

*Report on:*

# Multicast Routing Protocol by Multicast Agent in Mobile Networks

*2000*

*International Conference on Parallel Processing*

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## Introduction:

Laptops and handheld devices are in widespread demand as rapid progress in technology has made them low-cost. As a result, they have generated a demand for protocols that would enable them to exchange data without being tethered by wires. Hence there has recently been a great amount of research into wireless technology.

Multicasting is also gaining a lot of interest as the need for video/audio conferencing, distance learning and multiparty games has come into picture. There is a need to efficiently route data to mobile hosts (MH) and at the same time also prevent the problems of non-optimal path length, datagram duplication and disruption in datagram delivery during the multicast tree generation. This paper presents a protocol that efficiently addresses all the above problems.

## Existing protocols:

Two of the most widely used multicast protocols are the Foreign Agent (FA) Based and the Home Agent (HA) Based Protocols. In the Foreign Agent Based Protocol, whenever an MH moves into a foreign network, the FA, (if it is not already a member of the multicast tree) sends a tree join request. This approach is simple and prevents datagram duplication and non-optimal path delivery, but can cause data disruption till the node is connected to the tree. In the Home Agent Based Protocol, whenever an MH moves into another network, the HA is responsible for forwarding data to the MH. This prevents data disruption, but causes datagram duplication if several MHs of the same HA move to the same FA. Also the datagrams are delivered through a non-optimal path. The MoM protocol aims to prevent this in which a HA forwards only once to a FA irrespective of the number of its MHs that are in the FA network. But this causes the 'Tunnel Convergence' problem in which several HAs may forward one packet for some of their MHs in the FA. To prevent this, the FA selects a Designated Multicast Service Provider (DMSP) for every group. The DMSP is a HA that is responsible for forwarding a multicast packet to the FA for the group. This also has a datagram duplication possibility if the FA itself is a tree node. Also, the datagrams do not arrive through an optimal path. The proposed protocol attempts to solve these problems.

### Multicast by Multicast Agent (MMA) Protocol:

The MMA protocol introduces the concept of a Multicast Agent (MA) and a Multicast Forwarder (MF). Both the MA and the MF are the nodes (LANs) in the network and they have both static as well as mobile hosts that are connected below them. The MA provides multicast service to the mobile hosts. The MF is responsible for forwarding data packets to the MA. The MF of an MA, e.g. MA1, is the MA itself, if it is already a node in the multicast tree or the MF can be an MA, e.g. MA2, in another network if MA1 is not a node of the multicast tree.

Whenever a node moves into another network, it sends a registration request to the MA of that network in which it sends its ID and its old MF. If the MA is already a member of the tree, then the MH sets its MF information field to that of the MA. The MA then forwards packets to the MHs through an optimal path. If the MA is not a node of the tree, then it first takes the MF information from the new MH and then sends a request to that MF to forward packets for that group. In the meantime, the MA also starts the tree join process. As soon as the MA becomes a member of the multicast tree, it sets the MF field with its MA field, and then sends a request to the old MF to stop forwarding the packets. It then sends a message to its MHs to set their MF field with the MA itself. Thus, as long as the MA does not join the tree, it receives the packets through the MF of the MH and so this prevents any data disruption during this period. Also, once the MA joins the tree, it stops reception of packets through the old MF and receives the packets through the shortest path from the source.

### Performance Evaluation:

Simulations were performed using a network of 400 nodes (LANs) with varying numbers of mobile hosts that were connected to them. The number of nodes that were initially connected to the multicast tree was varied. The performance of the MMA protocol was compared to that of the Home Agent Based Protocol and the Foreign Agent Based Protocol. The features considered were the amount of multicast traffic and the average delivery path length. The total network traffic is the sum of the traffic occurred on the multicast tree and the additional traffic that is generated due to the multicast tunneling. The number of nodes that receive tunneled packets is proportional to the number of

mobile hosts in the HA based protocol, the number of foreign networks in which the mobile hosts are visiting in the MoM based protocol and the number of MAs that receive data forwarded by the MFs in the MMA protocol. It was observed that the MMA protocol performed far better than the other protocols. Also when the average number of mobile hosts per node crossed a certain value, it was observed that the MMA protocol performed still better. This was because as the average number of hosts increased, the probability that a MH was already in the multicast tree increased. Hence, the MA did not need to request the MF of the MH to forward packets to it. This decreased the number of MAs that were receiving tunneled packets. It was also observed that the MMA protocol had a lower total path length as compared to the MoM protocol. This was because the MMA protocol uses the MF that is situated closest to it.

### Conclusions:

The MMA protocol that has been proposed in this paper uses Multicast Agents that receive multicast packets from Multicast Forwarders located either in the same network or in some nearby networks. It solves the problems of the datagram duplication, non-optimal tree path and the disruption in reception of data that are observed in the Home Agent Based and the Foreign Agent Based Protocols. The protocol shows improved performance over the HA based and the MoM based protocols. The future work includes quantifying the overhead involved in the proposed protocol as opposed to the HHA based protocol, since in the MMA protocol every MH movement into the network of a MA triggers the MA to start the tree join process.