Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Fast Bandwidth request scheme for Relay Station**
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Re:	IEEE802.16j-06/027: “Call for Technical Proposals regarding IEEEP802.16j”
Abstract	This contribution proposes two fast bandwidth request/allocation schemes for relay systems.
Purpose	To propose text to describe two fast bandwidth request/allocation schemes for relay systems
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Fast Bandwidth request scheme for Relay Station

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Introduction

In this document, two bandwidth request and grant scheme on relay link is proposed.

Figure A-1 shows the typical bandwidth request and allocation scheme using a bandwidth request CDMA code defined in 802.16e.

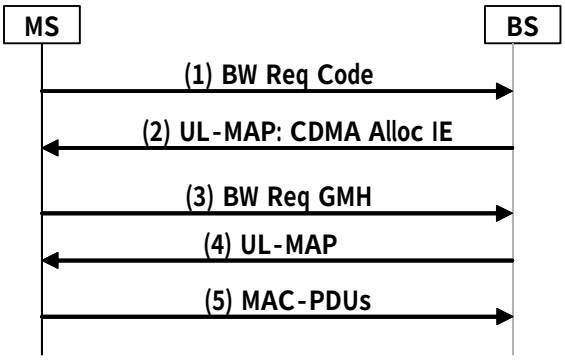

Figure A-1 BW request/allocation using CDMA code

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.

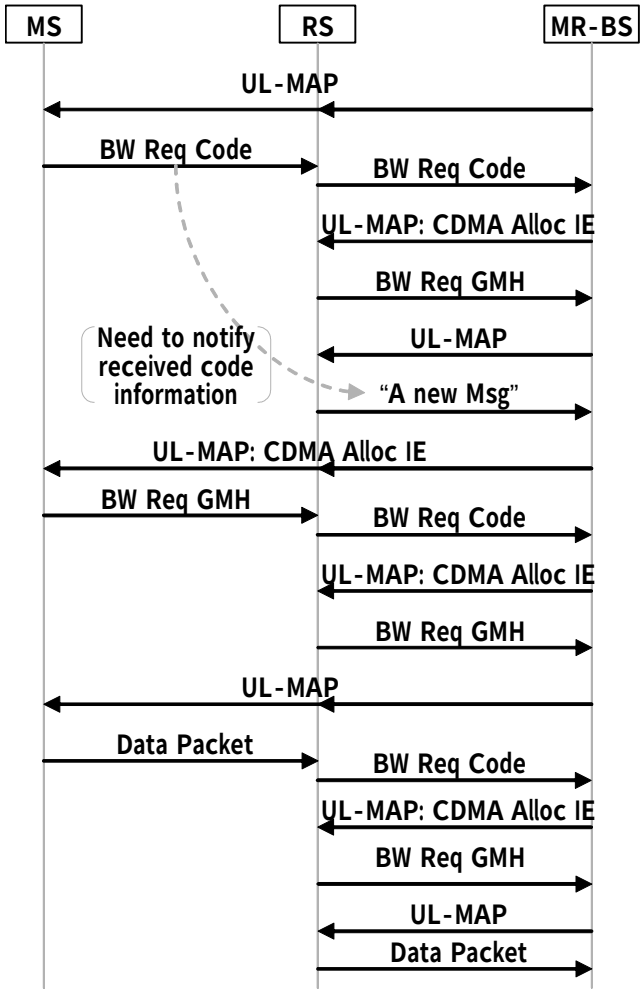

Figure A-2 BW request/allocation based on the 802.16e in a relay systems

In order to solve the above mentioned problem, two schemes are proposed in this document.

(1) Fast CDMA bandwidth request and allocation

When a RS send a BW request CDMA code, it uses a specific CDMA code which is uniquely assigned by the MR-BS during RS network entry process. So, the MR-BS can identify the requesting RS from the received code index and directly allocates bandwidth on the relay uplink to the RS without using CDMA_Allocation-IE.

(2) Continuous Bandwidth Allocation Mechanism

A MR-BS allocates uplink bandwidth to a RS after RS processing delay since the MR-BS allocates uplink bandwidth to a MS connecting the RS without any bandwidth request from the RS. The processing delay at RS is notified to the MR-BS during the RS network entry procedure.

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

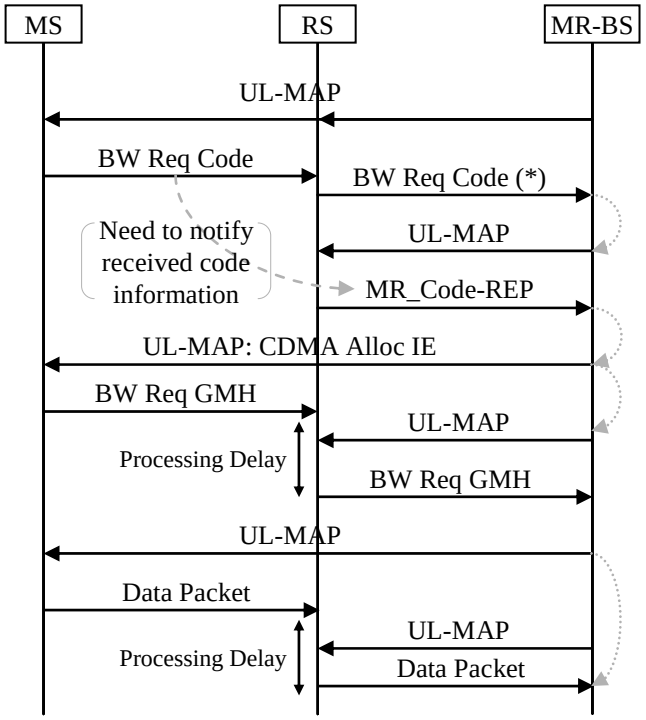

Figure A-3 BW request/allocation sequence using proposed schemes

Specific Text 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 a new subclause 6.3.6.8:

6.3.6.8 Bandwidth allocation and request mechanisms for MR

Insert new subclause 6.3.6.8.3:

6.3.6.8.3 Fast Bandwidth Request and Allocation Mechanism

For MR system where MR-BS manages bandwidth allocation on access link between RS and MS in addition to MR-link, double bandwidth allocation on access and MR link must be done by the MR-BS so that data burst is transferred between MR-BS and MS.

6.3.6.8.3.1 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. However, the specific CDMA code used this scheme is uniquely assigned to the RS by its superordinate MR-BS using SBC-RSP message during RS network entry process. Up on receiving the specific CDMA code, the MR-BS identifies 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.

6.3.6.8.3.2 Continuous Bandwidth Allocation Mechanism

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

In case that the 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.

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 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.

Downlink bandwidth allocation can be done in the same manner as the uplink. The MR-BS automatically allocates downlink bandwidth on access link later than the downlink processing delay at the RS after downlink bandwidth allocation to the MS

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

Insert the following text at the end of the subclause 8.4.7.3:

– The next P codes produced are for RS bandwidth request. Clock the PRBS generator 144 × ((N + M + L + O + S) mod 256) times to 144 x ((N + M + L + O + P + S) mod 256) – 1 times.

Insert new subclause 11.8.3.7.X:

11.8.3.7.X RS Specific Bandwidth Request Code Index

Type	Length	Value	Scope
TBA	1	RS Specific Bandwidth Request Code Index	SBC-RSP

Insert 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] M. Hart, et al., “Transparent RS network entry”, IEEE C802.16j-06_142, IEEE 802.16 meeting #46, Dallas, November 2006.

[2] M. Hart, et al., “Non-Transparent RS network entry”, IEEE C802.16j-06_143, IEEE 802.16 meeting #46, Dallas, November 2006.