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Source(s)	Hang Zhang, Peiying Zhu, Mo-Han Fong, Wen Tong, David Steer, Gamini Senarath, Derek Yu, Mark Naden, G.Q. Wang Nortel 3500 Carling Avenue Ottawa, Ontario K2H 8E9 Voice: +1 613 763-1315 [mailto:wentong@nortel.com] [mailto:pyzhu@nortel.com]
Re:	A response to a Call for Technical Proposal, http://www.ieee802.org/16/relay/docs/80216j-07_007r2.pdf
Abstract	This contribution proposes two operation modes for mobile RS to facilitate mobile RS handover.
Purpose	To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026r2)
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Moving Relay Station Operation

Hang Zhang, Peiying Zhu, Mo-Han Fong, Wen Tong, David Steer, Gamini Senarath, Derek Yu, Mark Naden, G.Q. Wang

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1. Introduction

One of the main differences between a fixed RS and a mobile RS is RS handover frequency. More frequent handovers occur for mobile RSs. Usually, when a RS performs handover; all attached MS(s) shall also perform handover at the same time. This procedure incurs a lot overhead. In fact, for the fixed access on moving platform usage model, when a RS moves, the relative movement happens between the RS and the fixed network and there is no relative movement between the RS and all of its associated MS(s) on the platform. Thus, we can utilize this property to simplify the mobile RS handover procedure.

In this contribution, we propose two modes of mobile RS: moving RS mode and moving BS mode. For the moving RS mode, the RS performs handover alone with all associated MS(s), while for the moving BS mode, the RS handover occurs between the mobile RS and the MR-BS, which is transparent to its associated MS(s). The overhead caused by the RS handover can be significantly reduced if a mobile RS is in moving BS mode. However, the complexity for such mobile RS is increased. Therefore, we recommend support both modes in the standard.

2. Statement of Problem

Considering the usage scenario where a mobile RS1 is installed on a moving platform and serving multiple MS(s) as shown in Figure 1, MR-BS1 is the serving station for MRS and MS(s) with which MRS and MS1-3 complete registration during the initial entry. MRS is the access station which provides the direct access to MS1-3. In addition, MR-BS1 is also an access station for MRS. When MRS requests a handover from MR-BS1 to MR-BS2, the following procedure need to be defined:

- Access station hand over procedure for MRS
- Serving station hand over procedure for MS(s)
- Optionally, a simplified access station handover in the case when MRS changes its CellID or preamble index due to handover to avoid CellID/preamble collision, which is described in a separate contribution [1]

The current IEEE 802.16e-2005 standard considers a BS act as both access and serving station. Therefore, one handover procedure is enough. With the introduction of the relay station, we need to define both procedures. One straightforward extension is to use the same procedure as defined in IEEE 802.16e-2005 handover procedure with the modification/adaptation of signaling for relay links. In this case, the following steps could be used:

- MRS performs a handover from MR-BS1 to MR-BS2, similar to a MS handover
- MRS requests a handover for each of its associated MSs, MR-BS1 performs network initiated handover for MS1-3.

Depending on the number of MS(s) supported by MRS, this handover can take quite a long time and significant amount of overhead.

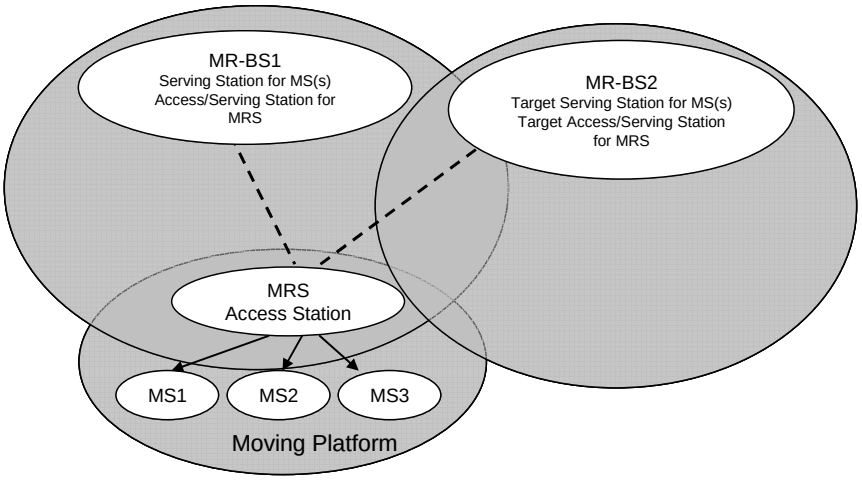

Figure 1 MRS handover Senario 1

Alternatively, a more efficient working model is illustrated in Figure 2, in which MRS serves as both access and serving stations for its associated MS(s) (MS1-3). In this case, the handover of MRS from MR-BS1 to MR-BS2 is transparent to its associated MS(s).

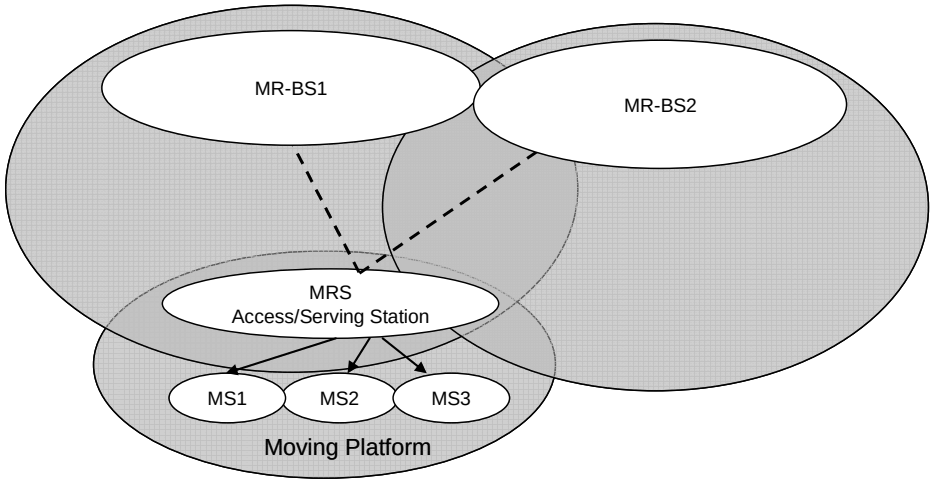

Figure 2 MRD Handover Scenario 2

Both working scenarios have its pros and cons. For scenario 1, MRS does not need to handle registration, security etc.., therefore, a simple MRS is possible. However, a significant overhead and delay occur. For scenario 2 requires more complex MRS, while reduces the overhead and latency. Therefore, we propose to support both scenarios in this contribution. To make the proposal easy to understand, we refers MRS supporting scenario 1 as moving RS mode and MRS supporting scenario 2 as moving BS mode and suggest to support both working modes

Proposal

Two operation modes are proposed for moving relay stations.

- Moving RS mode: the most of operation functions are the same as those of a fixed relay station. However for some physical layer operation parameters, such as 802.16e preamble may be configured in a different way to avoid complexity caused by frequent handover.
  The moving RS mode usually results in a relatively simple RS but incurs complicated handover procedure which consumes significant over-the-air overhead (refer to Figure 1)

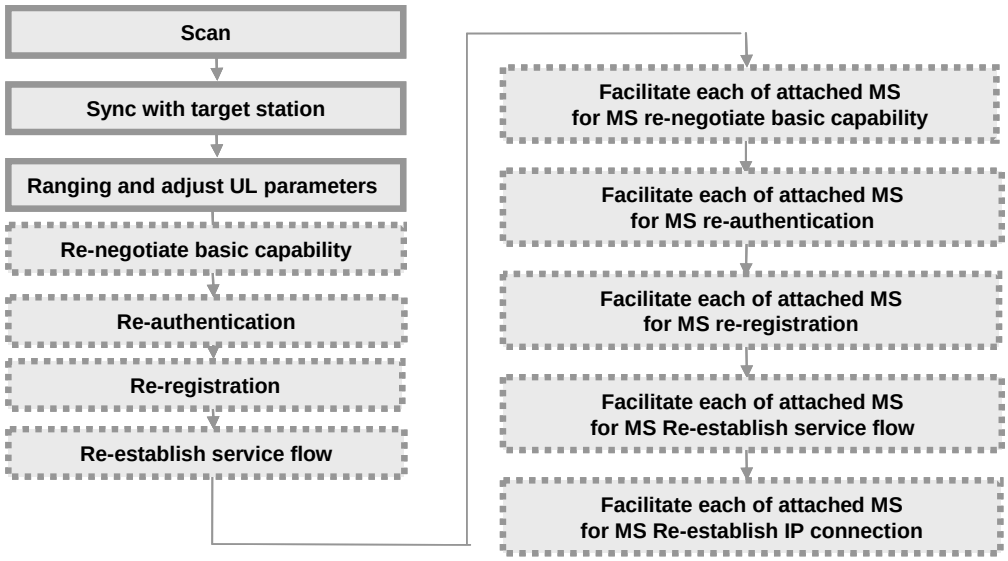

Figure 1. HO procedure of a mobile RS in moving RS mode.

- Moving BS (MBS) mode: as a serving station of a group of MSs, the relay station implements full set of functions of a base station. From a point of view of a MR-BS, this moving relay station operates like a MS. In this mode, the path between a MR-BS and MSs associated with a mobile RS can be divided into two parts: one part is between MR-BS and the mobile RS; the other part is between the mobile RS and its served MSs.
  Thus the connections can be established between MR-BS and a mobile RS. The connections of MSs associated with this mobile RS are established between those MSs and this RS. The privacy function is managed in the similar way (refer to Figure 2 below). The mobile RS is responsible for the privacy of all associated MSs while the MR-BS takes care of the privacy of the mobile RS. This MBS mode requires a relative sophisticated relay station, but brings significant benefits in terms of much simple HO procedure and much lower resource consumption compared to moving RS mode (refer to Figure 3)

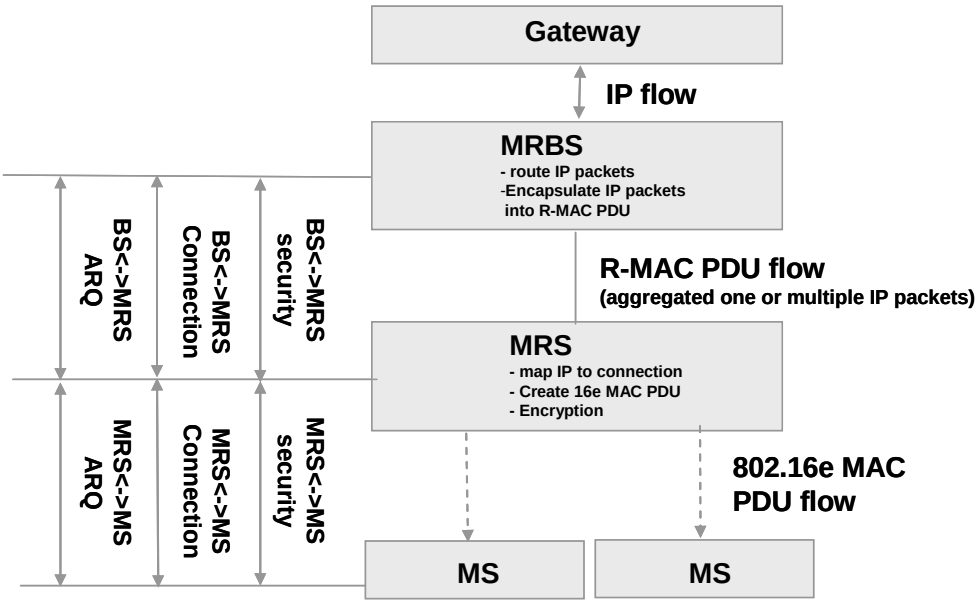

Figure 2. System architecture of relay station in moving BS mode

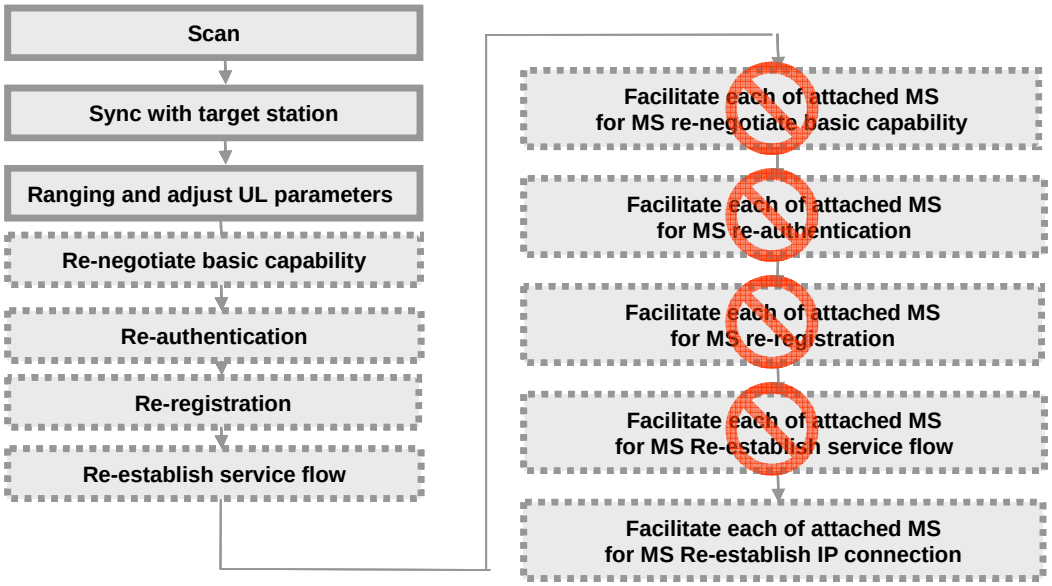

Figure 3. HO procedure of a relay station in moving BS mode

- Operation mode of a mobile RS can be negotiated during basic capability negotiation phase by SBC-REQ/RSP MAC management message.

3. Text Proposal

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[Insert the following text into section 6.3.22.4]

6.3.22.4 Mobile relay station handover

6.3.22.4.1 Operation modes of mobile relay station

A mobile RS can operate in two different modes: moving RS mode and moving BS mode.

6.3.22.4.1.1 Moving RS mode

An RS, when operating in moving RS mode, this RS may implement only a subset of physical layer and MAC layer functions defined in IEEE802.16e-2005. No MAC convergence sub-layer function is implemented. For a MS who selects a mobile RS in moving RS mode as its access station, the connection and privacy of this MS shall be established and maintained by the serving MR-BS and this MS. Most of the operations of a mobile RS in moving RS mode are similar to those of a fixed RS, except the handover operation. During a handover, a mobile RS in moving RS mode may need to initiate handover procedure of all attached MSs.

6.3.22.4.1.2 Moving BS mode

An RS, when operating in moving BS mode, the RS shall implement a full set of physical layer and MAC layer functions defined in IEEE802.16e-2005. For an MS, who selects a mobile RS in moving BS mode as its access station, the connection and privacy of the MS shall be established and maintained by this mobile RS. The mobile RS is also the serving station of the MS. The mobile RS shall perform handover per 6.3.22.2. After the mobile RS handovers to a new target MR-BS, if the mobile RS enters into a new IP subnet, the IP addresses of all the MSs served by this mobile RS need to be re-established. A dedicated transport connection shall be established between the mobile RS and its serving MR-BS to relay the IP address re-establishment related signaling between the MS and the MR-BS.

The operation mode of a mobile RS can be negotiated through basic capability messages exchange at RS initial network entry and re-entry.

At RS initial network entry, during the basic capability negotiation, the RS uses SBC-REQ message to indicate to the associated MR-BS the operation mode of this mobile RS. The MR-BS uses SBC to confirm the operation mode.

[Insert the following into the end of section 6.3.2.3.23]

The following parameter may be included:

Mobile RS Mode

This parameter is sent by a mobile RS to indicate its capability of support moving RS mode or moving BS mode.

[Insert the following into end of section 6.3.2.3.24]

The following parameter may be included:

Mobile RS Mode

This parameter is sent by a MR-BS as a response to SBC-REQ to confirm the mode of a mobile RS.

[Insert new subclause 11.8.9]

11.8.9 Mobile RS mode support

This field indicates the mobile RS operation mode. A mobile RS uses this field in SBC-REQ to indicate its operation mode. The MR-BS uses this field in SBC-RSP to confirm the mobile RS mode.

Type	Length	Value	Scope
168	1	Bit #0 = 1: moving RS mode Bit #0 = 0: moving BS mode	SBC-REQ/RSP

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Reference:

[1] Hang Zhang et al, "Moving Relay Station Preamble/Segment Selection", IEEE 802.16j-07/088