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Title	**A Discussion of Bit Assignment in Relay MAC Header**
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Source(s)	Zhifeng (Jeff) Tao, Jin Zhang Mitsubishi Electric Research Lab Voice: 1-617-621-7557 E-mail: tao@merl.com Toshiyuki Kuze Mitsubishi Electric Corp Mary Chion ZTE Guoqiang Wang Nortel
Re:	Response to the call for technical comments regarding IEEE Project 802.16j (i.e., IEEE 802.16j-07/019).
Abstract	This contribution provides a discussion of detailed bit assignment in relay MAC header.
Purpose	To initiate a discussion in the 802.16j task group on the subject matter described in this contribution.
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A Discussion of Bit Assignment in Relay MAC Header

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

Toshiyuki Kuze
Mitsubishi Electric Corp

Mary Chion
ZTE

Guoqiang Wang
Nortel

1. Introduction

The current 802.16j baseline document [1] specifies a relay MAC header used on the relay link to support new operations particular to multihop relay network. However, there are totally 8 bits set as "reserved" in the current baseline, the actual usage of which is still subject to future discussion.

This contribution intends to initiate the discussion on whether some of the IEEE 802.16e [2] functions shall still be supported in 802.16j multihop relay network; and if so, how to use the "reserved" bits to support these legacy functions.

2. Discussion

For comparison purpose, the format of generic MAC header (GMH) defined in IEEE 802.16e and the relay MAC header introduced in the current baseline is shown in Figure 1 and Figure 2, respectively.

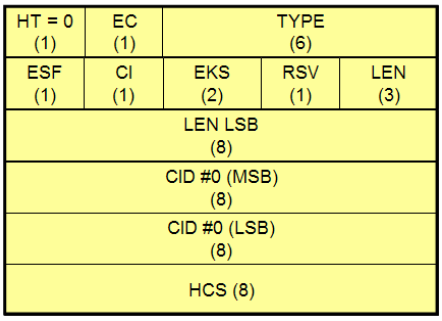

Figure 1: Generic MAC header (GMH) defined in IEEE 802.16e.

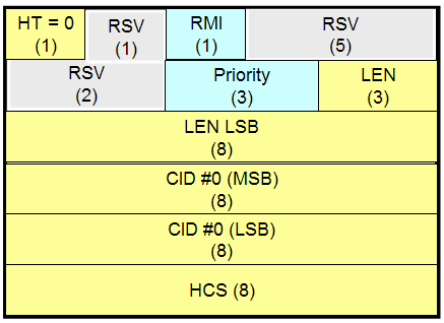

Figure 2: Relay MAC header (GMH) introduced in the current baseline.

Bit	Name	Definition in 802.16e
2nd	EC	Encryption control 0 = Payload is not encrypted 1 = Payload is encrypted
4th	ARQ feedback payload	1 = present, 0 = absent
5th	Extended type	Indicates whether the present Packing or Fragmentation Subheaders is Extended For non ARQ-enabled connections 1 = extended 0 = not extended. For ARQ-enabled connections, this bit shall be set to 1.
6th	Fragmentation subheader	1 = present, 0 = absent
7th	Packing subheader	1 = present, 0 = absent
8th	Downlink: FAST-FEEDBACK Allocation subheader Uplink: Grant Management subheader	1 = present, 0 = absent
9th	ESF	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.
10th	CI	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

Table 1: The original definition of the “RSV” bits in legacy 802.16e.

Table 1 lists all the reserved bits in relay MAC header, and its corresponding definition in legacy 802.16e. A discussion on whether the 16e definition of these bits should remain intact in 802.16j or these bits can be further reused for some new purpose is offered below.

- ***EC***
  Encryption will be performed on each individual MPDU collected on the access link. No additional encryption on a relay MAC PDU is anticipated. Thus, this bit can be reused for new function.

- ***ACK feedback payload***

It is yet to be decided whether an end-to-end ARQ (i.e., between BS and MS) or link-by-link ARQ (i.e., between BS and RS, adjacent RSs, and access RS and MS) will be supported in 802.16j. If an end-to-end ARQ architecture will be used, this bit then can be released for future usage.

- ***Extended type***
  Whether to preserve this bit or not depends on whether packing and fragmentation will be supported on relay link.

- ***Fragmentation subheader***
  It is not always possible for a RS to have sufficient bandwidth to forward the relay MPDU it receives from its neighbor RS. In this case, the RS may decide to fragment the relay MPDU before forwarding, and the receiving RS has to reassembly the fragmented relay MPDU.

- ***Packing subheader***
  If fragmentation is performed on relay link, packing would also be needed to improve efficiency. An example of possible fragmentation and packing is provided in Figure 3.

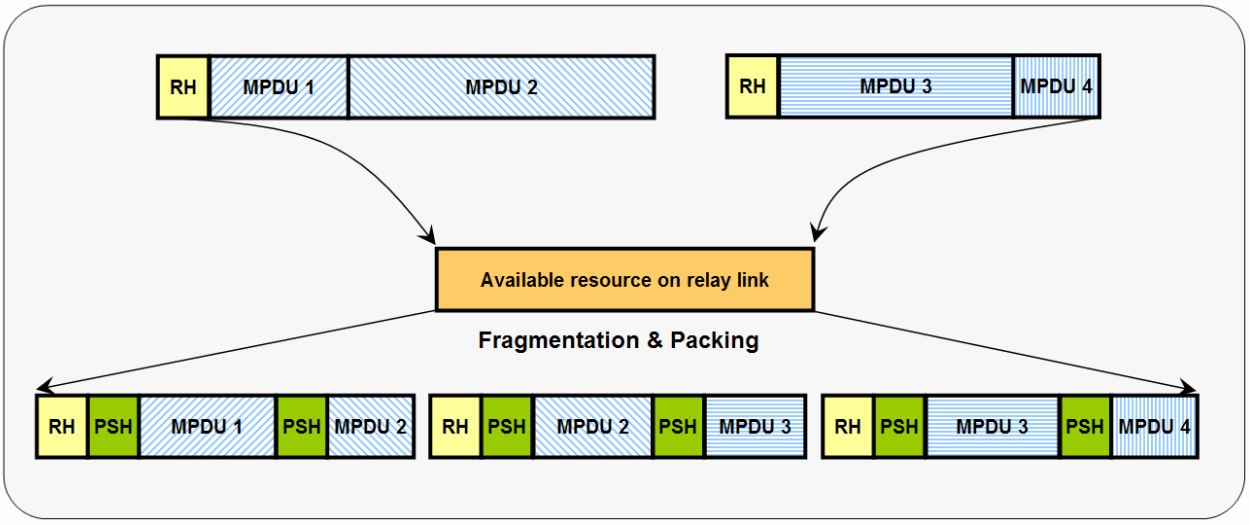

Figure 3: An example of fragmentation and packing on relay link.

- ***FAST-FEEDBACK Allocation subheader(Downlink)/Grant Management subheader(Uplink)***
  It is yet to be decided whether this Fast-Feedback Allocation and Grant Management would be needed on relay link. But it seems like there is a need for an upstream RS to request its downstream RS to fast feedback some MIMO related information; and for a downstream RS to convey bandwidth management needs to its upstream RS.

- ***ESF***
  Various extended subheader may still exist on relay link. Thus, this ESF bit should be preserved in the relay MAC header.

- ***CI***
  There is no foreseeable need to attach an additional CRC at the end of a relay MAC PDU. Thus, this bit

can be reused for new function in relay MAC header.

As a summary, Table 2 lists the suggestion on how to define these "RSV" bits in 802.16j relay MAC header.

Bit	Name	Possible Definition in 802.16j Relay MAC Header
2nd	EC	Can be released
4th	ARQ feedback payload	TBD
5th	Extended type	Dependent on the preservation of fragmentation subheader bit and packing subheader bit.
6th	Fragmentation subheader	Shall be preserved.
7th	Packing subheader	Shall be preserved.
8th	Downlink: FAST-FEEDBACK Allocation subheader Uplink: Grant Management subheader	May shall be preserved
9th	ESF	Shall be preserved.
10th	CI	Can be released

Table 2: Suggestion/discussion on bit assignment in relay MAC header.

3. Reference

[1] "Air Interface for Fixed and Mobile Broadband Wireless Access Systems - Multihop Relay Specification", IEEE 802.16j-06/026r4, June 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.