Towards Reliable Data Delivery for Highly Dynamic Mobile Ad Hoc Networks

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Abstract--This paper proposes routing protocol based on context information for MANET. Context information represents the rate of change in connectivity, degree of mobility, battery level and available memory. This protocol follows the fully aware routing in which it context information for opportunistic routing and also provides mechanisms to use context information. In our work, we focus on route discovery and packet relay. Ours is a proactive protocol, which continuously monitor the network connectivity change. Our packet relay follows next hop routing. Here, only the destination address is provided and the corresponding path is determined as such. Also, a routing table is maintained. A route request message is sent to the promising carrier and it is updated in the routing table. This process continues until it a route is found. A route request message consists of source ID and a sequence number.

Keywords: *Mobile Ad-Hoc Networks, MANET, data delivery, context information, MANET routing*

I. INTRODUCTION

Mobile adhoc networks gain popularity due to its infrastructure less network of mobile devices. Each node in a network can move freely to anywhere and thus the link needs to be modified each time, in order to send the message. Inspite of several advantages, it is easily prone to problems because all the nodes are needed to be monitored keenly, for tracing the current location of the destination. But this is not a simple task. Since, it is a wireless network every node has to be monitored thoroughly. Excluding the source and destination nodes, mostly all of the nodes contribute themselves as routers. Thus, reliable data delivery is the major concern here.

Traditionally, all the nodes are static and hence a correct route can be figured out even before data transmission. Nowadays, due to the mobility of nodes, whenever the path breaks up or any other problem occurs, then packet recovery and retransmission is a big question mark. Also, traditional MANET techniques cannot be applied because it assumes that all the nodes are connected anyway, hence it believes that the source and destination nodes have connection. Keeping all this in mind, we create a new protocol based on context information. This protocol assumes that the network is divided and no end to end path is available. Sometimes, end to end path might be available. Here, a message may get transferred via an existing link, meaning that the message gets buffered in

The next hop until its link come up and this is continued until it reaches its destination.On the basis of current connectivity connection and prediction of future connectivity information, local forwarding decisions are taken with the point that the message can be delivered successfully only through the best carriers, if the message is not delivered instantly. Fig 1 illustrates the behaviour of MANET. Here, just four nodes came into the picture. In reality, there is a need to handle so many nodes coming in and getting out.

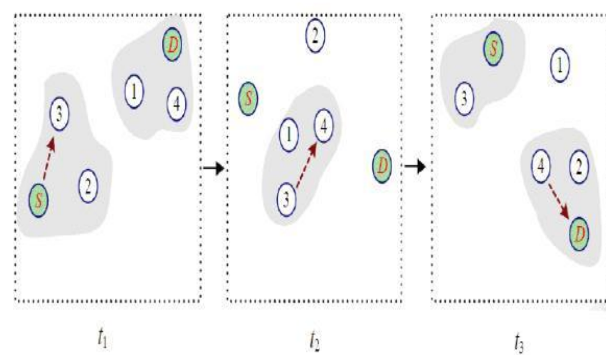


Fig 1: Illustration of MANET

Our protocol is based on context information. Context in the sense, it considers the information about node mobility, network connectivity and history of node behaviour. After collecting the above mentioned information about the destination, the carrier is selected by the probability of contact with other users. There are three flavours in context information routing. They are context-oblivious, partially context aware and fully context aware routing. Context oblivious routing may suffer from high possession and results in network congestion. Partially context aware routing makes use of some contextual information in order to optimize forwarding. It exploits context information for opportunistic routing and also provides mechanisms to use context information.

In this work, we propose a routing protocol based on context information. Here, the context information includes the rate of connectivity change, degree of mobility, available memory and battery level. All these factors are considered to achieve effective routing.

II. RELATED WORK

To enhance a system's robustness, the most straightforward method is to provide some degree of redundancy. According to the degree of redundancy, existing robust routing protocols for MANETs can be classified into two categories. One uses the end-to-end redundancy, e.g., multipath routing, while the other leverages on the hop-by-hop redundancy which takes advantage of the broadcast nature of wireless medium and transmits the packets in an opportunistic or cooperative way. Our scheme falls into the second category.

Multipath routing, which is typically proposed to increase the reliability of data transmission [1] in wireless ad hoc networks, allows the establishment of multiple paths between the source and the destination. Existing multipath routing protocols are broadly classified into the following three types:

1) using alternate paths as backup (e.g., [2], [3], [4]); 2) packet replication along multiple paths (e.g., [5], [6]); and 3) split, multipath delivery, and reconstruction using some coding techniques (e.g., [7], [8]). However, as discussed in [9], it may be difficult to find suitable number of independent paths.

Especially in the network area of high mobility nodes, all the node paths will be changing frequently due to their mobility in nature, in addition to it, when the end-to-end path length is long, making multipath routing still incapable of providing satisfactory performance.The concept of opportunistic forwarding, which was used to increase the network throughput ([10], [11]) also shows its great power in enhancing the reliability of data delivery. In the context of infrastructure networks, by using opportunistic overhearing, the connectivity between the mobile node and base station (BS) can be significantly improved.

In [12], an opportunistic retransmission protocol PRO is proposed to cope with the unreliable wireless channel. Implemented at the link layer, PRO leverages on the path loss information Receiver Signal Strength Indicator (RSSI) to select and prioritize relay nodes.By assigning the higher priority relay a smaller contention window size, the node that has higher packet delivery ratio to the destination will be preferred in relaying. With respect to the impact of mobility, Wu et al. [13] investigate the WiFi connectivity for moving vehicles, with focus on the cooperation among BSs. BSs that overhear a packet but not its acknowledgment probabilistically relay the packet to the intended next hop.With the help of auxiliary BSs, the new protocol performs much better than those schemes with only one BS participating in the communication even if advanced link prediction and handover methods are involved. However, due to the lack of strict coordination between BSs, false positives and false negatives exist. While the aforementioned two schemes deal with the issues in WLANs, the authors of [14] concentrate on the robust routing in mobile wireless sensor networks.

In the proposed RRP, traditional ad hoc routing mechanism is used to discover an intended path while the nodes nearby act as guard nodes. Leveraging on a modified 802.11 MAC, guard nodes relay the packet with prioritized backoff time when the intended node fails. If the failure time exceeds a certain threshold, the guard node who has recently accomplished the forwarding will become the new intended node.

A potential problem is that such substitution scheme may lead to suboptimal paths. Unlike RRP, our protocol uses location information to guide the data flow and can always archive near optimal path.Alternatively our proposed system targets on route discovery from the network environment perspective and it does not need of any difficult changes in MAC. The nodes which are going to take place in forwarding candidates are been sorted using the candidate list and so there will not be any collusion problems. By limiting the forwarding area, duplication can also be well controlled.

III. PROPOSED WORK

In this work, we propose a new routing protocol based on context information. We concentrate on:

Route discovery: In the mobile host communication, when a node needs to have a communication link with the another mobile node then the source should have the correct routing information and also with the help of some intermediate nodes, it can be achieved. According to how route information is collected, routing protocols can be classified as proactive and reactive. A proactive protocol attempts to continuously monitor the change of connectivity within the network, so that when a packet needs to be forwarded, a fresh route may exist immediately [20]. On the contrary, to reduce the effect of host mobility on routing, a reactive protocol invokes a route discovery/search procedure only when a route is needed. Several protocols are developed based on such on-demand concept.

Packet relay: This specifies the process of how to forward data packets. Two ways are possible: source routing and next- hop routing. In source routing, the whole path to deliver a packet is specified in each packet header, and an intermediate node simply follows the path to deliver the packet (e.g., [15]). On the other hand, in next-hop routing, only the destination host is specified. Each intermediate node must keep a routing table to determine which node to forward the packet to (e.g., [16]).

Route maintenance: In the mobile Ad-hoc environment there may the problem of route break, this occurs due to the nature of mobile ad-hoc networks which are mobility and inference occurred while establishing the route. Route maintenance should concern with how route problems are reported and recovered. An established route may even be outperformed by a newly formed better route, and thus a route optimization may be executed [17].

This protocol stamps the destination id and the sequence number alone. This is because of the mobility of the nodes in the network. As the destination address is mentioned alone, any possible feasible route can be taken. The path taken by a packet is stored in a routing table.

A route request message is sent to the promising carrier and it is updated in the routing table. This process continues until it a route is found. A route request message consists of source_id and a sequence number.When it reaches destination an acknowledgement is sent back to the source and immediately the message is passed through the available possible route by taking rate of change in connectivity and degree of mobility into account.Apart from this, we also available memory and battery level of every node through which the message passes by. Memory is maintained to hold routing tables. Battery level is maintained such that node shut down can be prevented.

IV. ALGORITHM & ARCHITECTURE

This system follows the below given algorithm and its corresponding flow chart is presented in Fig 3.

s sends route request;

if(path exists)

immediate transfer of message;

else

find route; end if; check d_id;

update route table;

reach d;

d sends ack;

s sends message;

if(battery level<threshold) find another suitable node;

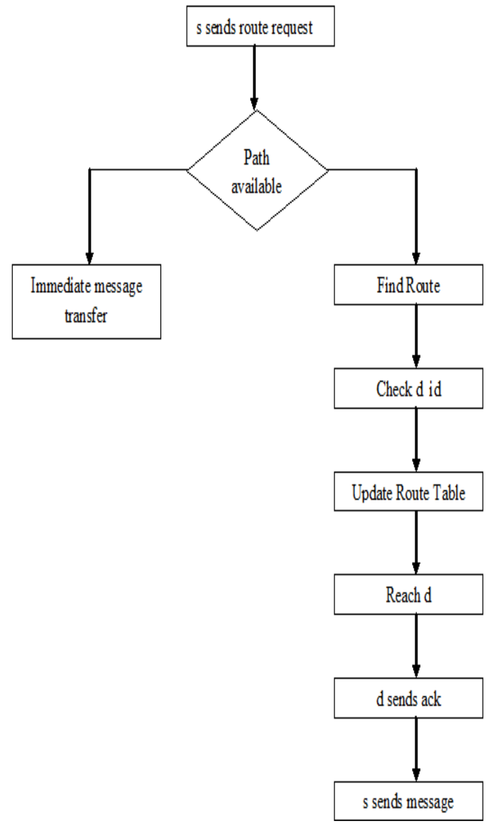
end if;

end;

Fig: 2 Algorithm

As shown in algorithm, s indicates Source node, d_id stands for destination id and ack represents acknowledgement. Corresponding flow chart is given below.

Thus, the source node sends the route request in order to reach the destination. If the path is already available between source and destination, then the message is transferred immediately. If not, the optimum route is found out. The id of the destination is checked and the path through which the route request is passed is updated in the route table. As soon as the route request is received by the destination, it sends an acknowledgement to s and then s sends the actual message to it.



V. SIMULATION RESULTS

We have simulated our system in DOT NET. We implemented and tested with a system configuration on Intel Dual Core processor, Windows XP and using Visual Studio 2010, C#.net. We have used the following modules in our implementation part. The details of each module for this system are as follows

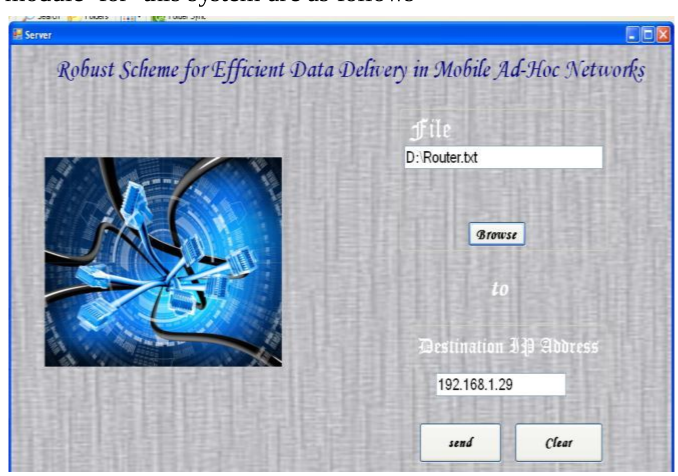


Figure 3: Source Node where data packets transmitted through destination through its IP address

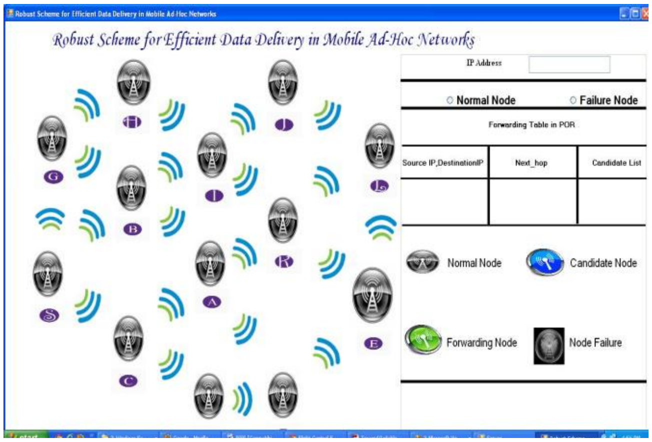


Fig 4: Simulation Area with the Forwarding Table

Fig 5: Data delivery scheme on Normal Mode

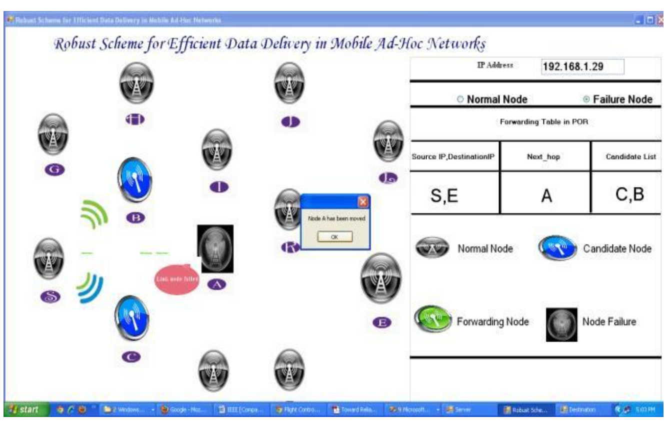


Fig 6: Data delivery scheme on Failure Mode (i.e) if node is moved

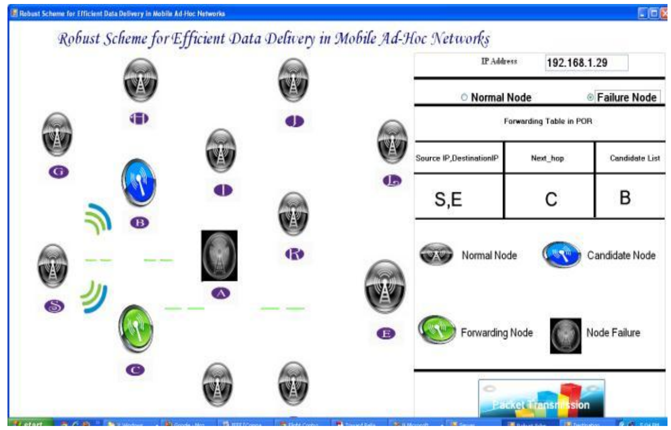


Fig 7: Data delivery scheme on updated Forwarding table

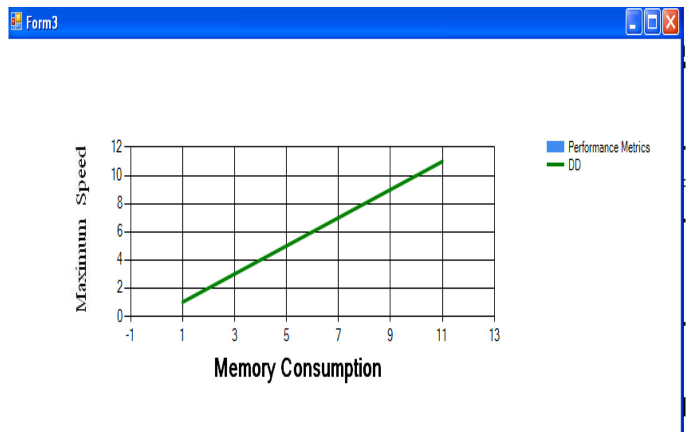


Fig 8: Simulation results

VI. CONCLUSIONS

In this work, we developed a protocol based on context based information. The word context represents the rate of change in connectivity, degree of mobility, memory and battery level. By keeping all these information, an effective route can be provided to the nodes. In future, we can extend this model with enhanced security. Experimental results show that our work performs well when compared with the existing methodologies.

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