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Re:	IEEE 802.16j-07/043: "IEEE 802.16 Working Group Working Group Letter Ballot #28"
Abstract	This contribution proposes MAP IEs in non-transparent RS systems for burst-based forwarding
Purpose	Text proposal for 802.16j Baseline Document.
Notice	
Release	
Patent Policy	

MAP IEs for Non-transparent RS Systems

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Introduction

In 16j/D1, a burst-based data forwarding scheme for transparent RS systems is defined by 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 and R-MAP has been defined in 16j/D1 by RS_Access-MAP and RS_RLY-MAP, respectively. 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 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.

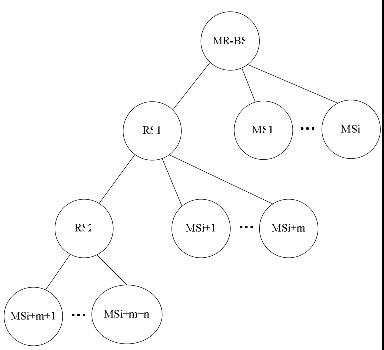
In order to elaborate that the burst-based data forwarding scheme defined in 16j/D1 can be applied to non-transparent RS systems, the R-MAP IE with "RS-DL_Burst_Transmit_IE" is first described in Tables 1 for the corresponding non-transparent RS to transmit data burst it received to its subordinated 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 draft standard IEEE P802.16j/D1 are listed below.

Table 1 RS DL Burst Transmit IE format

Syntax	Size	Note
RS_DL_Burst_Transmit_IE() {		
Type	5 bits	RS_DL_Burst_Transmit_IE = 0x11
Length	8 bits	
RCID_IE	4, 8, 12, 16 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++) {	-	-
MBC burst indicator	1 bit	0: unicast 1: broadcast/multicast
Relay burst length	15 bits	Relay burst length (in unit of byte)

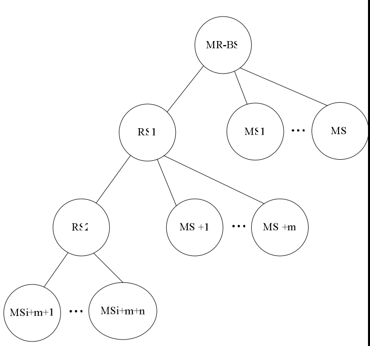
}		
If (data remains) {		
Ns2	8 bits	The first IE number in associated R-MAP the RS shall relay in the DL Relay Zone
Nr2	8 bits	Number of IEs following the Ns2-th IE for RS transmitting to subordinated RSs
for (n = 0; n < Nr2; n++) {	-	-
MBC burst indicator	1 bit	0: unicast 1: broadcast/multicast
Relay burst length	15 bits	Relay burst length (in unit of byte)
}		
}		
Padding	Variable	Padding to ensure byte alignment
}		

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	$DL\text{-}MAP\_IE_1()$ ⋮ $DL\text{-}MAP\_IE_i()$	MAP IEs for MS receiving from RS1 in DL access zone
			STC_Zone_IE	Indicate zone switch
			DL-MAP_IE ()	Describe 1st DL relay zone
			STC_Zone_IE	Indicate zone switch
			DL-MAP_IE ()	Describe 2nd DL relay zone
	1st DL Relay Zone (BS :Tx, RS1 :Rx)	R-MAP (DL Part)	DL-MAP_IE()	Data burst for RS1 itself with RS1 basic CID
			DL-MAP_IE()	Data burst for RS1 relaying with RS1 primary management CID
			R-link specific IE() with RS DL Burst Transmit IE for RS1	RS1 is assigned to transmit data as indicated by DL-MAP IEs in RS_Access-MAP and RS_RLY-MAP sent in regular DL data burst. The relaying data is described in the R-MAP_IE with RS1 primary management CID
		Regular DL data burst for RS1	RS_Access-MAP (RS1)	DL-MAP information for RS1 sending to its subordinated MSs in first DL access zone of next frame

			RS_RLY-MAP (RS1)	R-MAP information for RS1 sending to RS2 in next DL relay zone
	2^{nd} DL Relay Zone (RS1 :Tx ,RS2 :Rx)	R-MAP (DL Part)	DL-MAP_IE()	Data burst for RS2 itself with RS2 basic CID
			DL-MAP_IE()	Data burst for RS2 relaying with RS2 primary management CID
			R-link specific IE() with RS DL Burst Transmit IE for RS2	RS2 is assigned to transmit data as indicated by MAP IEs in RS_Access-MAP sent in regular DL data burst. The relaying data is described in following R-MAP_IE
		Regular DL data burst for RS2	RS_Access-MAP (RS2)	DL-MAP information 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)
	1^{st} UL Relay Zone (RS1 :Rx RS2 :Tx)	R-MAP (UL Part)	UL-MAP_IE()	MAP IE for RS2 transmitting to RS1
	2^{nd} UL Relay Zone (BS :Rx, RS1 :Tx)	R-MAP (UL Part)	UL-MAP_IE()	MAP IE for RS1 transmitting to MR-BS

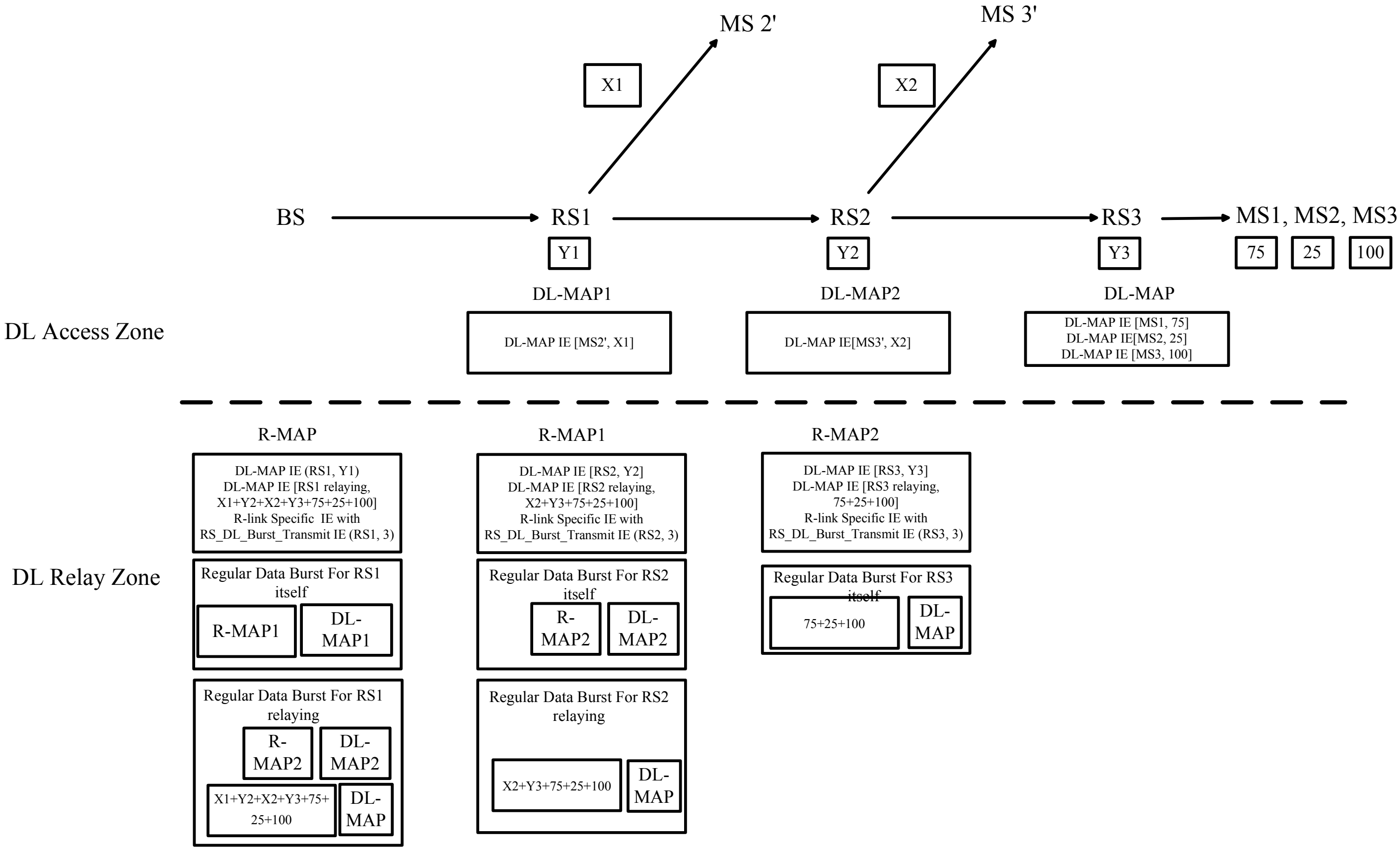


Figure 1 Example of proposed burst-based scheme for unicast data relaying (MBC=0)
(Note: 1. For convenience, burst size does not include the sizes of MAPs in the burst)

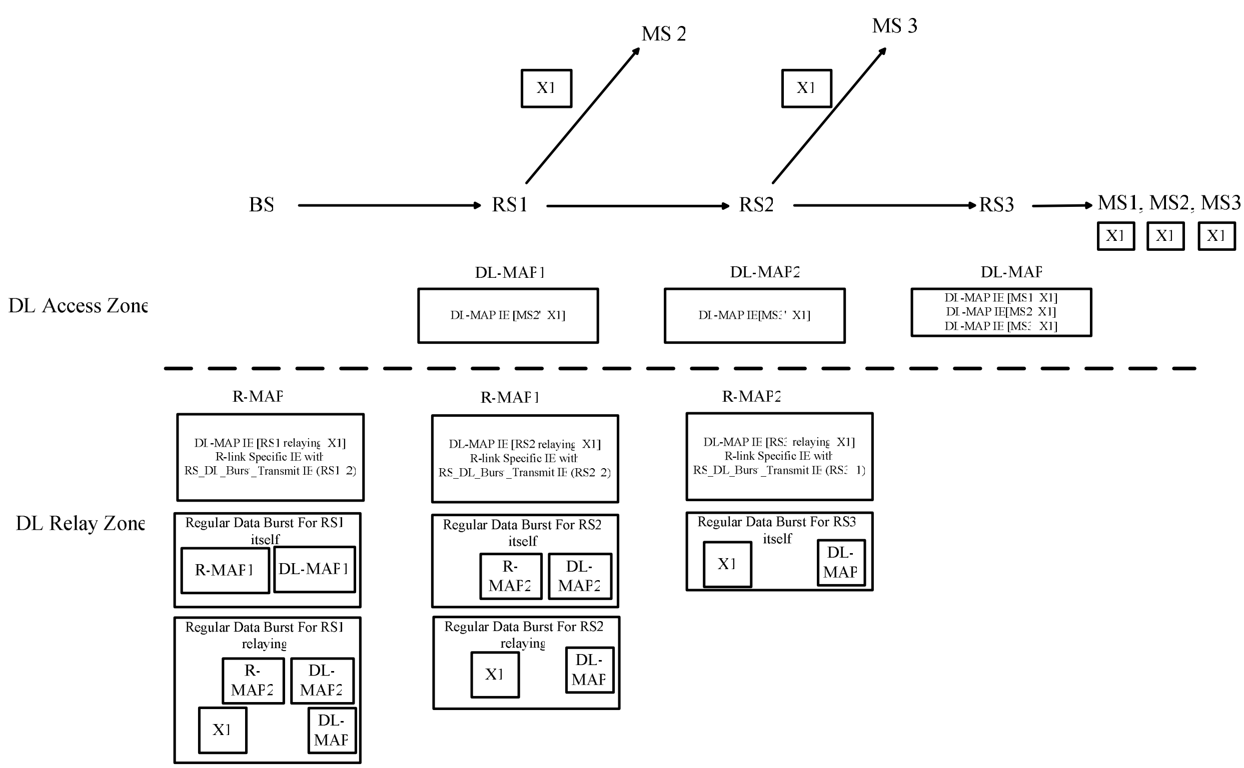


Figure 2 Example of proposed burst-based scheme for multicast data relaying (MBC=1)
(Note: 1. For convenience, burst size does not include the sizes of MAPs in the burst)

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

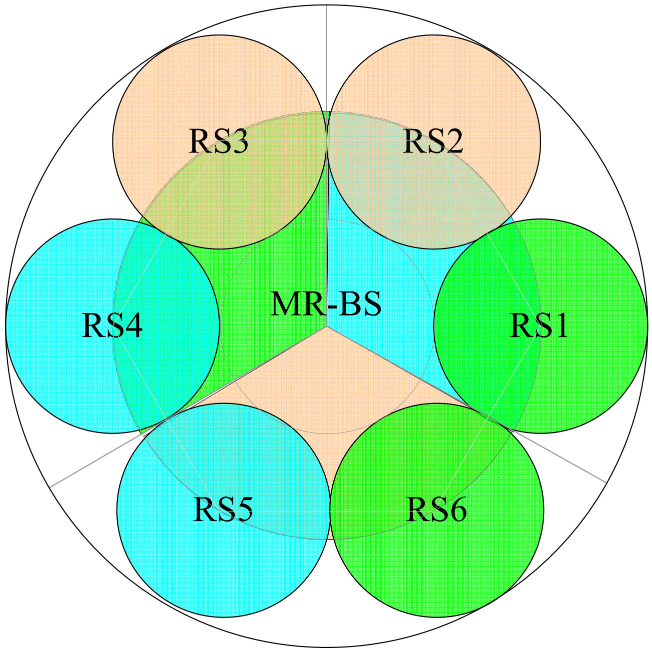


Figure 3 Example of two-hop system deployment

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-07/546 is marked in red as indicated:]

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, the forwarding of MPDUs by each RS is performed based on the CID contained in the MPDU header. An RS is informed about the next hop station during the setup of the service flow. The inclusion of CID in the DL-MAP is optional.

~~Optionally, u~~Under centralized scheduling, forwarding of MPDUs by each RS ~~is~~may be performed based on burst described in MAP IEs, namely burst-based forwarding. The burst-based forwarding scheme~~ works~~ utilizes~~ing~~ forwarding rules encoded in MAPs. Data bursts that are scheduled to be relayed by the receiving RS~~,~~ ~~but are not destined for the same RS must rely on MAP IEs~~ shall be sent with the RS primary management CID. For transparent RS, ~~T~~the DL_Burst_Transmit_IE and UL_Burst_Receive_IE, as described in 8.4.5.3.~~29~~28 and

8.4.5.4.29, (respectively,) are the IEs that shall be used. The DL_Burst_Transmit_IE is used to describes the DL data relaying information and the UL_Burst_Receive_IE is used to describes UL data relaying information. For DL MAP IEs following the DL_Burst_Transmit_IE, the RS shall forward the data in allocations defined by these IEs, where the forwarded data is received in the DL burst with the RS primary management CID. For UL MAP IEs following the UL_Burst_Receive_IE, the RS shall receive the data in allocations defined by these IEs and forward to its superordinated station in the next available allocation, defined by legacy UL-MAP IE, in UL relay zone.

For non-transparent RS, RS-DL_Burst_Transmit_IE defined in 8.4.5.9.1.4 shall be used for DL burst-based forwarding. The RS-DL_Burst_Transmit_IE indicates DL-MAP IEs, which the RS shall forward the data received in the burst with the RS primary management CID to the subordinated stations in the allocations defined by these DL-MAP IEs. If the DL-MAP IE is within the RS_Access-MAP message, the RS shall forward the data on the access link, whereas if the DL-MAP IE is within the RS_RLY-MAP message, the RS shall forward the data on the relay link.

[Change the following Table 496b in line 34 of page 191:]

Table 496b—R-link specific IE format

Syntax	Size	Note
RS-link specific IE() {		
Type	5 bits	
Length	4 or 8 bits	If Type = 0x00-0x10, then Length size = 4 bits, If Type = 0x11-0x1F, then Length size = 8 bits
IE specific data	variable	
}		

[Change the following Table 496c in line 3 of page 192:]

Table 496c—R-link specific IE types

11	RS DL Burst Transmit IE
02-10,12-1F	Reserved

[Insert the following new subclause]

8.4.5.9.1.4 RS DL Burst Transmit IE format

Table xxx — RS DL Burst Transmit IE format

Syntax	Size	Note
RS_DL_Burst_Transmit_IE() {		
Type	5 bits	RS_DL_Burst_Transmit_IE = 0x11
Length	8 bits	
RCID_IE	4, 8, 12, 16 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++) {	-	-

MBC burst indicator	1 bit	0: unicast 1: broadcast/multicast
Relay burst length	15 bits	Relay burst length (in unit of byte)
}		
If (data remains) {		
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++) {	-	-
MBC burst indicator	1 bit	0: unicast 1: broadcast/multicast
Relay burst length	15 bits	Relay burst length (in unit of byte)
}		
}		
Padding	Variable	Padding to ensure byte alignment
}		