# RBMulticasting Protocol in Ad-Hoc Networking

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**Abstract-** An emerging network application for delivering packet from one source to group of destination. The application includes the transfer of audio, video, text to live lecture to set of participants, Video broadcasting to media such as headlines, weather, and sports, from file distribution and caching to monitoring of information such as stock prices, sensors, and security. In adaptive Network with data traffic, where long time of intervals are expected among the bursts of data, thus multicast state maintenance adds a large amount of communication, processing, and memory overhead for no benefit to the network application. Implementing a stateless receiver-based multicast protocol that simply uses a directory of the multicast members addresses, attached in packet headers, to enable group to decide the best way to ahead the multicast traffic. Which exploits the information of the geographic locations of the nodes to remove the need for costly state maintenance, making it ideally suited for multicasting in dynamic networks. RBMulticast will be implemented in the Ns2 simulator.

**Index Term –** Ad-Hoc Networking, Stateless, Receiver-based, Multicast, Routing, Protocol

## 1. Introduction

Multicasting is the transmission of packets to the group of mobile nodes identified by a single multicast destination address and hence is intended for group-oriented computing. An applications such military battlefields, emergency search and rescue sites, classrooms, video broadcasting to push media such as headlines, weather, and sports, from file distribution and conventions where participants share information dynamically using their mobile devices that lend themselves well to multicast operations. Improved transmission efficiency can reduce energy consumption, which is an important consideration in MANETs.

Multicasting topologyy can be classified into Tree-Based and Mesh-based topology. Further Tree-based is divided into group-shared tree and Source based tree. Group-shared tree is to constructs one single tree for a multicast group even if there is more than one source which uses less memory, get sub-optimal path from source to destination. Source-Based Tree is to Constructs an individual tree for each sender in a multicast group which uses more meomory, get optimal path from source to destination and minimizes delay. Mesh-based topology is to create a multiple paths exist between any sender and receiver pair. One possible way to implement mesh is using the concept of forwarding group.

Work is focused on a Receiver-Based Multicasting Protocol, which is stateless cross-layer multicast protocol where packet routing, packet splitting medium access of single node rely solely on location information of multicast destination nodes. RBMulticast includes a list of the multicast members' locations in the packet header, which prevents the overhead of building and maintaining a multicast tree at intermediate sensor nodes, because all the necessary information for routing the packet is included within the packet header. Additionally, the medium access method employed does not require any state information such as neighbor wake-up time or any a priori operations such as time synchronization. No tree creation or maintenance or neighbor table maintenance is required, making RBMulticast require the least state of any multicast routing protocol, and it is thus ideally suited for dynamic networks.

RBMulticast is a receiver-based protocol, which means that the send node of a packet transmission is decided by the probable receivers of the packet in a spread manner. This routing draw near does not require routing tables and enables the use of the current spatiotemporal locality; this can be compared to proactive and reactive routing protocols where the route is decided using the latest available information, which can be decayed. This is a crucial property, especially for energetic networks. In RBMulticast, receivers contend for the channel based on their potential payment toward forwarding the packet, which is inspired by the cross-layer protocol XLM, a receiver based unicast protocol designed for sensor networks. Nodes that make the most forward development to the destination will contend earlier and hence have a higher possibility to become the next-hop node. In RBMulticast, the multicast routing uses the concepts of "virtual node" and "multicast region" for forward packets closer to the destination multicast nodes and determining when packets should be split into separate routes to finally reach the multicast members.

## 2. RELATED WORK

Existing multicast protocols for WSNs and MANETs generally use a tree to connect the multicast members. Additionally, multicast algorithms rely on routing tables maintained at intermediate nodes for building and maintaining the multicast tree. ODMRP applies on-demand routing techniques to avoid channel overhead and improve scalability. It uses the concept of , forwarding group , a set of nodes responsible for forwarding multicast data on shortest paths between any member pairs, to build forwarding mesh for each multicast group. A soft state approach is taken in ODMRP to maintain multicast group members. No explicit control message is required to leave the group.

The Core-Assisted Mesh Protocol (CAMP) is designed to support multicast routing in very dynamic ad-hoc networks with broadcast links. It adopts the same basic architecture used in IP multicast. A mapping service is assumed to exist that provides routers with the addresses of groups identified by their names. In the Internet, this service would be provided by the Domain Name System (DNS), for example. Hosts wishing to join a multicast group must first query the mapping service to obtain a group address and then interact with their local routers (which we call routers here) through IGMP or an equivalent host-to-router protocol to request membership in a multicast group.

PUMA implements a distributed algorithm to elect one of the receivers of a group as the core of the group, and to inform each router in the network of at least one next-hop to the elected core of each group. The election algorithm used in PUMA is essentially the same as the spanning tree algorithm introduced for internetworks of transparent bridges. Within a finite time proportional to the time needed to reach the muter farthest away from the eventual core of a group, each router has one or multiple paths to the elected core.

## 3. RBMulticast Protocol

RBMulticast is a receiver-based cross-layer protocol that performs multicast routing based on receiver-based location unicast protocols such as XLM [2]. Void hole problem is solved implicitly by RBMulticast.

### 3.1. Multicast Regions

Multicast region is formed which has a set of node and assumed as a destination. When node receives the packet from the source, packets are split of the packet to each region that contains one or more multicast members. Approaches for dividing the multicast is either by quadrants or by dividing the region into three regions.

### 3.2. Packet Splitting

For Simplicity, algorithm 1 and algorithm 2 the RBMulticast method that splits packets at relay nodes for which the multicast destinations reside in different regions. Variation form RBMulticast requires similar or lower average number of hops to reach all members.

**Algorithm 1. RBMulticast Send**
**Require:** Packet output from upper layer
**Ensure:** Packets inserted to MAC queue

```
Get group list N from group table
for node n in group list N do
    for multicast region r in 4 quadrants regions R do
        if n 2 r then
            Add n into r:list
        end if
    end for
end for
for r 2 R do
    if r:list is non-empty then
        Duplicate a new packet p
        Add RBMulticast header (TTL, checksum, r.list) to p
        Insert p to MAC queue
    end if
end for
```

**Algorithm 2. RBMulticast Receive**
**Require:** Packet input from lower layer
**Ensure:** Forwarded packets inserted to MAC queue

```
Calculate checksum. Drop packet if error detected
Drop packet if not in Forwarding zone
Get destination list D from packet header
for node d in destination list D do
    if I am d then
        Duplicate the packet and input to upper layer
        Remove d from list D
    end if
end for
if TTL in header ¼ 0 then
    Drop the packet
    return
end if
for d 2 D do
    for multicast region r in 4 quadrants regions R do
        if d 2 r then
            Add d into r:list
        end if
    end for
end for
for r 2 R do
    if r:list is non-empty then
        Duplicate a new packet p
        Add RBMulticast header (TTL _ 1, checksum; r:list) to p
        Insert p to MAC queue
    end if
end for
```

### 3.3. Virtual Nodes

In RBmulticast,No knowledge of neighbor nodes and no routing tables are maintained. So, assume that virtual node located at the geographic mean of the multicast members for each multicast region. when using the nearest multicast node as the destination, all node addresses physically exist and virtual node necessary.

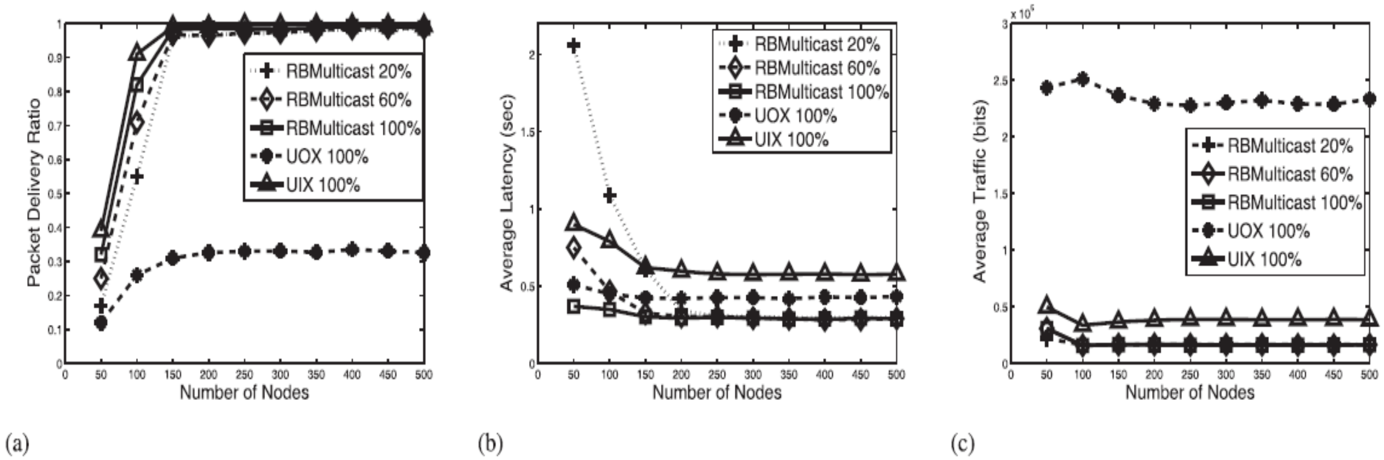

Fig. 1 Performance comparisons for RBMulticast: static scenario, five sinks. (a) Packet delivery ratio versus number of nodes (static nodes, five sinks). (b) Average latency versus number of nodes (static nodes, five sinks). (c) Average traffic for transmitting one data packet versus number of nodes (static nodes, five sinks).

### 3.4 RBMulticast Header

Objective of stateless is to keep intermediate nodes from having to store any data for routing and medium access. Destination List Length (DLL) indicates how many nodes are in the node list, and thus will determine the length of the header.

### 3.5 Group Management

RBMulticast simulations to compute the three performance metrics: packet delivery ratio, latency, and the average traffic generated to transfer one data packet to all multicast members Multicast group management where nodes can join or leave any multicast group. Node manages the multicast groups and act as the group heads. Nodes join and leave a group by sending “join” and “leave” packets to the group head.

## 4. Performance Evaluation

In all scenario, the area is a 150 m _ 150 m square. The transmission range is 30 m and the interference range is approximately 80 m. The channel data rate to be 220 Kbps, the length of RTS, CTS, and ACK packets to be 78 bits and of raw data packets to be 400 bits. The source packet generation rate is 0.2 pkts.

### 4.1 Static nodes, five sinks

To compute the performance of RBMulticast using Static Nodes. Fig 1a The packet delivery ratio is very low for a small for nodes and it’s close to 100%.Fig 1b The latency as a function of the number of nodes. Under low duty cycle and low node density of RBMulticast, since the sleeping times are not synchronized, it is very possible that no relay node candidate can be found in the first attempt, and multiple retransmissions are needed to find a relay node. RBMulticast reduces the total number of transmissions to reach all multicast members; the average latency is lower than the other two protocols. Fig. 1c The average traffic generated to transmit one data packet to all multicast members is shown in Fig. 1c. It is calculated by dividing the total number of traffic generated to transmit one data packet (RTS/CTS/DATA/ACK) by the packet delivery ratio. Since RBMulticast requires fewer packet transmissions, it generates the least traffic for the delivery of a data packet among the three methods.

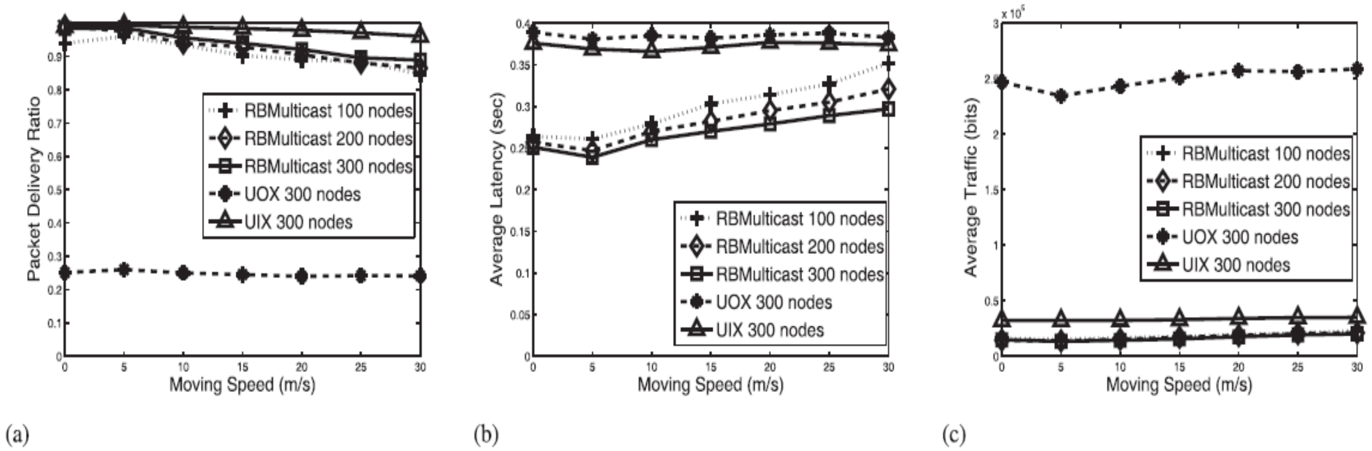

Fig. 2 Performance comparisons for RBMulticast: Dynamic scenario, five sinks. (a) Packet delivery ratio versus Moving Speed (b) Average latency versus Moving Speed (c) Average traffic for transmitting on se data packet versus Moving Speed.

### 4.2 Mobile Nodes, Five Sinks

All intermediate nodes move according to the Random Waypoint mobility model with a certain speed. The source and multicast members are moved inward 25 m as compared to avoid the issues with the "cluster into the middle" effect of the Random Waypoint model A duty cycle of 100 percent is investigated for three different numbers of nodes: 100, 200, and 300. Fig. 2a shows the packet delivery ratio as a function of mobile speed. Note that the data points corresponding to 0 m/s show the performance of static networks. All three curves indicate that when the intermediate nodes are moving at low speeds and the node density is low, the performance is slightly better than that when they are static.

Fig. 2b shows the average latency as a function of mobile speed. When density is increased, less time is required to finish the transmission.

Fig. 2c shows the average traffic generated to transmit one data packet as a function of mobile speed. When the speed of mobile nodes increases, the average traffic generated per transmission becomes higher due to the increase in the number of retransmissions caused by more link breaks.

## 5. Conclusion

RBMulticast uses geographic location information to route multicast packets, where nodes divide the network into geographic "multicast regions" and split off packets depending on the locations of the multicast members. RBMulticast stores a destination list inside the packet header; this destination list provides information on all multicast members to which this packet is targeted. Thus, there is no need for a multicast tree and therefore no tree state is stored at the intermediate nodes. RBMulticast also utilizes a receiver-based MAC layer to further reduce the complexity of routing packets. Because we assume that the receiver-based MAC protocol can determine the next-hop node in a distributed manner the sender node does not need a routing table or a neighbor table to send packets but instead uses a "virtual node" as the packet destination.Our simulations and implementation of RBMulticast showed that it can achieve high success rates, low latency, and low overhead in terms of the number of bits transmitted in the network for both static and dynamic scenarios, making RBMulticast well suited for both mobile and stationary ad hoc network environments.

## 6. References

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