to changes in the network conditions.

III. ROUTING

In this section, we explore the problem of efficient routing in mobile networks, and describe our proposed solution, Binary Spray Select Focus Routing. Our problem setup consists of a number of nodes moving inside a bounded area according to a stochastic mobility model. Additionally, we assume that the network is disconnected at most times, and that transmissions are faster than node movement.

Our study of Conventional routing algorithms [11] showed that using only one copy per message is often not enough to deliver a message with high reliability and relatively small delay. At the same time, routing too many copies in parallel, as in the case of epidemic routing, can often have disastrous effects on performance. Flooding based schemes begin to suffer severely from contention as traffic increases, and their delay increases rapidly. Based on the above observations, we have identified the following goals for a routing protocol in mobile ad hoc networks:

- Simple
- Highly scalable
- Perform significantly fewer transmissions than flooding-based schemes.
- Deliver a message faster than existing schemes with optimal delays.
- Efficient use of buffer space

3.1 Binary Spray Routing scheme

Although the optimal routing [6] performs well in some scenarios, we say it is inaccurate because of not considering the contention and unreachable packets in the network. In previous works [8] [9], the authors argue that the performance of a routing scheme is accurate when it is subjected to contention and unreachable packets in the network.

3.2 Contention

Contention means competition for resources. Contention is defined as that two or more nodes may try to send messages across the network simultaneously. In Spray and Focus algorithm the contention is not considered and they optimized the copies. As per [7] [8], for congestion adaptive routing the path is minimized for routing. In our algorithm we spray multiple copies to the neighbors from that neighbors we are finding a route; if the copy is reached we will discard the other copies. Other wise we see the other copies for transmission. So we are minimizing the route to avoid contention in the network. Our routing algorithm has three phases

Spray

For every message originating at a source node, L message copies are initially spread-forwarded by the source and possibly other nodes receiving [n/2] copy-to L distinct relays.

Select

Selects a node; from that node find the shortest route by hop distances to the destination.

Focus

Let Ux (Y) denote the utility of node X for destination y; a node A carrying a copy for destination D, forwardsits copy to a new node B it encounters, if and only if UB(D) > UA (D).By using the Spray Select Focus Algorithm we are reducing .the path and not the copies.

ALGORITHM FOR SPRAY SELECT FOCUS

Spray

1. Spray the message copies from the source
2. Check for coverage
3. If there is coverage
4. Nodes which are in neighbourhood receives

   [n/2] copy

Select

5. Nodes visited must not be visited again
6. Minimization of route is done
7. Copy is forwarded to the destination.

Focus

8. If the destination is not found

9. Let A be a node having copy for

Destination D

10. A forwards the copy[n/2] to a new

Node B

If UB(D) > UA(D)

11. performed by a node upon reception of an ACK message.(by using Autonomic diffusion).

Algorithm performed by a node upon reception of an ACK message.

1: Add the received ACK message to the internal ACK messages list

2 : if msgID *2 msgID* 1*; : : : ;* msgID *Lg* then

3: Remove the corresponding DATA message From the internal structure.

4: if Node ID belongs '*W 'then*

5: Update node's actual value (REWARDING).

6: end if

7: end if

3.3 Unrechability

Occur when the node gets struck with hardware failure or power failure. So no packets can be transmitted through the dead end. We cannot pass through the dead end and the copy on that route gets struck. In our proposed algorithm, if there is unreachable end we consider it in two ways. First way is to route the copy using the bypass recovery [7]. This is possible in case of route discovery. In the second way, if there is no route our algorithm's Focus phase will transmit the copy.

IV. SIMULATION RESULTS

The simulation is done with a good simulator having four types of dynamic node formations such as 25, 50, 75,100 nodes in the network. First the dynamic nodes hop distance, is found out by the node coverage. Then the source and the destination are identified. By this we get all the moving nodes between the source node and the destination node.

Multiple copies are sprayed into the network by spray select focus routing algorithms. Assuming a node as the source node and another node as the destination to reach, there are many moving nodes in between and we are choosing a node as moving node. Spray Select Focus algorithm is simulated to avoid congestion and overcoming Unrechability region. The normal routing routes the packet to every other node nearby Fig 2, so the packets are spread to all the nodes which are in neighbour to the source.

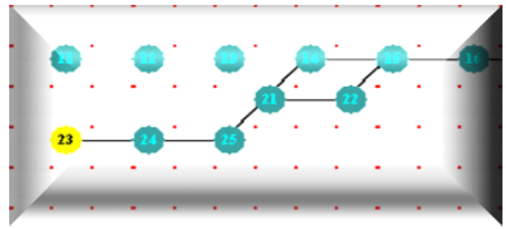


Fig. 1 : Normal Routing

By our Spray Select Focus Algorithm a Unrechability is overcome by a Bypass recovery in the with coverage case which we can see in the following figure, Fig. 3.

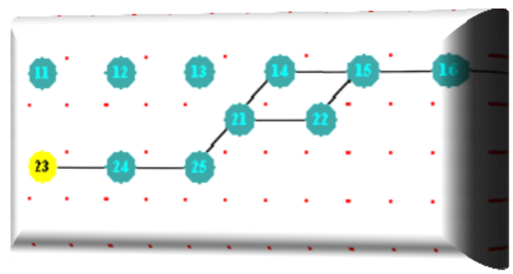


Fig. 2 : Bypass Recovery

In case of without coverage the Unrechability is overcome by the Focus phase of our algorithm. The following figure explains the Spray Select Focus routing Fig 4 &5 with and without coverage and dead ends

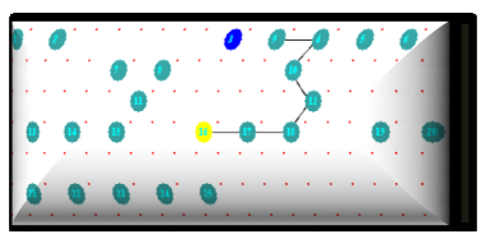


Fig. 3 : Spray Select Focus rechability.

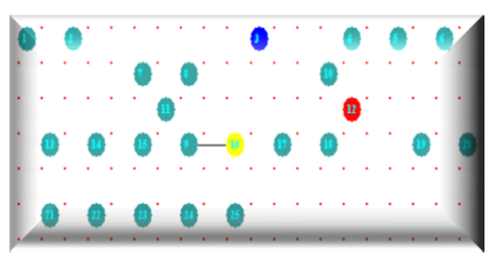


Fig. 4 : Spray Select Focus With unreachable.

We are going to compare the Spray and Focus algorithm which has no contention and dead ends with our Spray Select Focus algorithm with contention and unreachable regions.

The analysis is done with the following parameters:

- Transmission Rate(TR)
- Packet Delay(PD)
- Hop Distance(H)
- Space and Time

Transmission Rate =(Number of nodes Covered (H)*space(S))/Time(T)).

TR=(H*(0,2π))/T

PD= PS/H * T. Where PD,PS is the Packet Delay and Packet Size, H is the number of nodes covered by hops and T is the minimum time taken to deliver the packets

H= Distance between source and destination

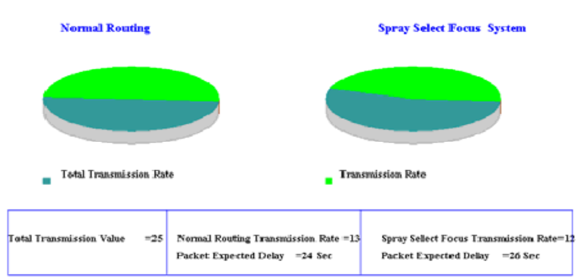


Fig. 5 : Transmission rate for Normal and Spray Select Focus Routing rechabilty region.

From the above figure we can say we have close to optimal transmission rate than Normal routing is shown in the above graph Fig 6. We have done analysis with our Spray Select Focus Routing with and without dead ends in the network. Fig 7 shows the transmission rate for Normal and Spray Select Focus Routing with Unrechability points.

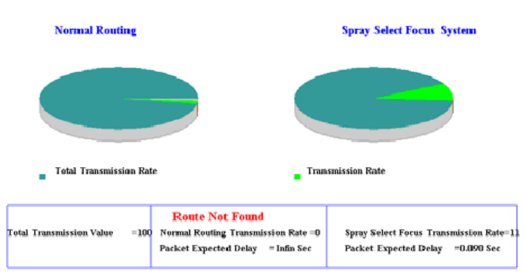


Fig. 7 : Transmission rate for Normal and Spray Select Focus Routing with rechability region.

Then we have done an analysis with Packet delay with the packet sizes 5,10,15,20 & 25. Fig 8 & 9 shows the bar chart for Packet delays with and rechability region.

PACKET DELAY - RECHABILITY REGION

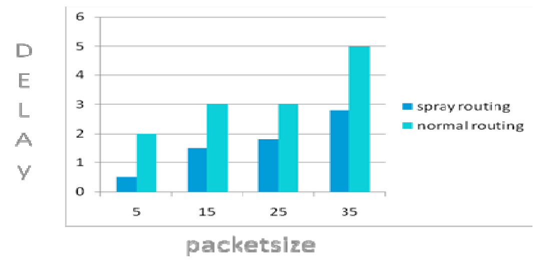


Fig. 8 : Packet delay for both routings rechability.

PACKET DELAY - UNRECHABILITY

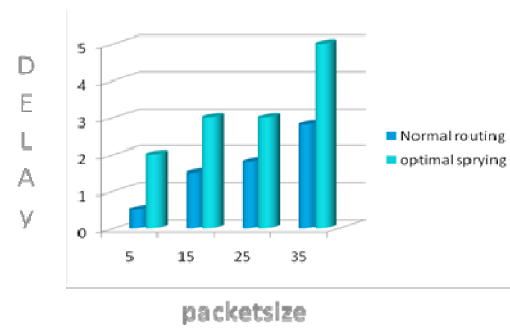


Fig. 9 : Packet delay for both routings unrechability

The above figure shows the high Packet delay for normal routing in the cases of with and without dead ends in the network. The Hop distance is calculated for both the case sand the following graphs are drawn, Fig 10 & 11.

HOP DISTANCE - UNRECHABILITY

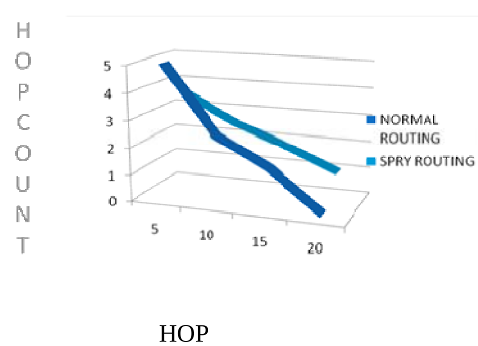
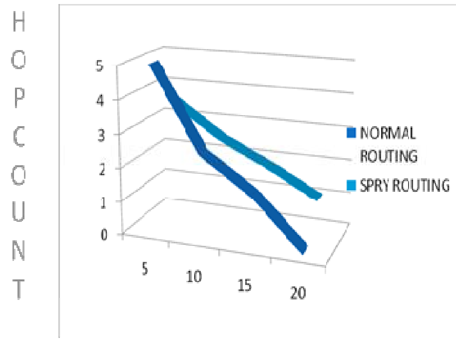


Fig. 10 : Hop Distance For Normal and Spray Select Focus Routing with Deadends.

HOP DISTANCE - RECHABILITY



HOP

Fig. 11 : Hop Distance For Normal and Spray Select Focus Routing without Deadends.

Here we have a small and optimized hop distance in our proposed algorithm and in Normal routing it has a larger hop distance.

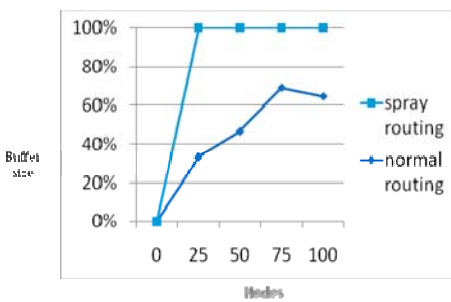


Fig. 12 : Space

Here Fig .12. explains we have optimized space while using our proposed Routing scheme than normal routing scheme.

$S=(0,2\pi)$ where s= space

V. CONCLUSION

Routing multiple copies in intermittently connected mobile network forwarded from the source to the destination does not have end to end paths. In this work, the investigation is about the problem of multi-copy routing in mobile wireless networks Spray Routing algorithm is used for avoiding contention and bypass recovery for unreachable nodes. Through simulations we have shown that avoiding unrechability and congestion leads to larger delays. Our Algorithm works well in With and Without Coverage's and our Focus phase worked well in the case of without coverage – with unreachable nodes and reduced contention. So to conclude we say that considering contention and unreachable node is very important and it leads to inaccurate results. And we say that our algorithm performed well than the previous routing schemes in case of with and without coverage and with and reachable nodes. Finally it is robust in case of delivering the message to the destination.

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