Project	**IEEE 802.16 Broadband Wireless Access Working Group <**http://ieee802.org/16**>**	
Title	**Clarification of Burst-based Forwarding in RS Group**	
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Re:	IEEE 802.16-08/007: "IEEE 802.16 Working Group Letter Ballot Recirc #28b: Announcement"	
Abstract	This contribution modifies the burst-based forwarding in RS group with non-transparent RSs	
Purpose	Text proposal for 802.16j Draft Document.	
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Clarification of Burst-based Forwarding in RS Group

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Introduction

The RS group has a superordinate station (non-transparent RS or MR-BS) that is the superordinate station of all RSs in the group. All the RSs in the RS group shall either transmit the same preamble, FCH and MAPs (non-transparent RS) or they all do not transmit any preamble, FCH or MAPs (transparent RS).

In p802.16j/D3, the burst-based forwarding scheme has been defined to accommodate frequent changes of the forwarding path due to the MS movement or the CDMA contention-based ranging within the RS group with the transparent RS. In an RS group with non-transparent RSs, the forwarding path also changes frequently due to the MS movement or the CDMA contention-based ranging, which should require a similar solution. Therefore, we proposed to apply the burst-based forwarding scheme to both transparent and non-transparent RS in the RS group

Our study shows that the burst-based forwarding scheme defined in D3 for the transparent RS could also be applied to the non-transparent RS in the RS group with the following minor modifications in the relaying scheme by re-using existing DL_Burst_Transmit_IE and the UL_Burst_Receive_IE already defined for the transparent RS

1. The DL_Burst_Transmit_IE and the UL_Burst_Receive_IE for the non-transparent RS to relay data in the access zone are included in the RS_Access-MAP sent in the relay zone
2. The data burst for relaying via the non-transparent RS is described by the R-MAP sent in relay zone with RS primary management CID.

In order to elaborate the burst-based forwarding scheme in the RS group, examples of the RS group with transparent RS and non-transparent RS are given in the following.

Table 1: Example of burst-based forwarding scheme with DL_Burst_Transmit_IE in RS group where all RSs do not transmit any preamble, FCH and MAPs.

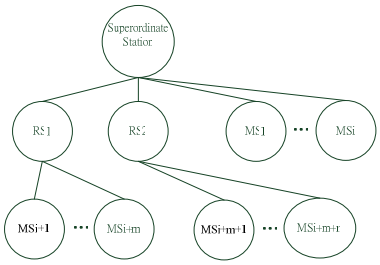
MR Network Topology	Zone	MAP-IEs used to describe the zone(s)	Notes
	DL Access Zone (superordinate station:Tx, MS :Rx, RS1:Rx, RS2:Rx)	DL-MAP_IE$_1$()	MAP IEs for MSs receiving from superordinate station
		⋮	
		DL-MAP_IE$_i$()	
		DL-MAP_IE$_{i+1}$ ()	Data burst for RS1 itself (with RS1 basic CID)
		DL-MAP_IE$_{i+2}$()	Data burst for RS1 relaying (with RS1 primary CID)
		DL-MAP_IE$_{i+3}$ ()	Data burst for RS2 itself (with RS2 basic CID)
		DL-MAP_IE$_{i+4}$()	Data burst for RS2 relaying (with RS2 primary CID)
		STC_Zone_IE	Indicate zone switch
	1st DL Trans-parent Zone (RS1:Tx, RS2:Tx MS:Rx)	DL-MAP_IE with DL_Burst_Transmit_IE (RS1, Nr = *m*)	RS1 is assigned to transmit the following *m* legacy DL-MAP IEs for MSs
		DL-MAP_IE$_{j+1}$()	MAP IEs for MSs receiving from RS1
		⋮	
		DL-MAP_IE$_{j+m}$()	
		DL-MAP_IE with DL_Burst_Transmit_IE (RS2, Nr = *n*)	RS2 is assigned to transmit the following *n* legacy DL-MAP IEs
		DL-MAP_IE$_{k+1}$()	MAP IEs for MSs receiving from RS2
		⋮	
		DL-MAP_IE $_{k+n}$()	

Table 2: Example of burst-based forwarding scheme with UL_Burst_Receive_IE in RS group where all RSs do not transmit any preamble, FCH and MAPs.

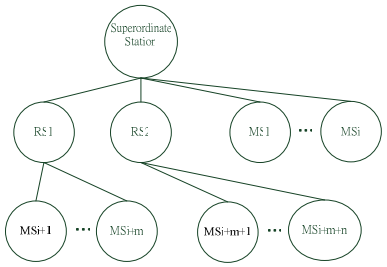
<table>
<tr><th>MR Network Topology</th><th>Zone</th><th>MAP-IEs used to describe the zone(s)</th><th>Notes</th></tr>
<tr><td rowspan="8"> 
</td><td rowspan="8">UL Access Zone
(MS:Tx, RS1:Rx, RS2:Rx)</td><td>UL-MAP_IE$_1$()</td><td rowspan="4">MAP IEs for MSs transmitting to superordinate station</td></tr>
<tr><td></td></tr>
<tr><td>⋮</td></tr>
<tr><td>UL-MAP_IE$_i$()</td></tr>
<tr><td>UL-MAP_IE with UL Burst Receive IE (RS1, m)</td><td>RS1 is assigned to receive following m UL-MAP IEs which are transmitted in DL Access Zone</td></tr>
<tr><td>UL-MAP_IE$_{j+1}$()</td><td rowspan="3">MAP IEs for MS transmitting to RS1</td></tr>
<tr><td>⋮</td></tr>
<tr><td>UL-MAP_IE$_{j+m}$()</td></tr>
<tr><td>UL-MAP_IE$_j$ with UL Burst Receive IE (RS2, n)</td><td>RS2 is assigned to receive following n UL-MAP IEs which are transmitted in DL Access Zone</td></tr>
<tr><td>UL-MAP_IE$_{k+1}$()</td><td rowspan="3">MAP IEs for MS transmitting to RS2</td></tr>
<tr><td>⋮</td></tr>
<tr><td>UL-MAP_IE$_{k+n}$ ()</td></tr>
</table>

Table 3: Example of burst-based forwarding scheme with DL_Burst_Transmit_IE in RS group where all RSs transmit the preamble, FCH and MAPs.

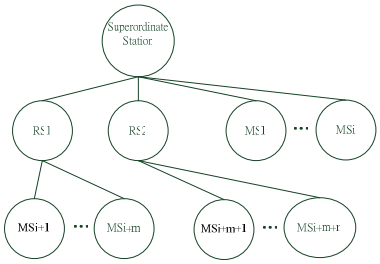
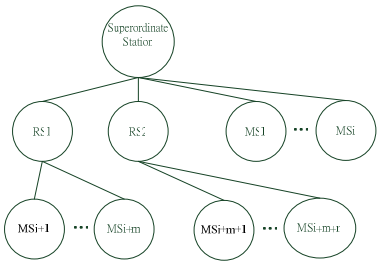
MR Network Topology	Zone	MAP-IEs used to describe the zone(s)	Notes
	DL Access Zone at frame # *k* (superordinate station :Tx, MS :Rx, RS1:Tx, RS2:Tx)	DL-MAP_IE$_1$() ⋮ DL-MAP_IE$_i$()	MAP IEs for MSs receiving data from the superordinate station in RS group
		DL-MAP_IE$_{i+1}$() ⋮ DL-MAP_IE$_j$()	RS1 is assigned to transmit data to MSs via the DL-MAP IEs in RS_Access-MAP received at frame # (*k-1)*
		DL-MAP_IE$_{j+1}$() ⋮ DL-MAP_IE$_k$()	RS2 is assigned to transmit data to MSs via the DL-MAP IEs in RS_Access-MAP received at frame # (*k-1)*
	DL Relay Zone at frame #*k* (superordinate station :Tx,, RS1:Rx, RS2:Rx)	DL-MAP_IE$_1$ ()	Data burst is for RS1 itself with RS1 basic CID via R-MAP. The data burst includes the RS_Access-MAP with DL_Burst_Transmit_IE (RS1, Nr = *m*) and *m* legacy DL-MAP IEs.
		DL-MAP_IE$_2$()	Data burst for RS1 relaying with RS1 primary CID via R-MAP
		DL-MAP_IE$_3$ ()	Data burst is for RS2 itself with RS2 basic CID via R-MAP. The data burst includes the RS_Access-MAP with DL_Burst_Transmit_IE (RS2, Nr = *n*) and *n* legacy DL-MAP IEs.
		DL-MAP_IE$_4$()	Data burst is for RS2 relaying with RS2 primary CID via R-MAP

Table 4: Example of burst-based forwarding scheme with UL_Burst_Transmit_IE in RS group where all RSs transmit the preamble, FCH and MAPs.

MR Network Topology	Zone	MAP-IEs used to describe the zone(s)	Notes
	UL Access Zone at frame # *k* (superordinate station :Rx, MS :Tx, RS1:Rx, RS2:Rx)	UL-MAP_IE$_1$() ⋮ UL-MAP_IE$_i$()	MAP IEs for MSs transmitting data to the superordinate station in RS group
		UL-MAP_IE$_{i+1}$() ⋮ UL-MAP_IE$_j$()	RS1 is assigned to receive data from MSs via the UL_Burst_Transmit_IE and UL-MAP IEs in RS_Access-MAP received at frame # (*k-1*)
		UL-MAP_IE$_{j+1}$() ⋮ UL-MAP_IE$_k$()	RS2 is assigned to receive data to MSs via the UL_Burst_Transmit_IE and UL-MAP IEs in RS_Access-MAP received at frame # (*k-1*)

In addition, in an RS group with non-transparent RSs, the burst-based forwarding could also be used to supplement the MPDU-based forwarding and RS_Member_List_Update messages. The combined scheme provides an efficient and complete solution. When CID routing tables of the RS group is converged, MPDU-based forwarding is the forwarding scheme that minimizes the overhead. However, when the CID routing table is required to be modified due to the RS group member updates, the MS movement or the CDMA contention-based ranging; the superordinate station unicast/multicast the RS_Member_List_Update message to related RSs and requires the acknowledgement from each RS to ensure the routing consistency within the RS group. The convergence of the CID routing table update could be time-consuming. So, the burst-based forwarding scheme could be used to mitigate the data forwarding outage due to the CID routing table convergence.

In order to facilitate the incorporation of this proposal into IEEE 802.16j standard, specific changes to the draft document P802.16j/D3 are listed below.

Text Proposal

6.3.3.8 MR construction and transmission of MAC PDUs

[Delete the following text in line 26 of page 78 as indicated]

~~The above description does not apply to RS group operation~~

6.3.3.8.2 Transmission using station CID

[Change the following text in line 17 of page 79 as indicated]

In t~~T~~he burst-based forwarding scheme~~, which is used in case of Transparent RS in a 2-hop topology,~~ the forwarding of the bursts is performed on the basis of forwarding rules encoded in MAP IEs. Data bursts that are scheduled to be relayed by the receiving RS shall be sent with the RS primary management CID or Multicast management CID. For transparent RS and non-transparent RS in an RS group, the DL_Burst_Transmit_IE and UL_Burst_Receive_IE, as described in 8.4.5.~~10.1.6~~3.29 and 8.4.5.4.29, respectively, shall be used. The DL_Burst_Transmit_IE for transparent RSs is described in DL-MAP, compressed DL-MAP, or SUB-DL-UL-MAP. The UL_Burst_Receive_IE for transparent RSs is described in UL-MAP, compressed UL-MAP, or SUB-DL-UL-MAP. Whereas the DL_Burst_Transmit_IE and the UL_Burst_Receive_IE for non-transparent RS are described in RS_Access-MAP. The DL_Burst_Transmit_IE describes the DL data relaying information and the UL_Burst Receive_IE 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 or Multicast 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 superordinate~~d~~ station in the next available allocation, defined by legacy UL-MAP IE, in UL relay zone.

8.4.5.3.29 DL Burst Transmit IE

[Change the following IE in line 4 of page 199 as indicated]

Table xxx—DL Burst Transmit IE format

Syntax	Size	Notes
DL_Burst_Transmit_IE{	-	-
Extended-2 DIUC	4 bits	DL_Burst_Transmit IE = 0x0F
Length	8 bits	Length = ~~2+2Nr or~~ 3+2Nr
~~R~~CID~~_IE~~	~~Variable~~ 16 bits	~~Reduced~~ RS basic CID or multicast management CID
Nr	8 bits	Number of bursts forwarding by RS
for(n=0;n<Nr;n++){	-	-
Relay burst length	16 bits	Relay burst length (in unit of byte)
}		
}		

8.4.5.4.29 UL_Burst _Receive_IE format

[Change the following IE in line 8 of page 203 as indicated]

Table 486b—UL_Burst_Receive_IE format

Syntax	Size	Notes
UL_Burst_Receive_IE() {	~~16 bits~~	
Extended UIUC	4 bits	UL Burst Receive IE = 0x0B
Length	4 bits	0x0: Nr=1 0x1: Nr>1
If (Length ==1){		
Nr	8 bits	Number of UL-MAP_IE following current IE for RS to receive data bursts from subordinate station(s)

}		
}		