Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Enhanced Handover Mechanism in IEEE P802.16e/D2-2004**
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Re:	Call for inputs for the Handoff Ad-hoc group
Abstract	This contribution describes Enhanced MBB Handover in IEEE P802.16e/D2-2004 by letting the MSS actively manage its session information stored at the BS.
Purpose	Handoff Ad Hoc draft proposal for the IEEE802.16e group.
Notice	
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Patent Policy and Procedures	

Enhancing an MBB Handover Mechanism in IEEE P802.16e/D2-2004

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1. Introduction

As per the current IEEE 802.16 standard, the handover procedures necessitate many message exchanges, which results in unbearably long delay for an MSS to change its serving BS. This contribution presents two ways to reduce the latency: an enhanced MBB handover procedure and a reduced handover network re-entry one.

The IEEE 802.16e/D2 draft defines that a *'make before break'* (MBB) handover is performed if and only if the old serving BS of an MSS keeps its session information by the reception of a handover completion backbone message (I-am-host-of message) from the target BS. Although the handover network re-entry procedure is completed, the MSS may still trigger the handover back to the former serving BS since it may stay around the cell boundary. Hence, for the MSS to indicate the former serving BS to purge the session information, the release signal given by the MSS which can measure the channel quality is more appropriate than the handover completion backbone message. This contribution presents the modified MOB-HO-IND message so that the MSS can indicate the former serving BS to purge the MSS information through the current serving BS, and it describes the MBB HO scenario using the message.

2. Proposed Enhanced MBB Handover Mechanism

2.1 Operation Scenario

While an MSS is connected, it knows its neighboring BS through its serving BS NBR-ADV broadcast message. When a certain condition is met, the MSS may want to make a handover to other BS. Then, it transmits MOB-HO-REQ with a list of preferred BS to which it wants to hand over. Then, its serving BS communicates and negotiates with the listed BS over the backbone. Based on the result of the negotiation, the serving BS sends BS-HO-RSP with a list of the successfully negotiated BS. Upon reception of the message, the MSS determines one BS from the list. Depending on the kind of HO, it sends MOB-HO-IND with different HO-IND-type. If it wants to make a BBM HO, it sends the message with a *serving BS release* option (HO-IND-type = 0x00). If it wants to make an MBB HO (the serving BS holds and does not release its session information until the release indication through the backbone network from its new serving BS), it does so with a *hold and switch* option (HO-IND-type = 0x03). Or if the serving BS has the previous MSS direction that it should hold the session information and the MSS just wants to make an HO, the MSS sends the MOB-HO-IND with a *switch* option (HO-IND-type = 0x04).

If the MSS keeps proceeding with the HO procedure, it shall perform the handover network re-entry procedure. After completing the re-entry procedure, the MSS shall indicates the former serving BS to purge the information by sending to the current serving BS the MOB-HO-IND message with a *removal* option (HO-IND-type = 0x05) if a certain condition like the deteriorated CINR value below the predetermined threshold. Upon reception of the message, the current serving BS relays it to the former serving BS over the backbone network. This indication finally allows the former BS to purge the MSS session information. When the BS start keeping the MSS session information, it turns on a newly defined timer T30. If the MSS does not return and connect to the BS and send MOB-HO-IND with the removal option within T30, the BS may purge its session information.

If the MSS tried made an HO with switch options (HO-IND-type = 0x03 or 0x04), it could resume the communication with the old serving BS only after sending MOB-HO-IND with a *switch* option (HO-IND-type = 0x04) to the current serving BS and

performing ranging since the BS keeps its session information. The call flow is shown in Figure 1.

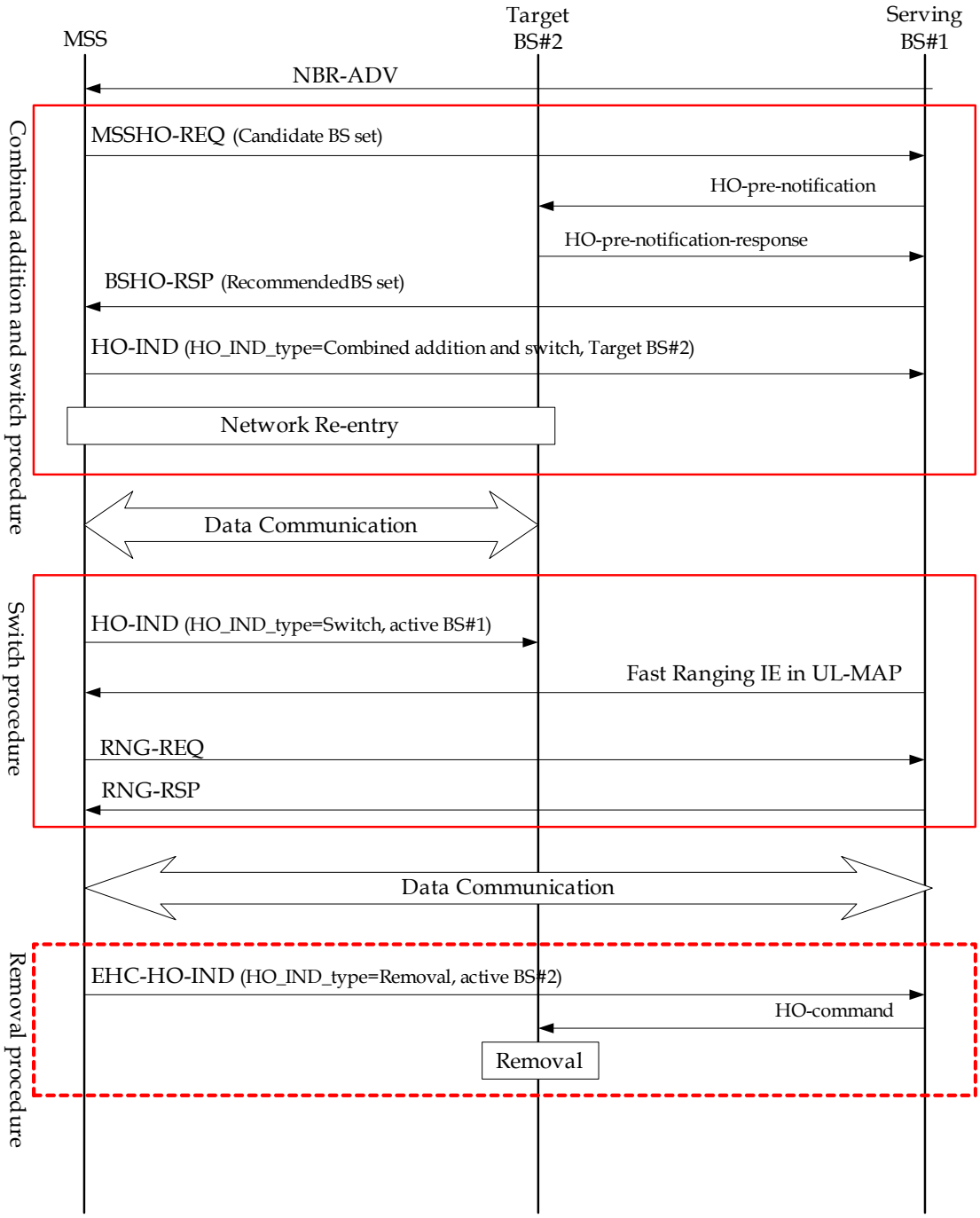

Figure 1 Call flow of the proposed enhanced MBB handover

2.2 Proposed text changes

6.3.2.3.56 HO Indication (MOB-HO-IND) message

An MSS shall transmit a MOB_HO-IND message for final indication that it is about to perform a HO. When the MSS cancels or rejects the HO, the MSS shall transmit a MOB_HO-IND message with appropriate HO_IND type field. The message shall be transmitted on the basic CID.

Table 92j— MOB-HO-IND Message Format

Syntax	Size	Notes
MOB_EHC-HO-IND_Message_Format () {		

Message Type	**8 bits**	**0x36=54**
~~**reserved**~~	~~**6 bits**~~	~~**Reserved; shall be set to zero**~~
HO_IND_type	**8 bits**	**0x00: Serving BS release** **0x01=HO cancel** **0x02=HO reject** **0x03=Hold and switch** **0x04=Switch** **0x05=Removal** **0x06~FF=Reserved**
if (HO_IND_type =0x00, 0x03 or 0x04) {		
~~**Target_BS_ID**~~ **SWITCH_BS ID**	**48 bits**	~~**Applicable only when HO_IND-type is set to 00.**~~ **Target BS ID**
}		
else if (HO_IND_type=0x05) {		
Num_of_BS	**8 bits**	**Number of BSs to be removed**
for (i=0; I<Num_of_BSs;i++) {		
BS ID	**48 bits**	**BS to be removed**
}		
}		
HMAC Tuple	**21 bytes**	**See 11.4.11**
}		

An MSS shall generate MOB-HO-IND messages in the format shown in Table 92j. If Privacy is enabled, the MOB-HO-IND message shall include the following TLV value, **HMAC Tuple** (see 11.4.11 in IEEE Standard P802.16-REVd/D3-2004) – The HMAC Tuple Attribute contains a keyed Message digest (to authenticate the sender).

6.3.20.2.2 HO decision & initiation

Add the following sentences at the end of the subsection in line 53 on page 46.

In an MBB HO, if an MSS sends an MOB-HO-IND message with option HO-IND-type = 0x03, it indicates the MSS commitment of an HO to the target BS and notifies the current serving BS that it the BS should hold all its session information until the MSS direction, which will be delivered to the BS through the backbone message. Generating such a backbone message is triggered by the MSS MOB-HO-IND message with option HO-IND-type = 0x05. The MSS can send this message to any BS to which it is connected.

If the target BS has already been connected to the MSS and holding its session information, the MSS may show its commitment of HO by sending a MOB-HO-IND message with option HO-IND-type = 0x04. At this time, the MSS and the BS does not need to exchange any HO-REQ/RSP message pair, and the MOB-HO-IND is only required to initiate and complete the HO except the HO network ranging procedure.

6.3.20.2.5 Termination with the Serving BS

After the hand-over request/response handshake has completed, the MSS may begin the actual HO. At some stage during the HO process, the MSS terminates service with the serving BS. This is accomplished by sending a MOB-HO-IND MAC Management message with the HO_IND_type value indicating serving BS release.

If the HO_IND_type field specifies Serving BS release, the BS may either close all connections and discard MAC state machines and MAC PDUs associated with the MSS or it may retain the connections, MAC state machine and PDU associated with the MSS to be forwarded to the Target BS for service continuation, or to be discarded upon reception of a backbone message from the Target BS.

If an MSS made an MBB HO by sending MOB-HO-IND with option HO-IN-type = 0x03 or 0x04, the BS holding its session information should keep them until its direction. The MSS issues a release direction to the previously connected BS which hold its session information by sending MOB-HO-IND with option HO-IND-type = 0x05 to the current serving BS. And the current serving BS generates a backbone message and sends it to those BS to indicate that it or they can release the MSS session information. In case of no reception of MOB-HO-IND with 0x05 within T30, the BS may also purge the MSS session information, and the MSS cannot presume that the BS would keep its session information after T30 expires.

10.1 Global Values

Add the follow timer in Table 269a

System	Name	Time Reference	Minimum Value	Default Value	Maximum Value
MSS & BS	T30	Timeout of session information stored in the former serving BS when sent MOB-HO-IND with HO-IND-type = 0x03 or 0x04			