Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	Control Plane and Data Plane Addressing, and MAC Header proposal in IEEE 802.16m
Date Submitted	2008-07-07
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Re:	Regarding IEEE 802.16m-08/024: Call for contribitions Project 802.16m System Description Document (SDD) on upper MAC concepts and methods.
Abstract	This contribution proposes upper layer MAC addressing scheme in IEEE 802.16m; in particular it proposes a separate addressing mechanism for Control Plane and the Data Plane.
Purpose	For discussion and approval by TGm
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Control Plane and Data Plane Addressing in IEEE 802.16m

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Introduction

IEEE 802.16e does not have an explicit MS addressing scheme. Connection Identifier (CID) is used for both Control Plane and Data Plane addressing. The Basic Management CID is used to identify the MS in the MAP. Although the MS can also be addressed by a traffic CID, this form of addressing is rarely used due to overhead considerations.

The CID in the MAC PDUs (i.e. GMH) is used to indicate: QoS, reassembly state machine context, and Control and Data Plane indication (basic/primary or traffic CID).

The overuse of the CID construct in the 16e system led to some inefficiency. For example:

- 16 bit CID is used in the MAC header even though the MS has been identified in the MAP. The range of the Data Plane 'CID' need only be large enough to accommodate the range of simultaneous reassembly state machine/QoS required by a single MS. This can typically be 3-5 bits.
- Sector wide Data Plane addressing scheme is also problematic during handover since it requires coordination between the service BS, target BS, and the MS. With an MS-wide Data Plane addressing scheme, coordination of the addresses is only required between the sBS and the tBS over the backhaul (as opposed to the 16e CID updates, which take place over the air interface), which can potentially save time during HO.
- MAP addressing use 16 bits CID even though the number of supported MS in a given base station is far less the 64K. Attempts of overhead reduction were made in 16e by using the RCID mechanism. However, decoupling MS address from CID can result in even more efficient address mechanism. For example, the range of MS address can be advertised as part of the essential system parameters required by the MS to complete access to the system. Or it can be defined in this standard.

Decoupling Data Plane addressing and Control Plane addressing scheme provide for opportunities to redesign the MAC headers. This is described in subsequent sections.

Generic MAC Header is 802.16e

The 802.16e GMH is shown in the figure below.

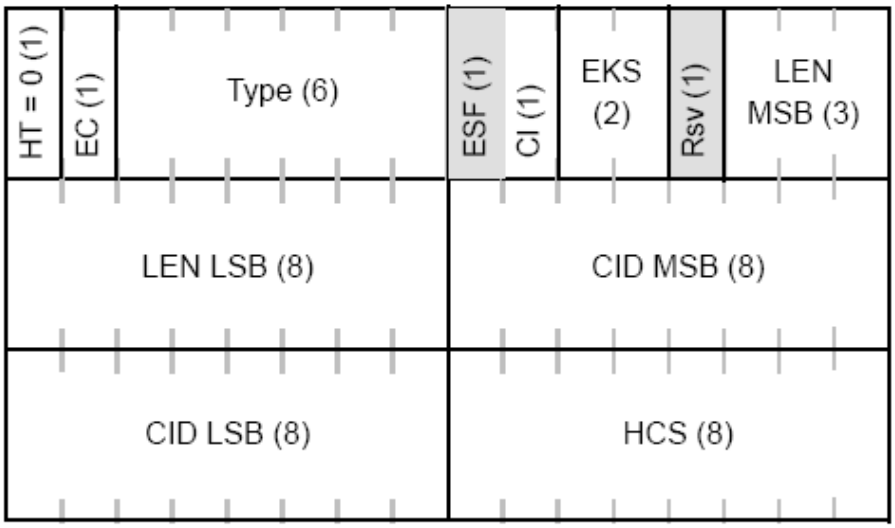

Figure 23—Generic MAC header format

- CID is used as a form of addressing in 16e
    - CID in the MAP indicates MS address
    - CID in the GMH indicates
        - MS address
        - QoS
        - Reassembly state machine context identifier at the receiver
        - Control and Data Plane indication – basic/primary or traffic CID
- Subheader and Extended Subheader (ESF):
    - Indicating of two subheader types:
        - PDU associated SH, e.g. fragmentation and Packing SHs
        - non-PDU associated SH, e.g. all extended SHs and ARQ SH.
    - We were motivated to piggyback non-PDU associated SH because of the high overhead of the 16e GMH
- PDU Length: 11 bits length field – used to support MTUs (maximum transmission unit) of up to 2K;
- HCS (CRC-8):
    - Requires hardware support (in most implementations)
    - Used primarily for PDU delineation in cases where multiple PDUs are sent within one PHY burst and the PHY burst is not protected by a CRC
    - Not required if a PHY CRC is used, e.g. HARQ sub-burst are protected by CRC-16
- 3 bits (EC and EKS) used to support link level encryption for all packets regardless of whether encryption is used or not. Move this information to a sub-header so that it is included only when the PDU is encrypted.
- CI indication: Indicates the inclusion of MAC level CRC (CRC-32); not required if the PHY CRC is used.

Proposed MAC Header in 802.16m

The proposed MAC header for 16m is shown below.

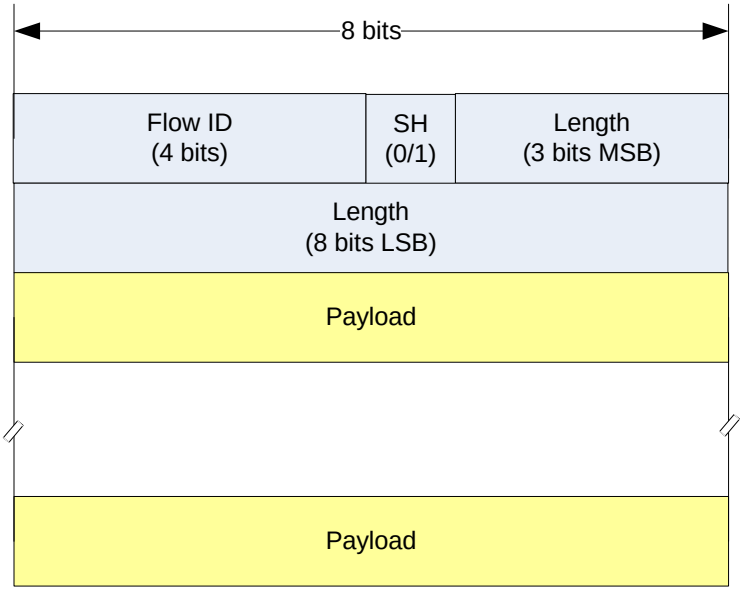

Figure 1: Generic MAC Header

MAC header fields:

- Flow ID – 4 bits (note that Connection Identifier (CID) would in our view be a better term, but we are concerned with causing confusion with the 16e CID term)
  - Reserve a well known Flow IDs to indicate MAC management flows – e.g. basic (0b0000) and primary (0b0001);
  - Reserved a well known value for Signalling MAC Header (SMH); this be can be used instead of the HT field of the 16e GMH.
  - Allows for 13 MAC traffic flows per MS per direction
- Sub-header indication – indicates the presence of sub-headers:
  - fragmentation sub-headers and encryption sub-header
  - Control Plane PDUs are not encrypted, but may be fragmented
  - Data Plane PDUs may be encrypted and fragmented
- Length – 11 bits

MAC PDU can be concatenated without the so-called packing procedures of 16e. Example is shown below.

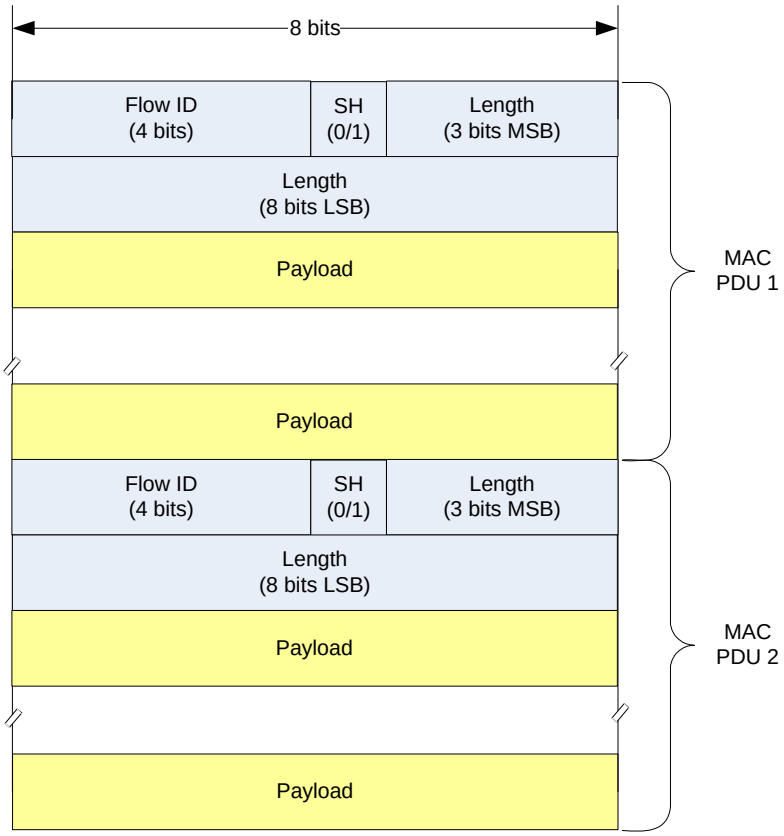

Figure 2: Concatenation example of two MAC PDUs

Signalling MAC header format

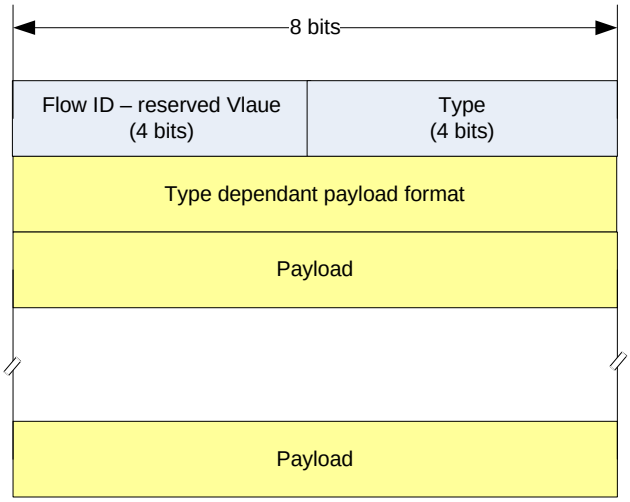

Figure 3: Signalling MAC Header (SMH)

Signalling MAC Header fields:

- Flow ID – use reserved well known Flow ID value to indicate Signalling MAC Header (SMH) (e.g. 0b1111)

- Type – indicates the format of the MAC signalling header; several signalling MAC headers types can be defined:
  - Fixed length type – can have multiple fixed length types
  - Variable length type with a shorter length field
  - Extended type using a reserved a well-known type for additional less frequently used signalling header types.

Conclusion

802.16m standard should support two separate addressing schemes: One to identify the MS and another to identify a MAC flow/connection. The MS address is a sector wide unique identifier used primarily in the Control Plane (e.g. MAP/assignment information). The MAC flow identifier is an MS wide unique identifier used primarily in the Data Plane (MAC header).

Proposed Text

Add the following to the SDD as shown:

Page # 5 , Start line # 2; Section 3: Definition…

Define the terms: MS ID and Flow ID

----------*Start of the Text*----------

MS Local ID (MS LID): a sector wide identifier used to identify the MS.

Flow ID: an MS wide identifier used to identify a logical MAC flow.

----------*Start of the Text*----------

Page # 19 , Start line # 7

----------*Start of the Text*----------

Connection Management block allocates ~~connection identifiers (CIDs)~~ the MS LID during initialization and handover. The Flow ID is allocated during ~~initialization/handover/~~ service flow creation procedures. Connection Management block interacts with convergence sublayer to classify MAC Service Data Unit (MSDU) from upper layer, and maps MSDU onto a particular transport connection.

----------*End of the Text*----------

Page # 24 , Start line # 3

----------*Start of the Text*----------

10.x MAC Addressing

802.16m supports two separate MAC addressing schemes:

1. MS Local ID is a sector ID unique identifier to identify the MS;
2. MAC Flow ID is an MS wide unique identifier to identify a logical MAC flow.

10.y MAC PDU Formats

The 802.16m supports two type of MAC headers: Generic MAC Header (GMH) and Signalling MAC Header (SMH). The figures below show these two header types.

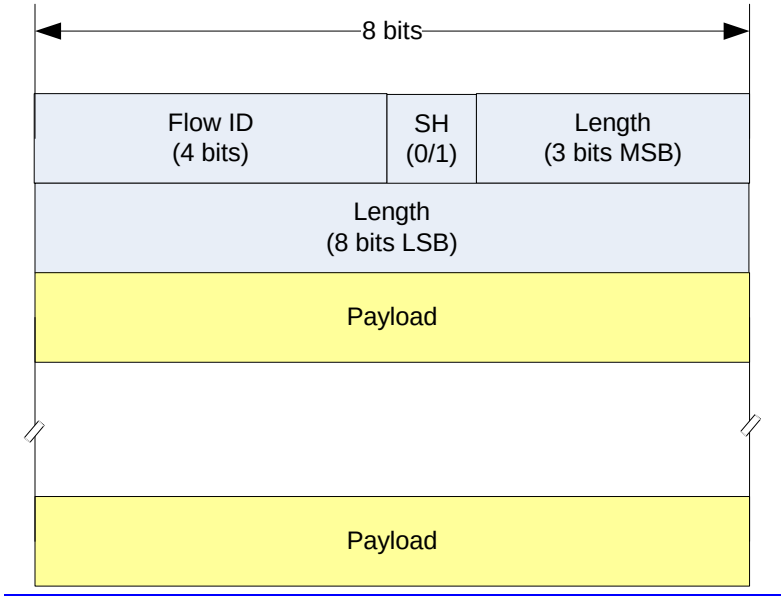

Figure 4: Generic MAC Header

Generic MAC Header fields:

Field	Size (bits)	Notes
Flow ID	4	Well known Flow ID values are used to indicate MAC management flows., e.g. the basic or primary Flow ID. The well-known value is also used to indicate Signaling MAC Header (SMH) format
Sub-header indication	1	Indicates the presence of sub-headers: fragmentation sub-headers and encryption sub-header
Length	11	Length of MAC PDU

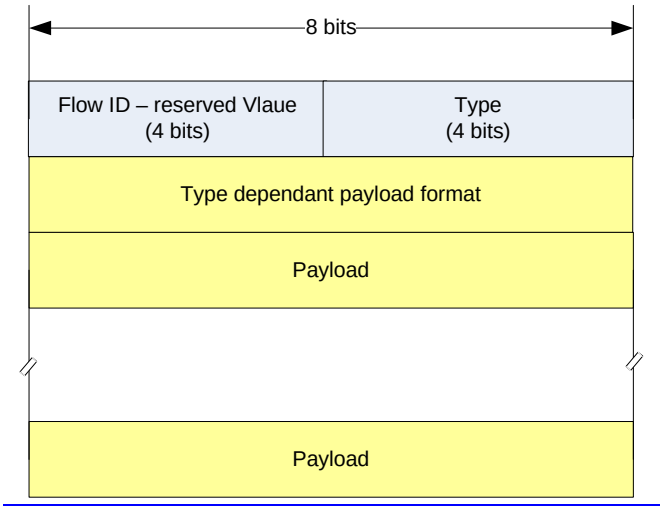

Figure 5: Signalling MAC Header

Signalling MAC Header fields:

Field	Size (bits)	Notes
Flow ID	4	Set to the well-known Flow ID value to indicate Signalling MAC Header
Type	4	Indicates the format of the signalling MAC Header Extended type using a reserved a well-known type for additional less frequently used signalling header types

----------*End of the Text*----------