MULTICASTING IN WIRELESS NETWORK

Abstract

Providing Multicast over the wireless networks has always been challenging because some of the issues involving multicast such as shielding the movement of the mobile host (MH) from the Main Multicast Delivery Tree, performance issues during hand off, reliability etc. require certain modifications and implementations to suit various applications. In this paper, I have discussed the buffer tree migration in mobile hosts and also its applicability for the present day scenario and the ease with which it manages multicast data delivery to multiple recipients.

1 Introduction to Multicasting

The bulk of the traffic on today's networks is unicast. A separate copy of the data is sent from the source to each client that requests it. Networks also support broadcasting. When data is broadcast, a single copy of the data is sent to all clients on the network. Now, if the same data needs to be sent to only a portion of the clients on the network, both of these methods waste network bandwidth. Unicast wastes bandwidth by sending multiple copies of the data. Broadcast wastes bandwidth by sending the data to the whole network whether or not the data is wanted. Broadcasting can also needlessly slow the performance of client machines. Each client must process the broadcast data whether or not the broadcast is of interest.

Multicasting takes the strengths of both of these approaches and avoids their weaknesses. *Multicasting* sends a single copy of the data to those clients who request it. Multiple copies of data are not sent across the network, nor data sent to clients who do not want it. The difference between multicasting and separately unicasting data to several destinations is best captured by the host group model- " host group is a set of net-work entities sharing a common identifying multicast address, all receiving any data packets addressed to this multicast address by senders (sources) that may or may not be members of the same group and have no knowledge of the groups' membership". This definition implies that, from the sender's point of view, this model reduces the multicast service interface to a unicast one. Thus, the multicast model was proposed to reduce the many unicast connections into a single multicast connection for a group of receivers.

Multicasting is necessitated in wireless networks basically for applications, which involve multiple sessions such as:(a) **A database query**, which has to query more than one server at the same time from the distributed database. (b) **A Teleconferencing** application, in which there are more than one receiver for the data at any given time etc. Multicasting is better suited for all such applications particularly in mobile environments because it is bandwidth efficient when compared to multiple unicast methods, because
multiple unicast flood the network apparently with duplicate packets.

1.1 Challenges in implementing Multicasting for Wireless Networks.

Some of the challenges in implementing Multicasting for Wireless Networks can be listed as follows. First of all, the host mobility is to be **hidden** from the multicast tree. Second, during **hand off**, the packet loss should be minimal and so should the hand off latency be. Third, the **dynamic group membership** is to be facilitated accordingly. Fourth, **Qos** provisioning with Resource Reservation is to be implemented as well.

2. Related Work

2.1 IETF Mobile IP standard approaches.

The two approaches proposed by IETF for multicasting over Mobile IP are:

(a) **Remote Subscription**, (b) **Bi-directional Tunneling.** In Remote Subscription, whenever the Mobile Host (MH) moves in to a new Foreign Network the MH resubscribes to the desired multicast group. Where as in Bi-directional tunneling method, the MH receives and sends multicast packets through its Home Agent (HA) by means of unicast tunnel.

The advantages of **Remote Subscription** method are: it does not call for special encapsulation, it is simple and offers the shortest path for the multicast data delivery to the MH. On the other hand this method is not suitable for MHs, which are highly mobile because frequent re-subscriptions could lead to lost packets.

The advantages of **Bi-directional Tunneling** lie in the fact that there is no need to re compute the Multicast Tree every time the MH moves in to a new foreign network as all the routing is done through the HA. However the **Bi-directional Tunneling** suffers from **Tunnel convergence problem**. In a way Bi-directional Tunneling offers **multiple unicast** than an exact **Multicast**.

3 Multicast-Based Re-Establishment

Some networks support multicast connections with dynamically changing memberships. The use of multicasting has several interesting ramifications. Because data for the downlinks are transmitted simultaneously to multiple base stations during the interim, the actual switchover can be fairly quick, with decreased buffering. This scheme also has an advantage in that only a small layer of functionality needs to be added on top of the multicast facility in order to support mobility.

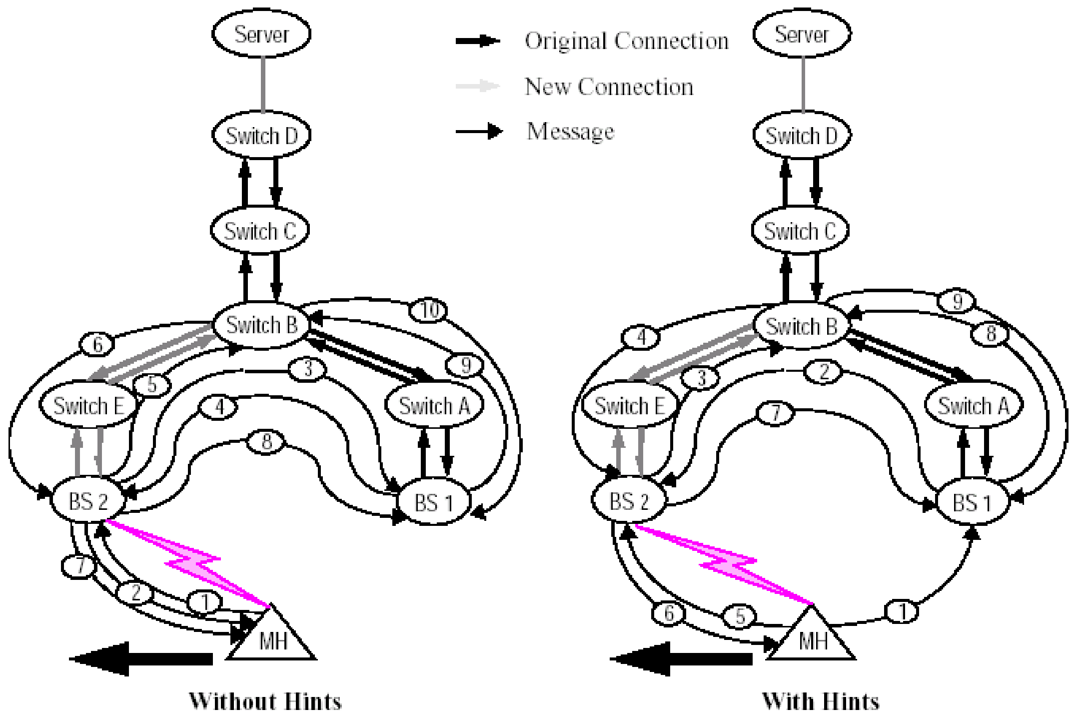

figure 1: Multicast-Based Re-Establishment

3.1 Multicast-Based Re-Establishment without Hints

The "Without Hints" diagram in Figure 1 illustrates the operation of the MB handoff algorithm. The MH detects that it is entering a new cell, so it acquires a wireless channel to the new BS, BS 2, and sends it a greeting message. This message contains an identifier for the old BS, BS 1, as well as a list of the identifiers for the various multicast channels originating or terminating on the MH. BS 2 immediately acknowledges this greeting. BS 2 then sends this channel list to the old BS along the pre-existing BS-to-BS connection, requesting that all data for each channel be forwarded to the new BS. In addition, BS 2 requests that it be allowed to forward data from the MH through BS 1. Upon receipt of an acknowledgment, BS 2 begins transferring forwarded data from BS 1 to the MH and forwarding MH data destined for the server. Concurrently with the forwarding requests, BS 2 executes a multicast join operation (which establishes a new branch connecting BS 2 with the existing channel) for each existing channel to add itself to the multicast channel. Upon receiving an acknowledgment indicating a successful establishment, the new BS notifies the MH of the successful join operation. BS 2 synchronizes the data arriving down the new branch with the data being drained from the old BS. To preserve in-order delivery of the data from the MH to the server, this data must be initially buffered at BS 2 until the data forwarded through BS 1 is drained from the old portion of the connection. When all of the multicast joins have completed and all necessary data have been obtained from the old BS, the new BS sends a completion message to the old BS over the control connection. At this point, BS 1 can assume that it has no more responsibilities to the MH, and so it executes a multicast leave operation for each of the channels associated with the MH. This operation deallocates node resources along the path from the BS to the first node in common with another branch of the multicast channel. The handoff is complete after the last branch has been torn down.

3.2 Multicast-Based Re-Establishment with Hints

The “With Hints” diagram in Figure 1 illustrates the advance setup the network performs in response to the hint and a best case scenario for an ensuing handoff. The hint is delivered as a message to BS 1 identifying the potential new BS, BS 2. BS 1 then notifies BS 2 that it should initiate multicast join operations to all of the MH’s channels in anticipation of a handoff. When the MH loses contact with BS 1 and enters BS 2’s cell, it identifies itself with BS 2 as before . Due to the hint, BS 2 will have already initiated joins for all of the channels associated with the MH. When the joins have been successfully completed, BS 2 notifies the MH and drains any data buffered for the MH. Finally to complete the handoff, BS 2 sends a completion message to BS 1, which then executes a multicast leave operation for each MH channel . Buffering requirements on the BSs are similar to the FR and IR algorithms with hints.

4 *References:*

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