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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://wirelessman.org/relay/docs/80216j-06_034.pdf
Abstract	This contribution proposes solutions for moving RS handover.
Purpose	To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026r1)
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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 moving RS is RS handover frequency. More frequent handovers occur for moving 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 moving RS handover procedure.

In this contribution, we propose two modes of moving 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 moving 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 moving RS is in moving BS mode. However, the complexity for such moving RS is increased. Therefore, we recommend support both modes in the standard.

2. Statement of Problem

Considering the usage scenario where a moving 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.

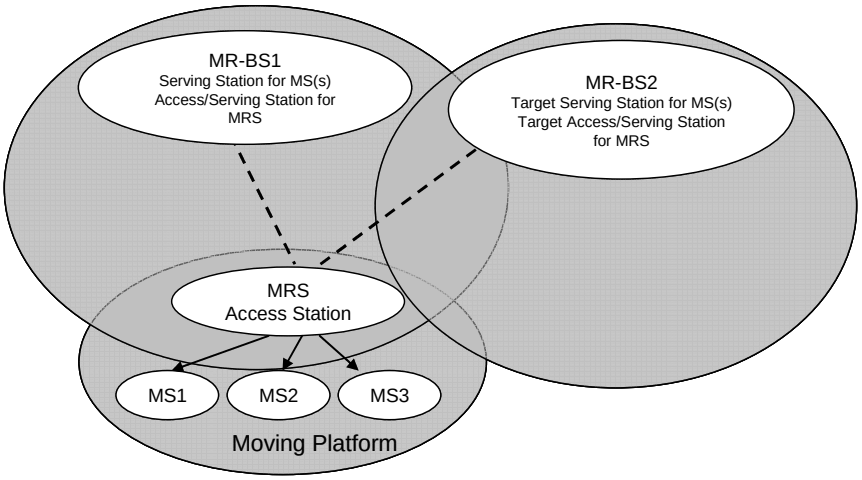

Figure 1 MRS handover Senario 1

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).

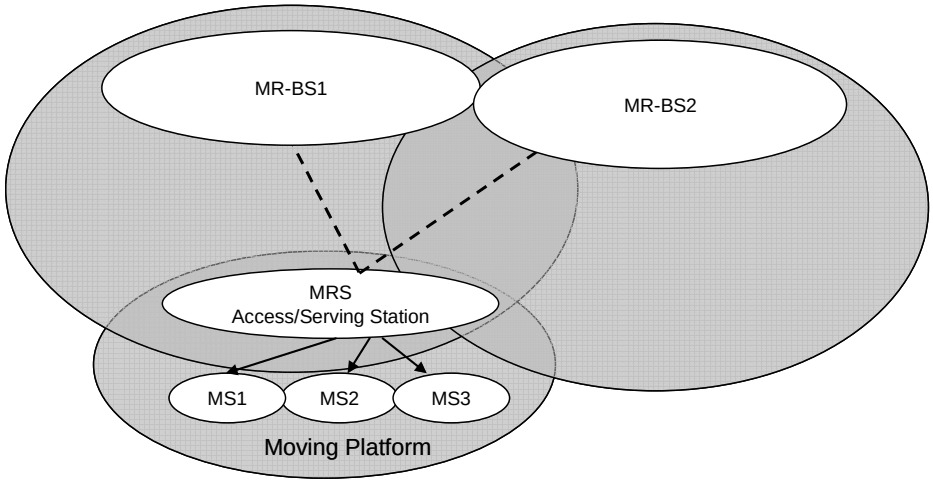

Figure 2 MRD Handover Scenario 2

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 (MRS) mode usually results in a relatively simple RS but incurs complicated handover procedure which consumes significant over-the-air overhead (refer to Figure 1)

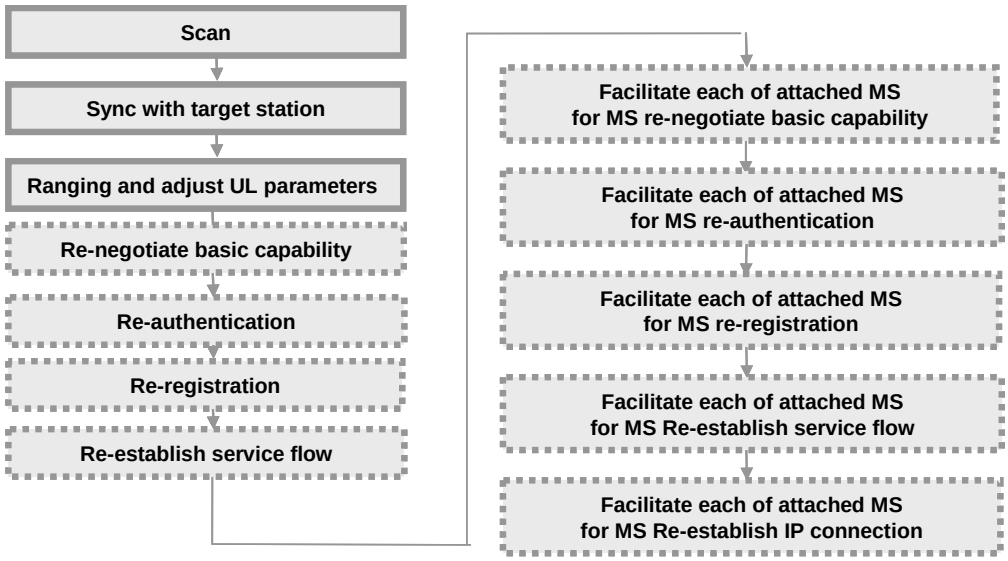

Figure 1. HO procedure of a moving RS in MRS mode.

- 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 MRBS, this moving relay station operates like a MS. In this mode, the path between a MRBS and MSs associated with a moving RS can be divided into two parts: one part is between MRBS and the moving RS; the other part is between the moving RS and its served MSs.
  Thus the connections can be established between MRBS and a moving RS. The connections of MSs associated with this moving RS are established between those MSs and this RS. The privacy function is managed in the similar way (refer to Figure 2 below). The moving RS is responsible for the privacy of all associated MSs while the MRBS takes care of the privacy of the moving 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)

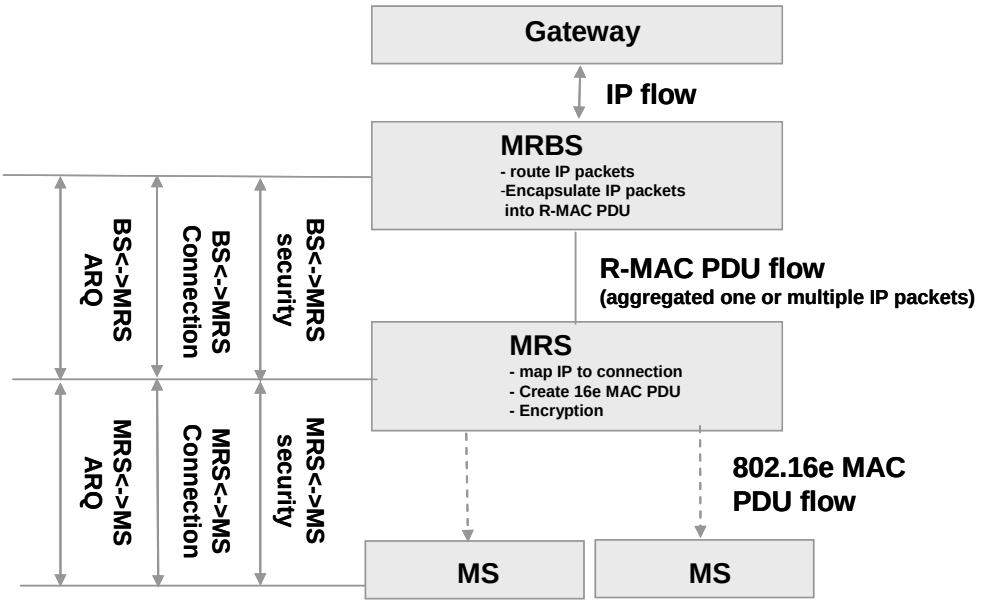

Figure 2. System architecture of relay station in moving BS mode

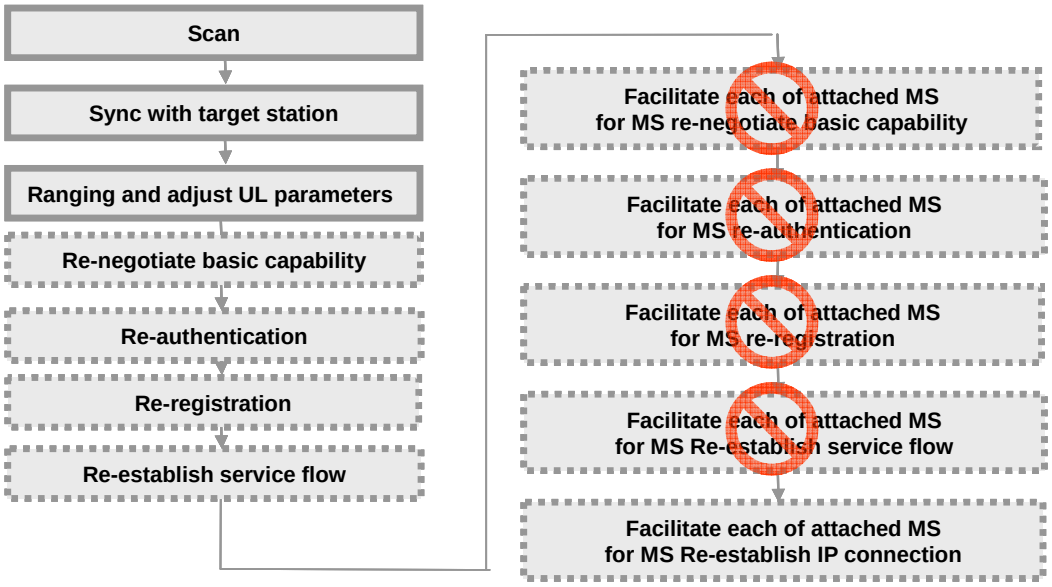

Figure 3. HO procedure of a relay station in moving BS mode

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

3. Text Proposal

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[Insert following text into XXX]

6.1.1.1 Moving RS operation

Moving RS can operate in two different modes: moving RS (MRS) mode and moving base station (MBS) mode.

A RS, when operating in moving RS mode, this RS may implements only subset of physical layer and MAC layer functions defined in 802.16d/e. No MAC convergence sub-layer function is implemented. For a MS, who selects a moving RS in MRS as its serving station, the connection and privacy of this MS shall be established and maintained by the associated MRBS and this MS. Most of operations of a moving RS in MRS mode are similar to those of a fixed RS, except the handover operation. During a handover, a moving RS in MRS mode needs to initiate handover procedure of all attached MSs.

A RS, when operating in moving BS mode, this RS shall implement full set of physical layer and MAC layer functions defined in 802.16d/e. For a MS, who selects a moving RS in MBS mode as its serving station, the connection and privacy of this MS shall be established and maintained by this moving RS. During a handover, the handover procedure described in 802.16e shall be followed by this moving RS for its handover. For all MSs served, the moving RS may need to facilitate the IP re-establishment and reauthorization when required.
The operation mode of a moving 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 MMRBS the mode of this moving RS. The MRBS uses SBC to confirm the mode.

[Insert the following into end of section 6.3.2.3.23]

The following parameter may be included:

Moving RS Mode

This parameter is used by a moving 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:

Moving RS Mode

This parameter is used by a MRBS as a response to SBC-REQ to confirm the mode of a moving RS.

[Insert the following section 11.8.9 after section 11.8.8]

11.8.9 Moving RS mode support

This field indicates the moving RS operation mode. RS uses this field in SBC-REQ to indicate moving RS mode. The MMRBS uses this field in SBC-RSP to confirm the moving 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