Project	IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>
Title	**Overview of the proposal for MS MAC handover procedure in an MR Network**
Date Submitted	2007-01-16
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Re:	Submitted in response to Call for technical proposals issued by IEEE 802.16j on 2006-12-12
Abstract	This document provides an overview of the proposal on a MS MAC handover procedure for IEEE 802.16j network systems where both MR-BS and its subordinate RSs in an MR-cell transmit their own broadcast control message such as preamble, FCH, DCD, UCD, DL-MAP and UL-MAP.
Purpose	This contribution is provided as input for the IEEE 802.16j amendment.
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	patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

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1. Introduction

In this proposal, we define the MAC handover procedure and corresponding MAC management messages over relay links so that an IEEE 802.16e compliant MS can handover seamlessly within an IEEE 802.16j network.

1.1 Terminologies and Definitions used in this contribution

access station: The station at the point of direct access into the network for a given MS or RS. An access station can be a BS, RS, or MR-BS.
serving station: For any MS, the serving station is the station with which the MS has most recently completed registration at initial entry or during a handover. A serving station can be a BS or MR-BS.
target access station: A station which is the primary candidate for MS network access following a handover. The target access station can be an RS, BS, or MR-BS.
target serving station: A station which is the primary candidate for MS registration following a handover. The target serving station can be a BS or MR-BS.
infrastructure station (IS): A station which is not a subscriber. The infrastructure station can be a BS, MR-BS, or RS.

1.2 Problem statement

Considering a 802.16j multi-hop relay (MR) network with non-transparent fixed or nomadic RSs, seven different handover cases illustrated in Figure 1 are possible to occur in an MR network. The seven cases belong to two main categories of handover: (1)Intra MR-BS handover if the handover is between two RSs controlled by the same MR-BS or between an MR-BS and one of its subordinate RSs; and (2) Inter MR-BS handover if the handover is between two MR-BSs, two RSs each controlled by different MR-BSs, or between an MR-BS and an RS controlled by a different MR-BS.

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There can be two to four infrastructure stations directly involved with an MS handover by counting access and serving stations but not including intermediate RSs. Discussions on optional handover features such as MDHO and FBSS in IEEE 802.16e-2005 are not included in this proposal. The signaling between the involved infrastructure stations occurs over the wireless relay links as well as over the wired backbone in an MR-network.

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There are only two infrastructure stations involved with an MS handover for Cases 1, 2, and 4. On the other hand, there are three infrastructure stations involved for Cases 3, 5, and 6: (1) Case 3: RS1 is the current access station, RS2 is the target access station, and MR-BS1 is the serving station. MR-BS1 remains as the serving station after the handover. (2)Case 5 - MR-BS2 is the current serving and access station, RS2 is the target access station, and MR-BS1 is the target serving station (3) Case 6- MR-BS1 is the current serving MR-BS, RS2 is the current access station, and MR-BS2 is the target serving and access station. Finally, there are four stations involved for Case 7: MR-BS1 is the current serving station, RS2 is the current access station, MR-BS2 is the target serving station and RS3 is the target access station.

A handover between a BS and an RS or MR-BS can be covered by the cases shown in Figure 1. That is, the procedure for an MS handovers between an MR-BS and a BS is identical to the one for Case 4, the procedure for an MS handover from a BS to an RS, the procedure identical to the one for Case 5, and the procedure for an MS handovers from an RS to a BS identical to the one for Case 6.

The handover protocol defined in 802.16e can be used to support MS handover between two MR-BSs (case 4). However, all other six cases (i.e., Cases 1, 2, 3, 5, 6, and 7) require MAC

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management message exchanges over relay links and corresponding signaling procedure among involved infrastructure stations. The handover procedures for these cases shall accommodate various types of RSs. Some access RSs may transparently relay handover signaling between MS and MR-BS, and others may process handover signaling.

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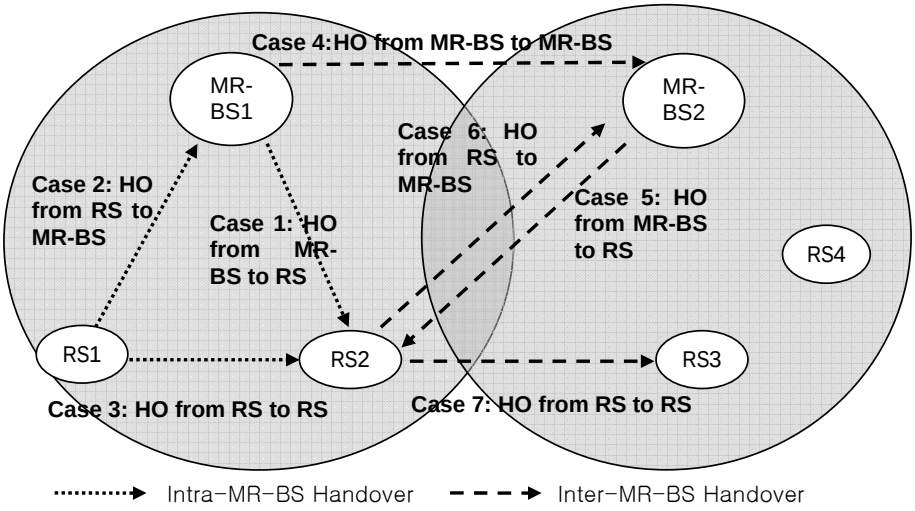

Figure 1 Seven Handover Cases in an MR network

Handover procedure can be different depending on the coordination between an MR-BS and its subordinate RSs with regards to broadcast control messages (i.e., Preamble, FCH, DCD, UCD, UL-MAP, DL-MAP). Accordingly, we further classify two different solutions based on this.

- Handover with transparent RSs: Only the MR-BS transmits all the broadcast control messages or RSs in the same MR-Cell transmit the same broadcast control messages with the ones from the MR-BS. Then, the MS considers these stations as the single BS. In this case, Intra MR-BS handover is transparent to the MS.
- Handover with non-transparent RSs: RS can transmit its own Preamble, DCD, UCD, UL-MAP, and DL-MAP. In this case, the MS recognizes an RS as a BS and Intra MR-BS Handover is same as regular 802.16e handover.

This proposal provides an introduction to the subsidiary contributions [1]-[3] aiming at defining the MAC handover procedure for an MR network with non-transparent RSs.

The proposed MAC handover scheme will enable an 802.16e compliant MS to handover seamlessly in an MR network following the MAC handover procedure defined in subclause 6.3.22 of IEEE 802.16e-2005. The focus of this proposal will be on defining a MS MAC handover procedure with *fixed or nomadic* RS.

The proposed scheme includes the approaches used in a centralized MR network and also in a distributed MR network. In a distributed MR network, an RS may have a capability of authentication on management messages from/to MS.

The proposed scheme addresses the following aspects of MAC handover procedure based on the

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structure of subclause 6.3.22 of IEEE 802.16e-2005:
- Handover decision and initiation
- Network entry/re-entry for handover execution with the new access and serving station(s)
- Termination with the current access and serving station(s)

2. New MAC management messages over relay links

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The following table lists the proposed new MAC management messages over relay links for infrastructure stations in an 802.16j network during each phase of the 802.16e MS MAC handover procedure. Depending on the RS authorization capability and also control method (centralized or distributed) in an MR network, the new messages can be used. With fixed RSs in a centralized MR network, RSs may simply relay all the signaling transparently between the MS and the MR-BS.

Table 1. New MAC Management messages for infrastructure stations

New MAC Management messages	Related MS handover Phase	Functionality
HO_INFO-REQ, HO_INFO-RSP	Handover decision and initiation	These messages are used to obtain the handover related information of potential target access station(s) over relay links.
MS_INFO-REQ/ MS_INFO-RSP	Handover execution	These messages are used to obtain MS information of old access and serving station which may be needed when the actual handover is performed between the target access station and MS.
HO_CPL	Handover termination	This message is used to notify successful handover to the current access and serving station(s) and to the target serving station.

3. Proposed text change

[Insert the following as a new subclause 3.xx]

3.xx infrastructure station (IS): A station which is not a subscriber. The infrastructure station can be a BS, MR-BS, or RS.

[Insert the following in subclause 6.3.22 before subclause 6.3.22.1]
[Editor's note: The proposed text provides an informative description]

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Considering a multi-hop relay (MR) network with non-transparent fixed or nomadic RSs, seven different handover cases illustrated in Figure 1 can occur in an MR network. The seven cases belong to two main categories of handover: (1)Intra MR-BS handover if the handover is between two RSs controlled by the same MR-BS or between an MR-BS and one of its subordinate RSs; and (2) Inter MR-BS handover if the handover is between two MR-BSs, two RSs each controlled by different MR-BSs, or between an MR-BS and an RS controlled by a different MR-BS.

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The MR network can have centralized or distributed control planes. In a distributed MR network, an RS may have a capability of authentication on management messages from/to MS. The handover procedures for these cases shall accommodate various types of RSs in a centralized or distributed MR network. Some access RSs may transparently relay handover signaling between MS and MR-BS, and others may process handover signaling. The capability of MS handover signal processing is negotiated through initial network entry of RS.

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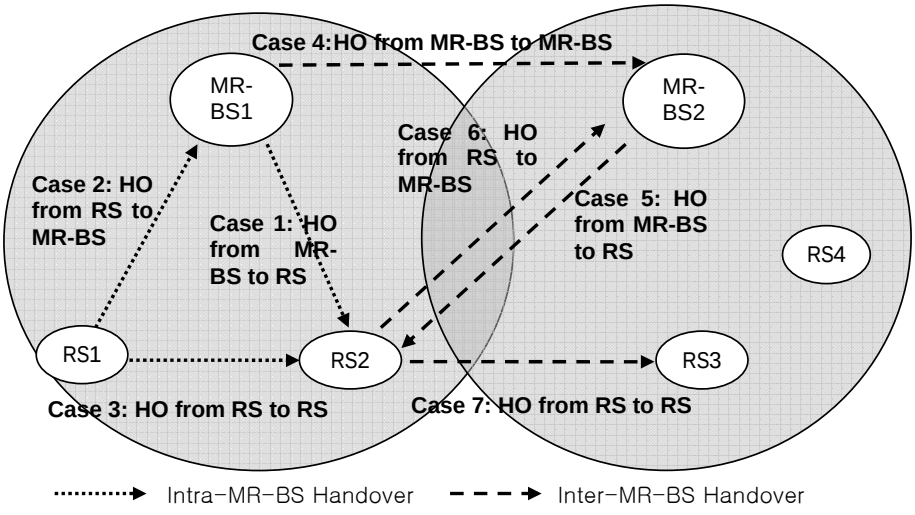

Figure xx Seven Handover Cases in MR networks

[Insert new subclause 11.7.xx:]

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11.7.xx MS HO support capability

The "MS HO support capability" field indicates whether or not the RS processes MS handover

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signaling. A bit value of 0 indicates "not supported" while 1 indicates it is supported.

Type	Length	Value	Scope
46	1	Bit #0: MS handover processing (include MS network re-entry) support Bit #1-#7: reserved	REG-REQ REG-RSP

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References

[1] IEEE C802.16j-07/083, "MS MAC Handover Procedure in an MR Network – Handover Decision and Initiation," Jan. 2007

[2] IEEE C802.16j-07/084, "MS MAC Handover Procedure in an MR Network – Handover Execution," Jan. 2007

[3] IEEE C802.16j-07/085, "MS MAC Handover Procedure in an MR Network – Termination," Jan. 2007