Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Handover Optimization**
Date Submitted	**2007-11-04**
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Re:	In response to LB26
Abstract	This contribution proposed bandwidth efficient HO optimization procedure to reduce HO interruption time.
Purpose	Accept the proposed specification changes on IEEE P802.16Rev2/D1.
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Handover Optimization

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Introduction

In IEEE 802.16e-2005, different types of Handovers are defined: 1) Hard Handover 2) FBSS and 3) MDHO. Hard Handover is the simplest type of HO where MS disconnects from the serving BS and reconnects at the target BS. MAC Management messages are used to perform the BS switching. This process creates interruption for data transmission. Current specification defines many optimizations in order to reduce the HO interruption time. Even with all the HO optimization features for Hard Handover like

- Complete MS context transfer from Serving BS to Target BS
- Use of association levels for neighbor scanning
- Use of action time and dedicated allocation at the target BS using fast_ranging_IE

TargetBS and MS is still required to exchange RNG-REQ and RNG-RSP messages to complete the MS network entry and allocate new CIDs. Therefore, HO interruption time still could be higher. Figure 1 shows the full-optimized HO procedure as defined in IEEE 802.16e-2005.

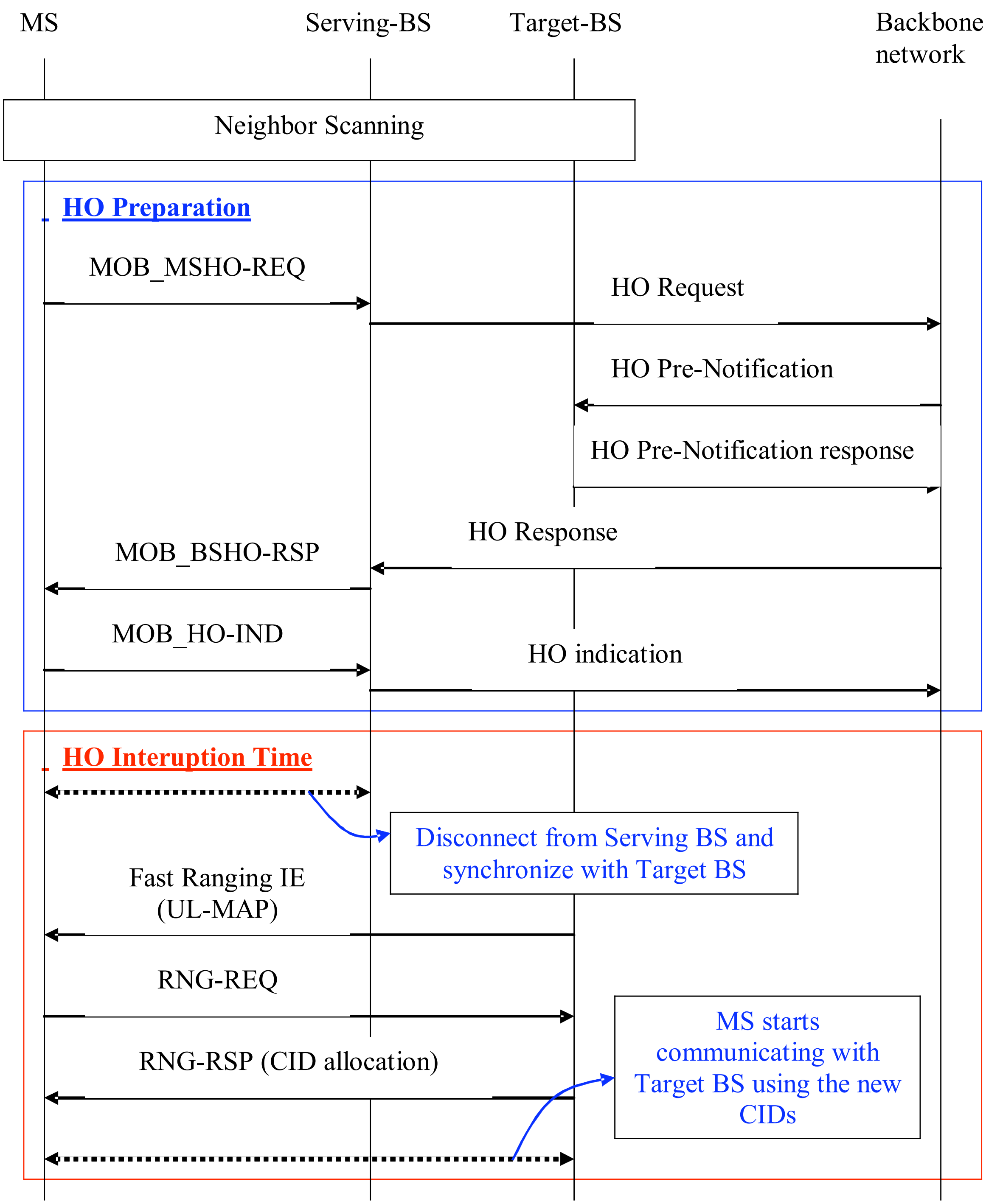

Figure 1: Fully optimized Handover procedure

This contribution proposed bandwidth efficient HO optimization procedure to reduce HO interruption time.

Proposed Remedy

This contribution proposes to remove the exchange of RNG-REQ and RNG-RSP messages during the network re-entry when HO is fully optimized and action time and fast_ranging_IE are used. We propose performing

CID update for Basic CID through fast_ranging_IE and implicit CID mapping for remaining CIDs i.e primary, secondary and transport CIDs. Figure 2 described the message flow for the proposed scheme.

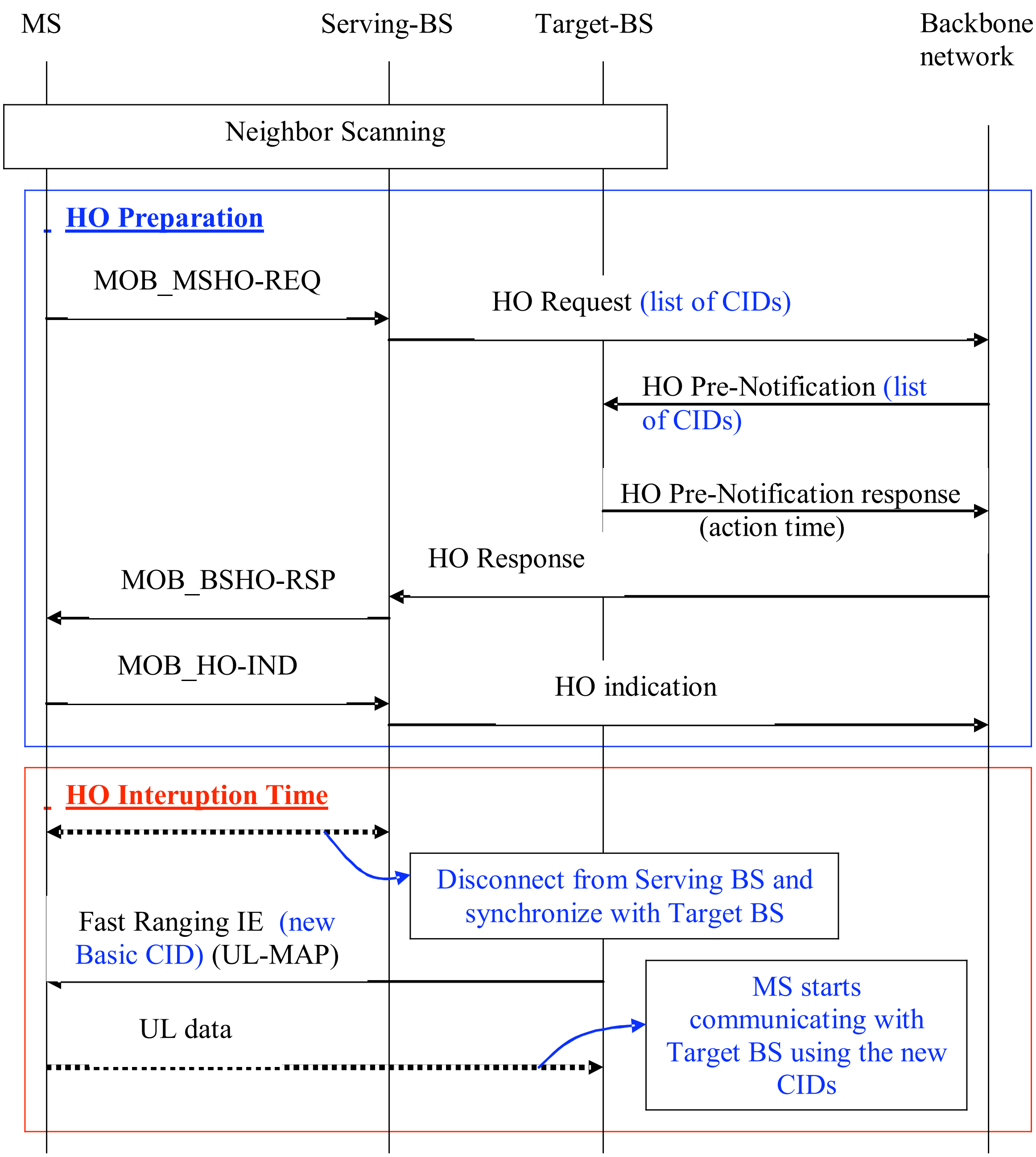

Figure 2: proposed Handover enhancement for Latency and overhead reduction

The proposed scheme is explained below:

- BS allocates contiguous range of CIDs to MS.
  - 16 bits CID is split into 12 bit and 4 bit region. That will give 16 CIDs for MS. First, second and third CIDs represents Basic, primiary and secondary CIDs and remaining CIDs are transport CIDs. BS allocate transport CID from the MS CID range. Basic CID consists of 12 bits + 4 bits

(which is all zeros).

- Basic CID allocation during Handover procedure
    - For a faster handover, Fast Ranging IE is sent anyway from the BS
    - Serving BS transfers the old CIDs along with the MS service flow context to Target BS.
    - Modify Fast Ranging IE to include 12 bit Basic CID assigned by the target BS.
        - Use reserved bits in the Fast Ranging IE to indicate the presence of the new CIDs for REV2 capable MS
        - When target BS does not receive the response in the allocation given by Fast_ranging_IE. Target BS can de-allocate CIDs. No additional timer or message is required.
- Implicit CID mapping
    - When MS receives the new Basic CID, it maps the other CIDs according to the offset it has with old Basic CID. Please see figure 3 for example.
- When MS receives the UL allocation using Fast_ranging_IE, MS start UL transmission using new CIDs allocated by fast_ranging_IE.
    - If MS has UL data to send, MS transmits encrypted UL data. The targetBS validates the MS identity when decryption of UL data is successful.
    - If MS does not have UL data to send or encryption is off, it sends the extended sub-header (defined in spec change section) that contain the HMAC/CMAC tuple. MS generates the HMAC/CMAC tuple on the MAC address and send only the HMAC/CMAC tuple in the extended sub-header.

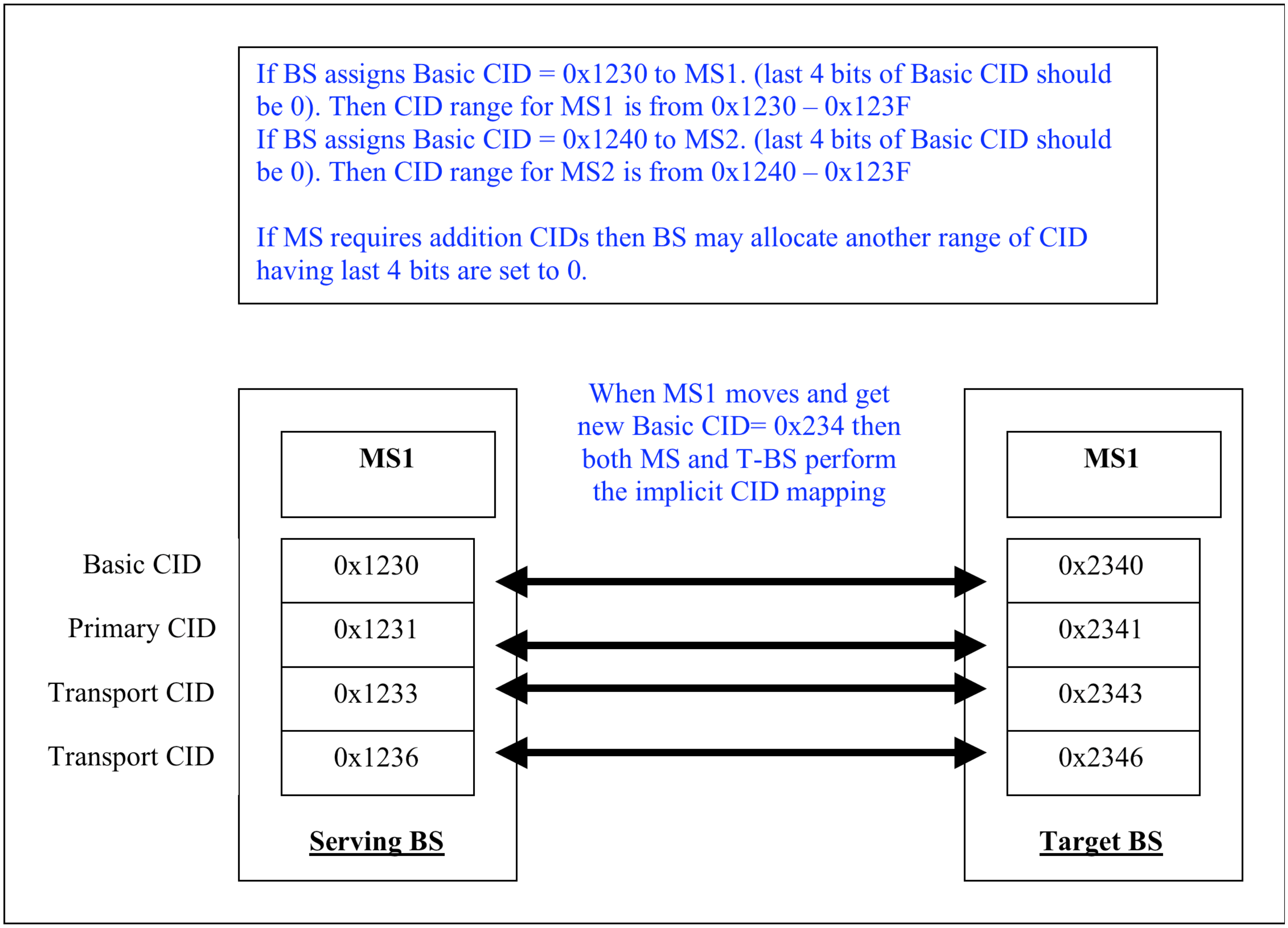

Figure 3: Implicit CID mapping

Advantages:

- No need to assign CIDs except Basic CID, therefore CID update TLV is not required.
- No CID pre-allocation is required therefore reduces the size of HO messages,
- Propose to remove RNG-REQ and RNG-RSP messages therefore reduce the number of messages exchanges and increase the HO success probabilities.
- Reduced Overhead and HO latency.
- Basic CID is assigned using Fast_ranging IE therefore more reliable.
- No timer or message is required to de-allocate the CIDs if MS is not handing over to target BS.

Spec Changes

[Insert the following para on Page 47 line 41 as shown below]

Implicit CID allocation may be done for each MS as shown in Table 598. An MS is assigned a basic CID, which serves as an index for allocating primary, secondary and transport CID. For example, if an MS is assigned a Basic=0x1000, then its primary CID, secondary and transport CID range will be 0x1001, 0x1002-0x100F.

[Change the following text on Page 77 line 53 (Table 480) as shown below]

Table 480— Description of extended subheaders types (UL)

Syntax	**Name**	**Extended subheader body size**	**Description**
5	Authentication code extended subheader	variable	See 6.3.2.2.7.9
6~~5~~-127	Reserved	-	-

[Insert the following para on Page 81 line 26 as shown below]

6.3.2.2.7.9 Authentication Code extended subheader

This subheader is sent from the MS containing CMAC/HMAC tuple as in Table 601/603. The CMAC/HMAC digest is calculated over the MAC address.

[Insert the following para on Page 474 line 55 as shown below]

If all the MS service and operational context information are obtained over the backbone network, including CIDs, the target BS may skip all the re-entry management messages including RNG-RSP. The target BS may send new basic CID to the MS in the Fast_Ranging_IE (see 8.4.5.4.21). Using implicit CID allocation, the MS and target BS shall determine the primary and secondary/transport CIDs for the MS. If the target BS can allocate the same basic CID as was on the serving BS, it may not send new CID in the Fast_Ranging_IE. The MS shall skip sending RNG-REQ and send encrypted data in the allocation provided by the Fast Ranging IE. The ciphertext message authentication code (7.5.1.2) provides authentication of the MS. If the MS doesn't have any data, it sends authentication code extended subheader (6.3.2.2.7.9).

[Change the table 598 on Page 1144 as shown below]

Table 598 – CIDs

Transport; Secondary Management	2m+1 – n~~0xFE9F~~	For the secondary management connection, the same value is assigned to both the DL and UL connection.
Implicit CIDs	n – 0xFE9F	This range is used for implicit CID allocation. MS is assigned a Basic CID that serves as an index for allocating other CIDs.

[Change table 480 on Page 916 line 4 as shown below]

Table 480—OFDMA Fast Ranging IE format

Syntax	Size (bit)	Notes
Fast_Ranging_IE() {		
Extended UIUC	4	Fast_Ranging_IE() = 0x09
Length	4	
HO ID indicator	1	0: MAC Address is present 1: HO ID is present
Basic CID Included	1	0: Basic CID is not included 1: Basic CID is included
Reserved	67	Shall be set to zero
if (HO ID indicator == 1) {		
HO ID	8	
} else {		
MAC address	48	MS MAC address as provided on the RNG-REQ mes-sage on initial system entry
}		
UIUC	4	UIUC ≠ 15. A four-bit code used to define the type of UL access and the burst type associated with that access.
Duration	10	In OFDMA slots (see 8.4.3.1)
Repetition coding indication	2	0b00: No repetition coding 0b01: Repetition coding of 2 used 0b10: Repetition coding of 4 used 0b11: Repetition coding of 6 used
If (Basic CID Included ==1) {		
Basic CID	12	
}		

[Change the table in 11.7.25 (Page 1208, line 33) as shown below]

		Bit 19: Authtentication code extended subheader Bits 1920–23: Reserved	