Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
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Re:	This is a response to the call for proposals 80216j-06_027.pdf .
Abstract	This contribution proposes a mechanism for requesting bandwidth allocation.
Purpose	Add proposed spec changes in P802.16j Baseline Document (IEEE 802.16j-06/026)
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Resource Request for Bandwidth and Ranging

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Introduction

In centralized MAP allocation, the MMR-BS allocates MAP for the relay and access links. Any bandwidth request from an originating station should go to the MMR-BS, so it can perform UL allocation accordingly on the relay and access links. Without Relay, an MS sends a CDMA code for indicating need for sending BR to the BS. The BS sends allocation to the MS for sending Bandwidth Request message. This allocation is done for the only link between BS and MS. With Relay, the CDMA ranging code would traverse multiple links. The MMR-BS needs to do UL allocation for all the links up to the MS, so the bandwidth request can reach the MMR-BS. The problem is that only by looking at a CDMA code, the MMR-BS does not know all the links to the MS.

In addition, if the existing bandwidth request and allocation scheme as specified in [2][3] used in MR system, it will introduced very large latency. Figure A-1 shows the typical bandwidth request and allocation scheme using a bandwidth request CDMA code defined in 802.16e.

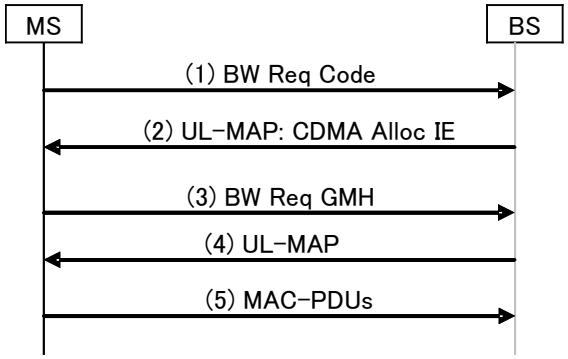

Figure A-1 BW request/allocation using CDMA code

As seen from the Figure A-1, Relay latency will become very large, if this mechanism is adapted to a relay system, in which UL-MAP of RS access link is created by the MR-BS (i.e. Centralized Scheduling).

The Figure A-2 shows an example of bandwidth request allocation sequence based on the 802.16e standard. The RS needs to notify the received code information to the MR-BS which creates UL-MAP including CDMA_Allocation-IE to provide bandwidth to the code sender. To send that information, the RS need to get uplink bandwidth on relay link. So, it must perform CDMA bandwidth request/grant sequence as shown in Figure A-1.

After the MS gets bandwidth with CDMA_Allocation-IE and sends a BW request header to the RS. Then, the RS needs bandwidth to relay the received BW request header to the MR-BS. So, CDMA bandwidth request/ grant sequence runs again between the RS and the MR-BS.
The similar sequence must run between the RS and the MR-BS, when the RS receives MAC-PDUs from the MS.

As described above, signaling delay in the relay system could be significantly large and degrades Service Quality.

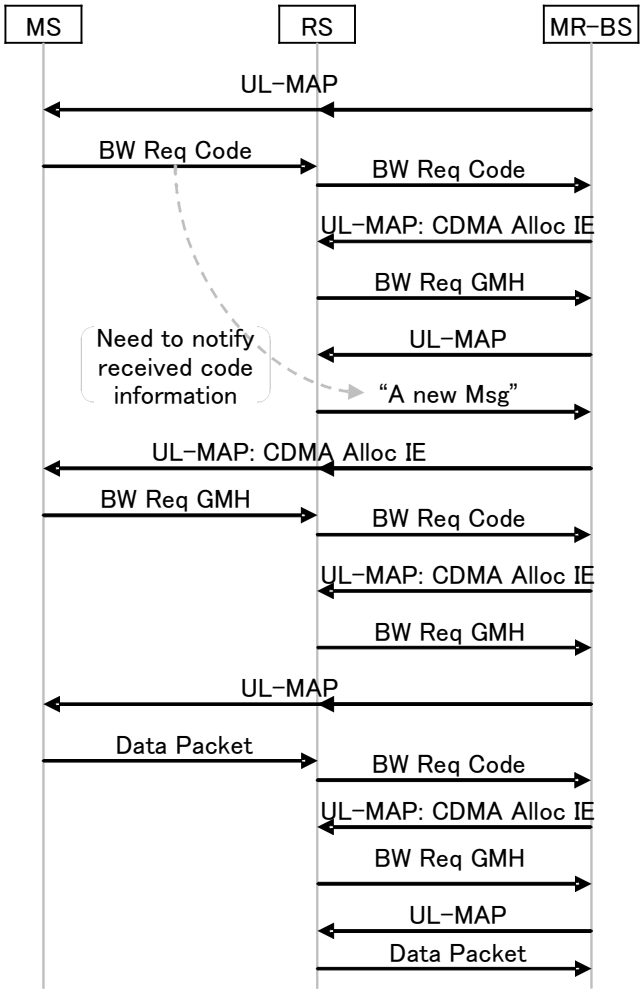

Figure A-2 BW request/allocation based on the 802.16e in a relay systems

Proposal

This contribution is proposing that each RS in the system is allocated a RS CDMA Ranging Code for a specific procedure (e.g. Bandwidth Request) during its initial ranging. When an MS sends a Ranging Code for the bandwidth request to the access RS, the access RS sends the assigned RS CDMA Ranging Code toward the MMR-BS. The MMR-BS knows the links to the access RS by the route discovery procedure, e.g. as in [1]. The MMR-BS assigns UL allocation to all the relay links and the access link for the bandwidth request. Similar procedures are executed for other CDMA code related procedures, e.g. initial ranging and periodic ranging.

The procedure is generic and solves the problem for the other CDMA code related procedures, e.g. initial ranging and periodic ranging. The procedure is same for fixed, nomadic, and mobile RS. It is completely transparent to the exiting procedures, and requires no changes on the MS. It is also same for two hop or more than two hop relay system.

The figure A-3 shows an example of bandwidth request and allocation sequence using the proposed schemes.

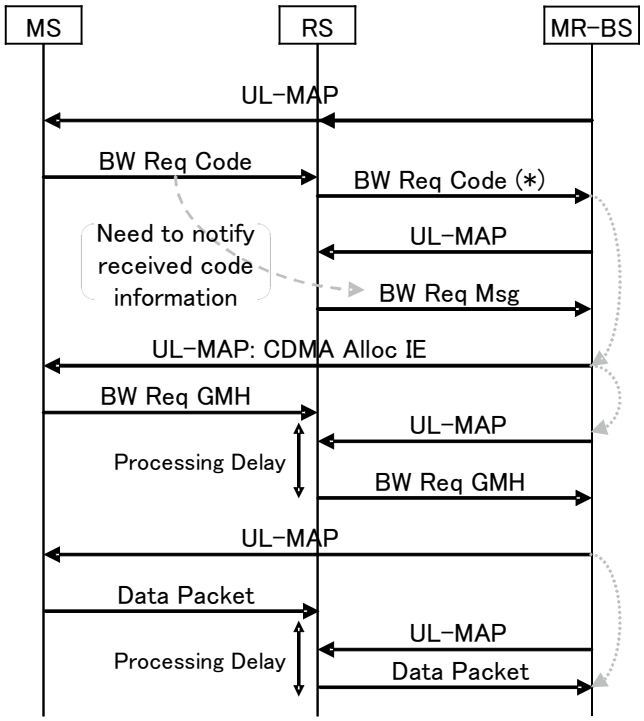

Figure A-3 BW request/allocation sequence using proposed schemes

Specification changes

Insert a new subclause 6.3.2.3.X:

6.3.2.3.X MR_Code-REP message

This message is used to notify the receive CDMA code information to MR-BS. This message is transmitted by a RS with using the RS's basic CID.

Table xx MR Code Report (MR_CODE-REP) message Format

Syntax	Size	Note
MR_Code_Report_format() {		
Management Message Type = xx	8 bits	TBA
MR_CODE-REP TLVs	Variable	
}		

See 11.X MR_CODE-REP TLV

Insert new section 6.3.6.7

6.3.6.7 Contention based CDMA Bandwidth Request for Relay

The MS attached to a relay uses the same CDMA bandwidth request procedure as specified in 6.3.6.5. In case of distributed MAP allocation, each RS in the multi hop path does MAP allocation. A receiving RS allocates the uplink using CDMA_Allocation_IE. The RS also relays the CDMA ranging code toward the MMR-BS. Each RS in the path, toward the MMR-BS, contends for relaying CDMA code, and gets allocation for the bandwidth request as in section 6.3.6.5.

In case of centralized MAP allocation, the MMR-BS does UL allocation on all the links between MMR-BS and MS after receiving a ranging code. In addition to the ranging code, the MMR BS needs to know all the links to the originator station. The MMR-BS allocates a specific RS CDMA ranging code to the RS during initial ranging by sending RS_CDMA_Codes TLV in RNG-RSP. When an RS receives a CDMA code from the MS, it sends its assigned RS CDMA code toward the MMR-BS. The intermediate RSs relays the code received in the uplink direction. When an MMR-BS receives an RS CDMA code, it recognizes the path to the RS and allocates uplink resources for all the relay links and the access link for sending bandwidth request.

6.3.6.7.1 Fast CDMA bandwidth request and allocation

MR-BS and RS shall support the Fast CDMA-based bandwidth request mechanism specified in this subclause. For the Fast CDMA bandwidth request, RS shall send a specific CDMA code in the same manner as specified in 6.3.6.5. After receiving the specific CDMA code, the MR-BS finds the links to the requesting RS and provides uplink bandwidth allocation using the Basic CID and the Burst Profile of the requesting RS, instead of using CDMA_Allocation-IE as specified in 6.3.6.5.

6.3.6.7.2 Continuous Bandwidth Allocation Mechanism

MR-BS and RS support continuous bandwidth allocation mechanism specified in this subclause.

When MR-BS allocates bandwidth on both the relay link and RS's access link (Centralized Scheduling), the MR-BS allocates bandwidth on each link continuously taking account of processing delay at the RS and multi-hop frame delay between MR-BS and RS. Multi-hop frame delay is calculated by MR-BS based on number of hops.

Once MR-BS allocates uplink bandwidth to a MS to send burst to the RS, it automatically allocates uplink bandwidth for relaying upstream traffic to the RS later than the uplink processing delay plus multi-hop frame delay at the RS after uplink bandwidth allocation to the MS. Relaying latency can be minimized by allocating bandwidth on relay uplink without transmitting a bandwidth request code.

The uplink processing delay is notified to the MR-BS with the SBC-REQ message during RS network entry process.

A new RS at multiple hops from the MMR-BS gets its RS_CDMA_Codes and request bandwidth using the same procedure as above. The new RS performs initial ranging with the access RS by sending a ranging code. The access RS receives the code, and sends its assigned ranging code for the bandwidth request to the MMR-BS. The MMR-BS recognizes the code and assigns the resources from the MMR BS to the new RS. The new RS completes ranging and gets its assigned RS_CDMA_Codes in RNG-RSP.

Insert new section 6.3.10.3.4

6.3.10.3.4 Requesting resources for ranging in Centralized Scheduling

Two CDMA ranging codes are assigned to an RS for requesting resources for ranging. One ranging code is for ranging with "continue" status. Second ranging code is for ranging with "success" status. When RS receives a CDMA ranging code for initial ranging, it shall perform the following step for resource allocation:

- When the RS determines that it needs to send RNG-RSP with continue status, it sends the RS Ranging Code assigned for requesting bandwidth on the access link to transfer RNG-RSP towards MS.
- When the RS determines it needs to send RNG-RSP with success status. It sends the assigned Ranging Code for requesting bandwidth for 1) transferring RNG_REQ towards MR-BS, 2) the CDMA_Allocation_IE() on access link to transfer RNG-REQ, and 3) the MMR-BS to RS link for relaying RNG-REQ.

Change the following section

6.3.2.3.5 Ranging request (RNG-REQ) message

Add the following text at the end:

The following parameter may be included in the RNG-REQ message when the RS is attempting to perform network entry, re-entry, association or handover:

RS Type TLV (see 11.5)

6.3.2.3.6 Ranging Response (RNG_RSP) message
Insert following text at the end of the subclause:

The following parameter is included in the RNG-RSP message for allocating specific CDMA ranging codes:

RS CDMA Codes TLV (see 11.19)

11.5 RNG-REQ message encodings

Add the following row in Table 364:

Name	Type (1 byte)	Length	Value (variable-length)
RS Type	-	1	0: Fixed RS 1: Mobile RS 2-255: Reserved

11.6 RNG-RSP management message encodings

Insert new subclause 11.6.2:

11.19.1 RS CDMA Codes TLV

Name	Type (1 byte)	Length	Value
RS CDMA Code	-	3	The TLV carries 1 byte ranging code in the following order - Ranging Request (Continue) - Ranging Request (Success)

			- Bandwidth Request

nsert new subclause 11.X:
11.X MR Code Report management message encodings

Name	Type	Length	Value
Code attributes	TBA	4	Bits 31:22 – Used to indicate the OFDM time symbol reference that was used to transmit the ranging code. Bits 21:16 – Used to indicate the OFDMA subchannel reference that was used to transmit the ranging code. Bits 15:8 – Used to indicate the ranging code index that was sent by the SS. Bits 7:0 – The 8 least significant bits of the frame number of the OFDMA frame where the SS sent the ranging code.

References

[1] Haihong Zheng, Yousuf Saifullah, Shashikant Maheshwari, Nokia , "Topology Discovery and Path Management in multi-hop relay System", IEEE C80216j-06_195.doc
[2] IEEE 802.16-2004 Part 16: Air Interface for Fixed Broadband Wireless Access Systems
[3] IEEE 802.16e-2005 Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands and Corrigendum 1
[4] M.Okuda, "**MS network entry for non-transparent Relay Station" IEEE C80216-06_133**