Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Support for Miscellaneous Functions in Relay MAC Header**
Date Submitted	**2007-11-01**
Source(s)	Zhifeng (Jeff) Tao, Jinyun Zhang **Mitsubishi Electric Research Lab** Voice: 1-617-621-7557 E-mail: tao@merl.com Toshiyuki Kuze **Mitsubishi Electric Corp** Voice: +81-467-41-2885 Kuze.Toshiyuki@ah.MitsubishiElectric.co.jp
Re:	Response to the IEEE 802.16 Working Group Letter Ballot #28 (i.e., IEEE 802.16j-07/043).
Abstract	This contribution proposes more detailed bit assignment in relay MAC header.
Purpose	To adopt the bit assignment proposed herein into IEEE 802.16j.
Notice	*This document does not represent the agreed views of the IEEE 802.16 Working Group or any of its subgroups*. It represents only the views of the participants listed in the "Source(s)" field above. It is offered as a basis for discussion. It is not binding on the contributor(s), who reserve(s) the right to add, amend or withdraw material contained herein.
Release	The contributor grants a free, irrevocable license to the IEEE to incorporate material contained in this contribution, and any modifications thereof, in the creation of an IEEE Standards publication; to copyright in the IEEE's name any IEEE Standards publication even though it may include portions of this contribution; and at the IEEE's sole discretion to permit others to reproduce in whole or in part the resulting IEEE Standards publication. The contributor also acknowledges and accepts that this contribution may be made public by IEEE 802.16.
Patent Policy	The contributor is familiar with the IEEE-SA Patent Policy and Procedures: <http://standards.ieee.org/guides/bylaws/sect6-7.html#6> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>. Further information is located at <http://standards.ieee.org/board/pat/pat-material.html> and <http://standards.ieee.org/board/pat>.

Support for Miscellaneous Functions in Relay MAC Header

Zhifeng (Jeff) Tao, Jinyun Zhang
Mitsubishi Electric Research Lab

Toshiyuki Kuze
Mitsubishi Electric Corp

1. Introduction

The MAC PDUs transmitted on relay link can use relay MAC (i.e., R-MAC) header. The R-MAC header specified in the current IEEE 802.16j baseline draft [1] can support following functions:

1. Routing/forwarding control
2. QoS control (via QoS subheader)
3. Efficient resource allocation/consumption (via Fragmentation/Packing subheader)
4. Timing indication in centralized scheduling (via ALC subheader)
5. CID encapsulation needed by *systematic CID assignment protocol* (via CE bit)
6. Extended subheader (via ESF bit)

Figure 1 illustrates the R-MAC header specified in the current baseline [1].

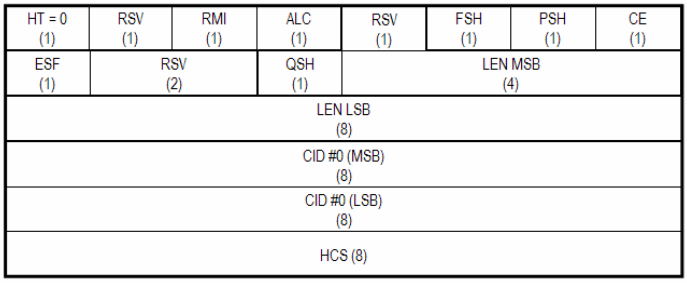

Figure 1: Relay MAC header specified in the current baseline.

This contribution intends to further discuss and suggest the usage of a few "reserved" bits in order to support some new features that 802.16j need to provide.

2. Summary of Proposal

There are still a few functions whose support in R-MAC header is absent.

- **CRC indication on relay link**

According to the current baseline, a CRC-32 field can be attached at the very end of the constructed relay MPDU. To indicate the existence of this relay CRC-32 field, a CRC Indication (i.e., "CI") bit is needed in the R-MAC header.

- **Fragment sequence number (FSN) size indication**

In 802.16d/e [2], the length of the fragment sequence number (FSN) field in the packing and fragmentation subheader can be of either 11-bit or 3-bit, depending on the value of a bit called ***Extended Type*** in the generic MAC header.

If 802.16j allows FSN to assume two possible values, an ***Extended Type*** bit will then also be needed in the R-MAC header.

Alternatively, if FSN is fixed to be 11-bit long in 802.16j, then no such ***Extended Type*** bit would be needed in the R-MAC header.

- **Bandwidth request support (UL)**
  In 802.16d/e, the grant management subheader *(GMSH)* is used to convey bandwidth management needs. According to the current version of the 16j baseline [1], the same GMSH can be used on the relay link as a *relay subheader* placed after the R-MAC header. In this case, a bit will be needed in the R-MAC header in the uplink to indicate the presence or absence of such a grant management subheader.

- **Fast feedback Support (DL)**
  In 802.16e, the fast feedback allocation subheader *(FFSH)* is used to define the uplink resource which will be used by MS to report the fast downlink measurement or fast MIMO feedback. This fast feedback mechanism will also be needed on relay link between an MR-BS and its subordinated RSs, and between a RS and its subordinate RSs. Thus, a bit will be needed in the R-MAC header in DL to indicate the presence or absence of such a fast feedback subheader.

- **Orderly data delivery support**
  When no ARQ is used, the out-of-order delivery problem has to be addressed by the protocol layer higher than MAC. However, given the multihop nature of relay network, the out-of-order data delivery issue can be aggravated. To ameliorate the problem, a sequence number subheader (SNSH) can be used between the MR-BS and access RS in the distributed security model. A bit indicating the presence or absence of such a subheader is also needed in the R-MAC header, if this SNSH is supported on relay link.

3. Proposed Text Changes

6. MAC Common Part Sublayer

6.3.2.1.1.1 Relay MAC header format

[Change Figure 22a as follows]

HT = 0 (1)	RSV (1)	RMI (1)	ALC (1)	*FFSH(DL)/ GMSH (UL) (1)*	FSH (1)	PSH (1)	CE (1)
ESF (1)	*CI (1)*	RSV (1)	QSH (1)	LEN MSB (4)			
LEN LSB (8)							
CID #0 (MSB) (8)							
CID #0 (LSB) (8)							
HCS (8)							

[Change Table 7a as follows]

Table 7a—Description of relay MAC header fields

Syntax	Size	Notes
MAC Header() {		
HT	1 bit	
if (HT == 0) {		
Reserved	1 bit	Currently reserved. Content is subject to further discussion
RMI	1 bit	Relay mode indication (RMI) is used to indicate whether this MAC header is GMH or Relay MAC header RMI = 0: use GMH RMI = 1: use relay MAC header
ALC	1 bits	Allocation subheader 1=present; 0=absent
FFSH/GMSH subheader	*1 bit*	*DL: fast feedback allocation subheader (FFSH)* *UL: grant management subheader (GMSH)* *1 = present, 0 = absent*
Fragmentation subheader	1 bit	Fragmentation/packing subheader (F/PSH) 1 = present, 0 = absent
Packing subheader	1 bit	Fragmentation/packing subheader (F/PSH) 1 = present, 0 = absent
CE	1 bit	CID encapsulation 1 = present, 0 = absent
ESF	1 bit	Extended subheader field. If ESF = 0, the extended subheader is absent. If ESF = 1, the extended subheader is present and will follow the GMH immediately. The ESF is applicable both in the DL and in the UL.
CI	*1 bit*	*CRC indication* *1 = CRC is included in the PDU by appending it to the PDU payload after encryption, if any.* *0 = No CRC is included.*
Reserved	2 bits	Currently reserved. Content is subject to further discussion
QoS subheader	1 bit	QoS subheader (QSH) 1 = present, 0 = absent
LEN	12 bits	The length in bytes of the relay MAC PDU including the relay MAC header.
CID	16 bits	May be tunnel CID or basic CID of the RS
HCS	8 bits	Header check sequence
}		
else if (HT == 1) {		If no payload is attached
Use legacy 802.16e or 802.16j Format	39 bits	
HCS	8 bits	
}		
}		

4. Reference

[1] “Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems - Multihop Relay Specification”, IEEE P802.16j/D1, August 2007

[2] “IEEE Standard for Local and Metropolitan Area Networks − Part 16: Air Interface for Fixed Broadband Wireless Access Systems, Amendment 2: Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands,” IEEE Computer Society and the IEEE Microwave Theory and Techniques Society, February 2006.