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MULTICAST QOS ISSUES & SOLUTIONS

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Abstract: Mobile Ad-hoc networks (MANET), an emerging field of wireless networking is a system of wireless mobile hosts, connected by wireless links that dynamically create a temporary network and establish an infrastructure less network. Multicast routing has been widely applied in mobile ad hoc networks (MANETs), to support different group oriented applications like video conferencing, interactions with Special groups etc., efficiently .Multicast enables one to many and many to many communication. In the Paper we present the Various issues regarding Multicasting and Solution to Quality of service .

I. INTRODUCTION

The Term MANET [1] is a collection of mobile nodes that can communicate with each other without the use of predefined infrastructure or centralized administration. Multicast [3] plays an important role in MANET. Many network applications need the nodes to work as a group to carry out a given work. This type of application is efficient due to the broadcast nature of wireless network as it can improve the efficiency of the wireless links. As a result, multicast routing has become a researcher's topic recently, and various multicasting protocols in MANET have been proposed in various publications. Regardless of the network environment, multicasting is very useful and efficient means of supporting group oriented applications [2]. Because of the broadcast capability, many types of mobile networks are better suited for multicast, rather than unicast routing and, is more effective to solve the multicast routing problem separately.

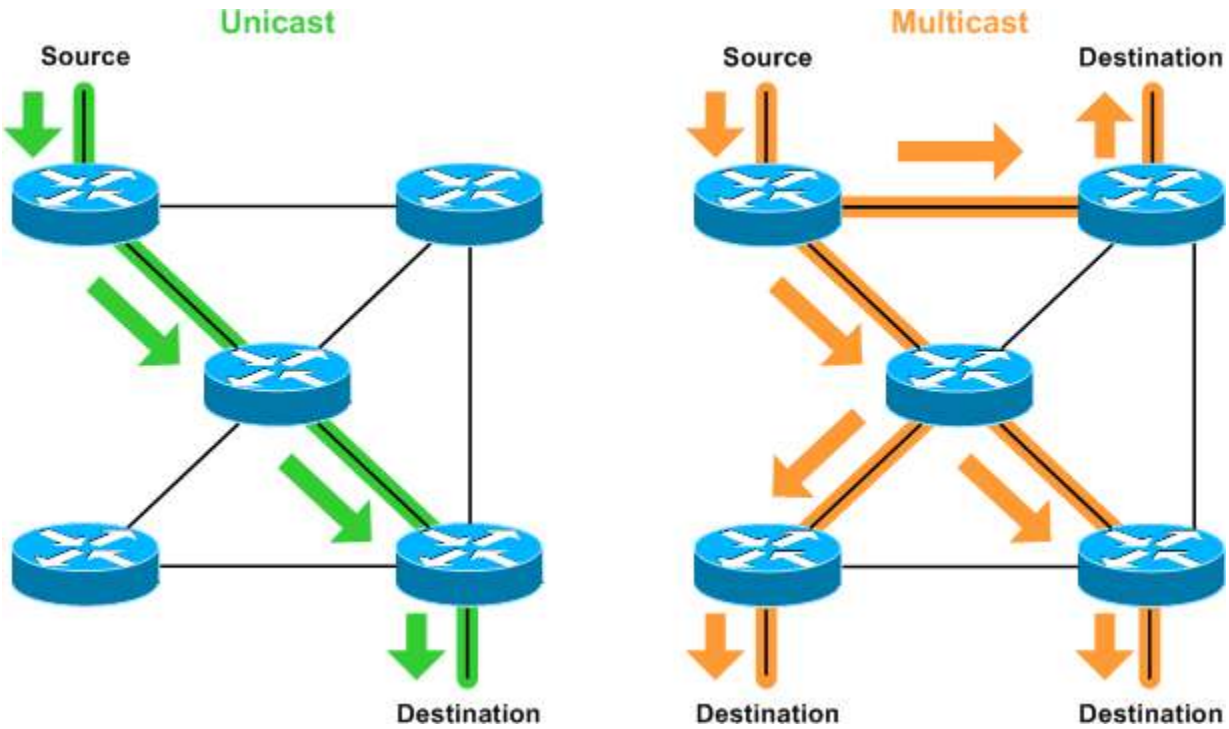


Fig 1: Unicast and Multicast Routing

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Unicast
Unicast is communication between a single sender and a single receiver over a network. Point-to-point transmission from one device to another is also unicast. Most internet transmissions (where one user connects with one sources or other user at a time) is unicast.

Multicast
Multicast is a form of communications where a single packet is transmitted to more than one receivers[4]. The Internet does not control the multicast group membership tightly. A multicast message is sent from a source to a group of destination nodes. A source sends a packet to a multicast group specifying as the multicast group address. The packet is automatically replicates itself at intermediate routers and any nodes that joined the group can receive a copy of the packet. Because a node can receive transmitted data of any multicast groups, secure communications is more important in multicasting than in unicasting.

II. MULTICASTING ROUTING PROTOCOLS

Multicasting consists of concurrently sending the same message from one source to multiple receivers. It plays an important role in video-conferencing, distance education, co-operative work, and video on demand, replicated database updating and querying, etc. Various multicast routing protocols have been proposed for Ad hoc networks, which are classified as mesh based or tree based. In mesh based multicast protocol, there may be more than one path between a source and receiver, hence providing more robustness compared to tree based multicast protocols. In tree based multicast protocol, there is only one single path between pair of source and receiver, thus leading to higher multicast efficiency[5].

- Tree based
  - One path between a source and receiver.
  - AMroute, MAODV, AMRIS.

- Mesh based
  - Multiple path between a source and reciver.
  - ODMRP, CAMP.
- Hybrid
  - Zone Routing protocol(ZRP).

III. ISSUES IN MULTICASTING

Robustness: Due to the high mobility of the nodes, link failures are very common in ad hoc networks. Thus, data packets sent by the source may be dropped, which results in a low packet delivery ratio. Hence, a multicast routing protocol should be robust enough to maintain the mobility of the nodes and achieve a high packet delivery ratio. Also, New techniques that stress rapid and robust delivery must be developed[2].

Efficiency: In an ad hoc network environment, where the bandwidth is insufficient & the efficiency of the multicast protocol is very important. Multicast efficiency is defined by the ratio of the total number of data packets received by the receivers to the total number of packets transmitted in the network.

Control overhead: In order to keep record of the members in a multicast group, the exchange of control packets is required. This consumes a good amount of bandwidth. Since bandwidth is limited in ad hoc networks therefore the design of a multicast protocol should ensure that the total number of control packets transmitted for maintaining the multicast group is kept to minimum.

Quality of Servive: One of the important applications of ad hoc networks is military applications. Hence, providing quality of service (QoS) is an issue in ad hoc multicast routing protocols. The main parameters which are required for providing the QoS are throughput, delay, delay jitter and reliability.

Resource management: Ad hoc networks consist of a group of mobile nodes, with each node having limited battery power and limited memory. An ad hoc multicast routing protocol should use minimum power by reducing the number of packet transmissions. To reduce memory usage, it should use minimum state information.

IV. QOS & MULTICASTING

In demanding QoS, the multicast problem becomes more challenging. In addition to improve scalability and efficient network support, group-based applications also demand high QoS requirements in terms of end-to-end delay, delay jitter and loss. Even though resource reservation protocols such as RSVP [6] address the issue of reserving resources for a multicast tree for a given path, these protocols do not address how to determine that path. It is the

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responsibility of the multicast routing protocol to determine that path.
Tree Based Multicast routing protocols can be classified into two main category:

- Source-based protocols
- Center-based protocols.

The source based approach uses the notion of shortest path tree (SPT) rooted at the sender/source. Every branch of the tree is the shortest path from the sender to each group member. Since the shortest path (in hops) is usually the shortest delay path, the receivers in multicast tree receive excellent QoS. However, source based trees introduce scalability problems for large networks since each receiver must have a shortest path from source to receiver. The shortest path yields additional performance (QoS) at the cost of network resources. Source-based routing is currently employed in Distance Vector Multicast Routing Protocol (DVMRP) [7].

Center-based or shared-tree protocols, creates a multicast tree & spans the members whose root node is the center or *core* node. These type of protocols are highly suitable for sparse groups and scalable for large networks. However, just as shortest path trees provide outstanding QoS at the cost of network bandwidth, shared trees provide high bandwidth conservation at the cost of QoS to the receivers. The Core Based Tree (CBT) [8] is well-known example of a shared tree routing protocol. When a node wants to transmit a message to the multicast group in the CBT protocol, the node sends the message towards the core. The message is spread to group members along the path to the core, and to the all remaining members once it reaches the core. Requests to join or leave the multicast group are organised by sending the request toward the group core. When a join request reaches a tree node, the tree node becomes the point of attachment for the new node. Conversely, when a node leaves a group, the part of the tree between the node and nearest tree node whose degree is greater than two is pruned.

The QoS of the multicast tree (receiver-perceived QoS) is not solely affected by the multicast routing protocol. Rather, the QoS of the multicast tree is a function of group dynamics, which includes the following issues:
• QoS-aware routing
• Tree rearrangement
• Core/tree migration

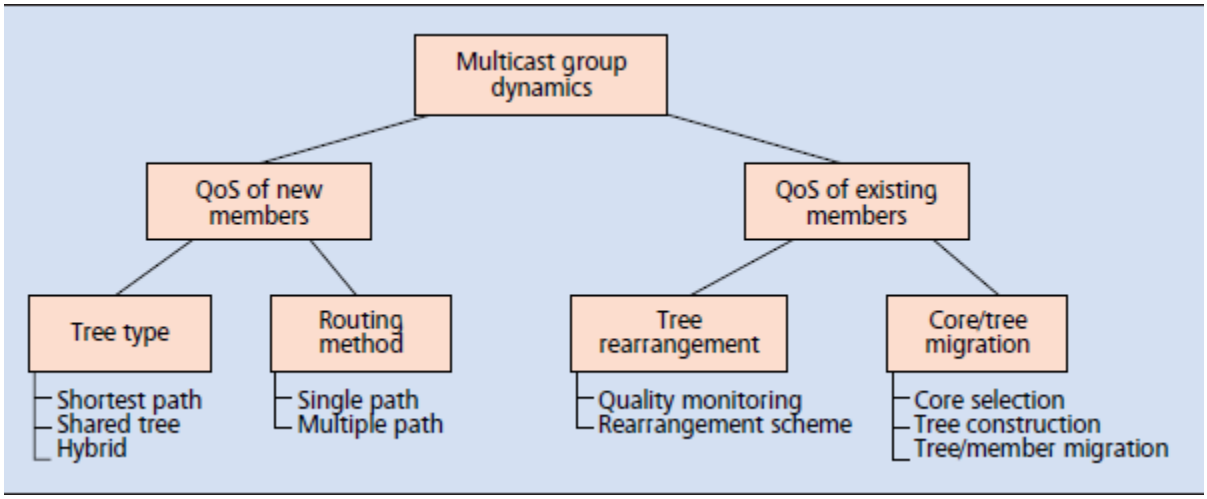


Fig 2: Issues in Multicast Group dynamics

QOS-AWARE ROUTING

The dynamic QoS multicast routing problem can be informally stated as ***Given a new member* Mnew, *find a path from* Mnew *to an on-tree node that satisfies the QoS requirements of* Mnew.** A multicast tree is dynamically constructed as members join and leave a group. When an existing member leaves the group, it sends a control message up the tree to delete the branch that no longer has active members. When a new member joins the group, the tree must be extended to cover it.

TREE REARRANGEMENT

In a dynamic multicast session, it is important to ensure that member join/leave will not interrupt the ongoing session, and the tree after member join/leave

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will still remain near optimal and satisfy the QoS requirements of all on-tree receivers [9]. One way to handle dynamic member join/leave is by reconstructing the tree every time a member join or leave the session. This involves migration of on-tree nodes to the new tree, which result in a large service disruption that is not tolerable, especially by QoS multicast sessions. Another way to handle dynamic member join/leave is by incrementally changing the multicast tree. This incremental change approach suffers because the quality (e.g tree cost) of the tree maintained may deteriorate over time. Therefore, an online multicast routing algorithm must take into account two important contradicting goals [8]: cost reduction and minimization of service disruption. Thus, a balance needs to be maintain between these goals by employing a technique that monitors the quality of the tree or part of the tree and triggers tree rearrangement when the quality degrades below a threshold. The tree rearrangement process is a means to achieve this balance [8].

CORE AND TREE MIGRATION

Another importance of tree maintenance reflects in core-based multicasting, where core selection is an important issue because the location of the core affects the tree cost and delay. The quality (e.g cost) of the tree based on the current core may decline over time due to dynamic join and dynamic leave of members (i.e the core *degenerates* [10] with time). The maintenance of a good-quality multicast tree needs online selection of a new core & online construction of a multicast tree based on the new core and migration of the members from the old tree to the new multicast tree.

V. IMPROVED QOS

After Studying various issues related to satisfy the QoS requirements, a good QoS-aware multicast routing protocol should aim to:
• Improve the probability of successful join.
• Minimize the cost of the joining path.
• Minimize the joining time.
• Be scalable to large networks.
• Minimization of service disruption.
• Online selection of a new core.
• Online Maintenance of Multicast Tree.

VI. CONCLUSION & FUTURE SCOPE

In the Paper we first outline the various issues in multicast communication. Then we focus on managing group dynamics which has three issues related to QoS. These issues have a profound impact on QoS multicast routing and the QoS experienced by the end user. For these issues, we recognize the following important research problems:
• *Join/leave QoS routing*: Although notable work has been done on QoS routing, the currently proposed schemes do not meet all of the goals of a good multicast routing protocol. Therefore, further research is needed to develop schemes that provide better performance on both intra and inter-domain routing scales.
• *Tree maintenance*: Tree rearrangement has received significant attention in the recent past and needs further research. The management of group dynamics is an integrated manner addressing all of the sub-problems (QoS routing, tree rearrangement, and tree migration) is an important issue for further research.
• *Core and tree migration*: Even though there has been some work on online core evaluation, but more has to be done in this area.
In the last various solutions has been proposed to improve Quality of Service, by keeping in mind all those solutions a good Multicast Routing protocol can be developed to improve QoS and other issues related to the area.

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