Project	**IEEE 802.16 Broadband Wireless Access Working Group** <http://ieee802.org/16>
Title	**Proposed header format to support Fragmentation/Packing/Multiplexing scheme in 16m**
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Re:	TGm SDD: 10.12.1 MAC Header formats
Abstract	SDD text proposal on 16m Headers
Purpose	For discussion and adoption in 802.16m SDD
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Header Format to support Fragmentation/Packing/Multiplexing

1 Introduction

SDUs or SDU fragments belonging to the same connection can be packed into one MPDU. SDUs or SDUs fragments belonging to different connections can also be multiplexed into one MPDU. When packing and multiplexing is used, the length information of each SDU or SDU fragment is included in the extended header. There is no need to have length field in the GMH. Therefore, using GMH to carry MPDUs with packing or multiplexing introduces more overhead. We propose a new 1-byte MAC header format –Multiplexing MAC header to carry the MPDU with packing or multiplexing. The same format can be used for MPDU with fragmentation as well without introducing any more overhead.

In addition, a new extended header – Multiplexing/Fragmentation/Packing Extended Header (MFPEH) is used to carry the information related to the fragmentation, packing and multiplexing. The detailed format of the Multiplexing MAC Header and Multiplexing/Fragmentation/Packing Extended Header (MFPEH) are shown in section 2 (Text Proposal).

In order to compare the exact overhead of our proposed header format with the potential GMH + Fragmentation/Packing extended header format, a detailed comparison is illustrated as following. Since the format of the Fragmentation/Packing extended header (FPEH) has not been specified, the following fields are assumed to be included in the FPEH.

SN (10b) + FC (2b) + End (1b – to indicate if there is more SDU/SDU fragment follows) + Length (11b) + End + …. + Length + End (Note: if there are N SDU/SDU fragments packed in the MPDU, there are N-1 Length+End pairs)

Scenario 1: only one fragment is included in MPDU

With Fragmentation/Packing Extended Header (FPEH) based solution, the Header + Extended Header format is as following:

GMH (3B) + FPEH (2B) = 5 Bytes, where FPEH contains EH Header Type, SN, FC and End.

With Multiplexing MAC header and Multiplexing/Fragmentation/Packing Extended Header (MFPEH) based solution, the Header + Extended Header format is as following:

Multiplexing MAC Header (1B) + MFPEH (4B) = 5 Bytes, where MFPEH contains 1 MFPEH block (MFPEHB).

=> The overhead of MAC header and extended header of both schemes are the same.

Scenario 2: N (N>1) SDUs or SDU fragments from the same connection are packed in MPDU

With Fragmentation/Packing Extended Header (FPEH) based solution, the Header + Extended Header format is as following:

GMH (24bits) + FPEH (12N + 1 bits) = 25 + 12N bits, where FPEH contains EH Header Type, SN (10b), FC

(2b), End(1) and (N-1) times (Length (11b) + End (1b)) pairs.

With Multiplexing MAC header and Multiplexing/Fragmentation/Packing Extended Header (MFPEH) based solution, the Header + Extended Header format is as following:

Multiplexing MAC Header (8bits) + MFPEH (12N + 15 bits) = 23 + 12N bits, where MFPEH contains 1 MFPEHB, which includes M bit (1b), FID (4b), SN (10b) and N times (L(1b) + Length (11b)) pairs.

=> The overhead of MAC header and extended header of our proposed scheme is slightly better.

Therefore, using our proposed header format, fragmentation and packing can be efficiently supported with the same or less header overhead as the traditional fragment/packing header formation. In addition, our proposed new header format can also support multiplexing of multiple SDUs or SDU fragments from different connection into one MPDU.

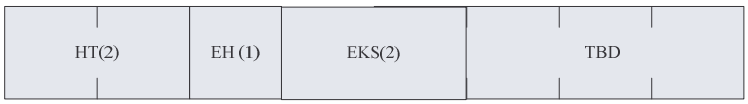
Therefore, instead of using GMH + Fragmentation/Packing Extended Header to support fragmentation/packing scheme and using Multiplexing Header and potentially multiplexing extended header to support multiplexing scheme, we propose to use Multiplexing MAC Header + Multiplexing/Fragmentation/Packing Extended Header (MFPEH) format to support all these features altogether.

2 Text Proposal

========== *Start of Proposed Text* ==========

~~{~~10.12.1.4 Multiplexing MAC Header~~}~~

The format of Multiplexing MAC header is shown below:



A Multiplexing/Fragmentation/Packing Extended Header (MFPEH) is always attached right after the Multiplexing MAC header. The EH bit indicates if there are more extended headers after the Multiplexing/Fragmentation/Packing extended header.

~~10.12.2.1 Fragmentation and packing extended header~~

~~Fragmentation and packing extended header format is FFS.~~

10.12.2.1 Multiplexing/Fragmentation/Packing Extended Header (MFPEH)

As shown in the figure x, Multiplexing/Fragmentation/Packing Extended Header (MFPEH) contains multiple Multiplexing/Fragmentation/Packing Extended Header Blocks (MFPEHB). The SDUs or SDU fragements

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belonging to the same connection are packed together and the information related to these SDUs is included in one MFPEHB. The M bit in MFPEHB indicates if there is more MFPEHB followed. If the SDUs or SDU fragement(s) included belong to the same connection, only one MFPEHB is present.

Figure x: Format of Multiplexing/Fragmentation/Packing Extended Header (MFPEH)

The format of MFPEHB is shown in Figure y.

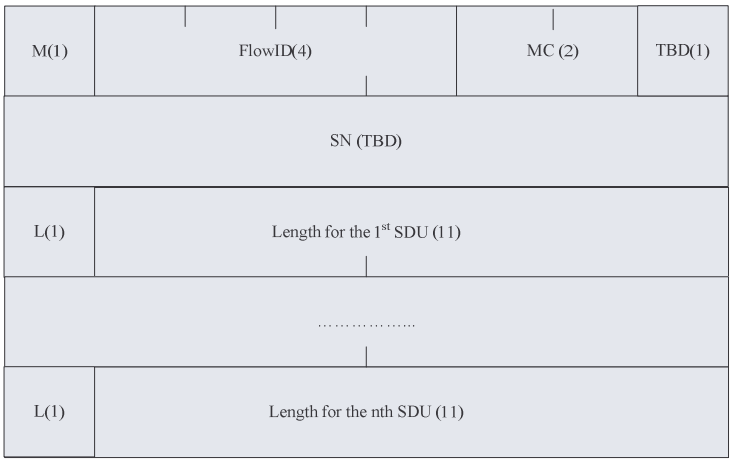

Figure y: Format of Multiplexing/Fragmentation/Packing Extended Header Block (MFPEHB)

M (1bit): indicate if there is more MEHB follows
Flow ID (4 bit): flow id of the SDUs identified in the MFPEHB
SN (TBD): ARQ BSN for ARQ enabled connection or Fragment SN for non-ARQ enabled connection
L (1bit): indicate if there is more length field follows
Length: length for each SDU identified in the MFPEHB
MC: Multiplexing Control Information (as shown in Table z)

MC	Meaning	Examples

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00	The first byte of data in the payload is the first byte of a MAC SDU. The last byte of data in the payload is the last byte of a MAC SDU.	One or Multiple Full SDUs packed in the payload
01	The first byte of data in the payload is the first byte of a MAC SDU. The last byte of data in the payload is not the last byte of a MAC SDU.	a) payload with only First fragment of an SDU; b) payload with one or more unfragmented SDUs, followed by first fragment of subsequent SDU
10	The first byte of data in the payload is not the first byte of a MAC SDU. The last byte of data in the payload is the last byte of a MAC SDU.	a) payload with only Last fragment of an SDU; b) payload with Last fragment of an SDU, followed by one or more unfragmented subsequent SDUs
11	The first byte of data in the payload is not the first byte of a MAC SDU. The last byte of data in the payload is not the last byte of a MAC SDU.	a) payload with only middle fragment of an SDU; b) payload with Last fragment of an SDU, followed by zero or more unfragmented SDUs, followed by first fragment of a subsequent SDU

Table z: Multiplexing Control Information

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========== *End of Proposed Text* ==========