Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Dedicated Ranging Opportunity for RS**	
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Re:	This is a response to Call for Technical Proposals regarding IEEE Project P802.16j.	
Abstract	The document contains technical proposals for IEEE P802.16j that would provide a ranging method on the Mobile RS.	
Purpose	The document is submitted for review by 802.16 Working Group members.	
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Dedicated Ranging Opportunity for RS

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1. Introduction

It's required for the MR-BS to differentiate RS from MS to manage and allocate radio resources effectively because the MR-BS cannot provide the optimized service for each RS or MS without knowing the type or capability of accessing terminal.

But the legacy contention based CDMA code ranging results in long delay because the MR-BS cannot know who has sent the CDMA code without additional message based information exchanges. Figure 1 shows the exchanged messages for the acquisition of accessing terminal in three different contention based CDMA code ranging.

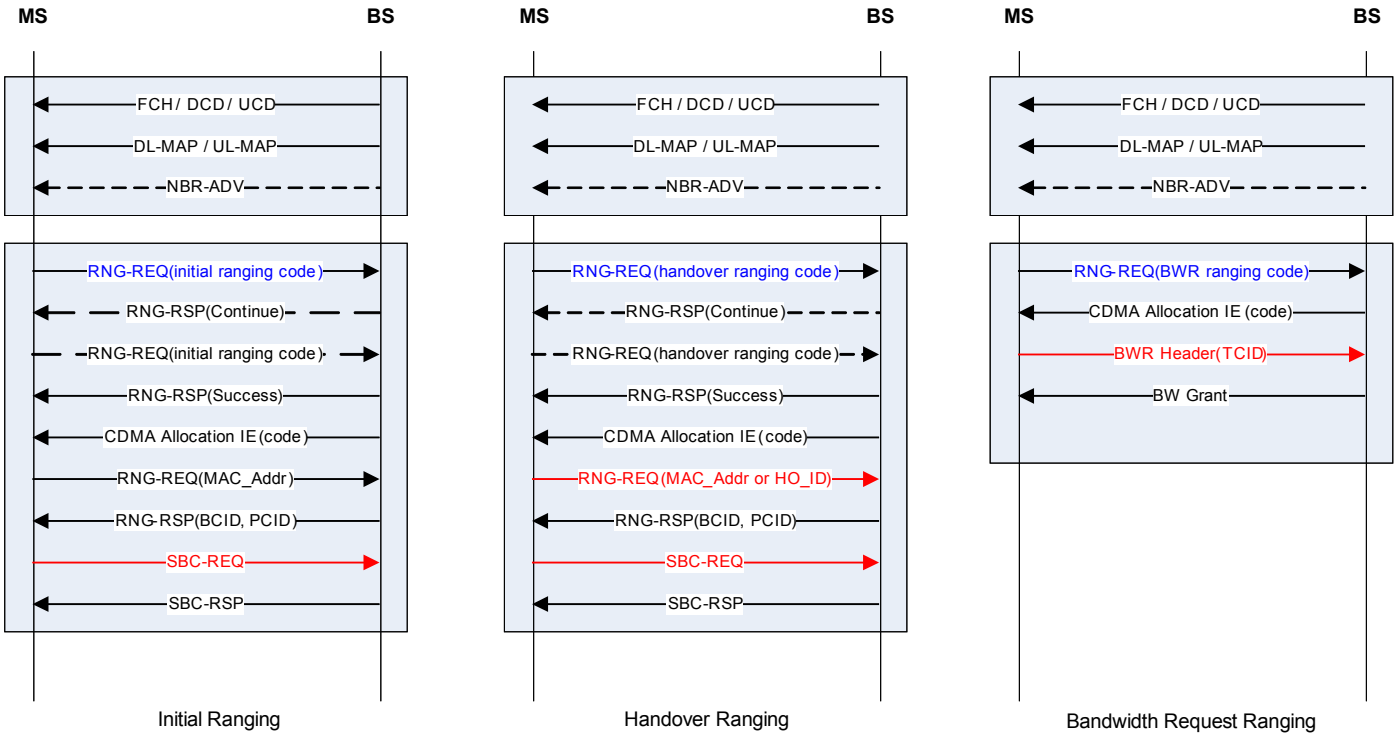

Figure 1 Legacy Contention Based CDMA Code Ranging

In Figure 1, the messages with blue color shows the contention based CDMA code ranging, and the messages with red color shows the point of accessing terminal information acquisition.

2. Proposed Solution

It would be helpful to differentiate RS from MS as early stage of network entry, handover, bandwidth request and etc. as possible. The CDMA code partitioning suggested by [1] could be a solution for this problem.

But it's hard to change the portion of CDMA code dynamically according to the various condition – for example, the number of RS and MS, the ratio of RS to MS, etc – because this information is delivered through UCD, and the change of this information causes the change of CCC(Configuration Change Count).
We propose the ranging opportunity partitioning for the dynamic allocation of ranging opportunity as well as the early acquisition of terminal type and capability. That is, the MR-BS broadcasts not only the ranging opportunity as is done through UIUC 12 (CDMA Bandwidth Request, CDMA Ranging) but also which type of terminal is permitted to send ranging code. To do that, we propose to define Ranging Region Allocation IE as a kind of UL-MAP extended IE. Ranging Region Allocation IE has same information with UIUC 12 except that it has additional 'Terminal Type' parameter.
Figure 2 shows the example of proposed dedicated ranging scheme.

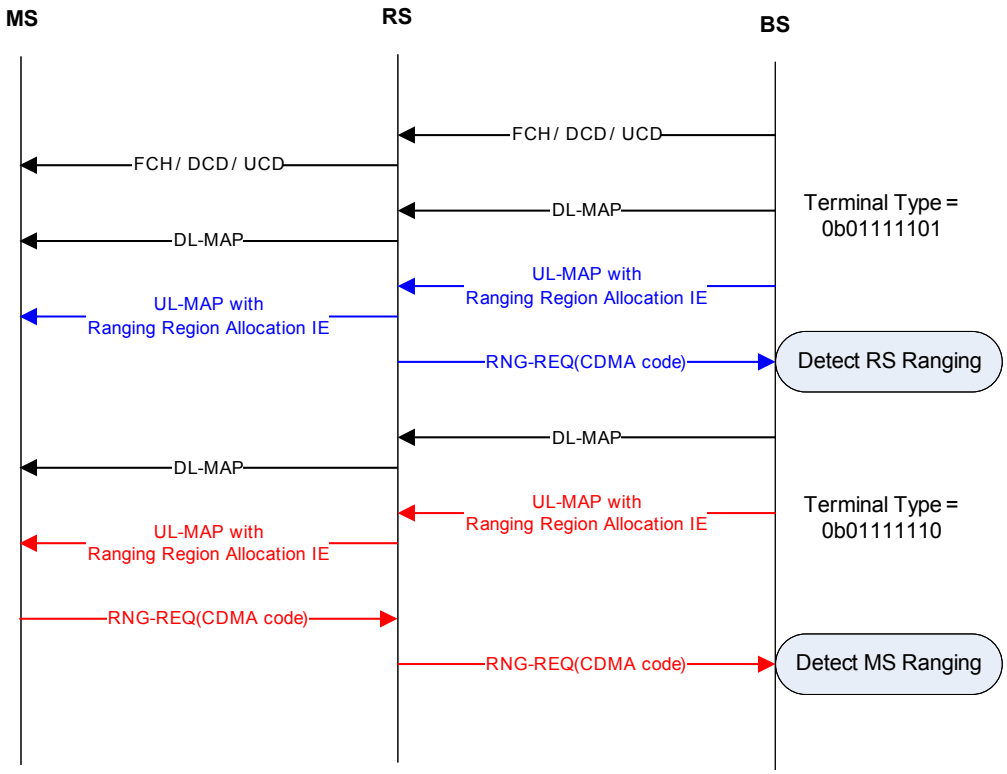

Figure 2 Proposed Dedicated Ranging Opportunity Scheme

The periodicity of ranging opportunity could be determined according to the number of RS and MS, the ratio of RS and MS or the service policy of service provider, or it could be dynamically changed by MR-BS ranging opportunity allocation algorithm. Especially, the periodicity of bandwidth request and periodic ranging opportunity might be suitable for the dynamic allocation because the RAS knows the information of terminals which would try the bandwidth request or periodic ranging – for example, the number of RS and MS or the ratio of RS and MS, etc..

Text Proposals

8.4.5.4.4.1 UL-MAP extended IE format

[Change the Table* Table 290a—Extended UIUC Code Assignment for UIUC=15 *as indicated:]

Extended UIUC (hexadecimal)	Usage
00	Power_control_IE
01	Mini-subchannel_allocation_IE
02	AAS_UL_IE
03	CQICH_Alloc_IE
04	UL Zone IE
05	PHYMOD_UL_IE
06	MIMO_UL_Basic_IE
07	UL-MAP_Fast_Tracking_IE
08	UL_PUSC_Burst_Allocation_in_Other_Segment_IE
09	Fast_Ranging_IE
0A	UL Allocation Start IE
0B~~… 0F~~	~~*Reserved*~~Ranging Region Allocation IE
0C … 0F	*Reserved*

[Insert new subsection 8.4.5.4.29:]

8.4.5.4.29 Ranging Region Allocation IE

Syntax	Size	Notes
Ranging Region Allocation IE() {		
Extended UIUC	4 bits	Ranging Region Allocation IE=0x0B
Length	4 bits	Length=0x06
OFDMA symbol offset	8 bits	—
Subchannel offset	7 bits	
No. OFDMA symbols	7 bits	
No. subchannels	7 bits	
Ranging method	2 bits	0b00 – Initial Ranging/Handover Ranging over two symbols 0b01 – Initial Ranging/Handover Ranging over four symbols 0b10 – BW Request/Periodic Ranging over one symbol 0b11– BW Request/Periodic Ranging over three symbols
Dedicated ranging indicator	1 bits	0: the OFDMA region and Ranging Method defined are used for the purpose of normal ranging

		1: the OFDMA region and Ranging Method defined are used for the purpose of ranging using dedicated CDMA code and transmission opportunities assigned in the MOB_PAG-ADV message or in the MOB_SCN-RSP message.
Terminal Type	8bits	Bit #0: RS Terminal Bit #1: MS Terminal Bit #2: non-MIMO, non-AAS Bit #3: MIMO support Bit #4: AAS(Beamforming) support Bit #5: non-HARQ Bit #6: HARQ support Bit #7: Reserved, set to zero
}		

The following table defines the meaning of 'MIMO support' and 'HARQ support'.

Bit	Items	Sub-items	References
MIMO support	OFDMA SS MIMO uplink support	Single-antenna Collaborative SM	11.8.3.7.6
	OFDMA SS demodulator for MIMO support	2-antenna STC matrix A	11.8.3.7.5
		2-antenna STC matrix B vertical coding	
	OFDMA SS modulator for MIMO support	Capable of single antenna	11.83.7.16

HARQ support	The number of UL HARQ channel	Number of UL HARQ channels = 4	11.8.3.7.3
	The number of DL HARQ channel	Number of DL HARQ channels = 4	11.8.3.7.2
	HARQ Chase combining and CCIR buffer capability	Downlink HARQ buffering capability for chase combining: K = 20	11.8.3.7.19.2
		Aggregation Flag for DL = 0 (OFF)	
		Uplink HARQ buffering capability for chase combining: K = 20	
		Aggregation Flag for UL = 0 (OFF)	
	Maximum number of burst per frame capability in HARQ	Maximum number of UL HARQ bursts per HARQ enabled MS per frame = 2	11.8.3.7.15
		Indicates whether the maximum number of UL HARQ bursts per frame = not included	
		Maximum number of DL HARQ bursts per HARQ enabled MS per frame = 2.	

References

[1] CDMA Code Partitioning for R-UL Ranging Control, C802.16j-07_128.doc, Sungcheol Chang , Juhee Kim and Chulsik Yoon, ETRI.

[2] “Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Corrigendum 2 Draft 2,” Jan. 2007.