Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Resource Request for Bandwidth**	
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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.

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.

Specification changes

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. It sends UCD with the correct range of the ranging codes for MS, excluding the codes allocated for RS. 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 for all the relay links and the access link for sending bandwidth request.

For the centralized MAP allocation, the bandwidth request procedures are as follows:

- The MMR-BS allocates a set of CDMA codes for RS. It sends UCD with the CDMA ranging codes excluding the RS CDMA codes.
- A station performs initial ranging with the MMR-BS with a code broadcast in the UCD. If the station is recognized as the RS, it is assigned RS_CDMA_Codes in RS_RNG-RSP. If the station is recognized as an MS, no code assignment is done.
- The MMR-BS finds the links to the RS by using Path Determination procedure to an RS.
- When a station in the system needs bandwidth, it sends a ranging code (from the UCD) on the access link.
    - If the station is one hop away, the MMR-BS receives a ranging code (from the UCD) and does UL allocation as in section 6.3.6.5.
    - If the station is multiple hops away, the access RS replaces the received ranging code (from the UCD) and replaces it with its assigned RS ranging code. The code is relayed toward the MMR-BS. The MMR-BS recognizes the RS with the help of the assigned RS code. It assigns uplink allocation using CDMA Allocation IE for each relay link and the access link.

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 code broadcast in the UCD. 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 RS_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 toward MMR-BS.
- When the RS determines it needs to send RNG-RSP with success status. It sends the assigned Ranging Code for requesting bandwidth for 1) the DL access link to transfer RNG-RSP to the MS, 2) the UL 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)

Insert new sub clause (6.3.2.3.61):

6.3.2.3.61 RS Ranging Response message

The RS_RNG-RSP shall be transmitted from an RS in response to RNG-REQ.

Table x

Syntax	Size	Notes
RS_RNG-RSP_Message_Format () {		
Management Message Type = x	8 bits	
TLV Encoded Information	Variable	TLV Specific
}		

The following parameter is included in the RS_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

Insert new subclause 11.19:

11.19 RS_RNG-RSP management message encodings
The encodings described in this subclause are specific to the RS_RNG-RSP message.

Insert new subclause 11.19.1:

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

References

[1] Topology Discovery and Path Management in multi-hop relay System, C80216j-06_195.doc; Haihong Zheng, Yousuf Saifullah, Shashikant Maheshwari, Nokia