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Efficient and Timely Data Transmission in MANET

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Abstract

The system addresses the problem of delivering data packets in highly dynamic Mobile Ad Hoc network. The existing routing protocols are susceptible to node mobility. To overcome this issue, the system propose the following POR protocol and VDVH. POR protocol uses the greedy forwarding which will forward the packet by geographic criteria. When a node wants to send data to another node, it first broadcast the data to nodes within its range. The best node in turns forwards to another which is close as possible to the destination, while the other node have the backup only, if the best node fails to forward the data packet then the sub-optimal node will forward the data. To handle communication voids, virtual destination is achieved to forward data to temporary target.

Keywords: *Void Handling, Geographic Routing, Greedy forwarding, Duplicate Relaying*

1.Introduction

A mobile ad-hoc network is a network composed of mobile nodes that does not rely on an existing infrastructure. Due to the transmission range constraint, a sender has to rely on intermediate nodes to forward data packets to a destination that is located outside its radio range. Since the mobility of node can frequently change the network topology, routing in MANET faces a different situation than in traditional wired networks.

2. Position-Based Opportunistic Routing

The design of POR is based on geographic routing and opportunistic forwarding. The nodes are assumed to be aware of their own location and the positions of their direct neighbors. Neighborhood location information can be exchanged using one-hop beacon or piggyback in the data packet's header. While for the position of the destination, we assume that a location registration and lookup service which maps node addresses to locations is available just as in. It could be realized using many kinds of location service.

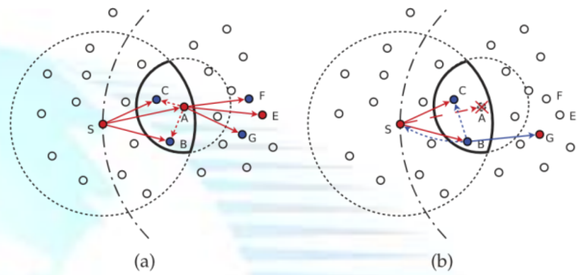

Fig. 1. (a) The operation of POR in normal situation. (b) The operation of POR when fails to receive the packet

In our scenario, some efficient and reliable way is also available. For example, the location of the destination could be transmitted by low bit rate but long range radios, which can be implemented as periodic beacon, as well as by replies when requested by the source.

3. Virtual Destination-Based Void Handling

In order to enhance the robustness of POR in the network where nodes are not uniformly distributed and large holes may exist, a complementary void handling mechanism based on virtual destination is proposed.

3.1 Trigger Node

The first question is at which node should packet forwarding switch from greedy mode to void handling mode. In many existing geographic routing protocols, the mode change happens at the void node, e.g., Node. If the mode switch is done at Node A, Path 3 will be tried instead of Path 2 while Path 1 still gets the chance to be used. A message called void warning, which is actually the data packet returned from Node B to Node A with some flag set in the packet header, is introduced to trigger the void handling mode.

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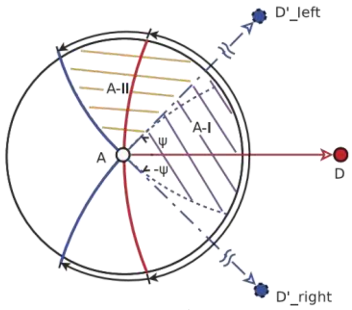

Fig. 2. Potential forwarding area is extended with virtual destination.

As soon as the void warning is received, Node A (referred to as trigger node) will switch the packet delivery from greedy mode to void handling mode and rechoose better next hops to forward the packet. Of course, if the void node happens to be the source node, packet forwarding mode will be set as void handling at that node without other choice.

3.2 Virtual Destination

In all existing mechanisms, if communication hole occur means it try to find a route around. The advantage of Greedy forwarding in void handling process, it cannot be achieved as the path that is used to go around the hole is usually not optimal and it won't exploit the robustness of multicast-style routing.To enable opportunistic forwarding in void handling, it transmit the packet in an opportunistic routing method, virtual destination is introduced, as the temporary target that the packets are forwarded to. Virtual destinations is located with the trigger node as center and the radius of the circle is set as a value that is large enough. A virtual destination has a certain degree of offset, compare to real destination. The potential forwarding area is significantly extended, with the help of virtual destination. This mechanism cannot handle all kinds of communication voids. Reposition scheme is used to smooth the edge of the holes, which is strange in shape.VDVH still has potential to deal with all kinds of communication holes.

3.3 Switch Back To Greedy Forwarding

In void handling, there is an issue as when and how to switch back to normal greedy forwarding. To prevent the packet from deviating from the right direction or even missing the chance to switch back to normal greedy forwarding, the candidates in A-I should be preferred and are thus assigned with a higher priority in relaying. Therefore, a scaling parameter is introduced for the candidates located in A-II.Toward the virtual destination, these nodes are multiplied by coefficient η, called scaling parameter which is set as 0.75. Around the communication void, a packet has been forwarded for more than two hops in a route, the forwarder will check whether there is any potential candidate that is able to switch back. If yes, that node will be selected as the next hop, but the mode is still void handling. Only if the receiver finds that its own location is nearer to the real destination than the void node and it gets at least one neighbor that makes positive progress towards the real destination, it will change the forwarding mode back to normal greedy forwarding.

3.4 Path Acknowledgment and Disrupt Message

In VDVH, the trigger node forward packets in both direction simultaneously. To avoid duplication, two control messages is passed, path acknowledgement and reverse suppression. In void handling mode, a forwarding candidate receives a packet that is being delivered and it is recorded in a reverse entry. Once the packet reaches the destination, a path acknowledgment will be sent along the reverse path to inform the trigger node. Then, the trigger node will give up trying the other direction. If there is another trigger node upstream, the path acknowledgment will be further delivered to that node.

If a packet that is forwarded in void handling mode , the number of hops traversed exceeds a certain threshold but it is still being delivered in void handling mode, a DISRUPT control packet will be sent back to the trigger node as reverse suppression. Once the trigger node receives the message, it will stop trying that direction.

4. Greedy Forwarding

As usual in computer science the routing algorithms presented in this section use the principle of local optimization. In each step an optimal sub path is selected. The protocols do not work with routes, but forward packets based on geographic criteria. Each intermediate hop forwards packets to exactly one of its neighbors, the one located as close as possible to the destination. Several strategies can be used to determine the next hop, including "most forward within radius (MFR)" or "compass routing".

4.1 Geographic Routing

Geographic routing has become an efficient solution for communications and information delivery in wireless ad hoc networks where the position information of nodes is available. This chapter provides a comprehensive overview of basic principles, classical techniques, as well as latest advances in geographic routing. The chapter first presents in detail the topic of geographic unicast routing, where the presentation is focused on two operation modes of geographic forwarding, that is, greedy forwarding and void handling. The chapter also briefly introduces three advanced topics in geographic routing: geographic multicast, geocast, and trajectory-based forwarding. Finally, the chapter makes some comments on the practical aspects of geographic routing for practitioners and discusses the directions for further research with a list of open issues in the area of geographic routing.

5. Duplicate Relaying

Due to collision and nodes' movement, some forwarding candidates may fail to receive the packet forwarded by the next hop node or higher priority candidate, so that a certain amount of duplicate relaying would occur. If the forwarding candidate adopts the same forwarding scenario as the next hop node, which means it also calculates a candidate list, then in the worst case, the propagation area of a packet will cover the entire circle comprising the destination as the center and the radius can be as large as the distance between the source and the destination.

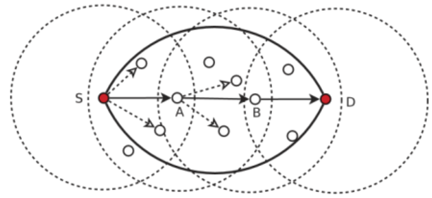

Fig. 3. Duplicate relaying is limited in the region enclosed by the bold curve.

To limit such duplicate relaying, only the packet that has been forwarded by the source and the next hop node is transmitted in an opportunistic fashion and is allowed to be cached by multiple candidates. In other words, only the source and the next hop node need to calculate the candidate list, while for the packet relayed by a forwarding candidate, the candidate list is empty.

6. MAC Interception

We leverage on the broadcast nature of 802.11 MAC: all nodes within the coverage of the sender would receive the signal. However, its RTS/CTS/DATA/ACK mechanism is only designed for unicast. It simply sends out data for all broadcast packets with CSMA. Therefore, packet loss due to collisions would dominate the performance of multicast-like routing protocols. Here, we did some alteration on the packet transmission scenario. In the network layer, we just send the packet via unicast, to the best node which is elected by greedy forwarding as the next hop. In this way, we make full utilization of the collision avoidance supported by 802.11 MAC. While on the receiver side, we do some modification of the MAC-layer address filter: even when the data packet's next hop is not the receiver, it is also delivered to the upper layer but with some hint set in the packet header indicating that this packet is overheard. It is then further processed by POR. Hence, the benefit of both broadcast and unicast (MAC support) can be achieved.

7. System Design

It is the process of converting a user oriented description of the inputs to a computer based business system into a program oriented specification. The main objectives is to produce a cost-effective method of input, achieve a highest possible level of accuracy and ensure that input is acceptable to and understood by the user staff. Several activities have to be carried out as a part of the overall input process as following Data Recording, Data Description, Data Conversion, Data Verification, Data Control, Data Transmission, Data Validation and Data Correction.

8. Conclusion

From the result the system shows the Position-Based Opportunistic Routing protocol and Virtual Destination-Based Void Handling gives excellent performance even if the node mobility is high.

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