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Title	A proposal of the configuration of MAPs and IEs for multi-hop relay network
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Source(s)	CHEN Yuqin, QU Hongyun, Standard Research Department/ ZTE Corporation 706, 3F, Pengji Industry District, Lian Tang, Shenzhen, P.R.China Voice: +86 13632552601 [chen.yuqin@zte.com.cn]
Re:	IEEE802.16j-06/034: "Call for Technical Proposals regarding IEEEP802.16j"
Abstract	This contribution proposes a dynamic super frame structure to support flexible payload ratio between access and relay links.
Purpose	To propose design and text for downlink HARQ for two hop RS.
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A Proposal of the configuration of MAP and IEs for Multi-hop Relay Network

CHEN Yuqin, QU Hongyun

ZTE Corporation

Introduction

Super frame structure configuration summarized in the baseline consists of fixed access zone and relay zone. Actually, the variant payload ratio between access and relay links requires a more flexible super frame structure to improve the resource efficiency. To solve this problem, we propose a dynamic super frame structure where the relay zone position can be changed according to some factors such as the network topology or the traffic payload ratio between access and relay links. BS and RSs control the relay zone position of each single frame throughby management messages. Moreover, to avoid interference to management messages in relay zone, simultaneous switch from access zone to relay zone among BS and RSs is considered.

Proposal

The proposed super frame structures of BS, intermediate RSs and the last hop RS are illustrated in Fig. 1. Since transmission of management messages in each hop requires one single frame delay, in order to have all BS and RSs switch to relay zone at the same time, BS needs to send the following frames' relay zone position in advance. Based on the network topology information, it is available for BS to be aware the maximum hop number, and also the delay (measured as the number of single frames) that management messages takes to transmit between BS and the last hop RS.

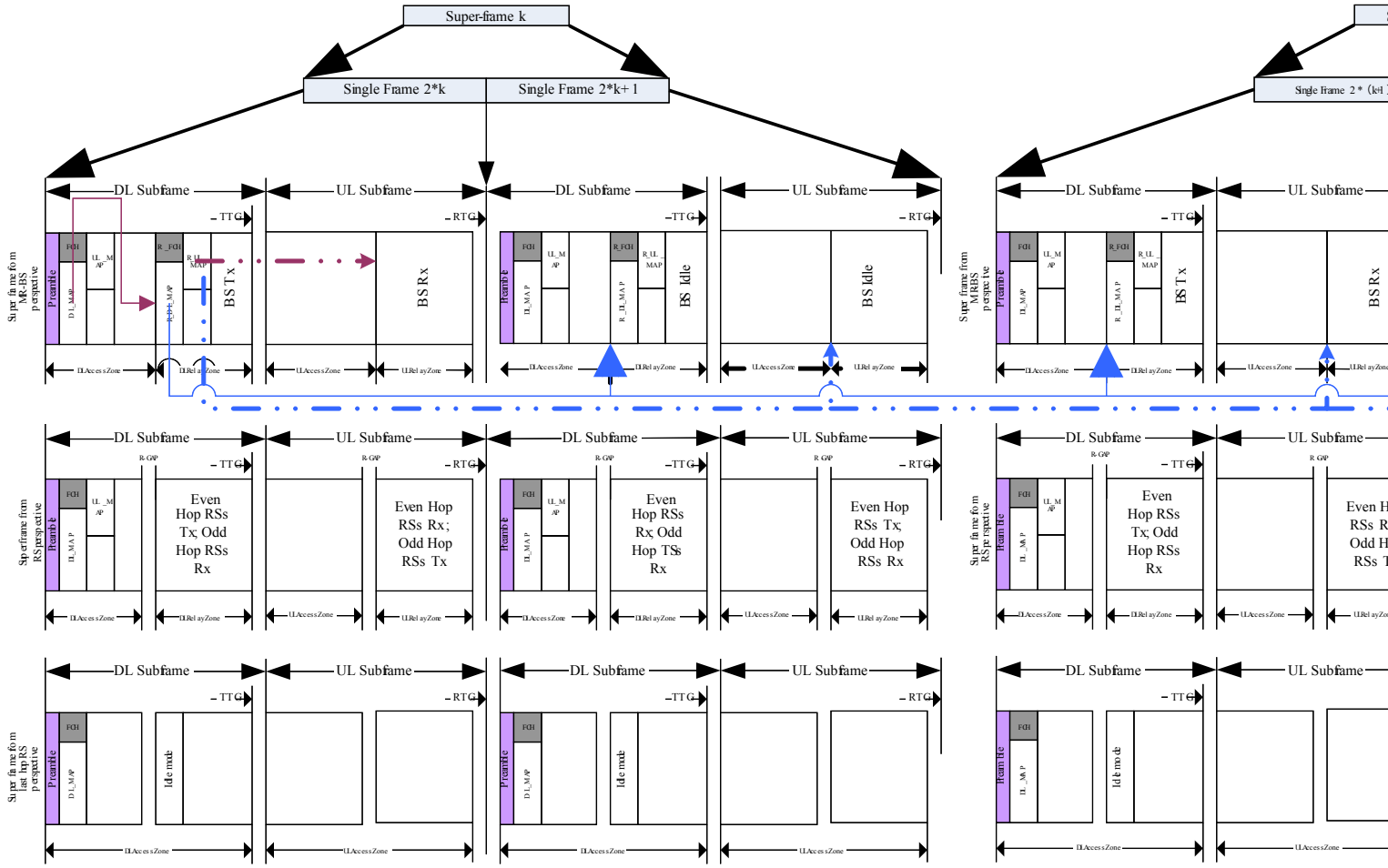
Super-frame k
Single Frame 2*k
Single Frame 2*k+ 1
DL Subframe
UL Subframe
TTG
RTG
R-GAP
Preamble
FCH
DL_MAP
UL_MAP
R_FCH
R_UL_MAP
BS Tx
BS Rx
BS Idle
Even Hop RSs Tx; Odd Hop RSs Rx
Even Hop RSs Rx; Odd Hop RSs Tx
Even Hop RSs Rx; Odd Hop TSs Rx
Even Hop RSs Tx; Odd Hop RSs Rx
Idle mode
DLAccessZone
DLRelayZone
ULAccessZone
ULRelayZone

Fig. 1 Dynamic Super Frame Structure.

In this proposal, two single frames are contained in the super frame where the first one is defined as odd frame and the second one as even frame. Assuming the maximum RS number is N, BS is required to send the relay zone position for sequential N frames in current odd frame. This position could be the relay zone start time in units of physical slot number.

The management messages DL-MAP/UL-MAP are transmitted by BS and RSs in access zone, and R-DL-MAP/R-UL-MAP are transmitted in relay zone. The DL and UL access zone boundary should be denoted to MSs by DL-MAP and UL-MAP. The DL relay zone position is indicated to RSs by DL-MAP and R-DL-MAP, and the UL relay zone position is indicated to RSs only by R-UL-MAP. In order not to change the existing DL-MAP/UL-MAP, new DL-MAP-IE for RSs is added.

The last hop RS only connects with MSs in downlink, therefore, all resource could be allocated to access zone to improve efficiency. And the part assigned to R_MAPs is set as idle mode, in order to avoid interference with other RSs' management messages.

This super frame structure proposed here considers the fact that the traffic payload ratio between access and relay links is various. It solves the resource inefficiency problem caused by fixed super frame structure. This method further improves the efficiency by allocating all resource to access zone in the last hop RS, and the synchronous zone switch avoids the interference to management message in relay zone.

Specified Text Changes

According to the proposed text in IEEE 802.16j-06/026r2, we propose the following changes.

[Change the definition of "No. OFDMA Symbols in Table 275 "OFDMA DL-MAP_IE format" of IEEE802.16-2004]

No. OFDMA Symbols

The number of OFDMA symbols that are used (fully or partially) to carry the Access Zone Downlink PHY bursts.

[Change the definition of "No. OFDMA Symbols in Table 287 "OFDMA UL-MAP_IE format" of IEEE802.16-2004]

No. OFDMA Symbols

The number of OFDMA symbols that are used to carry the Access Zone Uplink PHY bursts.

[Insert a new section 8.4.5.3.28]

8.4.5.3.28 MR DL Relay Zone Location IE

In the DL-MAP, BS and RS shall transmit DIUC=15 with MR_DL_Relay_Zone_Location_IE() to indicate ~~the relay~~ the relay zone position of current frame. This IE is addressed dedicatedly to RS.

Table xxx DL-MAP IE message format

Syntax	Size	Notes
MR_DL_Relay_Zone_Location_IE() {		
Extended DIUC	4bits	0x09
Length	4bits	
OFDMA symbol offset	32 bits	Indicate the start of DL Relay Zone in the current frame, counting from the frame preamble and starting from 0.
No. OFDMA Symbols	8bits	The number of OFDMA symbols in the DL Relay Zone.
}		

OFDMA symbol offest

An indicator regarding the DL Relay Zone Position in the current downlink frame.

No. OFDMA Symbols

The number of OFDMA symbols in the DL Relay Zone.

[add new section 8.4.5.9 Relay Map message fields and IEs]

8.4.5.9 Relay Map message field and IEs.

In DL relay zone, BS and RS shall transmit R-DL-MAP and R-UL-MAP message. Especially, the access RS will not transmit R-DL-MAP and R-UL-MAP message in DL relay zone.

8.4.5.9.1 R-DL-MAP IE format

8.4.5.9.1.1 R-DL_Relay_Zone_Location_Change_IE

BS transmits R-DL_Relay_Zone_Location_Change_IE in downlink relay zone to indicate the change of downlink relay zone in the following frames. RS receives this IE and restores the information about the location change of downlink relay zone for the following frames. According to the received information, RS adjusts the location of DL relay zone in the next frame and transmits the location change information of downlink relay zone for the remaining following frames to its subordinate RS. If RS receives the different location change information for the same frame from what it has stored, RS shall update the information, and RS shall transmit the new location change information. If BS does not transmit this IE, RS shall transmit and receive according to the location information it receives lately.

Table xxx R-DL_Relay_Zone_Location_Change_IE format

Syntax	Size	Notes
R-DL_Relay_Zone_Location_Change_IE Format(){		
DIUC	4bits	
Length	4bits	
No. frame	4bits	
For (i=0;i<No. Frame ;i++) {		
OFDMA symbol offset	8bits	denotes the start of downlink relay zone in (i+1)th frame after the current frame, counting from the frame preamble.
}		
Reserved	4bits	
}		

No. Frame

No. frame denotes the number of the following frame in which the location information of the downlink relay zone are included in this IE in current frame. For MR-BS, No. Frame is equal to the maximum number of RS among all of the relay paths between BS and MSs. MR-BS transmits this IE to indicate the downlink relay zone in the following No. Frame frames. For RS, No. frame denotes the number of frame minus 1 in R-DL_Relay_Zone_Change_IE it receives from MR-BS or superordinate RS. When RS receives the location

change information of the following No.Frame frames, in the next frame RS will adjust the location of relay zone and transmit the information of the following (No. Frame -1) frames to its subordinate RS.

OFDMA symbol offset

Denotes the start of downlink relay zone in the following ith frame.

8.4.5.9.2 R-UL-MAP IE format

8.4.5.9.2.1 R-UL_Relay_Zone_Location_Change_IE

BS transmits R-UL_Relay_Zone_Location_Change_IE in R-UL_MAP message to indicate the change of uplink relay zone in the following frames. RS receives this IE and restore the information about the location change of uplink relay zone for the following frames. According to the received information, RS adjusts the location of UL relay zone in the next frame and transmits the location change information of uplink relay zone for the remaining following frames to its subordinate RS. If RS receives the different location change information for the same frame from what it has stored, RS shall update the information, and RS shall transmit the new location change information. If BS does not transmit this IE, RS shall transmit and receive according to the location information it receives lately.

Table xxx R_UL_Relay_Zone_Location_Change_IE format

Syntax	Size	Notes
R-UL_Relay_Zone_Location_Change_IE Format(){		
UIUC	4bits	
Length	4bits	
No. Frame	4bits	
For (i=0;i<No. Frame; i++) {		
OFDMA symbol offset	8bits	denotes the start of uplink relay zone in (i+1)th frame after the current frame, counting from the UL Allocation Start time.
}		
}		

No. Frame

No. frame denotes the number of the following frame in which the location information of the uplink relay zone are included in this IE in current frame. For MR-BS, No. Frame is equal to the maximum number of RS among all of the relay paths between BS and MSs. MR-BS transmits this IE to indicate the uplink relay zone in the following No. Frame frames. For RS, No. frame denotes the number of frame minus 1 in R-DL_Relay_Zone_Change_IE it receives from MR-BS or superordinate RS. When RS receives the location change information of the following No.Frame frames, in the next frame RS will adjust the location of relay zone and transmit the information of the following (No. Frame -1) frames to its subordinate RS.

OFDMA symbol offset

Denotes the start of downlink relay zone in the following ith frame.

[Insert a new paragraph in the end of 8.4.4.7.2.2]

To improve the efficiency, the last access RS on the relay path is idle mode in the bursts allocated to R_Preamble, R_FCH, R_MAPs of the DL relay zone and UL relay zone.

Reference:

[1] IEEE C802.16j-06/026r2, “P802.16j Baseline Document”