

A Study on Timely and Reliable Data Delivery for Highly Dynamic Mobile Ad Hoc Network

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ABSTARCT:

Mobile Ad hoc Network (MANET) is an infrastructure-less and decentralized network which needs a robust dynamic routing protocol. In mobile adhoc network to accommodate the need of communications many routing protocols have been proposed. The problem of delivering data packets for highly dynamic mobile ad hoc networks in a reliable and timely manner is crucial. In order to facilitate it a Position-based Opportunistic Routing (POR) protocol is used, in which several forwarding candidates cache the packet that has been received, and if the best forwarder does not forward the packet in a particular time slots, then the suboptimal candidates will take turn to forward the packet according to a locally formed order. To handle communication voids Virtual Destination Based-Void Handling Scheme is also used. This paper presents a brief survey of Position based opportunistic routing protocol (POR) and Virtual Destination Based Void-Handling scheme (VDVH) which helps in reliable and timely data delivery.

Index Terms- Mobile Ad hoc network; Geographic Routing; Position based Opportunistic routing protocol; Virtual Destination Based Void Handling Scheme and Greedy forwarding.

1. INTRODUCTION

Mobile Ad hoc network (MANET) is a collection of wireless mobile nodes which forms a temporary network without using any network infrastructure or centralized administration. Due to node mobility in traditional topology-based MANET routing protocols, Position-based opportunistic routing protocols are achieved, since the network is highly dynamic. Maintaining a route is difficult in vastly changing network topology. If the path breaks, data packets will get lost and discovery procedures will be time consuming. Generally Ad hoc routing protocols make forwarding decisions based on geographical position of a packet's destination. Rather than destination node's position, each node has to know only its own position and the position of its neighbors to forward the packets. When the network is highly dynamic, position-based opportunistic routing is used. In position based opportunistic routing a sender can know the present position of the destination. In mobile ad hoc networks (MANET), geographic routing protocols allow stateless routing. A geographic routing protocol uses the location information of a mobile

node. It has high scalability. Without complex modification to MAC protocol 1, a Position - Based

Opportunistic Routing is achieved. IEEE 802.11 provides collision avoidance. Communication hole is handled by Virtual Destination-based Void Handling (VDVH) scheme. This scheme uses the advantage of greedy forwarding and opportunistic routing.

The paper is designed as follows Section-1 includes Introduction, Section-2 includes Geographic Routing protocol, Section-3 includes Virtual destination based void handling scheme, Section-4 Literature survey, Section-V Conclusion.

2. GEOGRAPHIC ROUTING

Geographic routing (georouting or position based routing) is a routing principle that relies on geographic position information. In geographic routing the source sends a message to the geographic location of the destination instead of using the network address. The Geographic routing requires that each of its node can determine its own location and that the source is aware of the location of the destination. With this a message can be routed to the destination without knowledge of the network topology or a prior route discovery. The different approaches, such as flooding-based strategies, single - path and multi-path. Most of the single-path strategies rely on two techniques: greedy forwarding and face

routing. Greedy forwarding helps to bring the message closer to the destination in each step by using local information. Hence, each node forwards the message to the neighbor that is most appropriate from a local point of view. The most appropriate neighbor can be the one who minimizes the distance to the destination in each step (Greedy).

Alternatively, one can consider another notion of progress, namely the projected distance on the source-destination-line (MFR, NFP), or the minimum angle between neighbor and destination (i.e. Compass Routing). All of these strategies are not loop-free, i.e. a message can flow among nodes in a certain group. It is known that the basic greedy strategy and MFR are loop free.

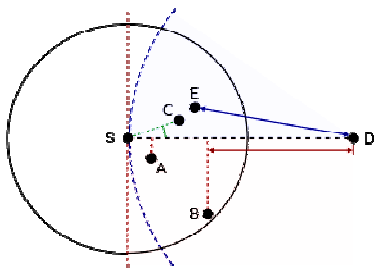


Fig. 1

Fig 1. Shows the Greedy forwarding variants: The source node (S) has different choices to find a relay node for further forwarding a message to the destination (D). A = Nearest with Forwarding Progress (NFP), B = Most Forwarding progress within Radius (MFR), C = Compass Routing, E = Greedy

2.1. Position-Based Opportunistic Routing Protocol (POR)

POR design is based on geographic routing and opportunistic forwarding. The nodes are thought to be aware of their location and their direct neighbor's positions. Neighborhood location information is exchanged through a one-hop beacon or piggyback in the data packet header. Then the location registration and lookup service that maps node addresses to the locations is available for the destination position [9], which can be realized through use of many types of location service. When a source node plans to transmit a packet, it first gets the destination location and after which it is attached with the packet header. As of the destination node's movement, a multi hop path may diverge from the final location's true location with a packet being dropped even if it has been delivered in the destination neighborhood. Additional destination node checks are introduced to handle such issues. The packet forwarding node checks the neighbor list at every hop to see whether destination is within its transmission range. If so, then

the packet is directly forwarded to the destination, similar to destination location prediction scheme. Though such identification checks prior to greedy forwarding based on location information, path divergence effect can be alleviated.

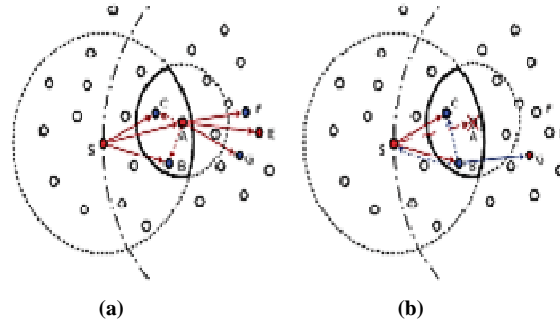


Fig. 2

Fig 2(a) The operation of POR in normal situation (b) The performance of POR when the next hop fails to receive the packet.

In Fig. 2 (a) In normal situation without link breakage, the packet is forwarded by the next hop node (e.g., nodes A, E) and the forwarding candidates (e.g., nodes B, C; nodes F, G) will be suppressed (i.e., the same packet in the Packet List will be dropped) by the next hop node's transmission. In case when node A fails to deliver the packet (e.g., node A has moved out and cannot receive the packet), then node B, the forwarding candidate with the highest priority, and will relay the packet and suppress the lower priority candidate's forwarding (e.g., node C) as well as node S.

3. VIRTUAL DESTINATION-BASED VOID HANDLING SCHEME (VDVH)

In order to enhance the robustness of POR in the network where nodes are not evenly distributed and were large holes may exist, so a complementary void handling mechanism based on virtual destination is proposed. In order to handle communication voids, virtually all existing mechanisms try to find a route around. In order to enable opportunistic forwarding in void handling, a virtual destination based void handling scheme (VDVH) is presented, as the temporary target that the packets are forwarded to.

4. STUDY OF RELATED WORKS

Several researchers have investigated the area of routing techniques in MANET. In this section we have discussed their works.

Alvin Valera et al., [1] proposed a new routing protocol called Caching and Multipath (CHAMP) Routing Protocol. Cooperative packet caching and shortest multipath routing technique to reduce packet

loss due to frequent route breakdowns is being used by CHAMP.

Angela Sara Cacciapuoti et al., [2] proposed an analytical model to describe any routing procedures operating according to the opportunistic paradigm. This technique is applied in a very general multi-hop scenario and is not restricted to any specific network topology or opportunistic protocol. This model requires the knowledge of both the node priority and delivery ratios, which is based on the adopted routing metric (Expected Transmission Count (ETX), geographic distance).

Aristotelis Tsirigos and Zygmunt J. Haas [3] proposed a routing scheme that uses multiple paths simultaneously by splitting the information between multitudes of paths, so as to increase the probability that the essential portion of the information is received at the destination without incurring excessive delay. This scheme works by adding an overhead to each packet, by which it is calculated as a linear function of the original packet bits. The resulting packet (information and overhead) is fragmented into smaller blocks and distributed over the available paths.

Brad Karp and H.T. Kung [4] proposed Greedy Perimeter Stateless Routing (GPSR), a novel routing protocol for wireless datagram networks that uses the positions of routers and a packet's destination to make packet forwarding decisions. GPSR makes greedy forwarding decisions by using only information about a router's immediate neighbors. When a packet reaches a region where greedy forwarding is not possible, then the algorithm recovers by routing around the perimeter of the region. By keeping state only near the local topology, GPSR scales better around per-router state than shortest path and ad-hoc routing protocols as the number of network destinations increases. Due to frequent topology changes, GPSR use local topology information to and correct new routes quickly.

Chiara Boldrini et al., [5] proposed context-based routing for opportunistic networks. A general framework is provided for managing and using context for taking forwarding decisions. A context-based protocol (HiBOP) is compared with popular Epidemic Routing and PROPHET solution.

Cong Liu and Jie Wu [6] proposed the small-world iterative navigation greedy (SWING+) routing protocol. SWING+ guarantees delivery and derive abundant for the worst-case route discovery delay in SWING+. SWING+ is a purely greedy routing algorithm where a message is always forwarded

greedily under the composition of the VFs leading it to the destination.

Coskun Cetinkaya and Edward W. Knightly [7] proposed Opportunistic Multipath Scheduling (OMS) technique for exploiting short term variations in path quality to minimize delay, by simultaneously ensuring that the splitting rules dictated by the routing protocol are satisfied. OMS uses measured path conditions on time scales of up to several seconds to opportunistically favor low-latency and high-throughput paths. But, a naive policy that always selects the highest quality path would violate the routing protocol's path weights and potentially lead to oscillation. Thus, OMS ensures that over longer time scales relevant for traffic management policies, the traffic is splitted according to the ratios determined by the routing protocol.

Dinesh Ramasamy and Upamany Madhow [8] proposed a geographic routing scheme; including an efficient position publish protocol and a routing protocol that can operate with imperfect information regarding the destination's location that scales to large mobile ad hoc networks. The traffic generated by our position publish protocol fits within the transport capacity of MANETs with constant communication bandwidth allocated for routing overhead, even as the network size increases. The routing protocol guarantees with high probability and routes whose lengths are within a constant "stretch" factor of the shortest path from source to destination. The key idea for underlying the scalability of the publish protocol is for each potential destination node to send location updates (with frequency decaying with distance) only to a subset of network nodes, which are structured as annular regions around it (the natural approach of updating circular regions in distance-dependent fashion does not scale). The routing protocol must therefore account for the fact that the source and/or relay nodes may not have estimates of the destination's location.

J.Johnsi and G.Abija [10] proposed an efficient Position-based Opportunistic Petal Routing (OPR) protocol which takes advantage of the stateless property of geographic routing and the broadcast nature of wireless medium. A Virtual Destination-based Void Handling (VDVH) scheme is further proposed to work together with OPR in case of communication voids.

Jubin Sebastian et al., [11] proposed a Location Based Opportunistic Routing Protocol (LOR) and Void Handling Based on Virtual Destination (VHVD) scheme to addresses the problem of delivering data packets for highly dynamic mobile ad hoc networks in a reliable and timely manner. This protocol takes

advantage of the stateless property of geographic routing and the broadcast nature of wireless medium. During the transmission data packet, some of the neighbor nodes that have overheard the transmission will serve as forwarding candidates, and they take turn to forward the packet if it is not relayed by the specific best forwarder within a certain period of time. By using such in-the-air backup, without interruption communication is maintained.

Kai Zeng et al., [12] proposed the impacts of multiple rates, candidate selection, prioritization and Co-ordination, on the performance of GOR. A opportunistic effective one-hop throughput (OEOT) scheme is proposed to characterize the trade-off between the packet advancement and one-hop packet forwarding time. A local rate adaptation and candidate selection algorithm is proposed to approach the optimum of this metric.

Michael Gerharz et al., [13] proposed adaptive metrics to identify stable links in a mobile wireless networking environment based on the analysis of link durations in several different mobility scenarios. This metrics rely only on online statistical evaluation of observed link durations. They neither do require information on signal strength, spacing of the mobile devices and radio condition, or they depend on the availability of additional hardware such as GPS receivers or a synchronisation of the devices.

S.M.Nandhagopal and S.N.Sivanandam [14] proposed a novel lightweight verification algorithm and Position-based Opportunistic Routing (POR) protocol which reduces node failure and data loss issues. The POR uses geographic routing to deliver the packets through several forwarding candidates by reducing the node failure and data loss by using lightweight verification algorithm.

Noa Arad and Yuval Shavitt [15] proposed a novel idea based on virtual repositioning of nodes that allows increasing the efficiency of greedy routing and significantly increasing the success of the recovery algorithm based on local information alone. It explains the problem of predicting dead ends which the greedy algorithm may reach and by passing voids in the network. Node Elevation Ad hoc Routing (NEAR), a solution that incorporates both virtual positioning and routing algorithms that improve performance in ad-hoc networks containing voids has been introduced.

Richard J. La and Eun young Seo [16] proposed a new framework for quantifying overhead due to control messages generated to exchange location information. Second, we calculate the minimum

number of bits required on average to describe the locations of a node, by borrowing tools from information theory. Then the result is then used to demonstrate that the expected overhead is $\Omega(n^{1.5} \log(n))$ where n is the number of nodes in both proactive and reactive geographic routing, with the assumptions that (i) nodes' mobility is independent and (ii) nodes adjust their transmission range to maintain network connectivity.

Shengbo Yang et al., [17] proposed a novel protocol called Position based Opportunistic Routing (POR) which takes full advantage of the broadcast nature of wireless channel and opportunistic forwarding. The data packets are transmitted in a multicast manner (which is actually implemented by MAC interception) by multiple forwarders. A forwarder list is determined by previous hop according to local position information is inserted into the IP header and the candidates take turn to forward the packet based on a predefined orders. The redundancy and randomness makes it quite efficient and robust. In addition, POR's control overhead is almost negligible which justifies its good scalability

P.Sivakumar and K.Duraiswamy [18] proposed a reliable real time data transmission technique in MANET by using connection possibility. A path with high connection possibility is selected as the main path by using transmission path discovery mechanism. A connectivity maintenance phase is initiated during link failures and delayed replies. The path with long link expiration time is chosen for data transmission.

Sonam Jain and Sandeep Sahu [19] proposed a Genetic based Algorithm for establishing a route with minimized delay in the Geometric Routing. Thus to deliver the message from the source to the destination does not only require to establish the shortest route for the message delivery to the destination and but they also required establishing such a route that can deliver the message with minimized delay so that the message can be transmitted from source to destination with the maximum data rate with minimized delay.

X. Xiang et al., [20] proposed a novel Efficient Geographic Multicast Protocol (EGMP). EGMP uses a virtual-zone-based structure to implement scalable and efficient group of membership management. More efficient membership management and multicast delivery is achieved by constructing a network wide zone-based bidirectional tree. The zone structure building, multicast tree construction, and multicast packet forwarding, which capably reduces the overhead for route searching and tree structure maintenance is guided by using position information.

The efficiency of the protocol have been improved by proposing several other strategies, for example, introducing the concept of zone depth for Building an optimal tree structure and integrating the location search of group members with the hierarchical group membership management. Finally, a new scheme is designed to handle empty zone problem faced by most routing protocols using a zone structure.

Xiaojing Xiang et al., [21] proposed two self-adaptive on-demand geographic routing schemes. According to the network dynamics and traffic demands the local topology is updated in a timely manner. The route optimization scheme adopts the routing path for both topological change and actual data traffic requirement. According to various network environments, data traffic conditions and node's requirements, the protocol parameter values of each can be determined and adjusted independently.

Zehua Wang et al., [22] proposed a new loop-free proactive routing scheme (PSR) for ODF (Opportunistic data forwarding) in MANETs. PSR utilizes the hop count information as a metric to better explore the broadcast nature of the wireless medium, and to enhance the efficiency and spatial use in ODF. Network topology information is efficiently maintained and exchanged by using the tree structure, and hence the overhead get greatly reduced.

Zhenqiang Ye et al., [23] proposed a modified version of the AODV protocol that allows us to discover multiple node-disjoint paths from a source to a destination and such paths are identified. As distances between sources and destinations increase, inevitably bottlenecks occurs and thus the possibility of finding multiple paths is significantly reduced. The reliable nodes are used (in terms of both being robust to failure and being secure) in the network for efficient operations. A deployment strategy is used to determine the positions and the trajectories of these reliable nodes such that it can achieve a framework for reliably routing information. A notion of a reliable path is used in which it is made up of multiple segments and each of which either entirely consists of reliable nodes, or may contain a preset number of multiple paths between the end points of the segment.

5. CONCLUSION

The opportunistic routing protocol presents a likely scheme to improve the wireless network performance by exploiting the broadcast nature of the medium. In this paper the effect of inaccurate location information caused by node mobility in geographic

routing protocols is described. This paper also reviews the main proposals for multihop ad hoc networks.

References

- [1] Alvin Valera; Winston K.G Seah and SV Rao. (2003): "Cooperative Packet Caching and Shortest Multipath Routing in Mobile Ad hoc Networks". IEEE INFOCOM .
- [2] Angela Sara Cacciapuoti; Marcello Caleffi and Luigi Paura. (2009): "A theoretical model for opportunistic routing in ad hoc network", Ultra-modern telecommunications and workshop.
- [3] Aristotelis Tsirigos and Zygmunt J.Haas. (2004): "Analysis of Multipath Routing—Part I: The Effect on the Packet Delivery Ratio", IEEE transactions on wireless communication, Vol. 3, No. 1.
- [4] Brad Karp and Kung H.T. (2000): "GPSR: Greedy Perimeter Stateless Routing For Wireless Network", MOBICOM.
- [5] Chiara Boldrini Marco Conti; Iacopo Iacopini and Andrea Passarella. (2009): "HiBOp: A History Based Routing Protocol for Opportunistic Networks", World of wireless, Mobile and multimedia network.
- [6] Cong Liu and Jie Wu (2009): "Virtual-Force-Based Geometric Routing Protocol in MANETs", IEEE Transactions on parallel and distributed systems, Vol. 20.
- [7] Coskun Cetinkaya and Edward .W Knightly. (2004): "Opportunistic Traffic Scheduling Over Multiple Network Paths ", IEEE INFOCOM.
- [8] Dinesh Ramaswamy and Upamanyu Madhow. (2012): "Geographic routing in large scale MANETs".
- [9] Dhivya. R et al., (2013) : "A Position Based Opportunistic Routing Protocol for Secured Data Transfer In MANET". IJREAT, Vol.1. Issue 1,ISSN:2320 – 879.
- [10] J.JohnsI and G.Abija. (2013) : " Reliable data delivery for highly dynamic mobile Ad hoc networks using OPR". International Journal of Emerging Technology and Advanced Eng, Vol. 3, Special Issue 1.
- [11] Jubin Sebastian E; Sreeraj V. R and Tauheed UI Islam. (2013) : " Reliable Data Delivery Mechanisms for Highly Dynamic Mobile Ad Hoc Network". IJSR. ISSN : 2319-7064, Vol. 2, Issue 1.
- [12] Kai Zeng; Zhenyu Yang and Wenjing Lou. (2009) : " Location - Aided Opportunistic Forwarding in Multi-Rate and Multi-Hop Wireless Networks". IEEE transactions on Vehicular Technology.
- [13] Michael Gerharze et al., (2002) : "Link

- Stability in Mobile Wireless Adhoc Networks”.
Institute of Computer Science IV, University of
Bonn, Germany. IEEE.
- [14] Nandhagopal S.M. and Sivanandam S.N.
(2013) : “ Reliable Data Delivery in Mobile Ad
hoc Networks Using Light Weight Verification
Algorithm with High Node Mobility”.
(IJITEE). ISSN: 2278-3075, Vol. 2, Issue-5.
- [15] Noa Arad and Yuval Shavitt . (2006):
“Minimizing Recovery State in Geographic Ad
Hoc Routing”. MobiHoc.
- [16] Richard J. La and Eunyoung Seo.(2011):
“Expected Routing Overhead for Location
Service in MANETs”, IEEE transactions on
mobile computing.
- [17] Shengbo Yang et al., (2009):“Position based
Opportunistic routing for robust data delivery in
MANETs”. IEEE GLOBECOM.
- [18] Sivakumar P. and Duraiswamy K.(2013):
Reliable real- time data Transmission in
MANET In connection possibility”. Journal Of
Theoretical and Applied Information Technology.
Vol. 49, No.1.
- [19] Sonam Jain and Sandeep Sahu. (2012):
“Geometric Routing Protocol based on Genetic
Algorithm for Minimized Delay in MANETs”.
IJECCCT. Vol. 2. Issue 3.
- [20] X. Xiang ; X. Wang and Y. Yang. (2011):
“Supporting Efficient and Scalable
Multicasting over Mobile Ad Hoc Networks”.
IEEE transactions on mobile computing. Vol. 10,
No. 5.
- [21] Xiaojing Xiang; Zehua Zhou and Xin Wang.
(2007): “Self-Adaptive On Demand Geographic
Routing Protocols for Mobile Ad Hoc Networks”.
IEEE INFOCOM.
- [22] Zehua Wang; Yaunzhu Chen and Cheng Li,
(2011): “A New Loop-Free Proactive source
routing scheme for Opportunistic data forwarding
in Wireless networks, ”IEEE communications
letters, Vol. 15, No. 11, November 2011”.
- [23] Zhenqiang Ye; Srikanth V. Krishnamurthy and
Satish K. Tripathi. (2003): “A Framework for
Reliable Routing in Mobile Ad Hoc Networks”.
IEEE INFOCOM.