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Re:	IEEE 802.16m-09/0012: Call for Contributions on Project 802.16m Amendment Working Document (AWD) Content
Abstract	This contribution proposes text for the handover section of the 802.16m amendment document
Purpose	For discussion and adoption by TGm
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Topology Acquisition for Optimized Handover in IEEE 802.16m

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Introduction

Text Proposal

----------Start of the text proposal ----------

10.3.1 Topology acquisition

10.3.1.1 Network topology advertisement

An ABS periodically broadcasts the system information of the neighboring ABSs using Neighbor Advertisement (NBR-ADV) message. The ABS formats NBR-ADV message based on the cell types of neighbor cells, in order to achieve overhead reduction and facilitate scanning priority for AMS. NBR-ADV message does not include information of neighbor private CSG femto cells. Special handling of neighbor information of CSG femto cell is described in section 10.3.3 4. A serving ABS may unicast the NBR-ADV message to an AMS.

The NBR-ADV message sorts neighbor BSs(RSs) according to their deployment type, which is categorized by the following parameters,

1. BS type (macro, femto, relay, TBD)
2. carrier frequency
3. TDD/FDD and related definitions (expected to be the same given carrier frequency)
4. BW,

Such that it is expected that other parameters will likely remain the same across BSs within the same deployment type.

To reduce broadcast overhead, the BS may broadcast only the TBD minimal subset system configuration information of its neighbors, as shown in Table 1, which includes

- Parameters that facilitate scanning and scanning report
- Parameters required for HO decision
- Parameters needed to perform network re-entry operations such as ranging
- Basic PHY parameters required for communications.
- Shall not include those that are unrelated to above operations (such as trigger actions definitions that are only used for HO out of the TBS)

Within each deployment type, configuration parameters are classified into common parameters and cell-specific parameters. In NBR-ADV broadcast, a typical cell is chosen for each cell type so that other entries in the same cell type only requires delta information for overhead reduction. The BS can adaptively broadcast common part

and unique part at different frequencies for overhead reduction.

Index		
	BS-ID	
	BS MAC address	
Cell/deployment type shared parameters		//a cell type is defined by [freq, BS type, MAC version] Duplexing mode is associated with freq and spectrum
	Carrier frequency	
	[BW]	Not needed if broadcast in SSCH
	BS type	
	MAC protocol revision	Shall indicate all supported mode!
	TDD/FDD	
	TTG**	
	RTG**	
	DL/UL ratio**	
Cell specific parameters		
	BS EIRP	
	MS TX Power limit	
	Available DL/UL resource	
	UL permutation config	
	DL permutation config	
	FFR partition for DL	
	FFR partition for UL	
	DL burst profile	Maybe only a subset
	UL burst profile	Maybe only a subset
	BCH change count	
	HO ranging code configuration	
	Multi-carrier related	
[Data communication related]		
	[HARQ configurations]	
	[Uplink control region configurations]	

** applicable to TDD deployment only

Table 1 Min set of system configuration broadcast in NBR-ADV

A framework of NBR-ADV message format is shown in Table 2.

NBR-ADV message format () {	
Message type	
Min set info //control TLV	
For cell-type = 0:m-1{	//Start loop for min subset of system config broadcast
cell/deployment common parameters	
n recommended	
For i=0:n-1 {	
BS index	
For j=0:num_subpkt -1 {	
Subpkt index	//non-shown subpkts are treated as omitted
Control bitmap	0: same 1: specified
cell specific parameters indexed by bitmap	
}	
Additional shared TLV	
}	
}	

Table 2 NBR-ADV message format

The NBR-ADV message shall indicate the total number of neighbor macro-cells it includes, and the fragment information if it is broadcast in different fragments separately.

If the T-ABS has a MAC version higher than IEEE 802.16m rev.1, in its entry of NBR-ADV, a TLV shall include a TBD bitmap explicitly signaling the MAC versions it concurrently supports in mixed mode. If AMS only reads the MAC version of a neighbor BS that is higher than its own, the AMS shall ignore this BS for scanning.

Inter-RAT neighbor advertisement shall be a separate broadcast message, defined in Section NNN.

10.3.1.2 Scanning procedure

The scanning procedure provides the opportunity for the AMS to perform measurement of the neighboring cells for handover decision. Scanning is triggered by

1. AMS initiation when serving ABS channel quality is below certain threshold or based on other TBD triggers

2. ABS initiation when serving ABS directs AMS to perform scanning via scanning control signaling [or unicast NBR-ADV]
3. MS autonomous scanning without signaling with ABS

During scanning, the AMS detects a T-ABS's PSCH/SSCH, measures its signal quality and obtain system configuration information carried in P-SCH/S-SCH. The AMS may obtain additional system configuration parameters in T-ABS's BCH broadcast if it does not receive those from NBR-ADV. The AMS shall not attempt to perform any uplink transmission or any type of association in a T-ABS during scanning procedure.

In case of intra-frequency scanning, the AMS may use any unavailable intervals assigned by the serving ABS to perform scanning. The AMS shall ensure that its UAI is sufficient for scanning. Otherwise, the AMS explicitly negotiate scanning gap with serving ABS. When MS only performs measurement on P-SCH/S-SCH, the AMS may do so without negotiating scanning gap while maintaining normal communication with the serving ABS.

In the case of inter-frequency scanning, the AMS may use any unavailable intervals assigned by the serving ABS to perform scanning. The AMS shall ensure that its UAI is sufficient for scanning. Otherwise, the AMS explicitly negotiate scanning gap with serving ABS. In addition, the AMS may perform scanning procedure without scanning gap while maintaining its communication with the serving ABS if the AMS supports the capability of dual RF operation.

AMS selects the scanning candidate ABSs by information obtained from the ABS including (unicast or broadcast) NBR-ADV message and ranging control signaling (TBD); or overlay femtocell information cached in the AMS. The measurements may be used by the MS or the network to determine the correct target BS for the MS to handover to. The measurements in the Advanced WirelessMAN-OFDMA Interface include the measurements specified as part of the WirelessMAN-OFDMA system as well as any other measurements defined in the Advanced WirelessMAN-OFDMA Interface.

The ABS or AMS may prioritize the neighbor ABSs to be scanned based on various metrics, such as cell type, loading, current RSSI in serving BS and location. The serving ABS may provide prioritization guidelines in trigger/action information in BCH broadcast.

AMS measures the selected scanning candidate ABSs and reports the measurement result back to the serving ABS. The serving ABS defines triggering conditions and rules for AMS sending scanning report. The AMS keeps the scanning results for a T-ABS if the measurement or system configuration satisfies the trigger defined by its S-ABS. Triggers may include

- Keep all scanning results
- channel measurement exceeds the threshold
- channel measurement difference relative to the serving ABS exceeds the hysteresis margin
- Load balancing based criteria

10.3.2 Handover Process

10.3.2.1 HO Framework

The handover procedures are divided into three phases, namely, HO initiation, HO preparation and HO

execution. When HO execution is complete, the AMS is ready to perform Network re-entry procedures at target ABS. In addition, HO cancellation procedure is defined to allow AMS cancel a HO procedure.

With proper network topology acquisition, an optimized HO call flow is shown in Figure 16. The network operation is informative. Some of the following steps may be optional.

1. The AMS initiates a HO by sending an HO initiation MSHO-REQ message to the serving ABS (S-ABS).
2. [NWG] S-ABS sends HO REQUEST to one or more target BS (T-ABS)
3. [NWG] T-ABSs reply S-ABS with HO RESPONSE, which may include HO optimization related MAC pre-update information.
4. In case of MS-initiated HO, the S-ABS responds to the HO initiation message by sending an HO command BSHO-CMD message to the AMS. In case of BS-initiated HO, the S-ABS sends an unsolicited HO Command BSHO-CMD message to the AMS without Step-1. In both cases (HO initiated by AMS or S-ABS) the HO command message shall include one or more target ABSs (T-ABSs).
   If the HO-CMD message includes only one target ABS, the AMS should execute the HO as directed by the ABS. If the AMS is unable to maintain communication with the S-ABS until the expiration of disconnect time (defined in section 10.3.2.2.2), it may send a HO indication message to the S-ABS before the expiration of disconnect time. The S-ABS stops sending DL data and providing UL allocations to the MS after expiration of the disconnect time or after reception of HO-IND.
   If the HO-CMD 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 HO-IND message to the S-ABS before the expiration of disconnect time.
5. [NWG] Upon the disconnect time, the S-ABS sends HO CONFIRMATION to the T-ABS and may trigger subsequent data path switching.
6. Starting from the defined action time, MS performs HO ranging at T-ABS in dedicated opportunity or earliest ranging channel allocation by sending a HO ranging code in T-ABS's ranging channel for unsynchronized users.
7. Upon successful reception of HO ranging code, if uplink synchronization is required, T-ABS signal the MS to adjust its timing/frequency/power to achieve uplink synchronization.
8. T-ABS and MS continue data communication.
9. T-ABS and MS perform additional RNG-RSP/REQ transactions before the predefined timer, which also serves the purpose of mutual authentication between ABS and AMS.

AMS may skip step 5 and 6 when the network determines the AMS's synchronization with T-ABS is sufficient and CDMA ranging and synchronization will be omitted.

AMS may also maintain communication with serving ABS while performing network re-entry at target ABS as directed by serving ABS. Such capability is negotiated between MS and S-ABS and S-ABS assigns the DISCONNECTION TIMER sufficient for MS's network re-entry at T-ABS. In this case, Step-5 happens after Step 6 and 7.

In the optimized handover case shown in Figure 16, the service interruption time during handover starts from disconnection time (step-5); ends at either the completion of synchronization or data path switching, whichever comes last.

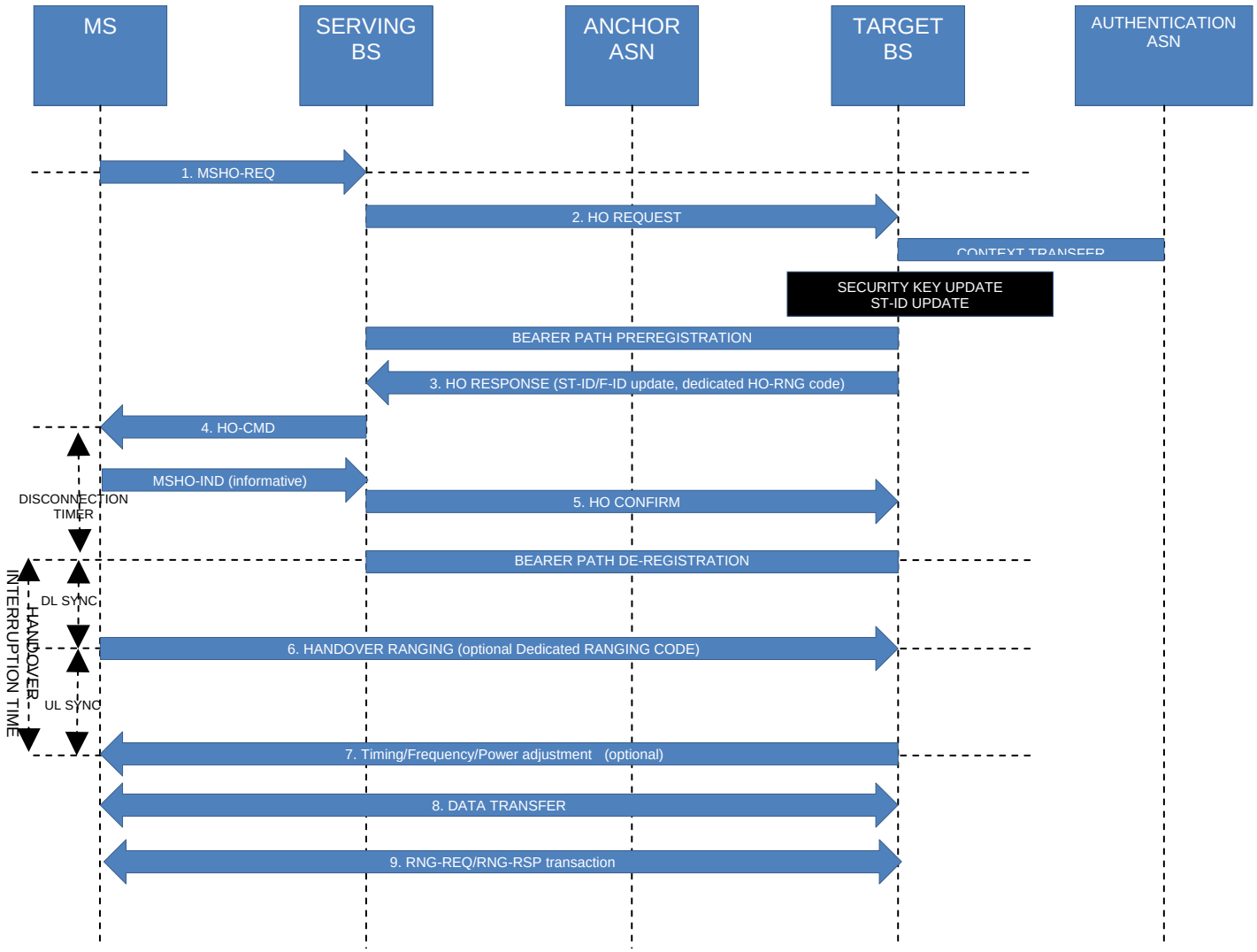

Figure 16 A general call flow for seamless HO

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