

## MAC SDU Fragmentation & Packing scheme for 16m

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### Venue:

CR to SDD as per configuration control procedure (80216m-09\_0008)

### Base Contribution:

N/A

### Purpose:

Discuss and approve the proposed text changes into SDD document

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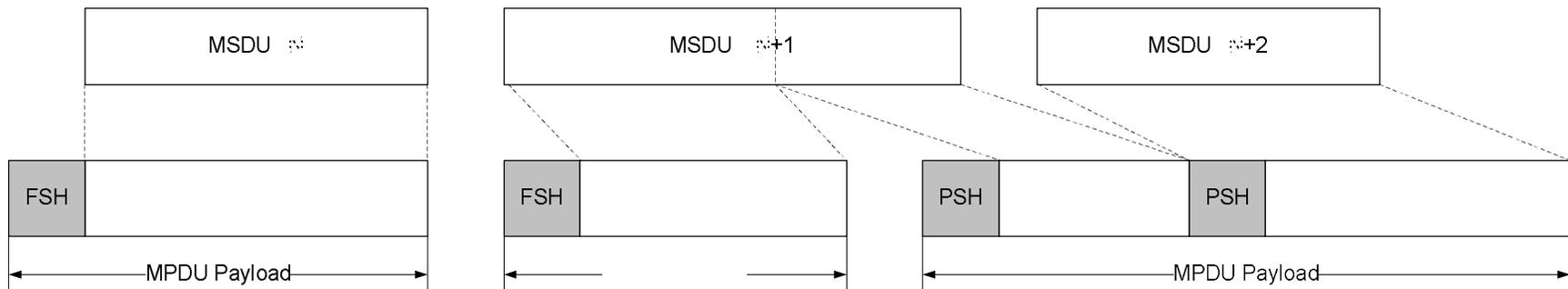
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# SDU Fragmentation/Packing in 16e

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- MAC SDUs (MSDUs) are transmitted in sequence & can be fragmented
- MAC PDU payload is formed by packing one or more SDU/SDU fragments
  - Packing Subheader (PSH) is appended per SDU/SDU fragment in the payload containing multiple SDU/SDU fragments
  - Fragmentation Subheader (FSH) is appended before SDU (ARQ Connection)/SDU fragment in the payload containing single SDU/SDU fragment



**Figure 1: SDU Fragmentation & Packing in IEEE 802.16e-2005**

# SDU Fragmentation/Packing in 16e - Issues

- Packing/Fragmentation overhead
  - Information bits per SDU/SDU fragment packed in MPDU payload
    - Fragmentation Control
      - Not needed per SDU/SDU fragments as SDU/SDU fragments are transmitted in sequence
    - Sequence Number
      - Not needed per SDU/SDU fragments as SDU/SDU fragments are transmitted in sequence
    - Length
      - Length is not needed for Last SDU/SDU fragment packed

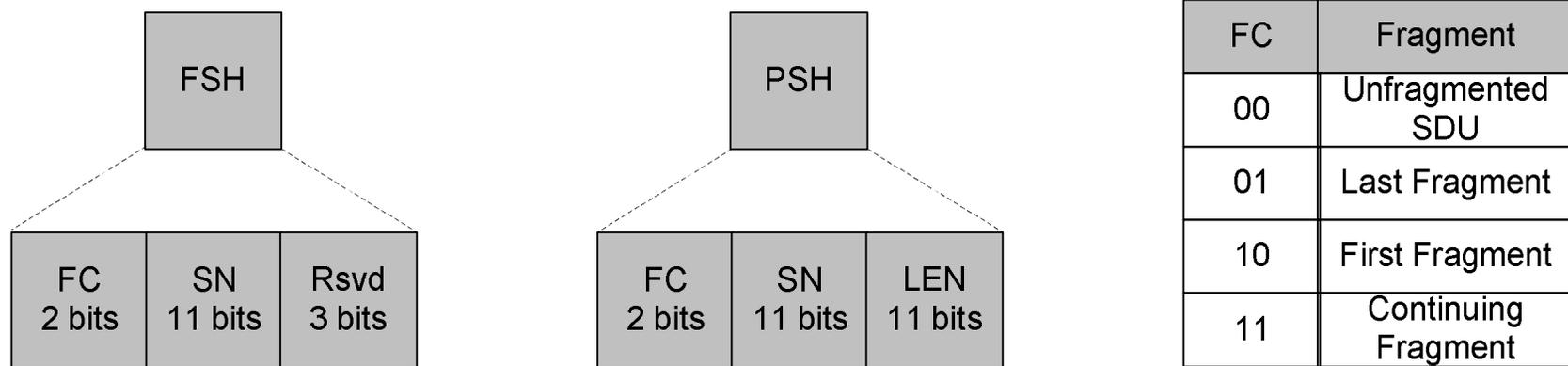
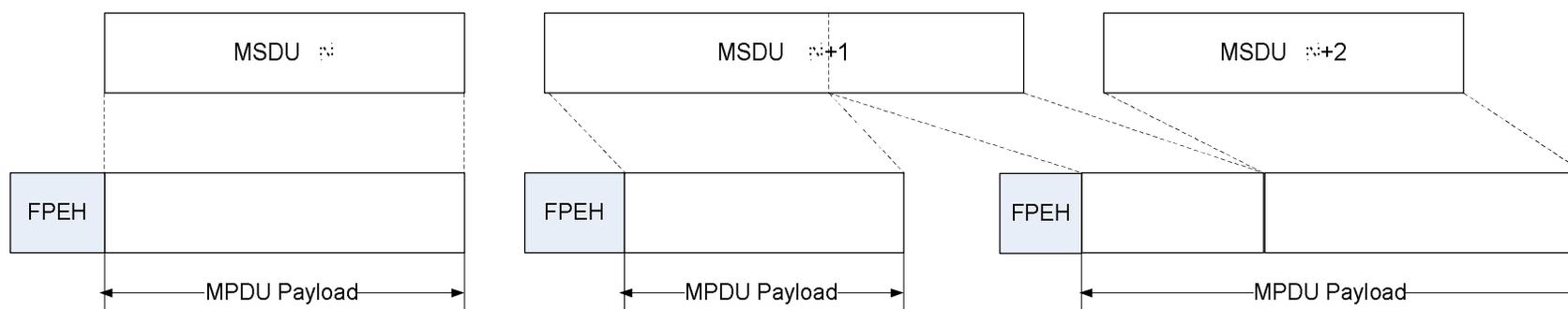


Figure 2: SDU Fragmentation & Packing Sub-headers in IEEE 802.16e-2005

# SDU Fragmentation/Packing Scheme for 16m

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- MAC SDUs (MSDUs) are transmitted in sequence & can be fragmented
- MAC PDU payload is formed by packing one or more SDU/SDU fragments
  - One Fragmentation & Packing Extended Header (FPEH) per MPDU



**Figure 3: SDU Fragmentation/Packing for 16m**

# SDU Fragmentation/Packing Scheme for 16m - FPEH

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- FPEH is the last extended header present in the MAC PDU
  - LAST = 1 and Type = FPEH
- FPEH consists of one or more FPEHB
  - Number of FPEHB = number of flow payloads in the MAC PDU, which need fragmentation & packing info
    - Number of FPEHB  $\leq$  Number of flow payloads multiplexed in a MAC PDU
    - Number of flow payloads multiplexed in a MAC PDU are identified using the GMH & Multiplexing extended header
    - Number of flow payloads which need fragmentation and packing info are present before other flow payloads, in a multiplexed MAC PDU

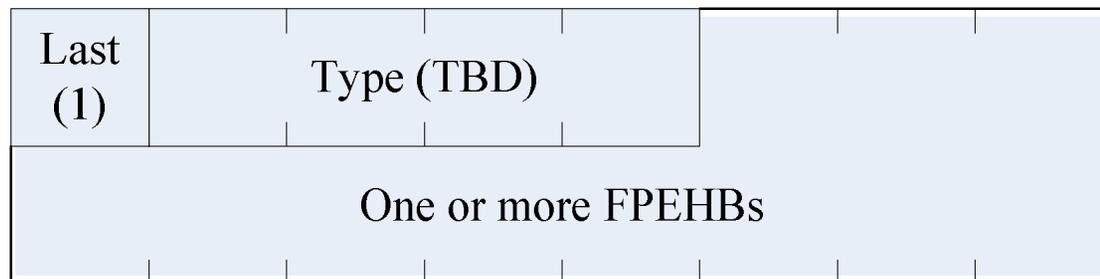
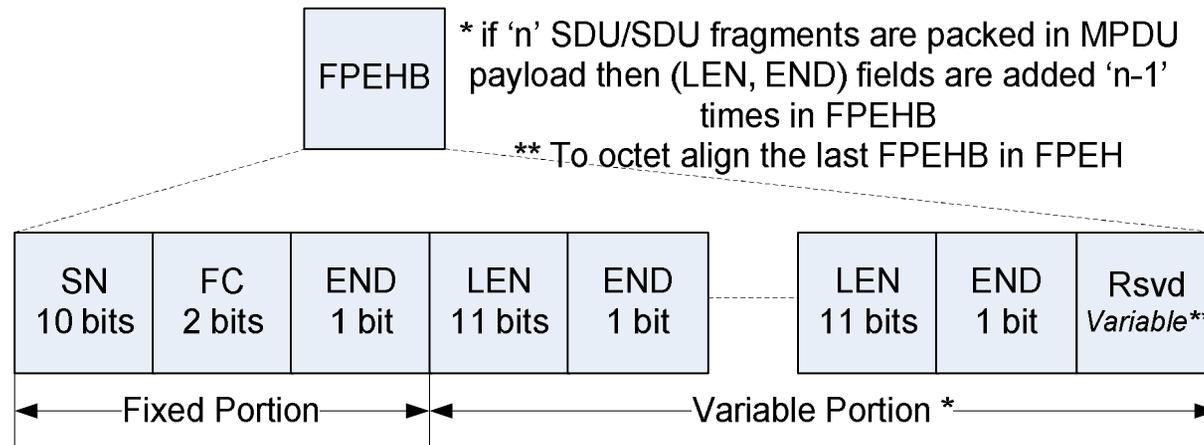


Figure 4: Fragmentation and packing extended header

# SDU Fragmentation/Packing Scheme for 16m - FPEHB

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- Sequence Number (SN) is assigned to each Flow payload
- Fragmentation Control bits are added once per Flow payload
  - Redefined to take advantage of in sequence transmission of SDU/SDU fragments
- Length Field is optimised



**Figure 5: Fragmentation and packing extended header block**

# SDU Fragmentation/Packing Scheme for 16m – Fragmentation Control (FC)

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

# SDU Fragmentation/Packing Scheme for 16m – Examples (1/3)

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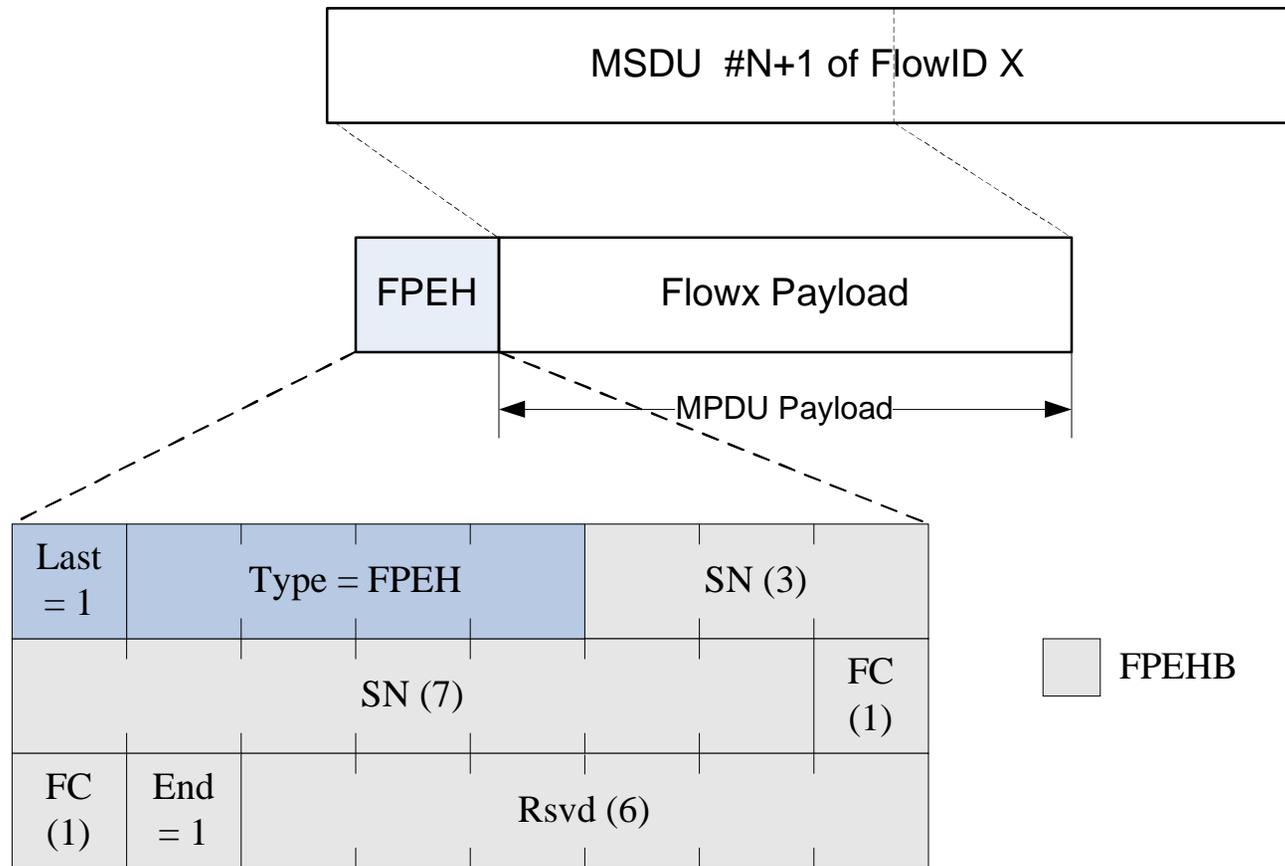
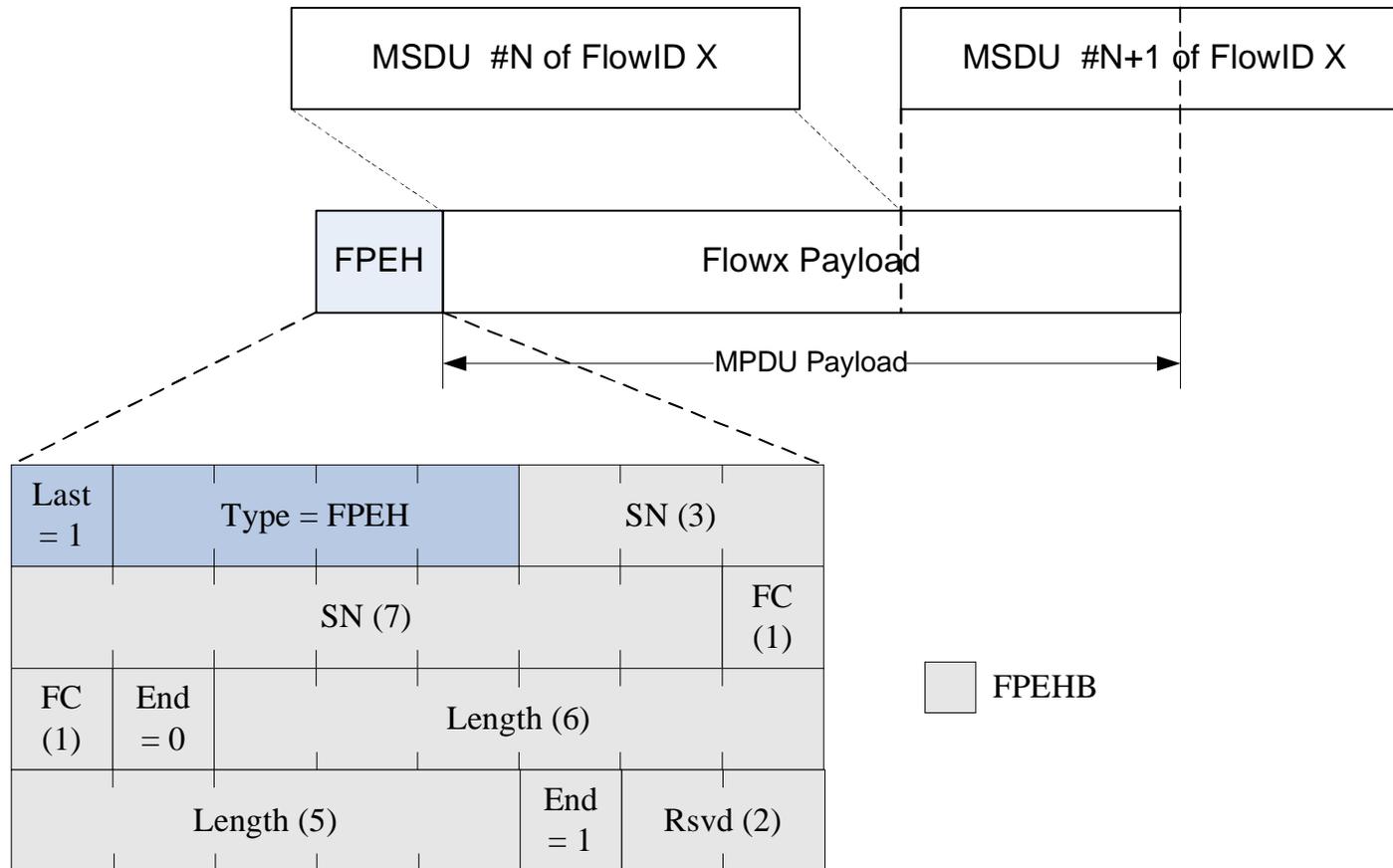


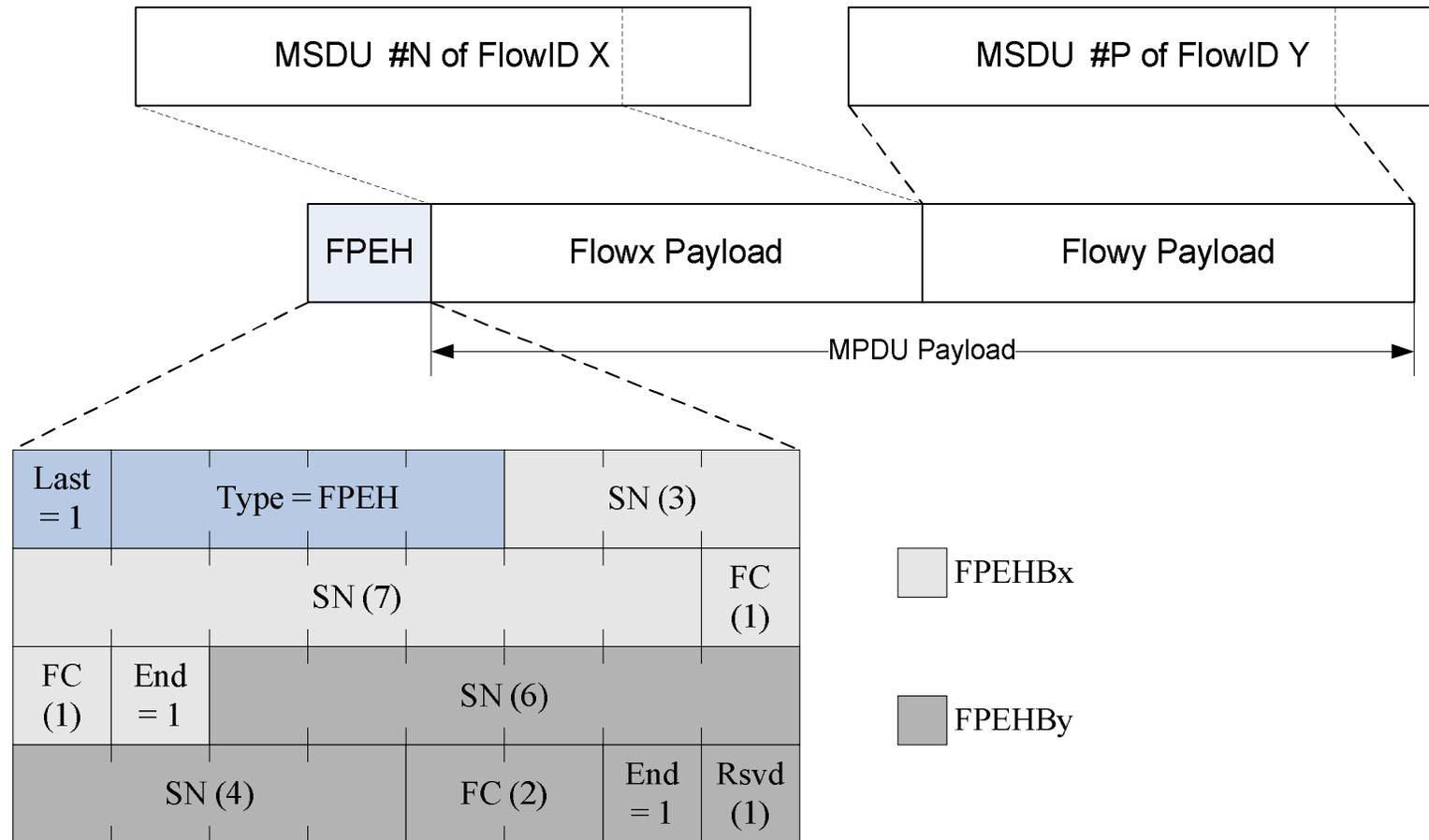
Figure 6: MAC PDU with One Flow Payload with one SDU fragment

# SDU Fragmentation/Packing Scheme for 16m – Examples (2/3)



**Figure 7: MAC PDU with One Flow Payload with multiple SDU/SDU fragment**

# SDU Fragmentation/Packing Scheme for 16m – Examples (3/3)



**Figure 8: MAC PDU with Multiple Flow Payload (Each Flow Payload having fragmentation and packing Info)**

# Proposed text change in SDD (1/3)

[ Insert the following text in section 10.12.2.1 in IEEE 802.16m-08/003r7]

----- **Text Starts** -----

## 10.12.2.1 Fragmentation & packing extended header

IEEE 802.16m supports fragmentation of MAC SDU into one or more MAC PDUs and also allows the packing of one or more SDUs/SDU fragments in a single MAC PDU. The fragmentation and packing extended header is shown in figure x. FPEH is the last extended header present in the MAC PDU. FPEH consists of one or more Fragmentation and packing extended header blocks (FPEHBs). The number of FPEHB in FPEH is equal to number of flow payloads in the MAC PDU, which need fragmentation & packing info. Number of flow payloads which need fragmentation and packing info are present before other flow payloads, in a multiplexed MAC PDU.

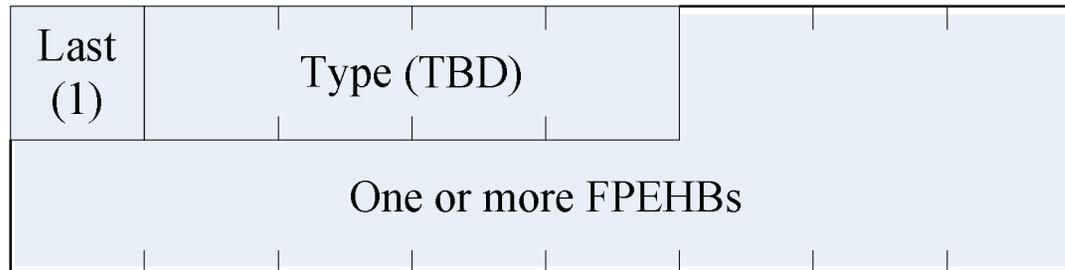


Figure x: Fragmentation & Packing Extended header for 16m

# Proposed text change in SDD (2/3)

The fragmentation and packing extended header block is shown in figure y.

- SN : Payload sequence number
- FC : Fragmentation Control Bits definition are given in table y.
- End = 1: If this is the last FPEHB in FPEH, Rest bits for byte alignment of FPEH are reserved.  
If this is not the last FPEHB in FPEH, another FPEHB follows after the End bit.
- End = 0: Length and another End field are followed

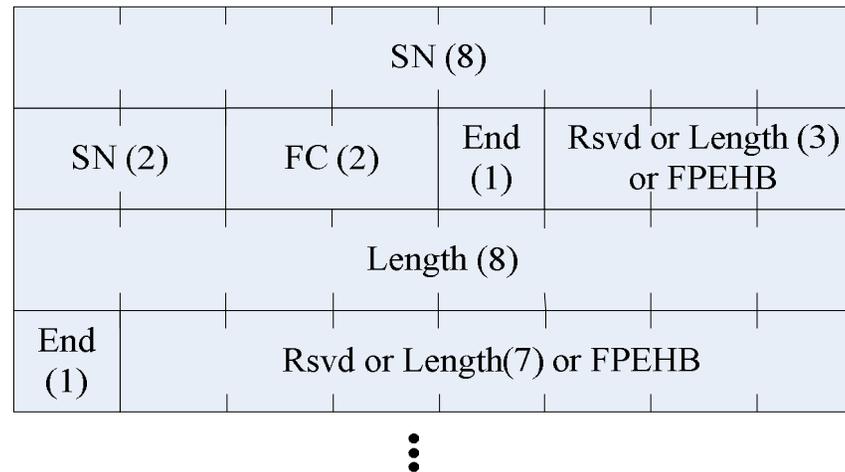


Figure y: Fragmentation & Packing Extended Block

# Proposed text change in SDD (3/3)

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

Table-y: Fragmentation Control (FC) Info

----- **Text Ends** -----