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Impeccable Data Dispatching In Strenuous Mobile Ad Hoc Network

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Abstract—This paper addresses the problem of delivering data packets for highly dynamic mobile ad hoc networks in a reliable and timely manner. Most existing ad hoc routing protocols are susceptible to node mobility, especially for large-scale networks. Driven by this issue, we propose an efficient Position-based Opportunistic Routing (POR) protocol which takes advantage of the stateless property of geographic routing and the broadcast nature of wireless medium. When a data packet is sent out, some of the neighbor nodes that have overheard the transmission will serve as forwarding candidates, and take turn to forward the packet if it is not relayed by the specific best forwarder within a certain period of time. By utilizing such in-the-air backup, communication is maintained without being interrupted. The additional latency incurred by local route recovery is greatly reduced and the duplicate relaying caused by packet reroute is also decreased. In the case of communication hole, a Virtual Destination-based Void Handling (VDVH) scheme is further proposed to work together with POR. Both theoretical analysis and simulation results show that POR achieves excellent performance even under high node mobility with acceptable overhead and the new void handling scheme also works well.

Index Terms—Geographic routing, opportunistic forwarding, reliable data delivery, void handling, mobile ad hoc network.

1.INTRODUCTION

Mobile ad hoc networks (manets) have gained a great deal of attention because of its significant advantages brought about by multihop, infrastructure-less transmis- sion. However, due to the error prone wireless channel and the dynamic network topology, reliable data delivery in manets, especially in challenged environments with high mobility remains an issue. Traditional topology-based MANET routing protocols (e.g., DSDV, AODV, DSR [1]) are quite susceptible to node mobility. One of the main reasons is due to the predetermination of an end-to-end route before data transmission. Owing to the constantly and even fast changing network topology, it is very difficult to maintain a deterministic route. The discovery and recovery procedures are also time and energy consuming. Once the path breaks, data packets will get lost or be delayed for a long time until the r econstruction of the route, causingTransmission interruption.

If the node moves out of the sender's coverage area, the transmission will fail. In GPSR [5] (a very famous geographic routing protocol), the MAC-layer failure feedback is used to offer the packet another chance to reroute. However, our simulation reveals that it is still incapable of keeping up with the performance when node mobility increases. In fact, due to the broadcast nature of the wireless medium, a single packet transmission will lead to multiple reception. If such transmission is used as backup, the robustness of the routing protocol can be significantly enhanced. The concept of such multicast-like routing strategy has already been demonstrated in opportunistic routing ([6], [7], [8]). However, most of them use link-state- style topology database to select and prioritize the for- warding candidates.

In this paper, a novel Position-based Opportunistic Routing (POR) protocol is proposed, in which several forwarding candidates cache the packet that has been received using MAC interception. If the best forwarder does not forward the packet in certain time slots, suboptimal candidates will take turn to forward the packet according to a locally formed order. In this way, as long as one of the candidates succeeds in receiving and forwarding the packet, the data transmission will not be interrupted. Potential multipaths are exploited on the fly on a per- packet basis, leading to POR's excellent robustness.

The main contributions of this paper can be summarized as follows:

- We propose a position-based opportunistic routing mechanism which can be deployed without complex modification to MAC protocol and achieve multiple reception without losing the benefit of collision avoidance provided by 802.11.
- The concept of in-the-air backup significantly en- hances the robustness of the routing protocol and reduces the latency and duplicate forwarding caused by local route repair
- In the case of communication hole, we propose a Virtual Destination-based Void Handling (VDVH) scheme in which the advantages of greedy forward- ing (eg, large progress per hop) and opportunistic routing can still be achieved while handling com- munication voids
- We analyze the effect of node mobility on packet delivery and explain the improvement brought about by the participation of forwarding candidates
- The overhead of POR with focus on buffer usage and bandwidth consumption due to forwarding candi- dates' duplicate relaying is also discussed Through analysis, we conclude that due to the selection of forwarding area and the properly designed duplica- tion limitation scheme, POR's performance gain can be achieved at little overhead cost
- Finally, we evaluate the performance of POR through extensive simulations and verify that POR achieves excellent performance in the face of high node mobility while the overhead is acceptable

2.POSITION-BASED OPPORTUNISTIC ROUTING

2.1 Overview

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 [5]. It could be realized using many kinds of location service ([11], [12]). 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

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

MAC Callback

When the MAC layer fails to forward a packet, the function implemented in POR—mac_callback will be executed. The item in the forwarding table corresponding to that destina- tion will be deleted and the next hop node in the neighbor list will also be removed. If the transmission of the same packet by a forwarding candidate is overheard, then the packet will be dropped without reforwarding again; otherwise, it will be given a second chance to reroute. The packets with the same next hop in the interface queue which is located between the routing layer and MAC layer will also be pulled back for rerouting. As the location information of the neighbors is updated periodically, some items might become obsolete very quickly especially for nodes with high mobility. This scheme introduces a timely update which enables more packets to be delivered.

ANALYSIS

In this section, theoretical analysis on the robustness of POR will be conducted. The overhead inclusive of memory consumption and duplicate relaying will also be discussed. Since our focus lies on the effect of node mobility, an ideal wireless channel is assumed in the following part and the unit disc graph model will be used by default: a link between two nodes exists if and only if the distance between them is less than a certain threshold. When two nodes are located inside each others' coverage range (R), bidirectional data transmission between them can be achieved without failure.

Algorithm 1. Candidate Selection
ListN : Neighbor List
ListC : Candidate List, initialized as an empty list
N_D : Destination Node
base : Distance between current node and N_D
if findðListN; N_D Þ then
next hop N_D
return end if
for i 0 to lengthðListNÞ do
ListN½i :dist distðListN½i ; N_D Þ
end for
ListN:sortðÞ
next hop ListN½0
for i 1 to lengthðListNÞ do
if distðListN½i ; N_D Þ base or lengthðListCÞ ¼ N
then break
else if distðlistN½i ; listN ½0 Þ < R=2 then
ListC:addðListN½i Þ
end if end for

Robustness versus Mobility

Owing to node mobility, it is impossible that the location information of a node's neighbors which is maintained through beacon exchange is always up to date. Therefore, an error disc bðx; r_e Þ corresponding to each neighbor exists from the current node's perspective, with x as the latest obtained coordinate of the neighbor. The radius of the error disc r_e is the maximum deviation from x and the value of r_e varies with the elapsed time, t, since the last update and is defined as follows:

PERFORMANCE EVALUATION

To evaluate the performance of POR, we simulate the algorithm in a variety of mobile network topologies in NS-2 [19] and compare it with AOMDV [20] (a famous multipath routing protocol) and GPSR [5] (a representative geographic routing protocol). The common parameters utilized in the simulations are listed in Table 2.

The improved random way point [21] without pausing is used to model nodes' mobility. The minimum node speed is set to 1 m/s and we vary the maximum speed to change the mobility degree of the network. The following metrics are used for performance comparison:

- Packet delivery ratio. The ratio of the number of data packets received at the destination(s) to the numberof data packets sent by the source(s).
- End-to-end delay. The average and the median

end-to- end delay are evaluated, together with the cumula- tive distribution function of the delay.

- Path length. The average end-to-end path length (number of hops) for successful packet delivery

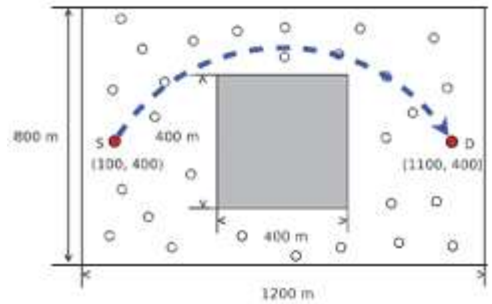
Parameter	Value
MAC Protocol	IEEE 802.11
Propagation Model	Two-ray Ground
Transmission Range	250 m
Mobility Model	Random Way Point (RWP)
Traffic Type	Constant Bit Rate (CBR)
Packet Size	256 Bytes
Number of Nodes	80
Simulation Time	900 sec

TABLE :Simulation Parameters

Effect of Communication Hole

To test the effectiveness of VDVH, we further evaluate the routing performance in mobile networks with a commu- nication hole. We create a network topology as illustrated in Fig. 15. The source and destination nodes are fixed at the two ends of the rectangle while the remaining 78 nodes move in the annular region according to the RWP model. The central gray area is simulated as the communication hole with no mobile node distributed. The traffic setup is the same as that in Section 5.1. By changing the maximum node speed, we obtain the simulation results shown in Fig.

From Fig. we can observe that in the face of communication hole, GPSR's void handling mechanism fails to work well. Even when the maximum node speed is 5 m/s, only 90 percent of the data packets get delivered which is relatively poor compared to the other protocols. As for POR, the improvement is not so significant since in the current implementation, VDVH is unable to deal with all cases of communication voids. However, when the node mobility is high (e.g., when the maximum node speed is larger than 25 m/s), POR still performs better.With respect to the path length, the end-to-end hops of GPSR are the largest due to the usage of perimeter mode,



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 [22] 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., [20], [23], [24]); 2) packet replication along multiple paths (e.g., [13], [25]); and 3) split, multipath delivery, and reconstruc- tion using some coding techniques (e.g., [26], [27]). However, as discussed in [28], it may be difficult to find suitable number of independent paths. More importantly, in the face of high node mobility, all paths may be broken with considerably high probability due to constantly changing topology, especially when the end-to-end path length is long, making multipath routing still incapable of providing satisfactory performance.

CONCLUSIONS

In this paper, we address the problem of reliable data delivery in highly dynamic mobile ad hoc networks. Constantly changing network topology makes conventional ad hoc routing protocols incapable of providing satisfactory performance. In the face of frequent link break due to node mobility, substantial data packets would either get lost, or experience long latency before restoration of connectivity. Inspired by opportunistic routing, we propose a novel MANET routing protocol POR which takes advantage of the stateless property of geographic routing and broadcast nature of wireless medium. Besides selecting the next hop, several forwarding candidates are also explicitly specified in case of link break. Leveraging on such natural backup in the air, broken route can be recovered in a timely manner. The efficacy of the involvement of forwarding candidates against node mobility, as well as the overhead due to opportunistic forwarding is analyzed. Through simulation, we further confirm the effectiveness and efficiency of POR: high packet delivery ratio is achieved while the delay and duplication are the lowest.

On the other hand, inherited from geographic routing, the problem of communication void is also investigated. To work with the multicast forwarding style, a virtual destination-based void handling scheme is proposed. By temporarily adjusting the direction of data flow, the advantage of greedy forwarding as well as the robustness brought about by opportunistic routing can still be achieved when handling communication voids. Traditional void handling method performs poorly in mobile environments while VDVH works quite well.

REFERENCES

[1] J. Broch, D.A. Maltz, D.B. Johnson, Y.-C. Hu, and J. Jetcheva, "A Performance Comparison of Multi-Hop Wireless Ad Hoc Net- work Routing Protocols," Proc. ACM MobiCom, pp. 85-97, 1998.

[2] M. Mauve, A. Widmer, and H. Hartenstein, "A Survey on Position-Based Routing in Mobile Ad Hoc Networks," IEEE Network, vol. 15, no. 6, pp. 30-39, Nov./Dec. 2001.

[3] D. Chen and P. Varshney, "A Survey of Void Handling Techniques for Geographic Routing in Wireless Networks," IEEE Comm. Surveys and Tutorials, vol. 9, no. 1, pp. 50-67, Jan.-Mar. 2007.

[4] D. Son, A. Helmy, and B. Krishnamachari, "The Effect of Mobility Induced Location Errors on Geographic Routing in Mobile Ad Hoc Sensor Networks: Analysis and Improvement Using Mobility Prediction," IEEE Trans. Mobile Computing, vol. 3, no. 3, pp. 233-245, July/Aug. 2004.

[5] B. Karp and H.T. Kung, "GPSR: Greedy Perimeter Stateless Routing for Wireless Networks," Proc. ACM MobiCom, pp. 243-254, 2000.

[6] S. Biswas and R. Morris, "EXOR: Opportunistic Multi-Hop Routing for Wireless Networks," Proc. ACM SIGCOMM, pp. 133-144, 2005.

[7] S. Chachulski, M. Jennings, S. Katti, and D. Katabi, "Trading Structure for Randomness in Wireless Opportunistic Routing," Proc. ACM SIGCOMM, pp. 169-180, 2007.

[8] E. Rozner, J. Seshadri, Y. Mehta, and L. Qiu, "SOAR: Simple Opportunistic Adaptive Routing Protocol for Wireless Mesh Networks," IEEE Trans. Mobile Computing, vol. 8, no. 12, pp. 1622-1635, Dec. 2009.

[9] A. Balasubramanian, R. Mahajan, A. Venkataramani, B.N. Levine, and J. Zahorjan, "Interactive WiFi Connectivity for Moving Vehicles," Proc. ACM SIGCOMM, pp. 427-438, 2008.

[10] K. Zeng, Z. Yang, and W. Lou, "Location-Aided Opportunistic Forwarding in Multirate and Multihop Wireless Networks," IEEE Trans. Vehicular Technology, vol. 58, no. 6, pp. 3032-3040, July 2009.

[11] S. Das, H. Pucha, and Y. Hu, "Performance Comparison of Scalable Location Services for Geographic Ad Hoc Routing," Proc. IEEE INFOCOM, vol. 2, pp. 1228-1239, Mar. 2005.

[12] R. Flury and R. Wattenhofer, "MLS: An Efficient Location Service for Mobile Ad Hoc Networks," Proc. ACM Int'l Symp. Mobile Ad Hoc Networking and Computing (MobiHoc), pp. 226-237, 2006.

[13] E. Felemban, C.-G. Lee, E. Ekici, R. Boder, and S. Vural, "Probabilistic QoS Guarantee in Reliability and Timeliness Domains in Wireless Sensor Networks," Proc. IEEE INFOCOM, pp. 2646-2657, 2005.

[14] D. Chen, J. Deng, and P. Varshney, "Selection of a Forwarding Area for Contention-Based Geographic Forwarding in Wireless Multi-Hop Networks," IEEE Trans. Vehicular Technology, vol. 56, no. 5, pp. 3111-3122, Sept. 2007.

[15] N. Arad and Y. Shavitt, "Minimizing Recovery State in Geo- graphic Ad Hoc Routing," IEEE Trans. Mobile Computing, vol. 8, no. 2, pp. 203-217, Feb. 2009.

[16] Y. Han, R. La, A. Makowski, and S. Lee, "Distribution of Path Durations in Mobile Ad-Hoc Networks - Palm's Theorem to the Rescue," Computer Networks, vol. 50, no. 12, pp. 1887-1900, 2006.

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