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Re:	IEEE 802.16j-07/019: "Call for Technical Comments Regarding IEEE Project 802.16j"
Abstract	This contribution proposes MAP IEs in non-transparent RS systems
Purpose	Text proposal for 802.16j Baseline Document.
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MAP IEs for Non-transparent RS Systems

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Introduction

In C80216j-07/255r1, a burst-based data forwarding scheme for transparent RS systems is proposed by defining new MAP IEs, namely DL-MAP IE with "DL_Burst_Transmit_IE" and UL-MAP IE with "UL_Burst_Receive_IE" in DL-MAP and UL-MAP sent by MR-BS. For a non-transparent RS, the RS broadcasts legacy MAPs (namely, DL-MAP and UL-MAP) in the first DL Access Zone and R-MAP if presented in the first DL Relay Zone that is in Tx mode. Under centralized scheduling, the legacy MAPs and R-MAPs are sent from MR-BS to the RS in the corresponding DL Relay Zone. The relaying scheme of legacy MAPs has been proposed in C80216j-07/257. Consequently, the same relaying scheme can also be applied to relay the R-MAP to the destining RS. Based on the relayed legacy MAPs and R-MAP received from MR-BS, the non-transparent RS is able to extract the information of downstream transmissions in the corresponding DL Access/Relay Zone and the information of upstream receptions in the corresponding UL Access/Relay Zone. From the viewpoint of burst-based data forwarding, the upstream bursts, a non-transparent RS received from its subordinated MS/RS(s) in the UL Access/Relay Zone within a frame, shall be transmitted by the RS in the corresponding UL Relay Zone to its superordinated station altogether. Therefore, the burst-based data forwarding can be easily achieved by only providing a non-transparent RS linkages between its downstream receptions and its downstream transmissions. Since the R-MAP must be decoded by a non-transparent RS in order to obtain the information of downstream receptions, the linkage information shall be included in the same R-MAP.

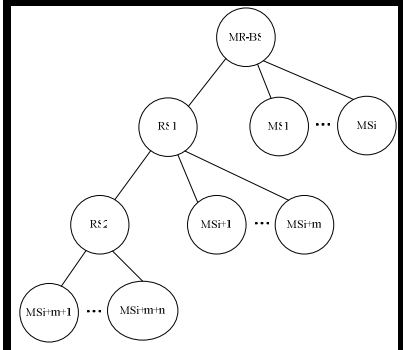
In order to elaborate that the burst-based data forwarding scheme proposed in C80216j-07/255 can be applied to non-transparent RS systems, the R-MAP IE with "RS-DL_Burst_Transmit_IE" proposed in C80216j-07/255 is first described in Tables 1 for the corresponding non-transparent RS to transmit data burst it received to its subordinated stations. Then an example of using the proposed MAP IE in R-MAP is given in Table 2. Moreover, two examples are given in Figures 1 & 2 to illustrate the proposed burst-based scheme for unicast and multicast data forwarding in non-transparent RS systems. Finally, in order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the baseline working document IEEE 802.16j-06/026r3 are listed below.

Table 1 R-MAP IE with "RS-DL_Burst_Transmit_IE"

Syntax	Size	Notes
R-MAP_IE()	variable	
{		
DIUC	4 bits	15 (Extended DIUC dependent IE)
RS_DL_Burst_Transmit_IE() {		
Extended DIUC-2	8 bits	RS_DL_Burst_Transmit_IE = 0x0F
Length	8 bits	Length = 3 + 2Nr1 or 5+2Nr1+2Nr2
RCID	8 bits	Reduced RS basic CID
Ns1	8 bits	The first IE number in associated DL-MAP the RS shall relay in DL Access Zone
Nr1	8 bits	Number of IEs following the Ns1-th IE for RS transmitting to subordinated MSs

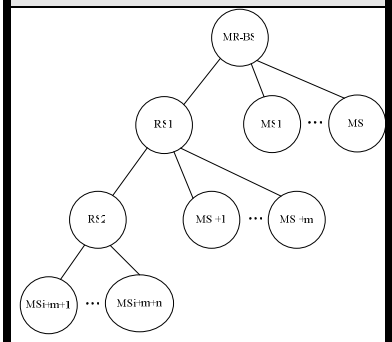
for (n = 0; n < Nr1; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
If (Length > 3 + 2Nr1) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated RSs
for (n = 0; n < Nr2; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
}		
}		

Table 2a : Example of proposed scheme for RS1 in DL

	Zone	MAP/ data region	MAP-IEs used to describe the zone(s)	Notes
	DL Access Zone (BS :Tx, RS1 :Tx, RS2 :Tx, MS :Rx)	DL-MAP	$DL\text{-}MAP\_IE_1()$	MAP IEs for MS receiving from RS1 in DL access zone
			⋮	
			$DL\text{-}MAP\_IE_i()$	
			STC_Zone_IE	Indicate zone switch
			DL-MAP_IE ()	Describe 1st DL relay zone
			STC_Zone_IE	Indicate switch
			DL-MAP_IE ()	Describe 2nd DL relay zone
	1st DL Relay Zone (BS :Tx, RS1 :Rx)	R-MAP (DL Part)	R-MAP_IE()	Data burst for RS1 itself, similar to legacy DL-MAP_IE(), with RS1 basic CID
			R-MAP_IE() with RS DL Burst Transmit IE for RS1	RS1 is assigned to transmit data as indicated by (condensed) DL-MAP and (condensed) DL- R-MAP sent in regular DL data burst. The relaying data is described in following R-MAP_IE
			R-MAP_IE()	Data burst for RS1 relaying, similar to legacy DL-MAP_IE(), with RS1 primary management CID

		Regular DL data burst for RS1	(Condensed) DL-MAP	DL-MAP for RS1 sending to its subordinated MSs in first DL access zone of next frame
			(Condensed) R-MAP (DL Part)	R-MAP for RS1 sending to RS2 in next DL relay zone
	2nd DL Relay Zone (RS1 :Tx ,RS2 :Rx)	R-MAP (DL Part)	R-MAP_IE()	Data burst for RS2 itself with RS2 basic CID, similar to legacy DL-MAP_IE()
			R-MAP_IE() with RS DL Burst Transmit IE for RS2	RS2 is assigned to transmit data as indicated by (condensed) DL-MAP sent in regular DL data burst. The relaying data is described in following R-MAP_IE
			R-MAP_IE()	Data burst for RS2 relaying with RS2 primary management CID, similar to legacy DL-MAP_IE()
		Regular DL data burst for RS2	(Condensed) DL-MAP	DL-MAP for RS2 sending to its subordinated MSs in DL access zone of next frame

Table 2b: Example of proposed scheme for RS1 in UL

	Zone	MAP/ data region	MAP-IEs used to describe the zone(s)	Notes
	UL Access Zone (RS1 :Rx , MS :Tx)	UL-MAP	UL-MAP_IE$_1$()	MAP IEs for MS transmitting
			⋮	
			UL-MAP_IE$_j$()	
			UL_Zone_IE	Indicate zone switch
			UL-MAP_IE ()	Describe the UL relay zone(s)
			UL_Zone_IE	Indicate zone switch
			UL-MAP_IE ()	Describe the UL relay zone(s)
	1st UL Relay Zone (RS1 :Rx RS2 :Tx)	R-MAP (UL Part)	R-MAP_IE()	MAP IE for RS2 transmitting to RS1, similar to legacy UL-MAP_IE

	2nd UL Relay Zone (BS :Rx, RS1 :Tx)	R-MAP (UL Part)	UR-MAP_IE()	MAP IE for RS1 transmitting to MR-BS, similar to legacy UL-MAP IE

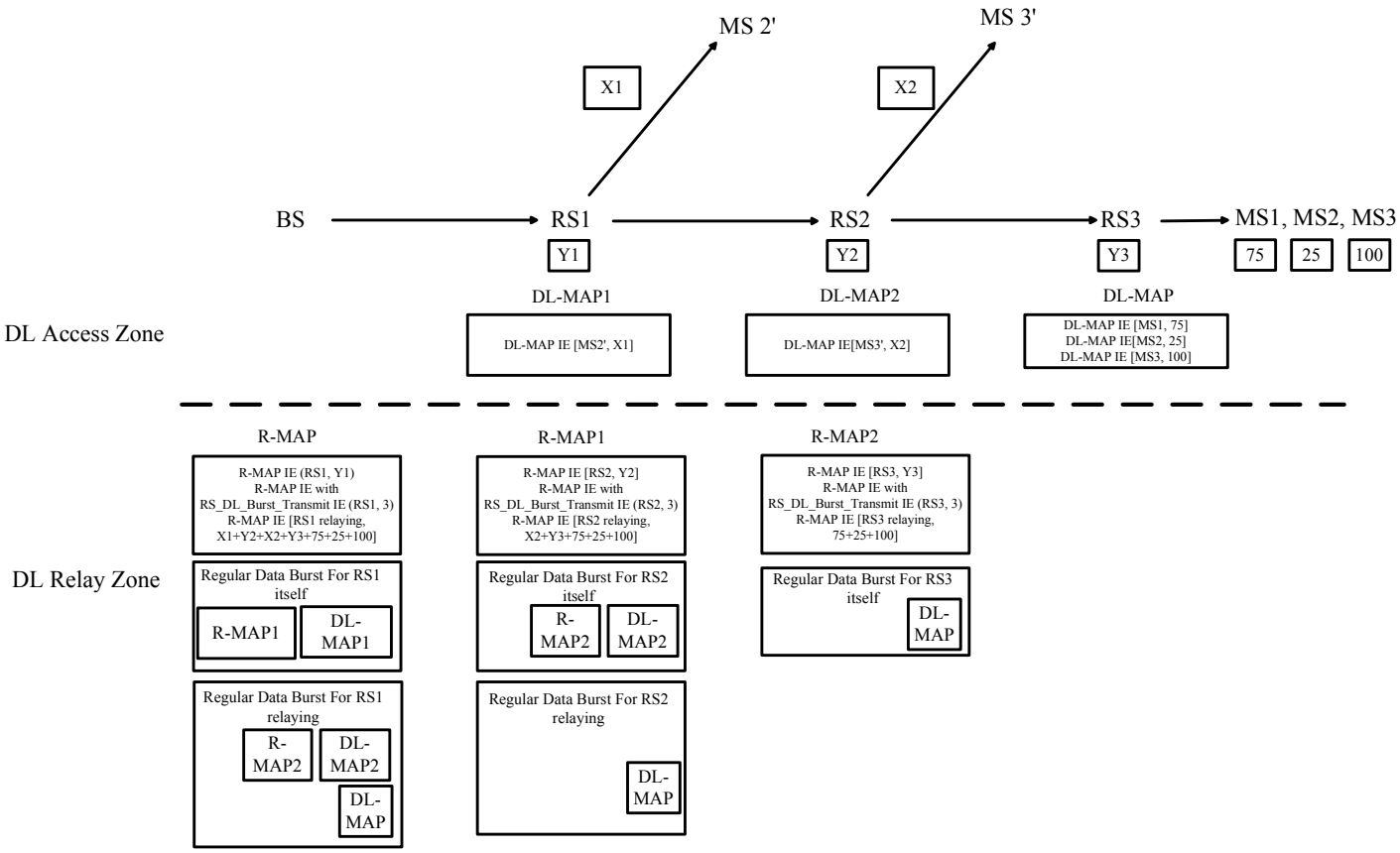


Figure 1 Example of proposed burst-based scheme for unicast data relaying

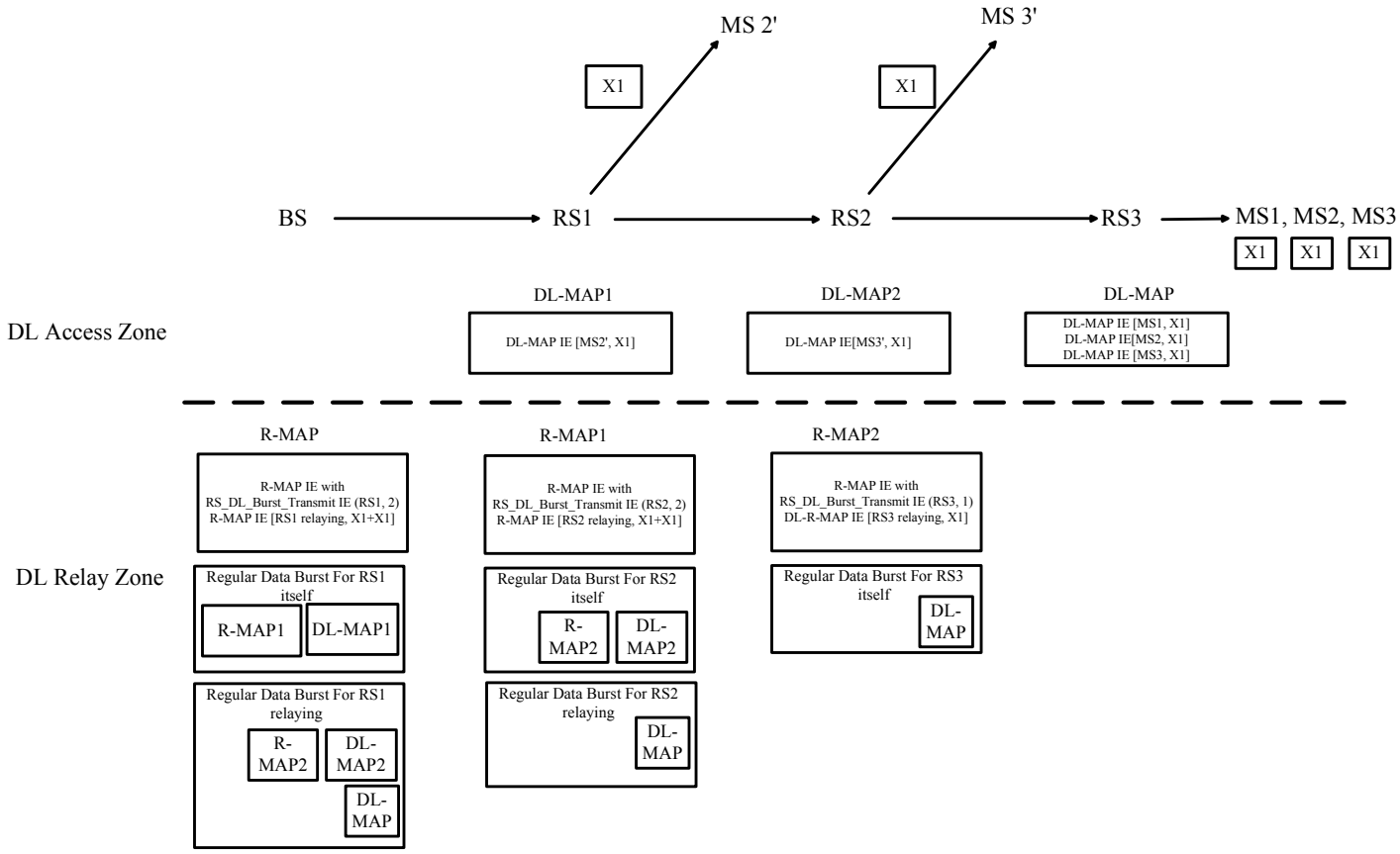


Figure 2 Example of proposed burst-based scheme for multicast data relaying

MAP Overhead Evaluation

An example of system deployment of two-hop scenario is shown in Figure 3, where the system parameters of the simulation are listed in Table I. The system deployment is 1×3×3 (1 MR-BS, 3 Sectors, and 3 Segments). On access links, the AMC (Adaptive Modulation & Coding) for sending both DL-MAP and UL-MAP is QPSK ½ with repetition 1, and the AMC for sending the data burst is 64QAM ¾. On relay links, the AMC for relaying DL-MAP, UL-MAP, and data burst is 64QAM ¾. In addition, the AMC of R-MAP sent on the relay link is 64QAM ¾ with repetition 1.

The pure VoIP service in the MR system is used to evaluate the MAP overhead as the extreme case. Two sizes of VoIP packet length are considered. One is 134 bytes which consists of 128-byte payload and 6-byte generic MAC header. The other is 19 bytes, for inactive user, which consists of 9-byte payload, 6-byte generic MAC header, and 4-byte CRC. Simulation results, summarized in Table II, show that the proposed approach in 7/271 can supports the same number of VoIP users per cell per frame. Although it increases an extra MAP overhead between 0.67% and 3.22%, the proposed approach in 7/271 save the processing time and reduce the comuptation complexity by per burst-based processing instead of by per PDU-based processing.

Table I System parameters

Parameter	**Value**
OFDMA symbol structure	PUSC

Channel Bandwidth	10 MHz
Sampling Frequency	11.2 MHz
FFT Size	1024
Number of Sub-Channels	30 (DL), 35 (UL)
Sub-Carrier Frequency Time	10.94 kHz
Useful Symbol Time	91.94 us
Guard Time	11.4 us (Tg=Tb/8)
OFDMA Symbol Duration	102.9 us
Number of OFDMA symbols (5 ms Frame)	48

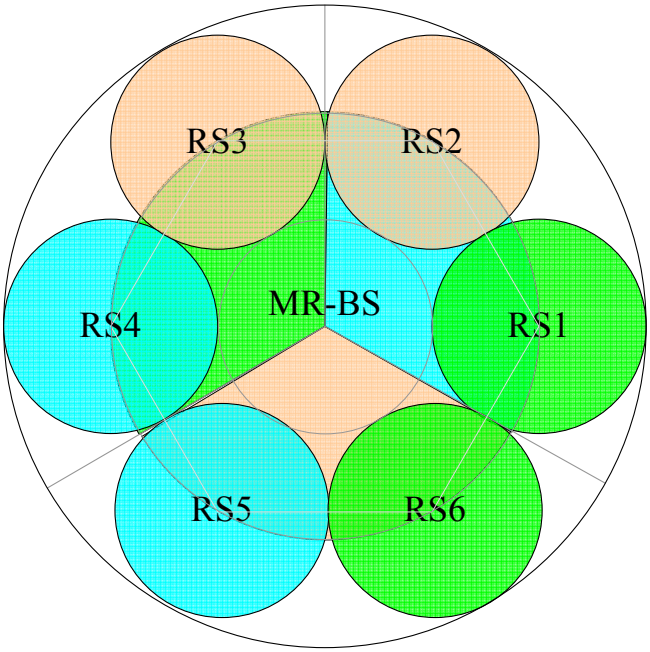


Figure 3 Example of two-hop system deployment

Table II Simulation results

	VoIP packet length = 134 (128+6) bytes		VoIP packet length of AMR w/ header compression = 19 (9+10) bytes for inactive user	
	Supported VoIP user number per cell per frame	MAP overhead	Supported VoIP user number per cell per frame	MAP overhead
w/o 07/271 Approach	45	12.06%	156	36.06%
07/271 Approach	45	12.77%	156	39.28%

Text Proposal

6.3.3.8.2 Transmission using station CID

[Change the following text as indicated:]
[Author's Note: the difference from C80216j-07/255r1 is marked in red as indicated:]

The construction of MPDUs is the same as without relay. There are two schemes for RS to forward received data. One is the MPDU-based forwarding and the other is burst-based forwarding.

In MPDU-based forwarding scheme, ~~T~~the forwarding of MPDUs by each RS is performed based on the CID of MPDUs. An RS is informed apriori about the next hop station during SF setup for a station CID. The inclusion of CID in DL-MAP is optional as it is without relay.

Optionally, under centralized scheduling, forwarding of MPDUs by each RS is performed based on burst described in MAP IEs, namely burst-based forwarding. The burst-based forwarding rules are encoded in the MAPs sent by MR-BS. Data bursts that are scheduled to be relayed by burst-based forwarding mechanism and destining to stations other than the receiving RS are described by MAP IEs with RS primary management CID. If burst-based forwarding is used for transparent RS, DL_Burst_Transmit_IE and UL_Burst_Receive_IE defined in 8.4.5.3.29, and 8.4.5.4.29, respectively, shall be used, where DL_Burst_Transmit_IE is used to describe DL data relaying information and UL_Burst_Receive_IE is used to describe UL data relaying information. If burst-based forwarding is used for non-transparent RS, RS-DL_Burst_Transmit_IE defined in 8.4.5.3.30 shall be used, which is used to describe DL data relaying information.

8.4.5.3.2 DL-MAP extended IE format
8.4.5.3.2.2 DL-MAP extended-2 IE format
[Change Table 277c as indicated:]

Table 277c—Extended-2 DIUC code assignment for DIUC=14

Extended-2 DIUC	(hexadecimal) Usage
00	MBS_MAP_IE
01	HO_Anchor_Active_DL_MAP_IE
02	HO_Active_Anchor_DL_MAP_IE
03	HO_CID_Translation_MAP_IE
04	MIMO_in_another_BS_IE
05	Macro-MIMO_DL_Basic_IE
06	Skip_IE
07	HARQ DL MAP IE
08	HARQ ACK IE
09	Enhanced DL MAP IE
0A	Closed-loop MIMO DL Enhanced IE
0B-0D	Reserved
0E	AAS_SDMA_DL_IE
0F	~~Reserved~~ RS-DL_Burst _Transmit _IE

[Insert the following new subclause]
8.4.5.3.30 RS DL Burst Transmit IE format

Table xxx — RS DL Burst Transmit IE format

Syntax	Size	Note
RS_DL_Burst_Transmit_IE() {		
Extended DIUC-2	4 bits	RS_DL_Burst_Transmit_IE = 0x0F
Length	8 bits	Length = 3 + 2Nr1 or 5+2Nr1+2Nr2
RCID	8 bits	Reduced RS basic CID
Ns1	8 bits	The first IE number in associated DL-MAP the RS shall relay in DL Access Zone
Nr1	8 bits	Number of IEs following the Ns1-th IE for RS transmitting to subordinated MSs
for (n = 0; n < Nr1; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
If (Length > 3 + 2Nr1) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated RSs
for (n = 0; n < Nr2; n++) {	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
}		