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Re:	802.16m AWD: IEEE 802.16m-09/0012 - "Call for Contributions on Project 802.16m Amendment Working Document (AWD) content" on MAC Handover Procedures
Abstract	This contribution proposes IEEE 802.16m AWD text on intra-16m HO procedure
Purpose	To be discussed and adopted in 802.16m AWD
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Intra-16m Handover Scheme

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1 Introduction

This contribution proposes amendment text on the intra-16m handover procedures for the WirelessMAN-OFDMA Advance System.

2 Text Proposal

================ *Start of Proposed Text* =======================

15.2.x Handover

15.2.x.1 Network Topology Acquisition

15.2.x.1.1 Network Topology Advertisement

An ABS shall broadcast information about the network topology using the AAI_NBR-ADV message. The message provides channel information for neighboring ABSs. An ABS may obtain that information over the backbone network. Availability of this information facilitates AMS synchronization with neighboring ABSs by removing the need to monitor SFH transmission from the neighboring ABS. Information of neighbor femtocells is not included in AAI-NBR-ADV.

15.2.x.1.2 Scanning

The scanning procedure provides the opportunity for the AMS to perform measurement of the neighboring cells for handover decision. The AMS may use any unavailable intervals, termed as scanning interval, assigned by the serving ABS to perform scanning. The AMS may request an allocation of a scanning interval by sending an AAI_SCN-REQ. The ABS may request AMS to perform scanning by sending an AAI_SCN-RSP without AMS's request. The AMS may perform scanning procedure without interrupting its communication with the serving ABS if the AMS supports multi-carrier or in the case of inter-frequency handover.

AMS selects the scanning candidate ABSs by information obtained from the ABS (e.g., via AAI_NBR-ADV or AAI_SCN-RSP) or information cached in the AMS. The AMS measures the selected scanning candidate ABSs and reports the measurement result back to the serving ABS using AAI_SCN-REP message. The measurements may be used by the MS or the network to determine the correct target BS for the MS to handover to.

15.2.x.2 Handover Process

Handover may be initiated by an AMS or a serving ABS. An AMS may maintain communication with the serving SBS while performing network reentry in the target ABS or stops communication with the serving ABS

before performing network entry in the target ABS. This section describes the different procedures during the HO process. A generic call flow for handover process is illustrated in figure x.
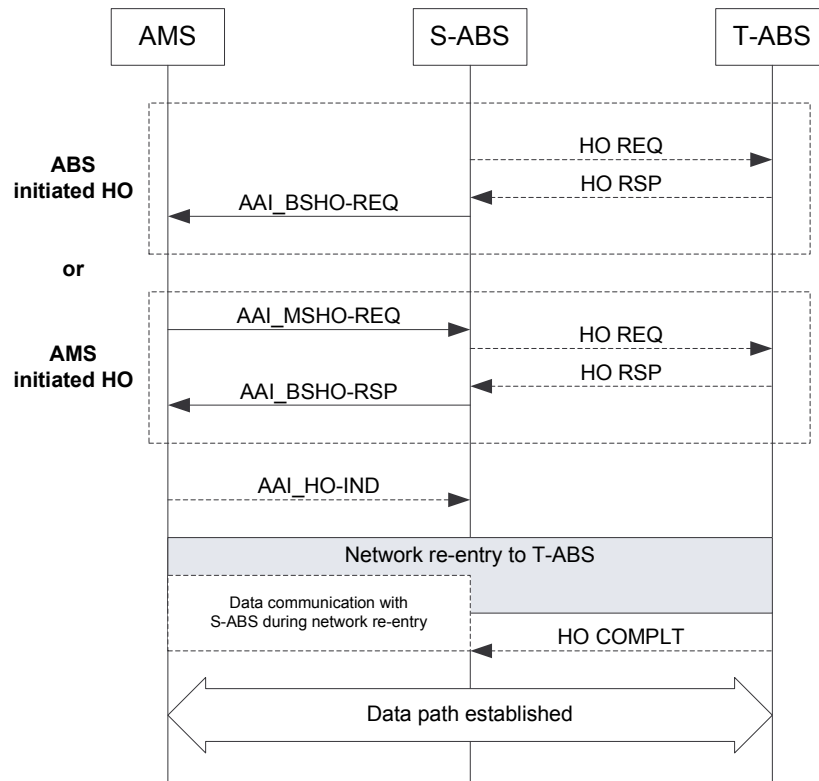

Figure x – Generic Call Flow for HO Process

15.2.x.2.1 Cell Reselection

The AMS uses information obtained from an AAI_NBR-ADV message to give insight into available neighbor ABSs for cell reselection consideration. The serving ABS may schedule scanning intervals or sleep intervals to conduct cell reselection activity. Such a procedure does not involve termination of existing connection to a serving ABS.

15.2.x.2.2 HO Initiation

Handover procedure may be initiated by either AMS or ABS. An AMS may initiate a handover by sending an AAI_MSHO-REQ message to the serving ABS when the triggers and conditions defined by the ABS have been reached. The serving ABS may also initiate a handover by sending an AAI_BSHO-REQ message to the AMS when HO triggers and conditions (e.g., MS measure report, load balancing requirement) are met.

During handover initiation, the AMS or ABS indicates whether the AMS maintains communication with the serving ABS while performing network reentry with the target ABS by setting the HO_Reentry_Mode in the AAI_MSHO-REQ or AAI_BSHO-REQ. If the AMS doesn't maintain communication with the serving ABS while performing network reentry in the target ABS, the HO_Reentry_Mode is set to 0; otherwise, it is set to 1.

If an AMS that transmitted a AAI_MSHO-REQ message detects an incoming AAI_BSHO-REQ message before the AMS_handover_retransmission_timer expires, it shall follow the request in the AAI_BSHO-REQ message.

An ABS that transmitted an AAI_BSHO-REQ message and detects an incoming AAI_MSHO-REQ message from the same AMS shall ignore the AAI_MSHO-REQ.

When handover is initiated by an AMS, the AMS may indicate one or more possible target ABS in AAI_MSHO-REQ. When handover is initiated by an ABS, the ABS may indicate one or more possible target ABSs in the AAI_BSHO-REQ. The AMS may evaluate possible target ABS(s) through previously performed scanning activity.

15.2.x.2.3 HO Preparation

In the AMS initiated HO case, the ABS starts HO preparation after receiving AAI_MSHO-REQ. In the ABS initiated HO case, the ABS performs HO preparation before sending AAI_BSHO-REQ. During HO preparation phase, the serving ABS communicates with target ABS(s) selected for HO. The target ABS may obtain AMS information from the serving ABS via backbone network for HO optimization. If ranging with target ABS is not performed prior to or during HO preparation, a dedicated ranging sequence or a dedicated UL resource at target ABS is reserved for the AMS to facilitate non-contention-based HO ranging. A new STID and a nonce used to derive the new TEK is provided from the target ABS to the serving ABS. The serving ABS provides the dedicated ranging sequence or UL resource, new STID and nonce to the AMS in AAI_BSHO-REQ/RSP.

If the serving ABS decides that the AMS shall maintain communication with the serving ABS while performing network reentry procedures with the target ABS, the serving ABS shall set the HO_Reentry_Mode to be 1 and negotiate with the target ABS the HO_Reentry parameters. In the single carrier case, the HO_Reentry parameters include the unavailable interval information (i.e., HO_Reenry_Interval) used in serving ABS for the AMS to communicate with the serving ABS. In the multi-carrier case, the HO_Reentry parameters include the carrier information in the target ABS for the AMS perform network reentry while continuing communication with the serving ABS concurrently.

When only one target ABS is included in the AAI_BSHO-REQ/RSP, the HO preparation phase completes when serving ABS informs the AMS of its handover decision. When multiple target ABSs are included in the AAI_BSHO-REQ/RSP, the HO preparation phase completes when the AMS informs the ABS of its target ABS selection via HO-IND message.

15.2.x.2.4 HO Execution

The AAI_BSHO-REQ/RSP message shall include an action time for the AMS to start network re-entry at each target ABS. If the HO_Reentry_Mode is set to 0, the MOB_BSHO-REQ/RSP message shall also include a disconnect time, which indicates when the serving ABS will stop sending downlink data and stop providing any regularly scheduled unsolicited uplink allocations for the AMS. After receiving AAI_BSHO-REQ/RSP, the AMS may initiate HO execution. If AAI_BSHO-REQ/RSP message includes more than one target ABSs, the AMS selects one of these targets and informs the S-ABS of its selection by sending an AAI_HO-IND message to the S-ABS before the expiration of disconnect time. Before the action time specified in the AAI_BSHO-REQ/RSP, the AMS shall initiate network re-entry at the target ABS.

If HO_Reentry_Mode is set to 0, the serving ABS stops sending downlink data and stop providing any regularly scheduled unsolicited uplink allocations for the AMS at disconnect time. After receiving MOB_HO-IND message or upon expiration of disconnect time, the ABS shall start the Resource_Retain_Time, and retain the connections, MAC state machine, and MPDUs associated with the AMS for service continuation until the expiration of the Resource_Retain_Time or notification of handover completion from the target ABS.

If HO_Reentry_Mode is set to 1 and the AMS is in the single carrier mode, the AMS performs network re-entry with the target ABS during HO_Reentry_Interval, while communicating with the serving ABS during the remaining time. However AMS cannot exchange data with target ABS prior to completion of network re-entry. The serving ABS stops sending downlink data and stop providing any regularly scheduled unsolicited uplink allocations for the AMS when the target ABS informs the serving ABS that the network reentry at target ABS completes.

15.2.x.2.5 HO Cancellation

After an AMS or ABS has initiated an HO using either AAI_MSHO-REQ or AAI_BSHO-REQ message, the AMS may cancel HO at any time. The cancellation shall be made through transmission of an AAI_HO-IND message that signals the HO cancel option (HO_IND_type = 0b01).

If HO_Reentry_Mode is set to 0, when the serving ABS receives the AAI_HO-IND message with HO cancel option before the expiration of Resource_Retain_Time, the serving ABS should acknowledge to the AMS by sending an unsolicited uplink grant. When AMS transmits and serving ABS receives AAI_HO-IND message with the HO cancel option (HO_IND_type = 0b01) during Resource_Retain_Time, regardless of AMS attempt at HO, the AMS and serving ABS shall resume normal operation communication.

If HO_Reentry_Mode is set to 1, when the serving ABS receives the AAI_HO-IND message with HO cancel option, it continues sending downlink data and providing uplink allocations to the AMS.

If the AMS detects the loss of AAI_HO-IND message, the AMS may react as being dropped during HO and apply the procedures specified in section 15.2.x.2.6.

15.2.x.2.6 Drops during Handover

An AMS may detect a drop by its failure to demodulate the DL, or by exceeding the AAI_RNG-REQ retries limit allowed for the initial/HO ranging mechanism. An ABS can detect a drop when the Number of retries limit allowed on inviting ranging requests for the initial/HO ranging mechanism is exceeded.

When the AMS has detected a drop during network reentry with a target ABS, it may attempt network reentry with its preferred target ABS as through Cell Reselection (see 15.2.x.2.1), which may include resuming communication with the serving ABS by sending AAI_HO-IND message with HO_IND type = 0b01 (HO cancel) or performing network reentry at the serving ABS.

The network reentry process at the serving ABS is the same as the network reentry process at any other target ABS, both for the serving ABS and for the AMS. If the serving ABS has discarded the AMS context, the network reentry procedure shall be the same as full network reentry.

15.2.x.2.7 Network Reentry

After DL synchronization with the target ABS, the AMS initiates network reentry. If a dedicated ranging sequence is pre-allocated from the target ABS and provided to the AMS in AAI_BSHO-REQ/RSP, the AMS may use the dedicated ranging sequence to perform initial ranging before the HO_Ranging_Deadline. Upon receiving the dedicated ranging sequence, the target ABS directly allocates UL resources for the correspondent AMS to send AAI_RNG-REQ. If the target ABS doesn't receive the pre-allocated dedicated ranging sequence before the HO_Ranging_Deadline, the target ABS shall release the dedicated ranging sequence as well as the

dedicated STID if pre-allocated during handover preparation phase.

Upon receiving the UL resource, the AMS may send a AAI_RNG-REQ using the STID if it is pre-allocated by the target ABS during handover preparation. The FIDs used for the management and transport connections remain the same as in the serving ABS. The RNG-REQ shall include the Key_Count for UL which is used to derive the TEK. The remaining network reentry procedures follow the procedures defined in section 6.3.21.2.7.

=============================== *End of Proposed Text* ===============