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A NEW APPROACH OF MULTICAST ROUTING PROTOCOLS IN MANETS BASED ON CBR (CASE-BASED REASONING) METHOD

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ABSTRACT
Multicast routing protocols significantly increase the performance of the network using a new approach of group-oriented services which become recently apparent for MANETs. Due to this reason several MANET-specific multicasting routing protocols have been proposed. Although numerous challenges in designing multicast routing protocols in MANETs become ostensible due to node mobility, contention for channel access, multi hop communications and dynamic topology, researchers tend to address such problems by designing simple, scalable and robust routing protocols. In this paper tried to explore the existing On-Demand Multicast Routing Protocol (OMRP) with its limitation and propose a new approach of CBR based multicast routing protocols without changing the basic structure of the protocol. Nodes with CBR based OMRP become autonomous by keeping track of previous route discovery experience to reuse back as a solution. This will reduce channel overhead and improves the scalability of the ad hoc network.

Keywords: Mobile ad hoc networks (MANETs), Multicast Routing Protocols, and Case-Based Reasoning (CBR).

1. INTRODUCTION

Mobile ad hoc networks (MANETs) are self-organizing networks which consists of different mobile nodes that are net without any network infrastructure. Researchers are inspired in MANETs due to challenges in designing a routing protocol which optimizes the performance by reducing the overall control overhead to support the scalability and robustness for adequate quality of service (QoS). Due to this reason multicasting plays a major role in increasing the performance of the network using a new approach of group-oriented services.

The group-oriented services which take advantage of the broadcasting nature of wireless network are of much importance [1]. The objective of a multicast routing protocol for ad hoc environment is to support the transportation of information from a sender to multiple receivers in a group while trying to use the available bandwidth efficiently in the presence of frequent topology changes. Adapting multicast communication in MANTs is challenging due to node mobility, multi hop communications, contention for channel access and dynamic topology due to mobility of the nodes.ODMRP [9], is an on-demand mesh based, besides it is a multicast routing protocol, ODMRP protocol can make use of unicast technique to send multicast data packet form the sender nodes toward the receivers in the multicasting group. To carry multicast data via scoped flooding it uses forwarding group concept.

In this paper we introduce a new approach of On-Demand Multicast Routing Protocol (ODMRP) using CBR method. The proposed method tried to show how CBR keep track of source routing discovery on-demand in order to reduce the channel overhead and improving the scalability of the MANETs.

1. On-Demand Multicast Routing Protocol (ODMRP):

In 2000, Bae et al. proposed a mesh based, rather than a conventional tree based, multicasting routing protocol, named On-Demand Multicast Routing Protocol (ODMRP) [2]. To carry multicast data via scoped flooding it uses forwarding group concept. The source, in ODMRP, establishes and maintains group membership. If source wishes to send packet to a multicast group but has no route to that group, it simply broadcasts JOIN_DATA control packet to the entire network. When an intermediate node receives the JOIN_DATA packet it stores source address and sequence number in its cache to detect duplicate. It performs necessary routing table updates for reverse path back to the source. Non duplicate message is re broadcasted if TTL value is greater than zero (figure1).

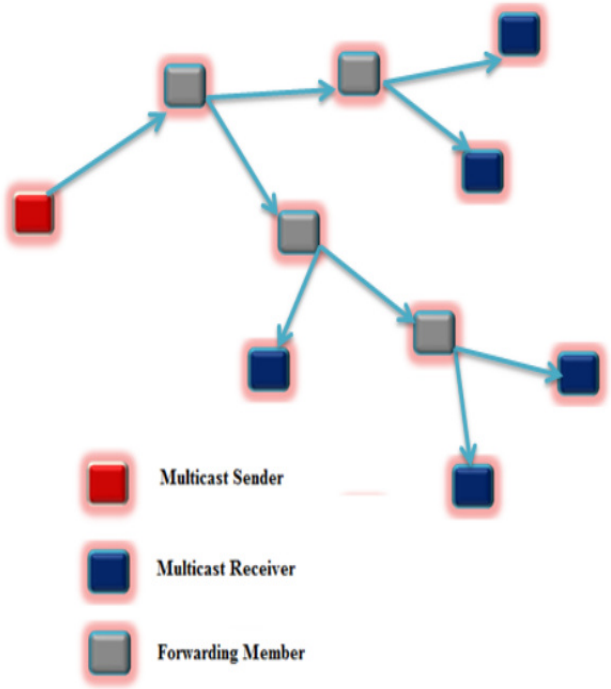

Figure1: Non-Duplicate Join-Data propagation

A multicast receiver constructs a JOIN_TABLE upon getting JOIN_DATA control packet and broadcasts it to its neighbors. When a node receives a JOIN_TABLE, it resolves whether it is on the way to the source by consulting earlier cached data. If it realizes it is the part of forwarding group it sets FG_FLAG. Considering the matched entry this node builds new join table and broadcasts it. In this way JOIN_TABLE is propagated with the help of forwarding group members and ultimately it reaches to the multicast source (figure 2). A multicast table is built on each node to carry multicast data (figure 3). This process either constructs or revises the routes from sources to receivers and forms a mesh.

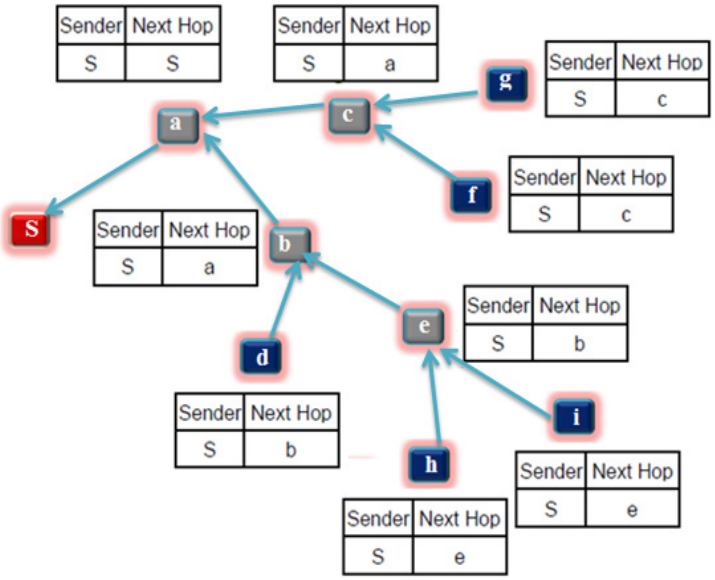

Figure 2: Join-Table propagation

Group maintenance in ODMRP is quite simple as it uses soft state approach[10]. No explicit control packets are required to join or leave the group. If a multicast source wishes to leave the group, it simply stops sending JOIN_DATA packets. On the other hand if a multicast receiver wants to escape from the group it just stops responding to the join reply.

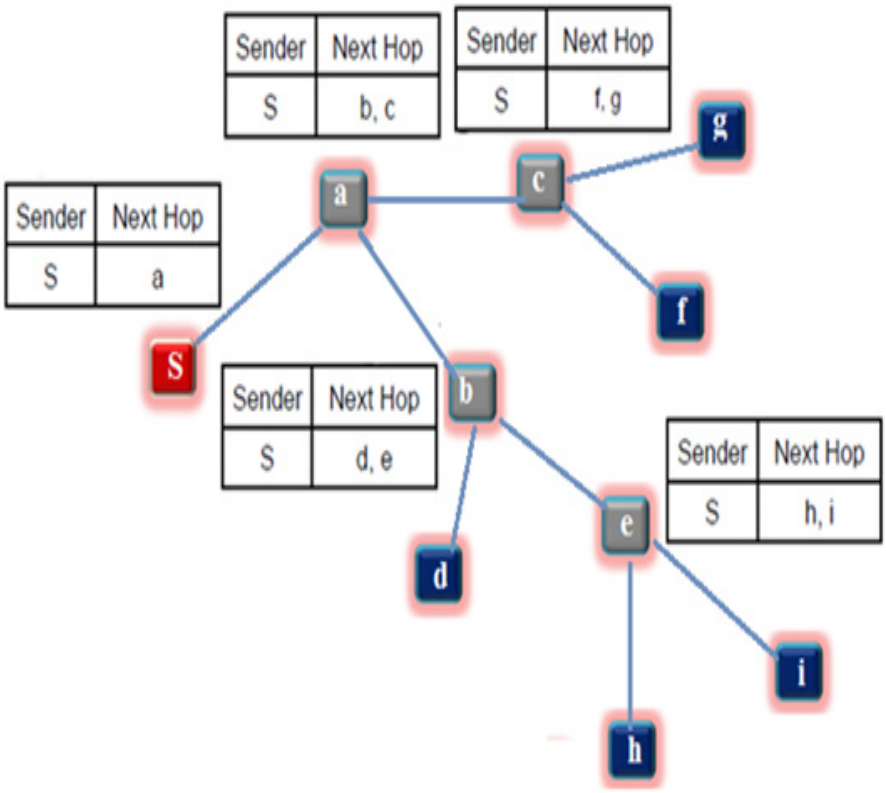

Figure 3: Multi table formed by ODMRP

2. Proposed Method of Multicast routing Protocols in MANETs based on CBR method:

Our adoption of using CBR (Case-Based Reasoning) method in ODMRP is because of its powerful nature of solving problems based on the solutions of similar past problems [4]. Case-based reasoning (CBR) can be viewed as reasoning from the old experiences. Case-based reasoning cycles are:

-Retrieving from old episodes,
-Reusing the output resulted from the retrieval,
-Revising or modifying the output if necessary and
-Adapting to the existing case base as a new case.

1.1 Motivation of using CBR method in OMRP:

CBR has been applied to different problem areas and users must explicitly define adaptation rules or functions for each case base.
Based on the four cycles of CBR; retrieval, reuse, revision and adaptation capabilities of it the proposed CBR method in OMRP helps to keep track of:

- best route path (shortest distance) between member pairs
- JOIN_TABLE propagation to multicast source
- forwarding group membership information
- location information and
- route maintenance and recovery

In MANETs since each node are equal On-Demand Multicast routing protocol 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 a forwarding mesh for each multicast group. Making each node as autonomous group at expense of previous routing information plays a major role in decreasing channel overhead which in turn improves the scalability of the network. Moreover, a multicast table built on each node doesn't have any back information about route discovery control packet (JOIN_DATA) kept under each participating nodes showing the best route path (shortest distance) between member pairs, JOIN_TABLE propagation to multicast source, forwarding group membership information (FG_FLG), location information, route maintenance and recovery; the multicast source will send the same route discovery for the same multicast receivers repeatedly. For this reason we are strongly motivated to apply CBR method in OMRP.

Based on our proposed method a multicast table is built on each node using CBR and it will carry a multicast data and retains resulting experience for reuse. This resulting experience to be retained in CBR includes the shortest path between member pairs, previous JOIN_TABLE propagation to multicast source and forwarding group membership information.

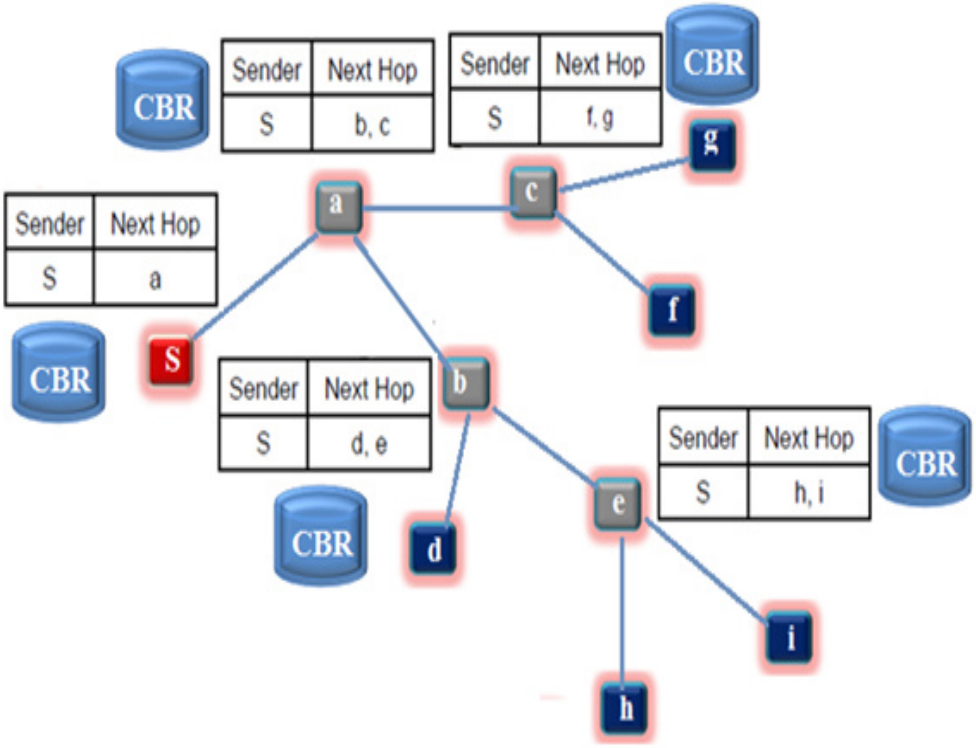

Figure 4: Proposed CBR based Multicast table formed by ODMRP

Assuming that the source broadcasts JOIN_DATA control packet to the entire network for more than one time for the same multicast receivers and if the source address and the sequence number of the control packet matches, the forwarding group member next to the source will rebroadcasts back to the source immediately by resolving from CBR whether it is forwarding group to the source without the intervention of other intermediate forwarding nodes (Figure 5). Since the multicast table is built based on CBR method, it maps the solution for same control packets similar to the past event. This decreases the repetitive broadcasting of JOIN_DATA control packet for the same multicast receiving nodes which in turn decreases the packet overhead as the number of nodes increases.

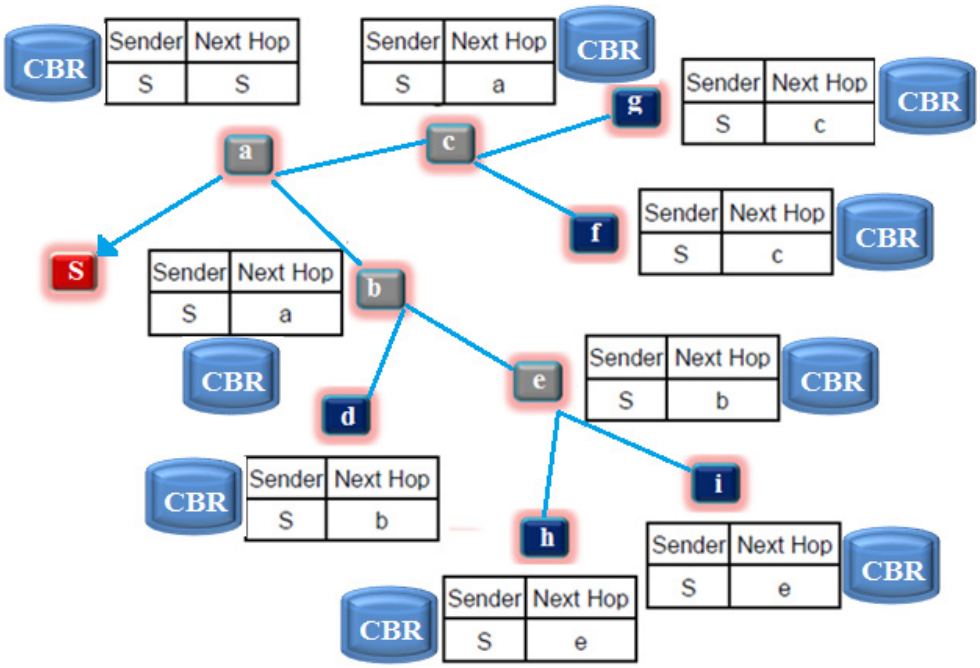

Figure 5: JOIN_TABLE propagation based on CBR

In each node the CBR will keep track of forwarding group by retaining the FG_FLG status to rebroadcast the packets to its neighbours. In case the multicast receiving nodes moves since MANETs are mobile in nature the location of the receiving node may be changed or lost their communication due to failure, the CBR will be updated via the neighbouring nodes about the status of the nodes since source will refresh with another packet control (JION_DATA). So the new approach achieves the mobility of the nodes.

When the number of an intermediate forwarding nodes increases due an increase in number of nodes the source control packet (JOIN_DATA) will broadcasted to all members and the JOIN_TABLE reply will be broadcasted back to multicast source in reverse direction during which CBR records and updates the shortest path between member pairs, previous JOIN_TABLE propagation to multicast source and forwarding group membership information along with multicast table formed by ODMRP.

Table 1: Comparison between previous method and proposed method:

Previous On-Demand Multicast Routing Protocol(OMRP)	**A new approach of CBR based On-Demand Multicast Routing Protocol (OMRP)**
More channel overhead	Less channel overhead
Less scalability	High scalability
Less multicast efficiency	Increases multicast efficiency
Periodic flooding	Controls periodic flooding to forwarding group nodes

3. CONCLUSION:

In this paper we proposed a new approach of multicast routing protocol based on CBR method which decreases the channel overhead and improves the scalability of the MANET based on the solutions of previous experience. But ODMRP based on CBR method needs the design issues of individual nodes to increase the efficiency of each participating nodes. Since MANETs are highly dynamic environments, with constraints, such as dynamic nature of the network topology, limited bandwidth and power, designing such a protocol with all constraints will be open for researches.

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Author's Brief:

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