	IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>
Title	**MAC message for configuring the multi-hop relay frame structure**
Date Submitted	**2007-03-15**
Source(s)	Changyoon Oh, Hyunjeong Kang, Youngbin Chang, , HyoungKyu Lim, Jaeweon Cho, Panyuh Joo Samsung Electronics 416, Maetan-3dong, Youngtong-gu, Suwon-si, Gyeonggi-do, Korea Voice: +82-31-279-7529 Fax: +82-31-279-5130 mail to: changyoon.oh@samsung.com Rakesh Taori Samsung Advanced Institute of Technology **Wen Tong,** **Peiying Zhu,** **Nortel** wentong@nortel.com Dorin Viorel Fujitsu Microelectronics Canada Inc Mike Hart Fujitsu Laboratories Europe dviorel@fmci.fujitsu.com **Kanchei(Ken) Loa** loa@iii.org.tw
Re:	Response to call for technical contributions on 80216j-07_007r2,"Call for Technical Comments and Contributions regarding IEEE Project P802.16j",Feb..19,2007
Abstract	This contribution proposes a new MAC message and its contents which can be used to configure the multi-hop relay frame structure.
Purpose	Discussion and Adoption in IEEE 802.16j
Notice	
Release	

Patent Policy and Procedures	The contributor is familiar with the IEEE 802.16 Patent Policy and Procedures <http://ieee802.org/16/ipr/patents/policy.html>, including the statement "IEEE standards may include the known use of patent(s), including patent applications, provided the IEEE receives assurance from the patent holder or applicant with respect to patents essential for compliance with both mandatory and optional portions of the standard." Early disclosure to the Working Group of patent information that might be relevant to the standard is essential to reduce the possibility for delays in the development process and increase the likelihood that the draft publication will be approved for publication. Please notify the Chair <mailto:chair@wirelessman.org> as early as possible, in written or electronic form, if patented technology (or technology under patent application) might be incorporated into a draft standard being developed within the IEEE 802.16 Working Group. The Chair will disclose this notification via the IEEE 802.16 web site <http://ieee802.org/16/ipr/patents/notices>.

MAC Message for configuring the multi-hop relay frame structure

Changyoon Oh, Hyunjeong Kang , Youngbin Chang, HyoungKyu Lim, Jaeweon Cho, Panyuh Joo
Samsung Electronics
Rakesh Taori
Samsung Advanced Institute of Technology

1. Introduction

Frame structure for multi-hop relay has been agreed in January meeting. In this contribution, signaling method is proposed to support the multi-hop relay frame structure.

2. Multi-hop frame structure

The multi-hop relay frame structure that was agreed during the January meeting [1] and adopted in the 802.16j Baseline document allows both single frame approach and multi-frame approach for supporting multi-hop relay.

According to the specified single frame approach, the number of relay zones is configurable. In particular, two or more relay zones can be located back to back, or can be located such that an access zone is located in between the two relay zones. Furthermore, the transceiver mode in the relay zone can be one of either Tx mode, Rx mode, or idle mode.

For frame structure based on a multi-frame approach, the number of frames in a multi-frame can be varied. The basic frame unit, for example, the minimum configuration of frame structure depicted in [2] can be repeated in each frame. The transceiver mode in the relay zone alternates from Tx to Rx every other frame.

Figure 1 shows examples of frame structure depicting the single frame as well as multi-frame configurations for supporting multi-hop relay .

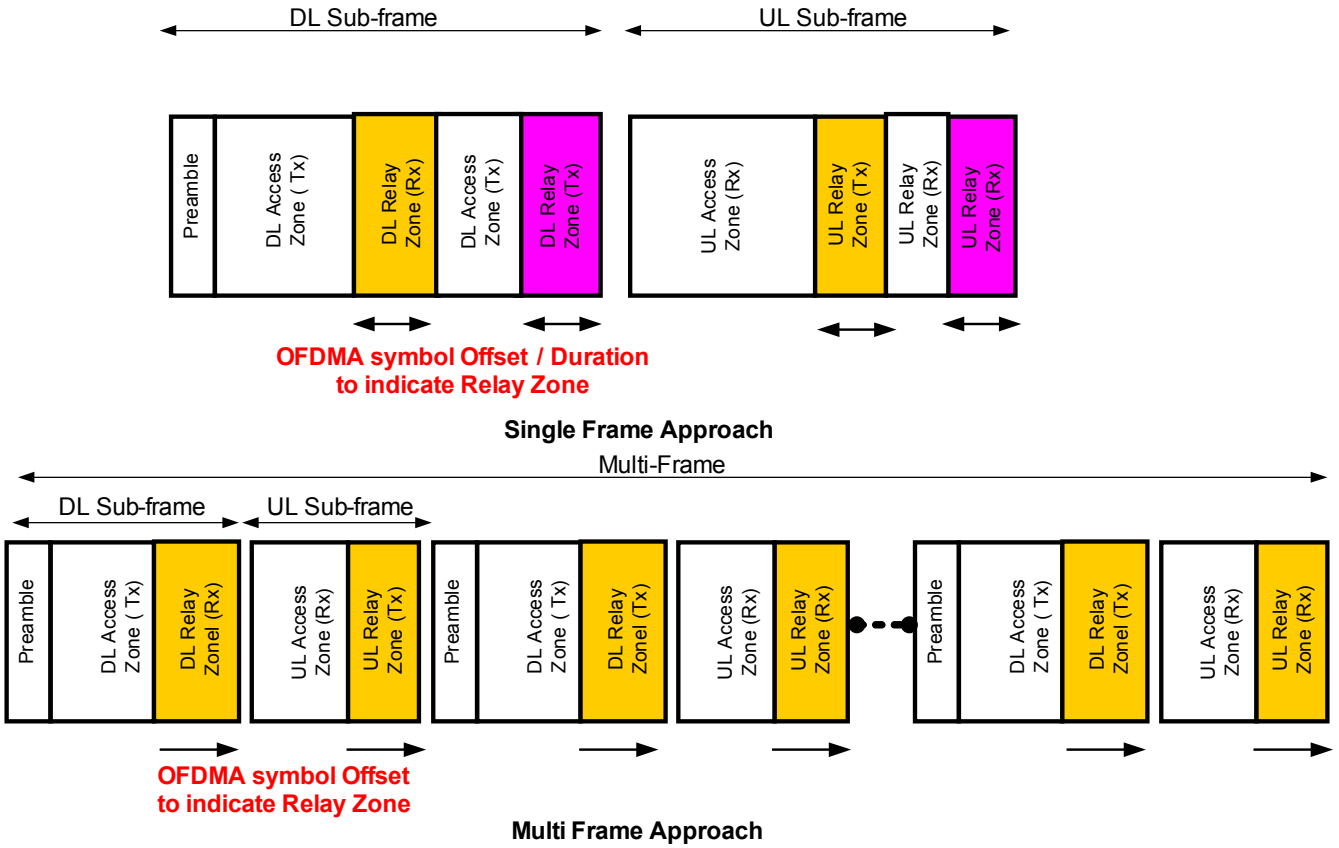

Figure 1. Configuration examples of frame structures for supporting multi-hop relay. Configuration using a single frame approach is shown above, while the illustration below shows an example configuration based on a multi-frame approach.

3.Frame configuration

In this contribution, we propose signaling in the form of a MAC message. The MR-BS or RS transmits message for subordinated RS to configure multi-hop relay frame structure. When the subordinated RS newly accesses to the MR-BS or RS in the access zone, MR-BS or RS transmits STC_DL_ZONE_IE through the DL-MAP in the access zone to indicate the start of the relay zone [3]. After moving to the relay zone, the RS receives the R-DL-MAP as well as frame configuration message. For RS to configure the relay frame structure, the MAC message needs to include:

1. Single frame/multi frame
2. Frame Number
3. Number of relay zones
4. Transceiver mode
5. OFDMA symbol offset
6. Duration

The MAC message includes the information of frame type, i.e., single frame structure or multi-frame structure. For both cases, the frame number, that indicates from where a particular configuration will take effect, is included. In case of the single frame approach, the number of relay zones in a single frame should be provided. By noting that the access zone may be located between any two relay zones, both OFDMA symbol offset and duration needs to be defined for each relay zone. Furthermore, the transceiver mode of each relay zone may be one of either Tx mode, Rx mode, or idle mode.

In case of the multi frame approach, the unit of multi frame, i.e., the number of frame in each multi-frame, should be provided. The transceiver mode of relay zone in each frame is one of either Tx mode, Rx mode, or idle mode. For multi-frame approach, OFDMA symbol offset is enough to describe the relay zone location.

Also note that frame configuration should include DL subframe and UL subframe. Initially both DL subframe and UL subframe should be configured. However, during the normal operation in the relay zone, when only one of either DL subframe configuration or UL subframe configuration needs to be changed, then that changed subframe configuration is transmitted.

The proposed MAC message can be transmitted as a unicast or a broadcast message.

To sum up, the proposed message format is :

Syntax	Size	Notes
Relay_Frame_configuration_Message_format() {		
Management message type = xx	8bits	
Type of frame	1 bits	0: single frame approach 1: multiframe approach
Frame Number	4 bits	Frame number to take effect
DL indicator	1 bit	1: indicates DL subframe configuration are included
UL indicator	1 bit	1: indicates UL subframe configuration is included
Reserved	1 bit	
If(Type of frame ==0){		
If (DL indicator ==1){		
Number of relay zones	8 bits	
for (i=0; i< Number of Relay zones; i++) {		
Transceiver mode	2 bits	00: Tx mode, 01:Rx mode, 11:Idle mode
OFDMA Symbol Offset	*8 bits*	
Duration	6 bits	
}		
}		
If (UL indicator ==1){		

Number of relay zones	8 bits	
for (i=0; i< Number of Relay zones; i++) {		
Transceiver mode	2 bits	
OFDMA Symbol Offset	8 bits	
Duration	6 bits	
}		
}		
}		
If(Type of frame ==1){		
If (DL indicator ==1){		
Number of frame	8 bits	
for (i=0; i< Number of frame; i++) {		
Transceiver mode	2 bits	00: Tx mode, 01:Rx mode, 11:Idle mode
OFDMA Symbol Offset	8 bits	
Reserved	6 bits	
}		
}		
If (UL indicator ==1){		
Number of frame	8 bits	
for (i=0; i< Number of frame; i++) {		
Transceiver mode	2 bits	00: Tx mode, 01:Rx mode, 11:Idle mode
OFDMA Symbol Offset	8 bits	
Reserved	6 bits	
}		
}		
}		
}		
Padding		

Type of frame: This field indicates whether a single frame approach or multi frame approach is being used.
Frame number: This is the frame number for the frame configuration to take effect. The system applies the frame configuration in the message starting from the frame number.
DL indicator: 1 indicates that the message include DL subframe configuration.
UL indicator: 1 indicates that the message include UL subframe configuration.

Transceiver mode: transceiver mode in the relay zone is one of either Tx mode, Rx mode, or Idle mode. When the transceiver mode is idle mode, it does not transmit nor receive.
OFDMA symbol Offset : The relay zone starts at the OFDMA symbol Offset.

Duration: The relay zone ends after the duration starting from the OFDMA symbol offset. The unit of duration is OFDMA symbol.
Number of frame : This field indicates the number of frames in a multi-frame.

4.R-FCH, R-DL-MAP transmission

In the agreed relay frame structure, the number of relay zones is configurable. However, the relay zone that transmits R-FCH, R-DL-MAP, possibly R-UL-MAP should be the first relay zone in Tx mode.

5. Proposed Text

++++++++++++ start text proposal ++++++++++++++++++++++++++++++++++

[Insert a new sentence at the end of subclause 8.4.4.7.2.2:]

The R-FCH and the R-DL-MAP shall be transmitted in the first DL Relay zone that is in Tx mode.

[Insert a new sentence at the end of subclause 8.4.4.7.2.2:]

The MR-BS or RS shall transmit the Relay_Frame_configuration_message in the DL relay zone for the subordinate RSs to configure the multi-hop relay frame structure.

[Insert the followings at the end of subclause 6.3.2.3.xx:]

6.3.2.3.XX Relay Frame configuration Message

The MR-BS or RS shall transmit the Relay_Frame_configuration message for subordinate RSs to configure the multi-hop relay frame structure. The message shall be transmitted on the basic CID or broadcast CID.

Syntax	**Size**	**Notes**
Relay_Frame_configuration_Message_format() {		
Management message type = xx	8bits	
~~**Type of frame**~~	~~1 bits~~	~~0: single frame approach~~ ~~1: multiframe approach~~
Frame Number	4 bits	Frame number to take effect
DL indicator	1 bit	1: indicates DL subframe configuration are included
UL indicator	1 bit	1: indicates UL subframe configuration is included
Reserved	~~1~~2bit	

~~If(Type of frame ==0){~~		
~~If (DL indicator ==1){~~		
~~**Number of relay zones**~~	8 bits	
~~for (i=0; i< Number of Relay zones; i++) {~~		
~~**Transceiver mode**~~	2 bits	00: Tx mode, 01:Rx mode, 11:Idle mode
~~**OFDMA Symbol Offset**~~	~~*8 bits*~~	
~~**Duration**~~	6 bits	
~~}~~		
~~}~~		
~~If (UL indicator ==1){~~		
~~**Number of relay zones**~~	8 bits	
~~for (i=0; i< Number of Relay zones; i++) {~~		
~~**Transceiver mode**~~	2 bits	
~~**OFDMA Symbol Offset**~~	8 bits	
~~**Duration**~~	6 bits	
~~}~~		
~~}~~		
~~}~~		
~~If(Type of frame ==1){~~		
If (DL indicator ==1){		
Number of frame	8 bits	
for (i=0; i< Number of frame; i++) {		
Number of relay zones	*2 bits*	
reserved	*6 bits*	
For (j=0;j<Number of relay zone;j++) {		
Transceiver mode	2 bits	00: Tx mode, 01:Rx mode, 11:Idle mode
OFDMA Symbol Offset	8 bits	
~~Reserved~~*Duration*	6 bits	
}		
}		
}		
If (UL indicator ==1){		
Number of frame	8 bits	
for (i=0; i< Number of frame; i++) {		
Number of relay zone	2 bits	
reserved	6 bits	
For (j = 0; j~~=~~<Number of relay zone; j++) {		
Transceiver mode	2 bits	00: Tx mode, 01:Rx mode, ~~11:Idle mode~~ 11 :Idle mode

OFDMA Symbol Offset	8 bits	
~~Reserved~~ *Duration*	*6 bits*	
}		
}		
}		
}		
Padding		
}		

~~Type of frame~~ ~~: This field indicates whether a single frame approach or multi frame approach is being used.~~

Frame number : This is the frame number for the frame configuration to take effect.
The system applies the frame configuration in the message starting from the frame number.

DL indicator : 1 indicates that the message includes DL subframe configuration.

UL indicator : 1 indicates that the message includes UL subframe configuration.

Transceiver mode : transceiver mode in the relay zone is one of either Tx mode, Rx mode, or Idle mode. When the transceiver mode is idle mode, it does not transmit nor receive.

OFDMA symbol Offset : The relay zone starts at the OFDMA symbol Offset.

Duration : The relay zone ends after the duration starting from OFDMA symbol offset. The unit of duration is OFDMA symbol.

Number of frame : This field indicates the number of frames in a multi-frame.

++++++++++++++++++++ *End of text proposal* ++++++++++++++++++++

References

[1] IEEE 802.16j-07/109r2, “Minimum guideline for harmonized frame structure”, Jan. 2007

[2] IEEE 802.16j-06/026r2, “IEEE 802.16j Baseline Document”, Jan. 2007

[3] IEEE 802.16j-07/235, “ Relay zone indicator”, Mar. 2007