

Project	IEEE 802.16 Broadband Wireless Access Working Group < http://ieee802.org/16 >	
Title	Bandwidth Request for Distributed Systems	
Date Submitted	2007-03-05	
Source(s)	Masato Okuda and Yuefeng Zhou Fujitsu	okuda@jp.fujitsu.com Yuefeng.Zhou@uk.fujitsu.com
	I-Kang Fu, Fang-Ching Ren, Chie-Ming Chou NCTU/ITRI 1001 Ta Hsueh Rd, Hsinchu, Taiwan, R.O.C.	IKFu@itri.org.tw
	Kenji Saito KDDI R&D Laboratories Inc.	Voice: +81 46 847 6347 saito@kddilabs.jp
	Shulan Feng, Yanling Lu, Ting Li, Liangliang Zhang Hisilicon Technologies Harbour Building, No.8, Dongbeiwang West Road, HaiDian District, Beijing, China	Voice: 86-10-82829010 Fax: 86-10-82829075 luyanling@hisilicon.com fengsl@huawei.com
Re:	IEEE802.16j-07/007r2: "Call for Technical Comments and Contributions regarding IEEE Project 802.16j"	
Abstract	This contribution proposes a distributed bandwidth request and allocation mechanism.	
Purpose	To propose text to describe a distributed bandwidth request and allocation mechanism	
Notice	This document has been prepared to assist IEEE 802.16. It is offered as a basis for discussion and is not binding on the contributing individual(s) or organization(s). The material in this document is subject to change in form and content after further study. The contributor(s) reserve(s) the right to add, amend or withdraw material contained herein.	
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.	
Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures < http://ieee802.org/16/ipr/patents/policy.html >, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft	

publication will be approved for publication. Please notify the Chair <<mailto:chair@wirelessman.org>> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <<http://ieee802.org/16/ipr/patents/notices>>.

Bandwidth Request for Distributed Systems

Masato Okuda and Yuefeng Zhou

I-Kang Fu, Fang-Ching Ren, Chie-Ming Chou

Kenji Saito

Shulan Feng, Yanling Lu, Ting Li, Liangliang Zhang

Introduction

In distributed bandwidth request and allocation, if an RS starts to request bandwidth on the R-UL after it receives PDUs from an MS, the latency of packet transfer becomes very large and service quality degrades. The figure A-1 shows an example of PDU transfer from MS to BS via RS.

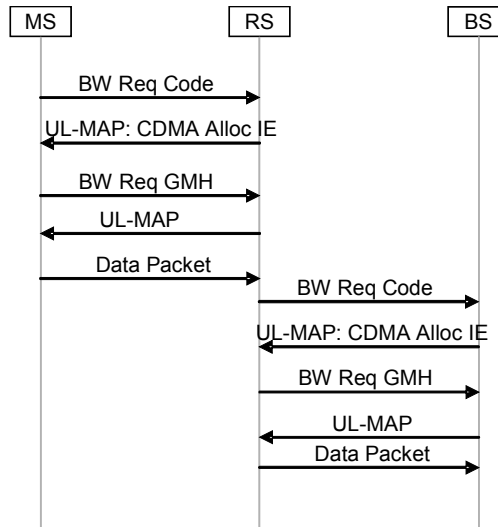


Figure A-1

In order to reduce latency, RS needs to start the bandwidth request process after it receives the BW request CDMA code from the MS. Figure A-2 shows an example where the RS sends a BW request code and starts the bandwidth request procedure after receiving a BW request code from an MS.

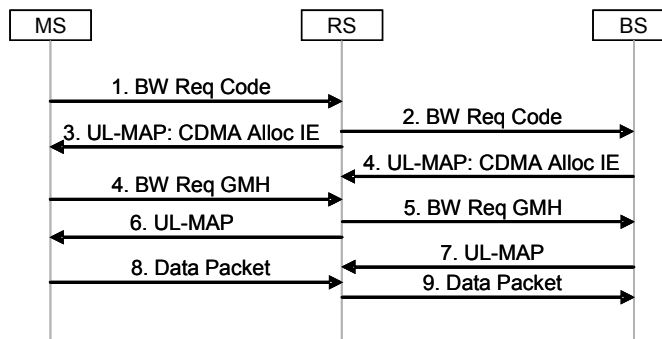


Figure A-2

Since bandwidth allocations on access and relay links are done individually by the RSs and the MR-BS in systems with distributed control, the UL bandwidth on the relay link could be assigned before the RS receives PDUs from the MS. Figure A-3 shows an example of an RS that does not receive the packets from its downstream station in time for its UL bandwidth allocation.

In this example, it is assumed that MS#1 requests UL bandwidth for a high priority connection (#1) and MS#2 requests UL bandwidth for a low priority connection (#2).

At first, each MS sends a bandwidth request CDMA code to the RS to get UL bandwidth for sending a BW request header. The RS also needs to send bandwidth request CDMA codes to the MR-BS so that it can minimize latency to send its own bandwidth request header to the MR-BS after receiving the headers from MSs. In this case, the RS may send two CDMA codes to the MR-BS because the RS does not know QoS classes requested by the MSs until it receives the BW request headers from them, although the RS may combine multiple BW request headers from MSs into a single BW request header per QoS class.

Once the RS receives these BW requests headers from MS#1 and MS#2, it transmits its own BW request headers to the MR-BS to get bandwidth on the relay uplink. At the same time, the RS allocates UL bandwidth to the MSs. But, in this case, the RS does not have enough bandwidth to serve both MS#1 and MS#2. So, it assigns UL bandwidth to MS#1 because its connection is of higher priority.

When the MR-BS has available bandwidth on its relay uplink, the RS gets assigned UL bandwidth for both MS#1 and MS#2 immediately. However, since the RS has only allocated UL bandwidth to MS#1, it sends PDUs from MS#1 using some of the allocated R-UL bandwidth and leaves the rest unused.

Once bandwidth becomes available for MS#2 on the access uplink, the RS allocates bandwidth to MS#2 and receives PDUs from it. However, by then the RS does not have bandwidth on the relay uplink on which to forward the received PDUs to the MR-BS.

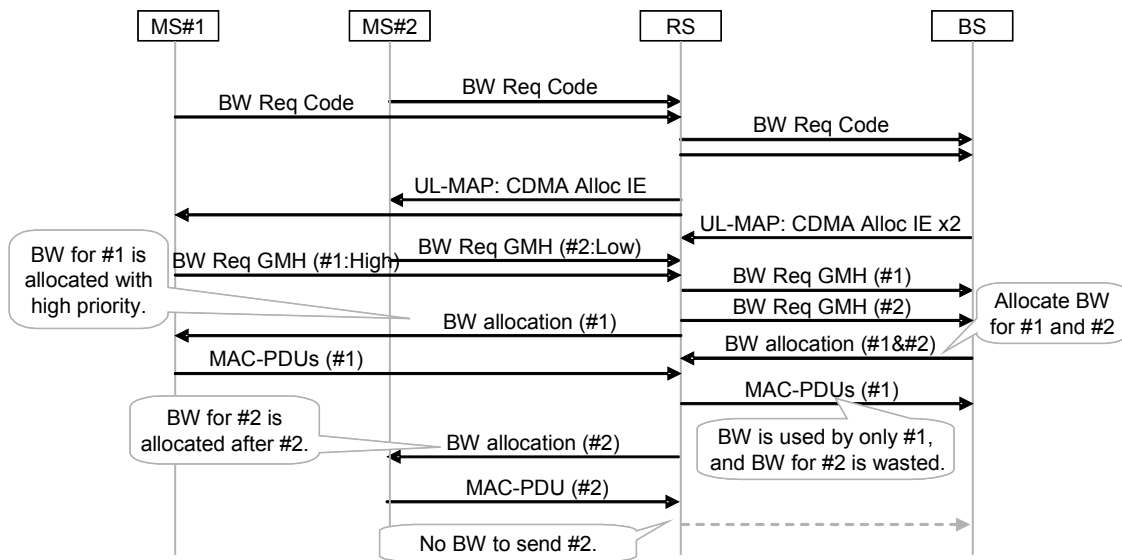


Figure A-3

To prevent the timing misalignment described above, the RS can insert timing information into the BW request header that it transmits to its upstream MR-BS or RS. This timing information informs the upstream station of when it expects to need the relay uplink allocation.

Figure A-4 shows an example of the proposed scheme. In this example, the RS requests the first relay uplink allocation be given at time T1 for the purpose of relaying MS#1's PDUs to the MR-BS and the second relay uplink allocation be given at time T2 for the purpose of relaying MS#2's PDUs to the MR-BS.

When a RS receive another high-priority BW request from a MS after sending low-priority BW request containing timing information to the MR-BS, RS should allocate uplink bandwidth to the high-priority MS and defer allocation to the low-priority MS. Therefore, it could happen that the RS might have received only high-priority PDUs from the MS when the MR-BS allocated UL bandwidth to the RS according to the low-priority bandwidth request. In this case, the RS can send high-priority PDUs to the MR-BS using the allocated bandwidth because the bandwidth grant is addressed to the RS's basic CID not specific connections. Additionally, the RS may send another bandwidth request to the MR-BS to update requesting bandwidth.

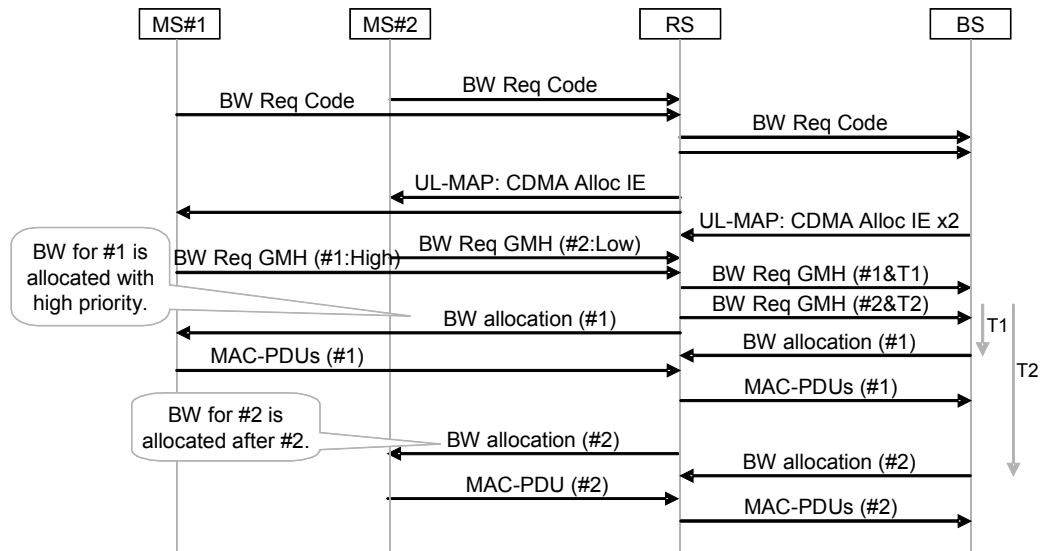


Figure A-4

Specific Text Changes

[Change Table 7g in 6.3.2.1.2.2 (MAC signaling header type II)]:

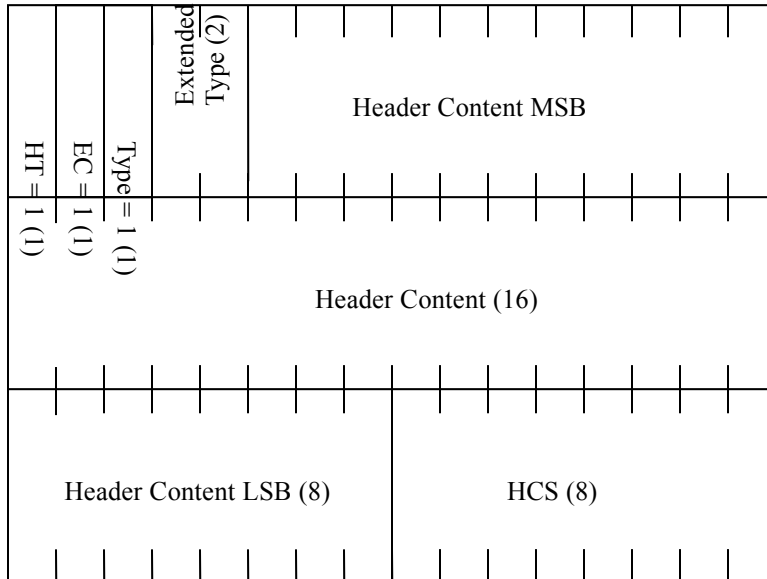
Table 7g—Type field encodings for MAC signaling header type II

Type field	MAC header Type (with HT/EC=0b11)	Reference figure	Reference table
0	Feedback header, with another 4-bit type field, see Table 7i for its type encodings.	20h, 20i	7h
1	Reserved Extended MAC Signaling Header Type II	—	—

[Insert the following subclause at the end of 6.3.2.1.2.2:]

6.3.2.1.2.2.2 Extended MAC Signaling Header Type II

This type of MAC header is UL specific. There is no payload following the MAC header. The Extended MAC signaling header type II is illustrated in Figure X-1. Table X-1 describes the encoding of the 3-bit extended type field following the type field.



[Figure X-1 Extended MAC Signaling Header Type II Format](#)

[Table X-1—Extended Type field encodings for Extended MAC signaling header type II](#)

Extended Type field	MAC header Type	Reference figure	Reference table
0	Relay Bandwidth Request Header		
1-3	Reserved		

[6.3.2.1.2.2.1 Relay Bandwidth Request Header](#)

[The Relay Bandwidth Request header is sent by an RS to request bandwidth on the relay uplink to its upstream MR-BS or RS. In addition to the bandwidth request itself, the Relay Bandwidth Request Header includes timing offset information that indicates at what time this bandwidth needs to be allocated. The RS or MR-BS receiving the header shall wait a period of time equal to the timing offset before allocating bandwidth on the relay uplink to the downstream RS.](#)

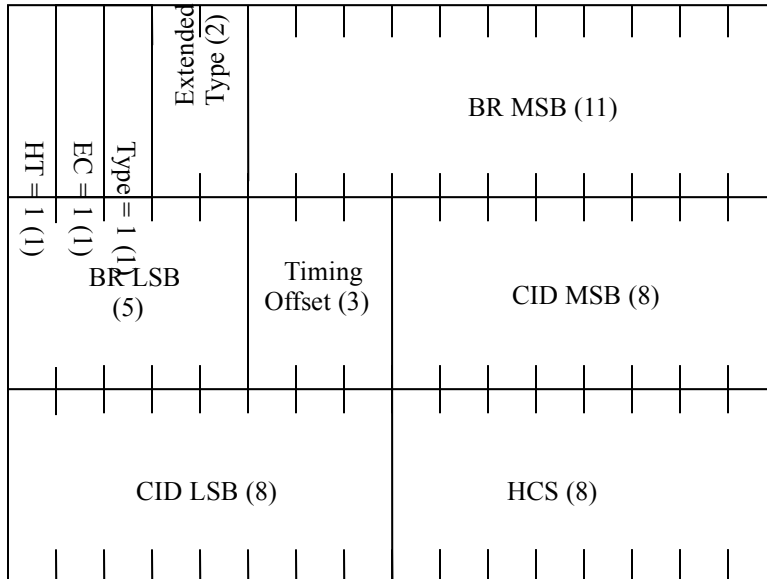


Figure X-1 Relay Bandwidth Request Header Format

Table X-2— Description of fields in Relay Bandwidth Request header

Name	Size	Description
<u>BR</u>	<u>16 bits</u>	<u>Bandwidth Request: The number of bytes of uplink bandwidth requested by the RS (unit of 4-Byte). The bandwidth request is for the CID. The request shall not include any PHY overhead.</u>
<u>Timing Offset</u>	<u>3 bits</u>	<u>Time (in units of a frame) the receiver shall wait before allocating bandwidth corresponding to this header.</u>
<u>CID</u>	<u>16 bits</u>	<u>The CID shall indicate the connection for which uplink bandwidth is requested.</u>
<u>HCS</u>	<u>8 bits</u>	<u>Header Check Sequence (same usage as HCS entry in Table 5).</u>