Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	MBS Section Re-organization and clarification
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Re:	This is a contribution to IEEE 802.16e.
Abstract	This contribution describes the proposed changes to Section 6.3.13 in 16e/D5.
Purpose	To remove the unnecessary confusions in 16e/D5.
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Suggested Changes in Section 6.3.13 in TGe/D5

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1. Introduction

This document describes the suggested changes in Section 6.3.13 in TGe/D5.

2. References

[TGe/D5]   IEEE P802.16e/D5, September 2004

3. Rationale

The entire section 6.3.13 needs a re-organization and clarification due to multiple reasons:

a) the current text really mixed up the descriptions for two different types of multicast connections, i.e., single BS and multiple BS;

b) Comparing to the TGd section 6.3.13, the newly added text in TGe is really just for the MBS for multiple BS cases;

c) Support multicast and broadcast services in both single BS case and multiple BS case is optional.

d) The multi-BS-MBS must have a centralized server, multi-BS-MBS server.

4. Proposed Changes

The proposed changes are highlighted in blue below:

6.3.13 ~~Establishment of multicast connections~~ Multicast and Broadcast Services (MBS)

Two types of multicast and broadcast services (MBS) may be supported: single-BS-MBS and multi-BS-MBS. The single-BS-MBS is defined as multicast and broadcast services within one BS, while the multi-BS-MBS is defined as multicast and broadcast services synchronized across multiple BS.

Both single-BS-MBS and multi-BS-MBS are optional.

ARQ is not applicable to either single-BS-MBS or multi-BS-MBS.

6.3.13.1   Single-BS-MBS

The BS may establish a downlink multicast service by creating a connection with each SS to be associated with the service. Any available traffic CID value may be used for the service (i.e. there are no dedicated CIDs for multicast transport connections). ~~For networks of BS employing synchronized transmissions of common multicast data, some traffic CID values may be assigned for the service (.i.e. there may be some dedicated CIDs for multicast transport connections).~~ To ensure proper multicast operation, the CID used for the service is the same for all SSs on the same channel that participate in the connection. ~~To ensure proper multicast operation on networks of BS employing synchronized transmissions of common multicast data, the CID used for the service may be the same for all BS and SSs on the same channel that participate in the connection.~~ The SSs need not be aware that the connection is a multicast connection. The data transmitted on the connection with the given CID shall be received and processed by the MAC of each involved SS. Thus each multicast SDU is transmitted only once per BS channel. Since a multicast connection is associated with a service flow, it is associated with the QoS and traffic parameters for that service flow.

If a downlink multicast connection is to be encrypted, each SS participating in the connection shall have an additional security association (SA), allowing that connection to be encrypted using keys that are independent of those used for other encrypted transmissions between the SSs and the BS.

6.3.13.2   Multi-BS-MBS

~~6.3.13.1 Seamless Multicast and broadcast service across multiple BS(MBS)~~

~~Multicast and broadcast service~~ Multi-BS-MBS is defined as a kind of service that all MSSs successfully registered to the specific multicast and broadcast content on the network level can receive on the cell the encrypted MAC PDUs of the multicast and broadcast content that multiple BSs transmit anywhere under the given time period. It requires the multiple BS to be synchronized in the transmissions of common multicast/broadcast data.

To ensure proper multicast operation on networks of BS employing synchronized transmissions of common multicast data, the CID used for a multi-BS-MBS connection shall be the same for all BS and SSs on the same channel that participate in the connection.

Multicast service synchronized across multiple BS enables an MSS to receive the multicast or broadcast transmission from multiple BS, and thereby improve the reliability of reception. In contrast to ~~normal multicast and broadcast~~ Single-BS-MBS connections, multi-BS-MBS does not require that the MSS be registered to the BS from which it receives the transmission, or to any other BS. To provide seamless multicast and broadcast service over multiple BS, a multi-BS-MBS connection shall use the same CID, and transport the same data in a synchronized manner across the group of BS. A multicast and broadcast zone identifier (MBS_ZONE) is used to indicate the group of BS through which a CID and SA for a broadcast and multicast service flow are valid.

Multi-BS-MBS connections are established like ~~normal multicast~~ single-BS-MBS connections (i.e. when the MSS is registered to a specific BS), but unlike normal multicast connection, they may be maintained by the MSS during IDLE and Sleep mode, or when transitioning to another BS.

Multicast and broadcast service may provide access control against theft of service by enforcing data encryption based on AES-CTR defined in NIST Special Publication 800-38A, FIPS 197. Detail of MBS Security is defined in section ~~7.x.x.x~~ 7.8.1 PKMv2 MBS Security Support.

~~6.3.13.1.1~~ 6.3.13.2.1 Establishment and Maintenance of multicast and broadcast services

Since the MSS in the Idle Mode can receive the multicast and broadcast service on the cell, the connection establishment of multicast and broadcast service between the BS and the MSS should be maintained regardless of the MSS's current mode. That is the connection for the MBS that is not dedicated to the specific MSS and is maintained even though the MSS is either in awake/Sleep Mode or in the Idle Mode. If the MSS receiving MBS enters into the Idle Mode, the MSS continuously maintains the information of MBS connection such as the session context and the security context for the specific MBS and receives the current MBS without any interruption.

Multicast and Broadcast services are associated with Multicast and Broadcast Service Flows. Multicast and Broadcast Service Flows are not dedicated to the specific MSS and are maintained even though the MSS is either in awake/sleep mode or in the idle mode. When an MSS is registered at a BS for receiving Multicast and Broadcast service, Multicast and Broadcast Service Flows shall be instantiated as multicast connections. Data of Multicast and Broadcast Service Flows may be transmitted from BS and received at MSS also regardless of what mode the MSS is currently in. The BS may establish a downlink multicast and broadcast service by creating a Multicast and Broadcast Service Flows when the service commences.

Mapping of Multicast and Broadcast Service Flow IDs to CIDs may be known to all BSs belong to the same Multicast and Broadcast Service Zone.

When the MSS is being registered at BS for receiving Multicast and Broadcast services, it may initiate DSA procedure with respect to Multicast and Broadcast connections to inform the BS that the MSS is a consumer of certain Multicast / Broadcast services. Such knowledge may be used to initiate bi-directional upper layers communication between the MSS and the network for the purpose of configuration of Multicast / Broadcast service. After the successful configuration, the MSS may reuse the same configuration when it moves to another BS without re-configuration.

~~ARQ is not applicable to multicast and broadcast connection associated with Multicast and Broadcast Service Flows..~~

Multicast and Broadcast Service Flows are encrypted at either application layer or MAC layer. Upper layer encryption may be employed to prevent non-authorized access to multicast and broadcast content.

6.3.13.~~1~~ 2.2 Performance enhancement with macro diversity

To increase the receiving performance, MBS transmission in a group of BS may be synchronized. In such case, each BS shall transmit the same PDUs, using the same transmission mechanism (symbol, subchannel, modulation, and etc.) at the same time. The way that multiple BSs accomplish the synchronized transmission (which implies performing functions like classification, fragmentation, scheduling at a centralized point called the MBS Server) is outside the scope of the standard.

6.3.13.~~1~~ 2.3 **Power saving operation**

Power efficient reception of MBS connections is particularly important to MSS in Sleep and IDLE mode. To facilitate that, an MBS MAP IE may be placed in the DL-MAP to points to the location of a dedicated MBS zone in the DL sub-frame (see 8.4.5.3.9). The purpose of this IE is to do the initial direction of the MSS to the MBS zone, and to redirect MSS that lost synchronization with MBS zone back to the MBS zone. Inside the MBS zone a MBS_MAP message is transmitted and

functions like a DL-MAP in the sense that it provides the physical attributes for the connection allocated to the MBS zone. In addition to this functionality, the MBS_MAP provides per each connection the location of the next frame where data will be sent on it.

The BS may notify the number of the frame, which will contain the data for a multicast and broadcast service flow. If MSS knows the frame number that the BS transmits the information in, MSS may not monitor frames except the frame containing the data for the service flow. However, if MSS does not know the frame number, MSS shall continuously monitor frames until it can know the number of the frame containing the data for the service flow.

MSS in idle or sleep mode may only wake up at frames indicated as carrying the MBS connection(s) they are interested in. Since connections on the MBS zone point to future relevant MBS zones, there is no need for an MSS in IDLE or Sleep mode to decode the DL-MAP message unless it losses synchronization with the MBS zone, and has to re-acquire via the MBS MAP_IE.

6.3.13.1 2.4 **Multicast and broadcast zone (MBS_Zone)**

A multicast and broadcast service flow may be transmitted in only a certain region. Also, a different CID or a different SA(Security Association) may be used in a different region for the same multicast and broadcast service flow. A multicast and broadcast zone identifier (MBS_ZONE) is used to indicate a region through which a CID and SA for a broadcast and multicast service flow are valid. If a MSS moves into BSs in the same MBS zone, the MSS does not have to re-establish a connection or a virtual connection to monitor the multicast and broadcast service flow. However, if a MSS moves into a different zone, the MSS may need to re-establish a connection or a virtual connection for the multicast and broadcast service flow.

MBS zone may be associated with a CID for a multicast and broadcast service. Therefore, one BS may have multiple MBS zone identifiers. (see 8.4.5.3.10)