

Dynamic MBS Zone Configuration Mechanism for MCBCS over Mobile WiMAX

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Abstract—The pre-configured MBS permutation zone should not be used for unicast services but only used for MCBCS in the current WiMAX standard. The BS does not have any MS, the BS shall multicast or broadcast MCBCS for macro diversity. This may be caused radio resource waste. To solve the problem, we propose the procedures that MCBCS Controller/Server can configure a dynamic MBS zone with BS information received by ASN-GW. In addition, we define new messages to transfer information which is needed to configure dynamic MBS zone. The proposed approach can be used as a guideline for designing dynamic MBS zone configuration to efficiently utilize air frames of MBS permutation zone.

Keywords—WiMAX, MCBCS, MBS, MBS Zone, Handover

I. INTRODUCTION

Digital television broadcasting service was studying using single frequency networks[1]. Recently, 3GPP MBMS (Multimedia Broadcast/Multicast Service) [2][3] and WiMAX MCBCS [4-6] has been studying to support multimedia broadcast service over mobile communication systems. WiMAX networks with MCBCS shall provide MBS (Multicast Broadcast Service) using MBS zone and MBS MAP for macro diversity or frame-level coordination. The MCBCS data is sent to MSs at the same time and at the same downlink subframe for all BSs belonged to the same MBS zone. The pre-configured MBS permutation zone is used by all BSs belonged to the same MBS zone for MCBCS. The MBS permutation zone should not be used for other services in the current WiMAX standard. However, when the very last MS leaves the MCBCS service in the MBS zone, or moves to other MBS zone, there may be no more MS in the MBS zone. Even though the BS does not have any MS, the BS shall multicast or broadcast MCBCS for macro diversity. This may be caused radio resource waste because the air frames of MBS permutation zone should not be used for other services except for MCBCS.

To solve the problem, we propose the dynamic MBS zone configuration mechanism which allows BS to be dynamically included to the MBS zone. That is, air frames of MBS permutation zone can be used for other services when there is no MS which is not receiving MCBCS data.

This paper is organized as follows. In section II, we briefly introduce network architecture for WiMAX MCBCS. In session III, we propose dynamic MBS zone configuration

mechanism according to an MS handover. Finally, session IV presents the conclusion.

II. NETWORK ARCHITECTURE OF WiMAX MCBCS

Figure 1 shows network architecture of Mobile WiMAX MCBCS. There are mobile station (MS), base station (BS), access service network gateway (ASN-GW), multicast broadcast service controller/server (MCBCS C/S), authentication, authorization, and accounting (AAA) server, and MCBCS content server.

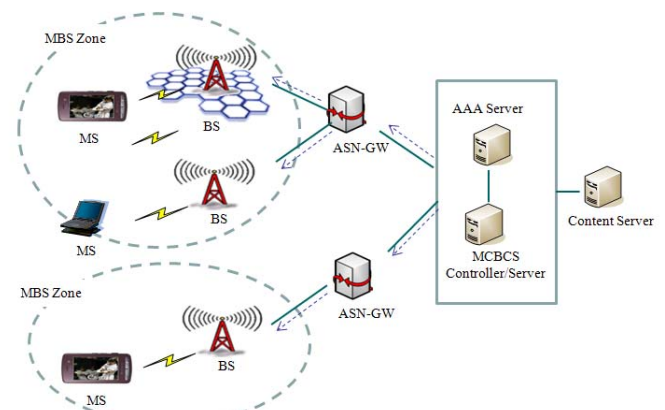


Figure 1. MCBCS Network Architecture

The MCBCS Content server provides the content for MCBCS services and sends contents to the MCBCS C/S. The MCBCS C/S performs MCBCS session control management functions and multicast or broadcast MCBCS contents. The AAA server is responsible for MCBCS authentications, authorizations, and accounting. In the ASN-GW, there are main functions for MCBCS services like the MBS Proxy and the MBS distribution data path function (DPF). The MBS Proxy performs a MBS control plane function and the MBS Distribution DPF performs a MBS data plane function. In case of type 1 for data path bearer, the MBS sync controller may be in ASN-GW and makes MBS synchronization rules and delivers them to the MBS sync executor. In the BS, there are service flow management (SFM) and MBS DPF for MCBCS. The SFM is responsible for interacting with the anchor service flow authorization (SFA) of the ASN-GW to create, modify or delete service flow for a given IP multicast address associating airlink service parameters assignment for an MS using the IEEE 802.16Rev2 based DSx airlink signaling. The MBS DPF

performs MBS bearer control management. The sync executer constructs the MAC PDU and the final PHY burst. The MS is responsible for perform MBS client functions to support the MCBCS service delivery.

III. PROPOSED DYNAMIC MBS ZONE CONFIGURATION MECHANISM

In this paper, the dynamic MBS zone configuration mechanism is designed when an MS moves from the old BS to the new BS in the same ASN-GW or to the new BS in the other ASN-GW.

A. Intra ASN-GW Handover

Figure 2 shows the procedure when an MS moves from the old BS to the new BS in the same ASN-GW.

After finishing the handover preparation phase, the Serving BS receives *MOB_HO_IND* message from the MS and sends *HO_Cnf* message with the service flow information of MBS service to the Target BS. The Target BS also sends *HO_Cnf* message with the additional information such as the MS Info, the Serving BS Info, and the Target BS Info to the control function of the ASN-GW. After the control function of the ASN-GW stores the information, it responses *HO_Ack* message to the Target BS. The Target BS also responses *HO_Ack* message to the Serving BS. The MS sends *RNG-REQ*

message to the Target BS for ranging. The Target BS sends *MS_Attachment_Req* message to the control function of the ASN-GW. To notify the MBS Proxy about the MS movement, the control function shall send *MBS_Ho_Request* message including also the MCBCS Info, MS Info, Serving BS Info, and Target BS Info to the MBS Proxy. If the MBS Proxy receives the new Target BS Info, it also sends *Access_Request* message including those information to the MCBCS C/S so that the MCBCS C/S is able to configure dynamic MBS zone. After processing the dynamic MBS zone configuration algorithm, the MCBCS C/S shall send *Access_Accept* message including updated MCBCS Info (e.g. MBS zone ID). Upon receipt of *Access-Accept* message from the MCBCS C/S, the MBS Proxy function shall send *MBS_Join_Request* message to the MBS Distribution DPF to create the MBS data path. After *Path_Reg_Request/Response* messages are performed between the Target BS and the ASN-GW, the MBS Distribution DPF sends *MBS_Join_Response* message to the MBS Proxy. The MBS Proxy also sends *MBS_HO_Response* message to the control function. The control function sends *MS_Attachment_Response* to the control function of the Target BS including the updated MCBCS Info. The control function of the Target BS responses *MS_Attachment_Ack* message to the control function of the ASN-GW and sends *RNG-RSP* message to the MS including the updated MCBCS Info. To

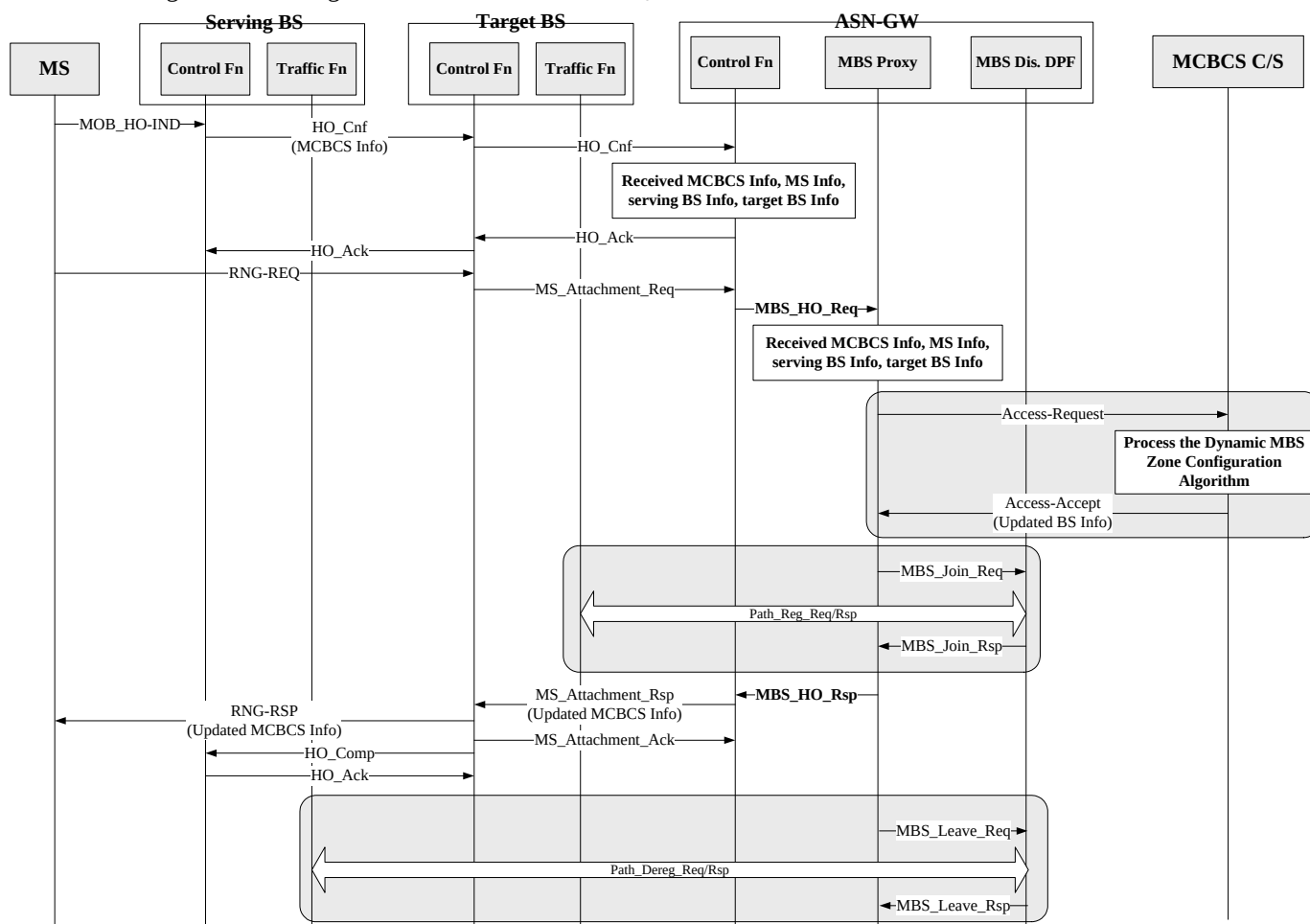


Figure 2. Procedure for Intra ASN-GW Handover

complete the movement of the MS, *HO_Complete/Ack* messages are processed between the Serving BS and the Target BS. The MBS Proxy determines whether the Serving BS is included in the MBS zone or not. If the Serving BS is not included in the MBS zone, the MBS Proxy shall send *MBS_Leave_Request* message to the MBS Distribution DPF to delete the MBS data path. After *Path_Dereg_Request/Response* messages are performed between the Serving BS and the ASN-GW, the MBS Distribution DPF sends *MBS_Leave_Response* message to the MBS Proxy.

B. Inter ASN-GW Handover

Like the Intra ASN-GW handover procedure, the handover messages are processed between the MS, the Serving BS, the Serving ASN-GW, the Target BS, the Target ASN-GW, and MCBCS C/S. The difference between the Intra ASN-GW handover and the Inter ASN-GW handover is that the *MBS_Zone_Leave_Request/Response* messages are processed between the MBS Proxy of the Serving ASN-GW and the MBS Proxy of the Target ASN-GW. These messages are used to inform the Serving ASN-GW that the Serving BS is no longer included in the MBS zone. Upon receipt of *MBS_Zone_Leave_Request* message from the Target ASN-GW, *Path_Dereg_Request/Response* messages are processed between the Serving BS and the Serving ASN-GW to delete the MBS data path.

C. Newly Defined Messages

For the MCBCS C/S to be able to configure the dynamic MBS zone, the MBS Proxy shall send the MS Info, the Serving BS Info, and the Target BS Info to the MCBCS C/S. To deliver these information, it is necessary for us to define new messages. The composition of the newly defined messages is presented in Table 1.

TABLE 1. NEWLY DEFINED MESSAGES

Information Element	MBS_HO_REQUEST	MBS_HO_RESPONSE	MBS_ZONE_LEAVE_REQUEST	MBS_ZONE_LEAVE_RESPONSE
> Failure Indication		O		O
> MCBCS Service Info				
>> MCBCS Transmission Zone ID	O	O	O	O
>> PDFID	O	O	O	O
> Node Info				
>> MSID	O			
>> sBSID	O		O	
>> tBSID	O			

The MCBCS Service Info is included in each message to identify MCBCS service. The Serving BSID and the Target

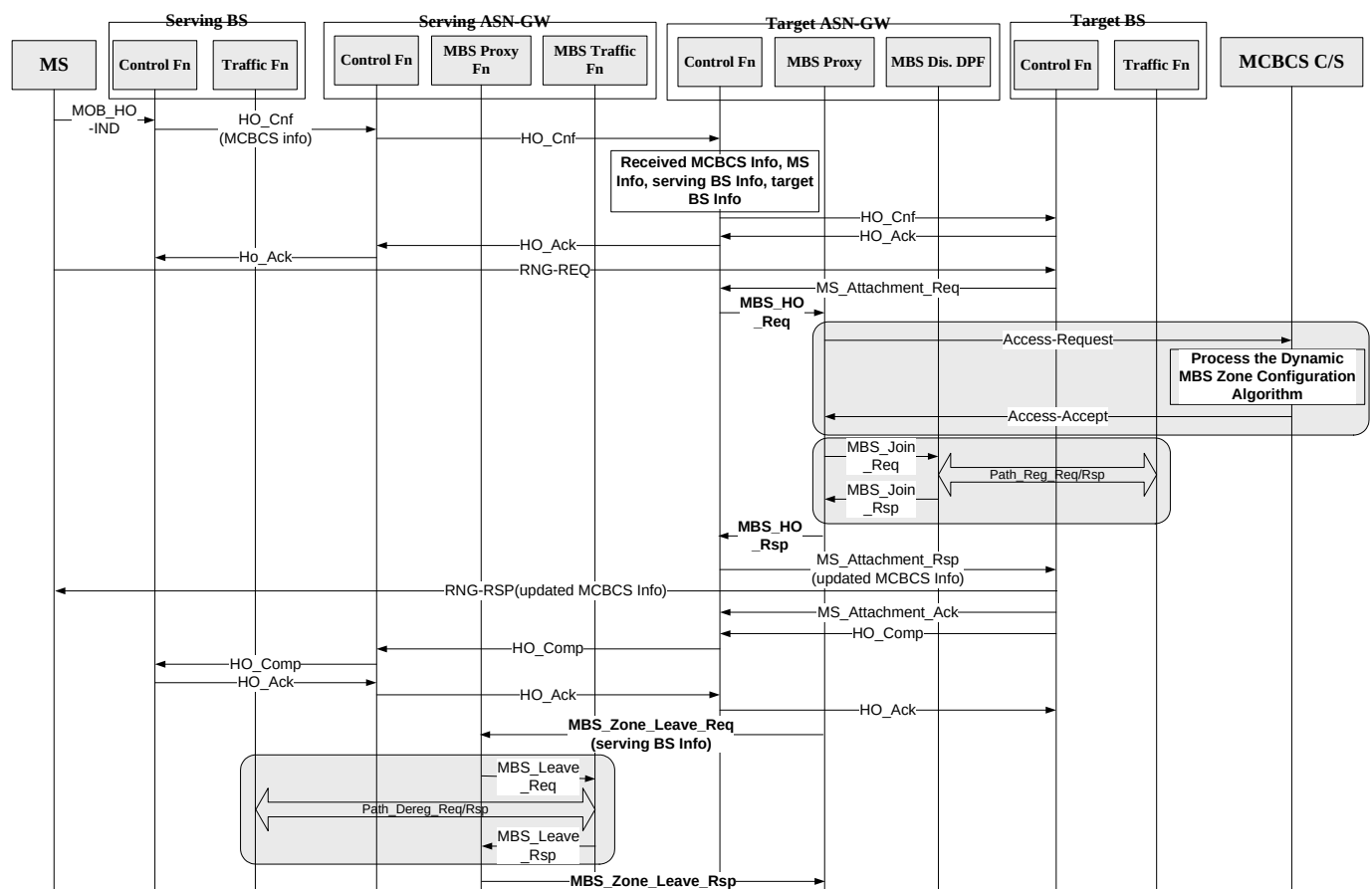


Figure 3. Procedure for Inter ASN-GW Handover

BSID parameters are included in *MBS_HO_Request* message. The only Serving BSID is included in *MBS_Zone_Leave_Request* message to notify the Serving ASN-GW to delete the MBS data path because of no longer included in the MBS zone.

For detailed information on the BS Info, refer to Table 2. If the Serving BS or the Target BS is included in the MBS zone, MBS Zone ID and MCID parameters shall be included in the BS Info.

TABLE 2. DETAILED INFORMATION OF NETWLY DEFINED MESSAGES

Information Element	M/(O)	Comments
BS Info (Serving)	M	
> Serving/Target Indicator	M	Set to Serving
> MBS Zone Indicator	M	0x00 : MBS ZONE NOT INCLUDED 0X01 : MBS ZONE INCLUDED
> MBS Zone ID	CM	If MBS Zone Flag is 0x01, this information element is included
> MCID	CM	
BS Info (Target)	M	
> Serving/Target Indicator	M	Set to Target
> MBS Zone Flag	M	0x00 : MBS ZONE NOT INCLUDED 0X01 : MBS ZONE INCLUDED
> MBS Zone ID	CM	If MBS Zone Flag is 0x01, this information element is included
> MCID	CM	

IV. CONCLUSIONS

In this paper, we presented the scheme to configure a MBS zone which allows BS to be dynamically included to the MBS zone for utilize efficient MBS permutation zone. We proposed the procedure that MCBCS Controller/Server can configure a dynamic MBS zone with BS information received by ASN-GW when an MS handover in intra ASN-GW or inter ASN-GW. Additionally, we newly defined new messages to transfer information which is needed to configure dynamic MBS zone. The proposed approach can be used as a guideline for designing dynamic MBS zone configuration to efficiently utilize air frames of MBS permutation zone.

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