EFFECTIVE DATA TRANSMISSION IN ADHOC NETWORKS

Nangai Abinaya S[1] , Sudha R[2]

M.E, Dept. of ECE, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India[1]
Asst. Prof, Dept. of ECE, Sri Shakthi Institute of Engineering and Technology, Coimbatore, Tamil Nadu, India[2]

ABSTRACT

A MANET is an autonomous collection of mobile users that communicate over relatively bandwidth constrained wireless links. Traditional MANET routing protocols are quite susceptible to link failure as well as vulnerable to malicious node attack. The problem in MANET is to deliver the data packets in highly dynamic network in a reliable and secure manner. This paper proposes Position based Opportunistic routing protocol (POR), here it utilizes the-air backup significantly enhances the robustness of the routing protocol and reduces the latency and duplicate forwarding caused by local route repair. In the case of communication void problem, proposes a Virtual Destination based Void Handling, which takes full advantage of the broadcast nature of wireless channel and opportunistic forwarding. Void or hole problems are removed for effective transmission. The data packets are transmitted for multiple forwarders without any link failure. Mobile nodes are dynamically moved. AODV protocol is compared with POR protocol. 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.

I INTRODUCTION

Adhoc network is an infrastructure less, local area network. In mobile adhoc networks, the nodes are free to move independently or having no constraint in any direction, and will therefore changes its causal connection to other devices frequently. The primary issue in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may handle by themselves or may be connected to the larger internet. All nodes are mobile and can be connected dynamically in an arbitrary manner. No default router available. Potentially every node becomes a router, must be able to forward traffic on part of others. The discovery and recovery of mobile nodes are also having time and energy consuming. Position based routing protocols [4] are achieved, since the network is highly dynamic. Maintaining a route is difficult in fastly changing network topology. Once the path breakage occurs, data packets will get lost or be interrupted for a long time until the reconstruction of the route, causing an abrupt occurrence for data transmission. 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 have to know only its own position and the position of its neighbors to forward the packets. When the network is highly dynamic, position-based routing is used. In position based routing a sender can know the present position of the destination. Communication hole is handled by Virtual Destination-based Void Handling (VDVH) [5] scheme. This scheme uses the advantage of greedy forwarding and opportunistic routing.

II RELATED WORKS

Greedy Perimeter Stateless Routing (**GPSR**) [1], 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 [7] makes greedy forwarding decisions using only information about a router's immediate neighbors in the network topology. **Greedy routing** [5] may fail to find a path between sender and destination, even though one does not exist. No end-to-end routes need to be maintained, leading to GR's high efficiency and scalability. However, GR is very sensitive to the inaccuracy of location information. In mobility prediction schemes, avoids the bad next–hop node selection, which results in wastage of energy and increase in delay. LLNK and LOOP problems are the node mobility problems can be identified. The relationship between node density and the performance of geographic routing protocol under more realistic mobility models is not considered. In EX-OR: **Opportunistic Multi-Hop Routing**

increases the throughput of large unicast transfers in multi-hop wireless networks. . ExOR [2] improves performance by taking advantage of long-distance but lossy links which would otherwise have been avoided by traditional routing protocols. But, Void handling mechanism is not carried out in this protocol. **Column-Row Location Service (XYLS),** XYLS [8] is a proactive location service that disseminates locations in a direction such that a query can intersect it subsequently. It is similar to the column-row quorum-based location service originally proposed. **Grid Location Service (GLS),** GLS is a hierarchical hashing-based location service. The geographic forwarding for GLS uses the two-hop beaconing protocol. Reactive routing protocols like AODV provide an efficient alternative to geographic routing for small to medium sized networks. Routing process is not discussed. Only performance of location service is done.

III PROPOSED WORK

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. The packet is transmitted as unicast (the best forwarder which makes the largest positive progress toward the destination is set as the next hop) in IP layer and multiple receptions are achieved using MAC interception. The use of RTS/CTS/DATA/ACK significantly reduces the collision and all the nodes within the transmission range of the sender can eavesdrop on the packet successfully with higher probability due to medium reservation.

The nodes are assumed to be aware of their own location and the positions of their direct neighbors. Neighbourhood 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. Each node maintains a forwarding table for the packets of each flow. The forwarding table maintains the data of next hop and forwarding candidate list. Source node will select the node as next hop which is in nearest distance from the destination. Forwarding candidates are selected as back up nodes which satisfies the following criteria. It should make positive progress towards destination. Its distance from the next hop should not exceed the half of a node's communication range(R). Next hop node (best forwarder) only forwards the packet to destination. 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 multi paths are exploited on the fly on a per packet basis, leading to POR's excellent robustness. If there exists communication hole in the path of the packet flow, then VDVH (Virtual destination based Void Handling) method is followed. The source which has sent the packet to the void node is selected as trigger node. Void handling mode is fixed at the trigger node. After forwarding the packet to more than two hops, mode is switch back to the normal greedy mode satisfying a condition.

In GPSR, consider the case when a destination node moves away from its original location and another becomes a node located closest to the original coordinate of the destination.

This situation is misunderstood as local maximum by GPSR protocol, and the perimeter mode forwarding is used to resolve this problem. However, packets normally get dropped unless the destination node doesn't come back to near the original location and becomes the closest node to the destination location of the packet. Perimeter forwarding generates wasteful loops in this situation, and we label these situations as LOOP problems.

IV POSITION BASED OPPORTUNISTIC ROUTING PROTOCOL

4.1 MODULES DESCRIPTION

4.1.1 Selection of Forwarding Candidates

Only the nodes located in the forwarding area would get the chance to be backup nodes. The forwarding area is determined by the sender and the next hop node. A node located in the forwarding area satisfies the following two conditions: 1) it makes positive progress toward the destination; and 2) its distance to the next hop node should not exceed half of the transmission range of a wireless node (i.e., R=2) so that ideally all the forwarding candidates can hear from one another.

4.1.2 PRIORITIZATION OF FORWARDING CANDIDATES

The priority of a forwarding candidate is decided by its distance to the destination. The nearer it is to the destination, the higher priority it will get. When a node sends or forwards a packet, it selects the next hop forwarder as well as the forwarding candidates among its neighbors. The next hop and the candidate list comprise the forwarder list. Due to the broadcast nature of the wireless medium, a single packet transmission will lead to multiple receptions. This transmission is used as backup, to enhance the robustness of the routing protocol. Not to interrupt the data transmission by forwarding the data using suboptimal candidates when the data is not transferred successfully through the best forwarder. Saving the time and energy by not computing the route previously.

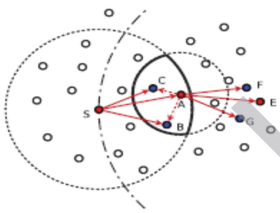

Fig 4.1 Selection and Prioritization Of Forwarding Candidates And Next Hop

4.1.3 GREEDY FORWARDING

Greedy forwarding is the process of forwarding the data through the nodes having the positive progress towards the destination and over the optimal path (least number of hops from source to destination). As the data packets are transmitted in a multicast-like form, each of them is identified with a unique tuple (src_ip, seq_no) where src_ip is the IP address of the source node and seq_no is the corresponding sequence number. Every node maintains a monotonically increasing sequence number, and an ID_Cache to record the ID (src_ip, seq_no) of the packets that have been recently received.

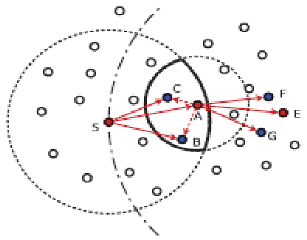

Fig 4.2 Greedy Forwarding

If a packet with the same ID is received again, it will be discarded. Otherwise, it will be forwarded at once if the receiver is the next hop, or cached in a Packet.

4.1.4 HANDLING THE BEST FORWARDER FAILURE

In case node A fails to deliver the packet (e.g., node A has moved out and cannot receive the packet), node B, the forwarding candidate with the highest priority, will relay the packet and suppress the lower priority candidate's forwarding (e.g., node C) as well as node S. By using the feedback from MAC layer, node S will remove node A from the neighbor list and select a **new next hop node for the subsequent packets.**

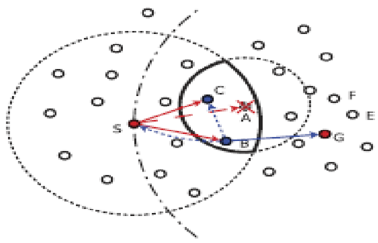

Fig 4.3 Handling the best forwarder failure

4.1.5 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.

To limit 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. Actually, such scheme has already been implied in Fig.4.4 (e.g., node B only forwards the packet to node G). In this way, the propagation area of a packet is limited to a certain band between the source and the destination, as illustrated in Fig. 4.4. Moreover, with the use of ID cache, duplicate packets will be dropped soon and would not propagate any further.

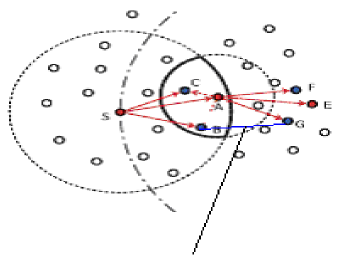

Fig 4.4 Link failure between Forwarding candidate and best forwarder

4.1.6 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. 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 B in Fig 4.5. Then, Path 1 (A-B-E-_ _ _) and/or Path 2 (A-B-C-F-_ _ _) (in some cases, only Path 1 is available if Node C is outside Node B's transmission range) can be used to route around the communication hole. From Fig 4.5, it is obvious that Path 3 (A-C-F-_ _ _) is better than Path 2. 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. 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 again choose 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 (i.e., in this case, the source node is the trigger node).

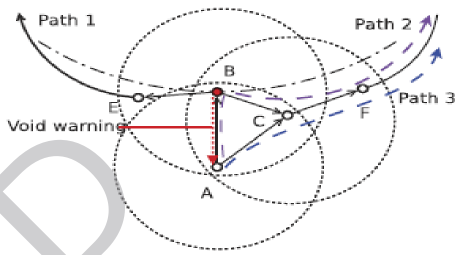

Fig 4.5 Selecting the Void Handling Path

V SIMULATION RESULTS

To evaluate the performance of POR, the algorithm is simulated in a variety of mobile network topologies in NS-2 and compares it with AODV. 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 number of data packets sent by the source(s).

PDR= (Number of packets received/Number of packets sent)*100%

End-to-end delay: The average and the median end-to-end delay are evaluated, together with the cumulative distribution function of the delay.

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

In Graph,

Series 1 – POR

Series 2 – AODV

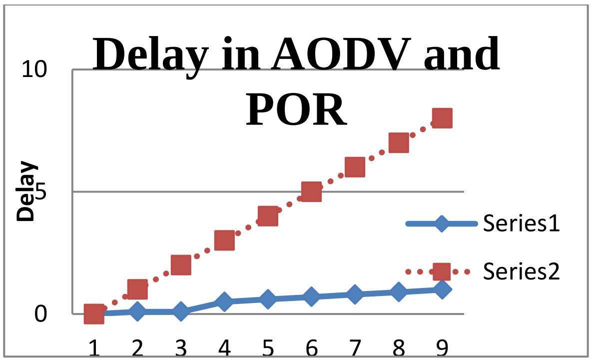

Fig 4.6 Comparison of Delay in AODV and POR

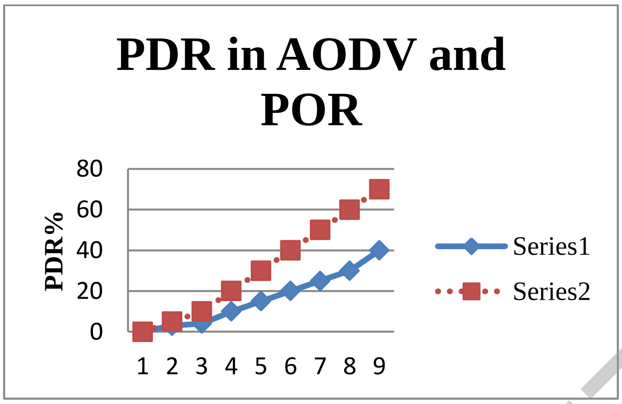

Fig 4.7 Comparison of Packet delivery ratio in AODV and POR

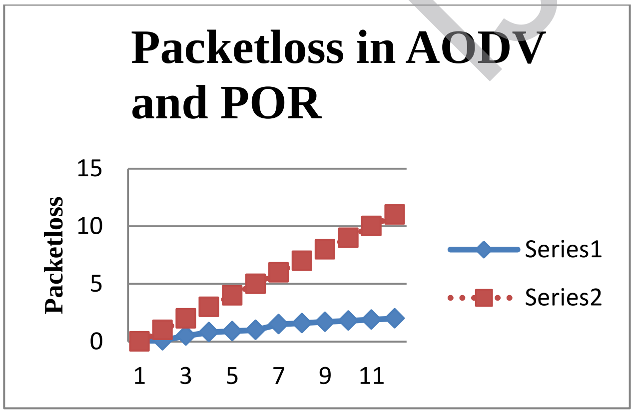

Fig 4.8 Comparison of Packet loss in AODV and POR

TABLE 1: ANALYSIS BETWEEN AODV & POR

	AODV	POR
Generated data Packets	202	368
Received data Packets	64	367
Packet Delivery Ratio	31.6382%	99.1378%
Total Dropped Packets	138	1
Average End-to-End Delay per packet	37.1707 ms	1.4433 ms

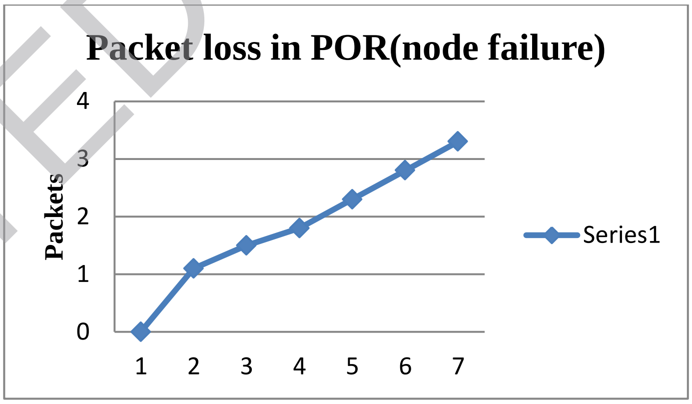

Fig 4.9 Packet loss vs Time in POR (node failure)

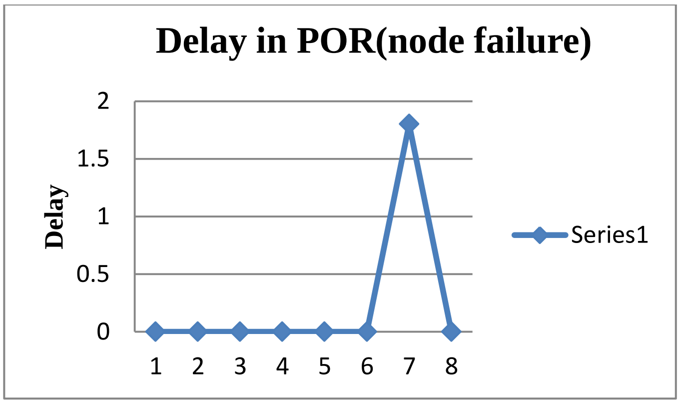

Fig 4.10 Delay in POR (node failure)

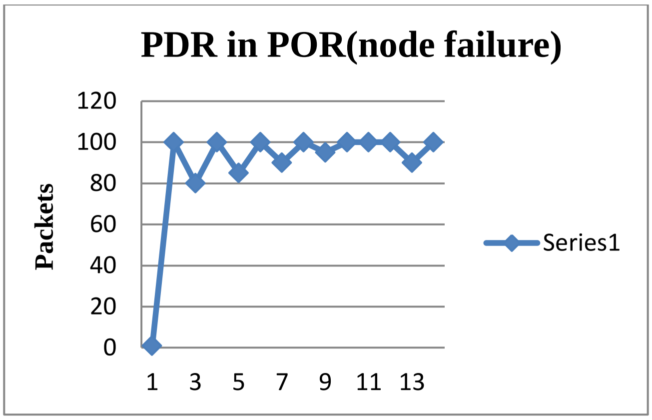

Fig 4.11 PDR vs Time in POR (node failure)

VI CONCLUSION

The problem of reliable data delivery in highly dynamic mobile ad hoc networks considered. 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. 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. Significant amount of lost packets and wasted network resources can be saved using destination location prediction scheme.

REFERENCES

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

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

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

[4] 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.

[5] 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.

[6] 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.

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

[8] 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.