



Enhanced Receiver Based Stateless Multicasting Routing Protocol for Ad-hoc Network

Patil Preeti

Dept. of Computer Engineering
Ramrao Adik Institute of Technology
India

Vidhate Amarsinh

Dept. of Computer Engineering
Ramrao Adik Institute of Technology
India

Abstract— Mobile Ad-hoc network consist of individual mobile nodes communicating via wireless link and provides multicasting with the aid of multicast routing protocols. These protocols are typically stateful, where each node in the group maintains the state information which requires more communication cost between the nodes. In dynamic network topology, communication traffic will be more, which leads to congestion. In this paper, to improve the performance of existing protocol we propose an Enhanced Receiver based Stateless Multicast routing protocol maintains threshold for congestion control in node buffer and forward packets towards receiver for multicasting. Hence congestion is reduced which results in minimized delay and improved packet delivery ratio.

Keywords- MANET, Multicast, Stateless Multicast routing, receiver-based communication.

I. INTRODUCTION

Mobile Adhoc Network (MANET) is recent and interesting era for wireless communication. MANETs are self- configured and infrastructure less networks. In day to day life, several applications required data delivery to multiple destination nodes in communication network. Multicasting is the typical solution to communicate to the group of users. To manage and reduce network traffic, multicasting provides fundamental service for supporting information and collaborative task execution among group of users. Multicasting is even more complex because it requires transmission of information to various destinations at approximately same time. Due to limited radio propagation range, nodes of MANETs communicate either single hop or multi-hop transmission. Such kind of network, which is self-organizing, is very useful when the fixed infrastructure is not economically practical or physically possible such as battlefield scenarios, natural disasters, and etc. Some of the main features of MANET are listed below [1][2]: MANET can be formed without any pre-existing infrastructure. It follows dynamic topology where nodes may join and leave the network at any time and the multi-hop routing may keep changing as nodes join and depart from the network, it does have very limited physical security, and thus increasing security is a major concern. Every node in the MANET can assist in routing of packets in the network. Limited Bandwidth & Limited Power and in some wireless multicast application, source and intermediate nodes are fixed but multicast receivers are not fixed. In any application to make support for multicast service, source node must know location of multicast destination node. While with packet forwarding each time, the source node updates the current node's sink location. Receiver based stateless multicasting protocol includes multicast members in packet header to prevent building and maintaining multicast tree. No tree creation or maintenance or neighbouring table maintenance is required, making receiver based multicast require the least state of any multicast routing protocol, and it is thus ideally suited for dynamic networks. Receiver Based Stateless Multicast, which is a stateless multicast protocol where packet routing, splitting packets into multiple routes and the medium access of each nodes rely solely on the location information of multicast destination nodes. ERSM uses similar concept of RBM virtual node and multicast region for forwarding packets to close distance to destination multicast members. Finally, the packet splits into separate routes to reach out to the multiple members.

The remainder of paper organized as follows: Section II presents an overview of state of art in the topic. Section III describes proposed method. Section IV provides solution for issue along with algorithm. In Section V we evaluated the actual performance of solution using simulation followed by the conclusion in Section VI.

II. RELATED WORK

Existing multicast routing protocols use tree or mesh based topology to connect multicast members [4][5]. The Takahashi-Matsuyama heuristic can be used to build incrementally build Steiner tree for the multicasting [11]. Additionally, multicast routing algorithms are used which rely on maintaining the routing table at intermediate node for creation and maintenance of multicast tree [14]. Location-based approaches are used to forward packets to different locations. In location-based approach,

multicast routing by default nodes obtain location information. If location is known, multicast routing is possible without building any external tree

Position based Multicast [7] first counts next hop neighbouring nodes and total geographic distant from the current node and destination node. Predefined threshold value decides to compare with next hop neighbouring nodes and total geographic distant, whether packets should split or not. But the problem here is it requires information about the neighbouring nodes.

Greedy-Face-Greedy (GFG) [16] routing operates over multiple destinations of network. In geographic routing protocols, only local information of each neighbour position is known to each node. If not, then the node is unable to select next hop node. This causes packets to enter in concave area. Here, the concave area mentions as any random direction.

Geocast [13] uses multicast flooding, Multicast packets forwarded by nodes using forwarding zone calculation which is done at runtime based on global knowledge of location information. Receiver based routing protocol do not need to establish global routing between source and sink node, but neighbouring node of sender have rights to forward contention using forwarding priority calculation [10].

S. Biswas and R. Morris have proposed Unicast without routing table [8]. A source node has a packet that it wishes to deliver to a distant towards destination. Among the source and destination, there are other wireless nodes willing to participate in ExOR. ExOR avoid simultaneous transmission using different node to minimize the collision of packets to forward. ExOR transmit each packet with less no. of interference of other users and same spectrum. It makes agreement that, which subset received each packet to reduce overhead and avoids duplication of forwarded packets. Penalty calculated is based on many nodes using for potential forwarder. Every batch follows upto receiver receives the packet, not receiving packets are again resend, rescheduling and forwarded to highest priority node. This obviously became time- consuming and tedious task.

I. Akyildiz, et al. [3] have proposed this XLM Cross layer protocol basically perform receiver based contention, local Congestion control in order to realize reliable and efficient communication. This concept provides freedom for each node to decide on participating in communication. This built on initiative determination concept to participate in communication. Consequently, operation of node deployment is completely distributed and adaptive.

E. Rozner, et al. [SOAR][9] have proposed this protocol to maximize the transmission without causing duplication of transmission. Concept of forward node selection, selecting node for communication in advance to avoid duplication of transmission, coordinate overhead tends to increase with no. of forwarding nodes. Multiple overhead is avoided to ensure only node closest to the destination. In opportunistic routing loss of packet detection and recovery is important. Adaptive rate controls to determine an appropriate sending rate according to the current network condition.

Chen-Hsiang Feng et al. have proposed RBMulticast without routing table or multicast tree [15]. To provide multicast service to any of application, source node must know location of destination node. But locations of particular destinations are fixed, as well prior location information by node known in network. To make route for communication assume knowledge of the sink's location[6]. The main idea to design stateless multicast protocol to avoid memory overhead and storage issue, this protocol include different components for communication. i.e. packet routing, splitting packets into multiple routes, virtual node and group management. Medium accesses of individual nodes rely solely on the location information of multicast destination nodes. RB is receiver based routing protocol relay node of packet transmission decided by potential receiver. This protocol does not require maintaining routing table/tree/mesh creation for communication. Transmission of packet delivery is done in multicast region, region created by quadrant approach using X and Y axes.

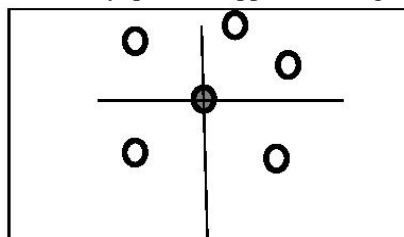


Fig 1: Quadrant Approach [15]

The above fig. states that, in between is a source and it wants to send information to the multicast members in nearby proximity as shown. The source calculates the geometric mean and finds shortest distance, but still collision is not reduced due to directive collection of packets at relay nodes. Further it becomes a severe packets splitting problem, which reduces packets delivery ratio. Few terms are defined for the meaning and its understanding.

Multicast Region: Multicast members receivers the packets, it divides the network into multicast regions and split of the copy of packets to different multicast members.

Packets splitting: split the packet reaches at relay node for which the multicast destinations are located in different region.

Virtual node: Virtual node concept is based on no knowledge of neighbour nodes and no routing tables. Virtual node is Calculated on geographic mean of multicast members for each multicast region.

Group Management: This is another concept in Receiver based stateless multicasting where nodes can join and leave to any multicast group. Join and leave packets are multicast packets with destination lists which contain only group head address.

III. PROPOSED METHOD

When packets are split Receiver based multicast suffer from the collision of packets and contention. The reason for collision is Receiver based multicast splitting packets to multicast regions through multicast members, resides in different locations splitting packets over different regions needs replication of packets after which nodes are buffered to transmit over different region. All packets inserted in nodes buffer and collision happens, so there is a possibility of packets loss which hampers the performance of packets delivery ratio, to avoid the collision and contention in large interference range to control congestion provide solution that, while keep threshold value QT1 maximum, no. of packets arriving for forwarding doesn't collide. So packet drop ratio is less. Threshold value is beyond the maximum capacity, another relay node shares the packet traffic and balance load overhead of routing without affecting the packet delivery ratio. Collision of packets due to replication is minimized, so packet delivery rate is high as compared to RBMulticast. Reduce memory overhead: Once packets are multicast to receiver then no need to maintain state. Memory overhead reduces and computation cost also reduces. Splitting packets in time interval for transmission to destined different region, delay is generated during transmission. Need to minimized delay for transmission along with minimum control head and high packet delivery ratio, memory overhead.

ALGORITHM 1: TO AVOID COLLISION OF PACKETS:

Requirement: Considering Group of Nodes $g = \{n1, n2, \dots, nm\}$

- Measure the distance d of each node from source
- Calculate relay node for one hop distance from virtual node.
- Ensure: Insert packet p to MAC queue

Proposed Algorithm to avoid the congestion in nodes.

- 1: Let no. of packet in queue is N
- 2: Let $QT1$ be the threshold for queue size indicating maximum capacity
- 3: if $(N \leq QT1)$ then
- 4: multicast flow released
- 5: end if
- 6: Else
- 7: if $(N > QT1)$ then
- 8: multicast flow is blocked.
- 9: end if

V. SIMULATION RESULTS AND DISCUSSION.

We have used network simulator NS2 for our simulation. Network Simulator -2, is an object oriented simulator, written in C++, with an OTcl interpreter as a frontend. The simulator supports a class hierarchy in C++ and a similar class hierarchy within the OTcl interpreter. The two hierarchies are closely related to each other. The following results like control overhead and packet interval, delay and packet delivery ratio. The in detail results are shown below with discussion

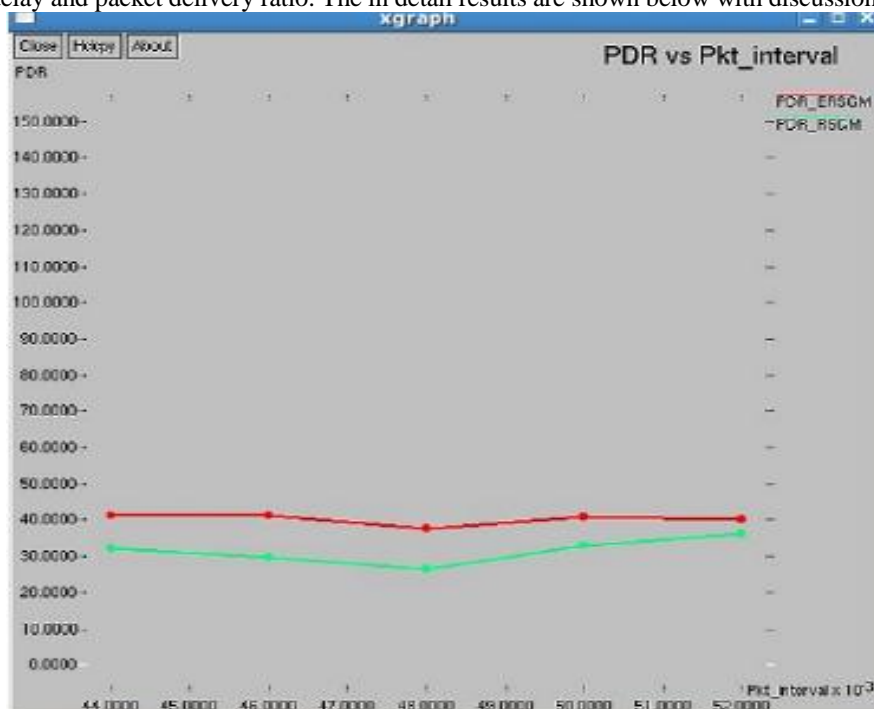


Fig4: Packet Delivery Ratio Vs Packet Interval

Packet Delivery Ratio: Pl. refers to Fig. no. 4. Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources. Packet delivery ratio has been improved since ERSM helps to reduce the Collision of packets.

Delay: Pl. refer to Fig. no. 5. Delay defined by sending data packets and receiving data packets with minimum time interval. Packet sending and packet receiving in buffer is at fixed interval of time according to ERSGM algorithm which helps to reduce collision which consequently reduce the delay.

Control Overhead: Pl. refer to Fig. no. 6. Total number of control message transmissions divided by receiver receives total number of data packets. As far as control over head is concerned, Number of control message pass down between nodes are very less according to ERSGM algorithm.

Throughput: Pl. refers to Fig no.7: An average rate of successful message delivered over channel. Throughput increases while using ERSGM to reduce the collision of packets.

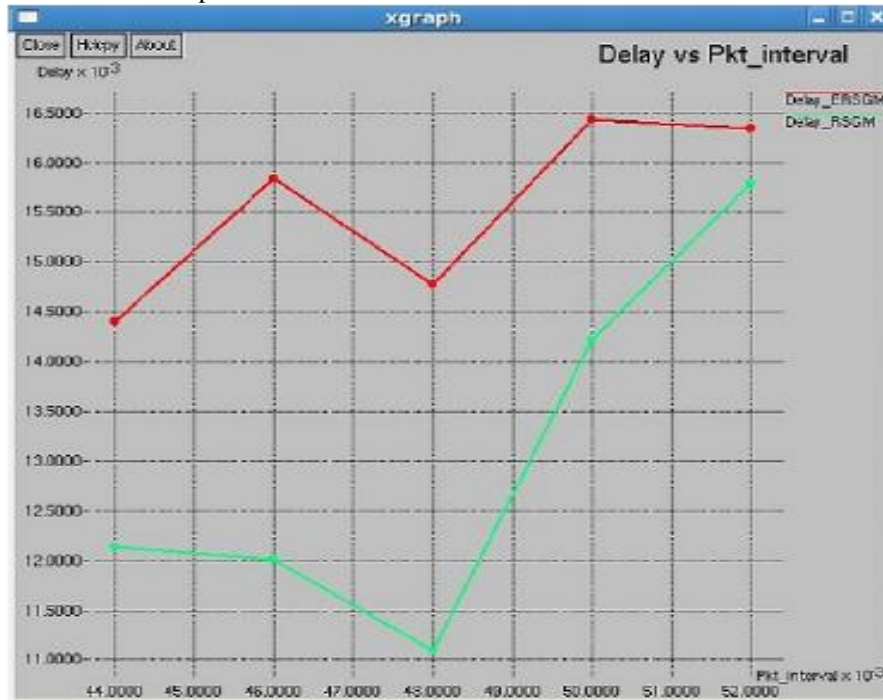


Fig5 : Delay Vs Packet Interval

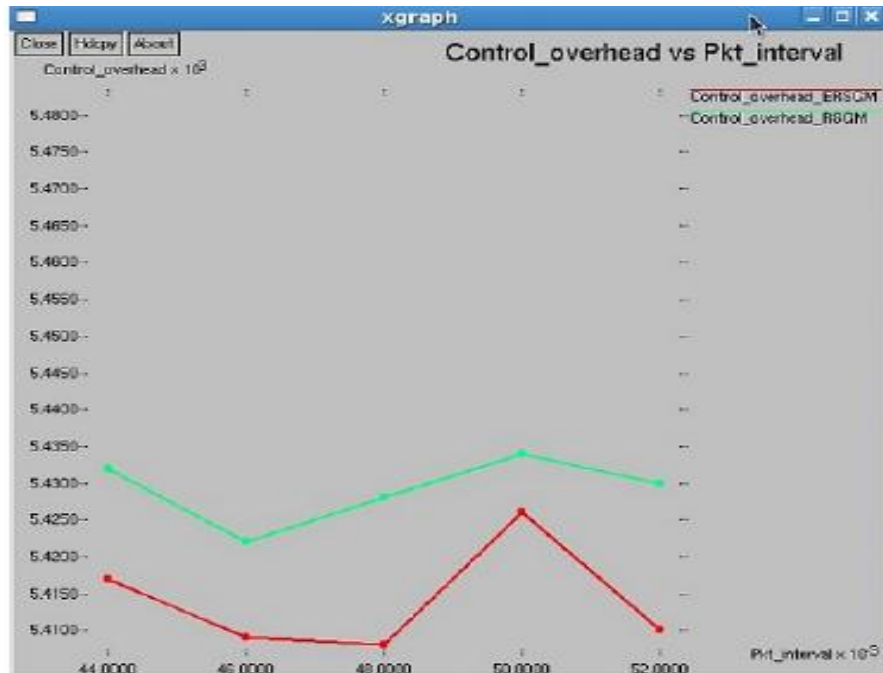


Fig6 : Control Overhead Vs Packet Interval

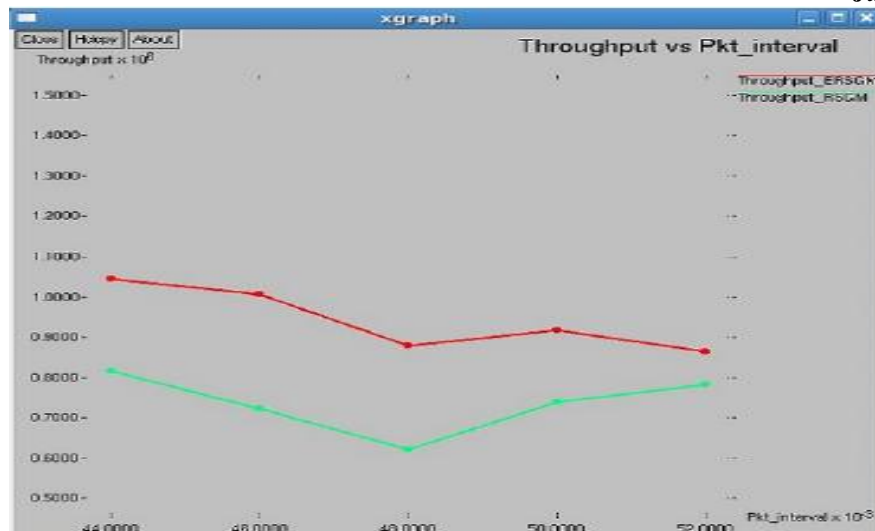


Fig7: Throughput Vs Packet Interval

VI. CONCLUSION

Current multicast routing protocols generally rely on various tree, mesh structures. Hence intermediate nodes need to maintain tree state information for packet delivery. This paper basically focuses on Enhanced Receiver based Stateless multicasting protocol. Enhanced RSM overcomes the disadvantages of existing Receiver Based Stateless Multicast in terms of congestion control. The Enhanced Receiver based stateless multicasting protocol sends packets and uses a threshold value to forward packets towards the receiver using multicasting such that it overcomes the problem of congestion.

REFERENCES

- [1] Kapang Lego, Kapang Lego, Dipankar Sutradhar, "Comparative Study of Adhoc Routing Protocol AODV, DSR and DSDV in Mobile Adhoc Network," Indian Journal of Computer Science and Engineering, 2012.
- [2] Anuradha Banerjee, Paramartha Dutta, "A Survey of Multicast Routing Protocols Mobile Ad Hoc Networks," IJEST Vol. 2(10), 2010.
- [3] I. Akyildiz, M. Vuran, and O. Akan, "A cross-layer protocol for wireless sensor networks," in Proc. of CISS, March 2006.
- [4] S.-J. Lee, M. Gerla, and C.-C. Chiang, "On-Demand Multicast Routing Protocol," Proc. IEEE Wireless Comm. and Networking (WCNC '99), vol. 3, pp. 1298-1302, 1999.
- [5] J. Garcia-Luna-Aceves and E. Madruga, "A Multicast Routing Protocol for Ad-Hoc Networks," Proc. IEEE INFOCOM, vol. 2 pp. 784-792, Mar. 1999..
- [6] C.-H. Feng and W.B. Heinemann, "RBMulticast: Receiver Based Multicast for Wireless Sensor Networks," IEEE Wireless Comm. And Networking Conf. (WCNC '09), Apr. 2009.
- [7] M. M. And Holger Fuler, J. Widmer, and T. Lang, "Position Based Multicast Routing for Mobile Ad-hoc networks," SIGMOBILE Mob.Comput. Commun. Rev., vol. 7, no. 3, pp. 53-55, 2003
- [8] S. Biswas and R. Morris, "Opportunistic Routing in Multi-hop Wireless Networks," SIGCOMM Computer Communications Review," vol. 34, no. 1, pp. 69-74, 2004.
- [9] E. Rozner, J. Seshadri, Y.A. 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.
- [10] Lian Li, Limin Sun, Jian Ma, "A Receiver-based Opportunistic Forwarding Protocol for Mobile Sensor Networks," ICDCS.workshop, 2008.
- [11] K. Chen and K. Nahrstedt, "Effective Location-Guided Tree Construction Algorithms for Small Group Multicast in Manet," Proc. IEEE INFOCOM, vol. 3, 2002.
- [12] S. Basagni, I. Chlamtac, and V.R. Syrotiuk, "Location Aware, Dependable Multicast for Mobile Ad HOC Networks," Computer Networks, vol. 36, nos. 5/6, pp. 659-670, 2001.
- [13] J. Sanchez, P. Ruiz, and I. Stojmenovic, "GMR: Geographic Multicast Routing for Wireless Sensor Networks," Proc. Third Ann.IEEE Comm. Soc. Conf. Sensor and Ad Hoc Comm. and Networks (SECON '06), vol. 1, pp. 20-29, Sept. 2006.
- [14] Chen-Hsiang Feng, Yuqun Zhang, Ilker Demirkol and Wendi "Stateless Multicast Routing Protocol for Adhoc Networks," IEEE Transactions On Mobile Computing, vol 11, No.2, Feb 2012.
- [15] Shashanka HP, Madhurani M.S, Jothi R. "A Survey on Quadrant Approach Routing protocol for Receiver Based Dynamic Multicast Adhoc Network" IJRT, vol.2, Issue3, March 2013.