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Title	MMR Protocol Stack and Definition of RS Types	
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Source(s)	<p>Hang Zhang, Mo-Han Fong, G.Q. Wang ,Peiyong Zhu, Wen Tong, David Steer, Gamini Senarath, Derek Yu, Mark Naden</p> <p>Nortel 3500 Carling Avenue Ottawa, Ontario K2H 8E9</p> <p>Kanchei (Ken) Loa, Yi-Hsueh Tsai, Shiann-Tsong Sheu, Hua-Chiang Yin, Chih-Chiang Hsieh, Yung-Ting Lee, Frank C.D. Tsai, Heng-Iang Hsu, Youn-Tai Lee</p> <p>Institute for Information Industry 8F, No. 218, Sec. 2, Dunhua S. Rd., Taipei City 106, Taiwan, ROC.</p>	<p>Voice: +1 613 7631315 <a href="mailto:WenTong@nortel.com">[mailto:WenTong@nortel.com]</a>  <a href="mailto:pyzhu@nortel.com">[mailto:pyzhu@nortel.com]</a></p> <p><a href="mailto:loa@nmi.iii.org.tw">loa@nmi.iii.org.tw</a></p>
Re:	A response to a Call for Technical Proposal, <a href="http://wirelessman.org/relay/docs/80216j-06_027.pdf">http://wirelessman.org/relay/docs/80216j-06_027.pdf</a>	
Abstract	In order to more efficiently support 802.16e MAC PDU forwarding by RSs, a new sub-layer R-MAC is suggested.	
Purpose	To incorporate the proposed text into the P802.16j Baseline Document (IEEE 802.16j-06/026)	
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# MMR Protocol Stack and Types of Relay Stations

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

*Nortel*

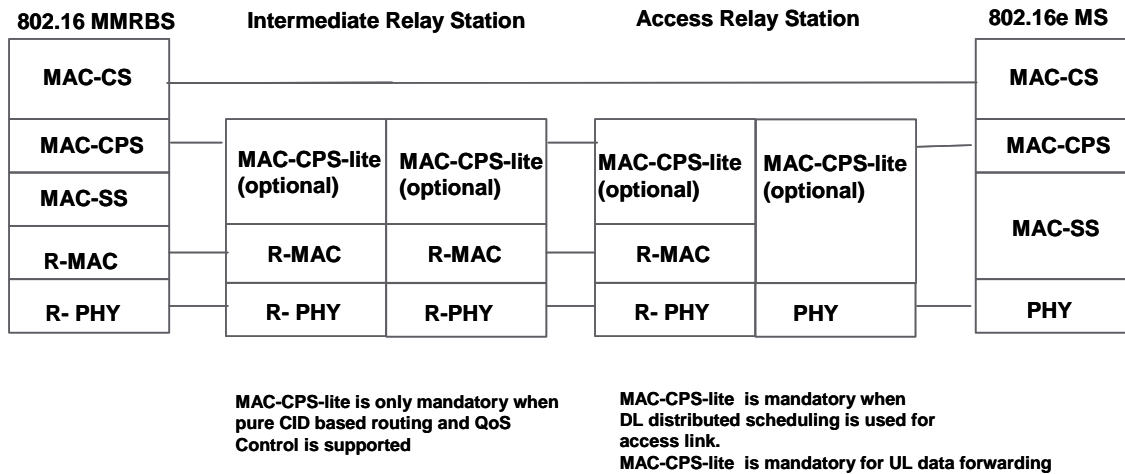
Kanchei (Ken) Loa, Yi-Hsueh Tsai, Shiann-Tsong Sheu, Hua-Chiang Yin, Chih-Chiang Hsieh, Yung-Ting Lee, Frank C.D. Tsai, Heng-Iang Hsu, Youn-Tai Lee

*Institute for Information Industry*

## Introduction

To efficiently support 802.16e MAC PDU forwarding by RSs, a new sub-layer R-MAC is proposed. The resulting new data protocol stacks are shown in Figure 1 and Figure 2. Figure 1 shows the protocol for MS traffic relaying where the MS connection and privacy managements are on end-to-end basis (between MMRBS and MS). Figure 2 shows the other protocol for MS traffic relaying where the MS connection and privacy management are managed by the RS and the RS connection and privacy management are controlled by MMR-BS. The R-MAC layer provides an extendable framework for various relay related functions, such as QoS control, routing control and etc.

For purely physical layer relaying, the protocol is the same as current 802.16d/e protocol stack.



**MAC-CPS-lite: only includes the CID process function (CID based routing and QoS control)**

Figure 1 MMR data protocol stack for simple RS (MS traffic relaying)

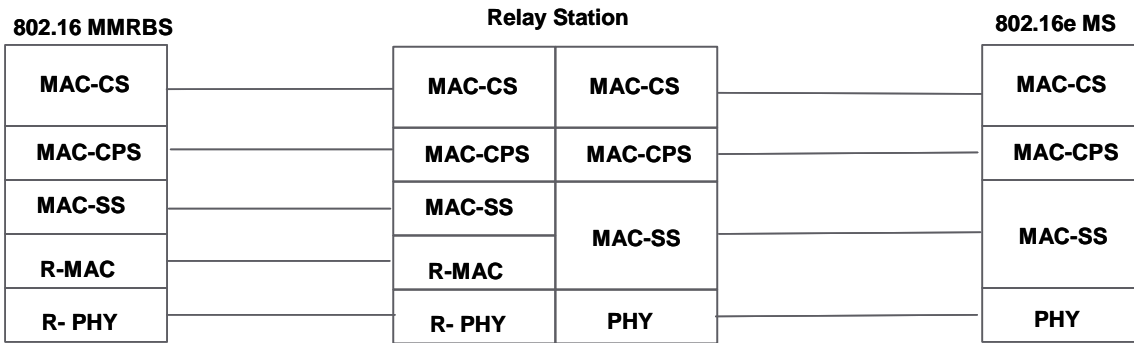


Figure 2 MMR data protocol for micro-BS RS (MS traffic relaying)

The design principles of the R-MAC layer proposal should:  
 Enable extensibility of functionality  
 Minimize overhead

Protocol stack shown in Figure 2 can be used for mobile RS usage scenario, see contribution C80216j-06\_235 [1].

Based on the functions a relay station implements, relay stations can be categorized into 4 types. The following table shows the functions of each type of relay station implements and corresponding operations.

		Type 1 R-link: R-PHY Access link: PHY	Type 2 R-link: R-PHY, R- MAC Access link: PHY, MAC-CPS	Type 3 R-link: R-PHY, R- MAC, MAC-CPS Access link: PHY, MAC-CPS	Type 4 R-link: R-PHY,R- MAC, MAC-SS, MAC-CPS, MAC- CS Access link: PHY, MAC-SS, MAC- CPS, MAC-CS
RS properties	RS naming (RSID)	Yes	Yes	Yes	Yes
	Basic CID/Primary CID	Yes	Yes	Yes	Yes
	Secondary CID	No	No	No	Yes
	Transport CID	No	Yes (for connection originated relaying)  No (for packet originated relaying)	Yes (for connection originated relaying)  No (for packet originated relaying)No	Yes
	RS <-> MMRBS security	No	Yes	Yes	Yes
MS connection and security and service flow management	MS connection management	No (MS end-to-end connection with MMRBS)	No (MS end-to-end connection with MMRBS)	No (MS end-to-end connection with MMRBS)	Yes (MS connection with serving RS)
	MS security management	No (MS end-to-end security established with BS)	No (MS end-to-end security established with BS)	No (MS end-to-end security established with BS)	Yes (MS security established with serving RS)
	MS service flow management	No	No	No	Yes
R-link functions (MS data/message and other RS control message forwarding)	Route control	No	Yes (e.g., destination RS based, T-CID based, source routing based, etc)	Yes (CID based)	Yes (any routing methods)
	QoS control-forwarding scheduling	No	Yes if supported	Yes if supported	Yes if supported
Access-link functions	Preamble/MAP transmission (IDCell)	No  Or optionally it may transmit the same preamble as the MR-BS.	Yes	Yes	Yes
	MS control message/control header process	No (i.e., transparent)	Yes (for non- authenticated MS control management)	Yes (for non- authenticated MS control management)	Yes (for all MS control)

			message, RS may process No (for authenticated MS control message, RS only forwards)	message, RS may process No (for authenticated MS control message, RS only forwards)	messages and control header, RS can process)
	MS traffic scheduling (DL/UL)	No	Optional	Optional	Yes
	UL traffic forwarding QoS control	No	Yes if supported	Yes if supported	Yes if supported
	MS MAC state management	No	No	No	Yes

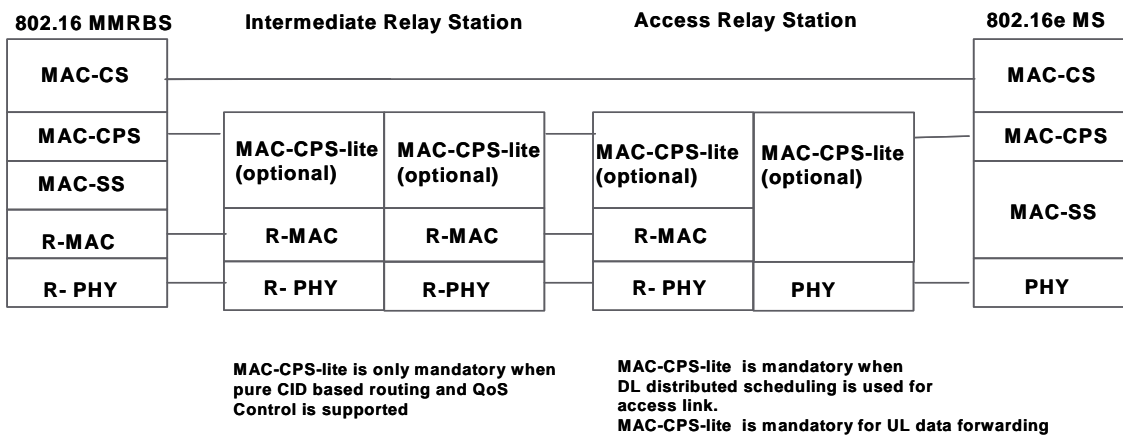
Note: Types 2, 3 and 4 may consider as non-transparent relays.

## Proposed text change

[Insert a new section 4.1.1 MMR Protocol]

### 4.1.1 MMR Protocol

The R-MAC sub-layer is introduced to 802.16d/e protocol for efficient 802.16e MAC PDU relaying/forwarding and control functions. This sub-layer is applicable to the links between MMR-BS and RSs and between RSs. The resulting data protocol stacks are shown in Figure XX and Figure XXX. Figure XX shows the protocol for MS traffic relaying where the MS connection and privacy managements are on end-to-end basis (between MMRBS and MS). Figure XXX shows the other protocol for MS traffic relaying where the MS connection and privacy management are managed by the RS and the RS connection and privacy management are controlled by MMRBS.



**MAC-CPS-lite: only includes the CID process function (CID based routing and QoS control)**

Figure XX. MMR Data Protocol for simple RS (MS traffic relaying).

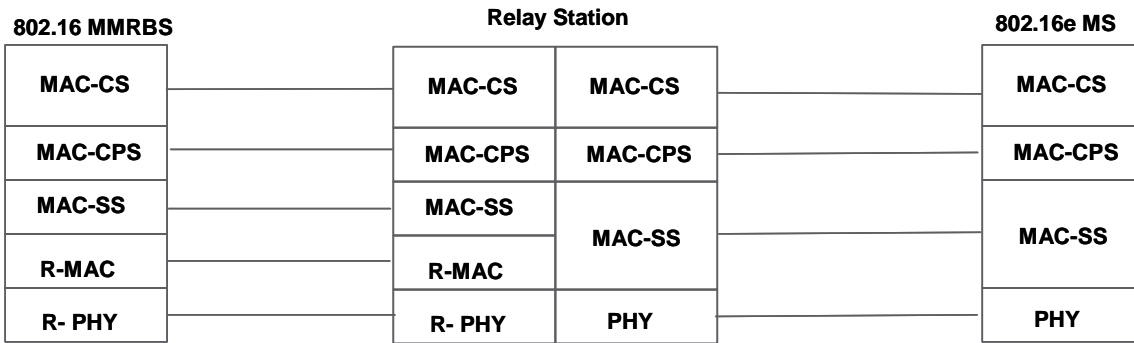


Figure XXX. MMR Data Protocol for micro-BS RS (MS traffic relaying)

The R-MAC provides the concatenation of forwarded 802.16d/e MAC PDU and control functions, such as scheduling, routing, flow control and etc.

The R-PHY layer provides definition of physical layer design, such as, sub-channelization, modulation and code set and etc, for links between MMR-BS and RS and between RSs.

A relay station can optionally implement R-MAC sub-layer, or 802.16e MAC CPS function and MAC CS function.

If a relay station only implements R-PHY layer on R-link and 16e PHY on access link, this relay station is defined as a type 1 relay station; If a relay station implements R-PHY and R-MAC layers on R-link, this relay station is defined as type 2 relay station; If a relay station implements R-PHY, R-MAC and MAC-CPS layers on R-link, this relay station is defined as type 3 relay station; If a relay station implements R-PHY, R-MAC, MAC-SS, MAC-CPS and MAC-CS layers on R-link, this relay station is defined as type 4 relay station.

The transport connection(s) of a MS can be established between MMR-BS and MS (end-to-end connection) or established between its serving station (MMR-BS or relay station) and the MS.

For type 1 relay stations, management connections may be established and no any transport connection is established between MMR-BS and this relay station.

For types 2 and 3 relay station, management connections are established for control purpose between MMR-BS and the relay station. One or multiple transport connection may be established for relaying purpose.

For type 4 relay station, management connections are established and transport connection(s) are established for relaying MSs's traffic.

The following table XXX shows the functions of each type of relay station implements and corresponding operations of each type of relay station.

Table xxx. Relay station types and functions implemented.

		Type 1 R-link: R-PHY Access link: PHY	Type 2 R-link: R-PHY, R- MAC Access link: PHY, MAC-CPS	Type 3 R-link: R-PHY, R- MAC, MAC-CPS Access link: PHY, MAC-CPS	Type 4 R-link: R-PHY,R- MAC, MAC-SS, MAC-CPS, MAC- CS Access link: PHY, MAC-SS, MAC- CPS, MAC-CS
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	Basic CID/Primary CID	Yes	Yes	Yes	Yes
	Secondary CID	No	No	No	Yes
	Transport CID	No	Yes (for connection originated relaying)  No (for packet originated relaying)	Yes (for connection originated relaying)  No (for packet originated relaying)No	Yes
	RS <-> MMRBS security	No	Yes	Yes	Yes
MS connection and security and service flow management	MS connection management	No (MS end-to-end connection with MMRBS)	No (MS end-to-end connection with MMRBS)	No (MS end-to-end connection with MMRBS)	Yes (MS connection with serving RS)
	MS security management	No (MS end-to-end security established with BS)	No (MS end-to-end security established with BS)	No (MS end-to-end security established with BS)	Yes (MS security established with serving RS)
	MS service flow management	No	No	No	Yes
R-link functions (MS data/message and other RS control message forwarding)	Route control	No	Yes (e.g., destination RS based, T-CID based, source routing based, etc)	Yes (CID based)	Yes (any routing methods)
	QoS control-forwarding scheduling	No	Yes if supported	Yes if supported	Yes if supported
Access-link functions	Preamble/MAP transmission (IDCell)	No  Or optionally it may transmit the same preamble as the MR-BS.	Yes	Yes	Yes
	MS control message/control	No (i.e., transparent)	Yes (for non- authenticated MS	Yes (for non- authenticated MS	Yes

	header process		control management message, RS may process) No (for authenticated MS control message, RS only forwards)	control management message, RS may process) No (for authenticated MS control message, RS only forwards)	(for all MS control messages and control header, RS can process)
	MS traffic scheduling (DL/UL)	No	Optional	Optional	Yes
	UL traffic forwarding QoS control	No	Yes if supported	Yes if supported	Yes if supported
	MS MAC state management	No	No	No	Yes

[1] "Moving RS operation", Hang Zhang, G.Q. Wang, Peiying Zhu, Wen Tong, David Steer, Gamini Senarath, Derek Yu, Mark Naden, C80216j-06\_235.