SDU Fragmentation and Packing scheme for 16m

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Venue:

Re: MAC: Data Plane; in response to the TGm Call for Contributions and Comments 802.16m-08/033 for Session 57

Base Contribution:

None

Purpose:

Discuss and adopt the proposed text changes into SDD document

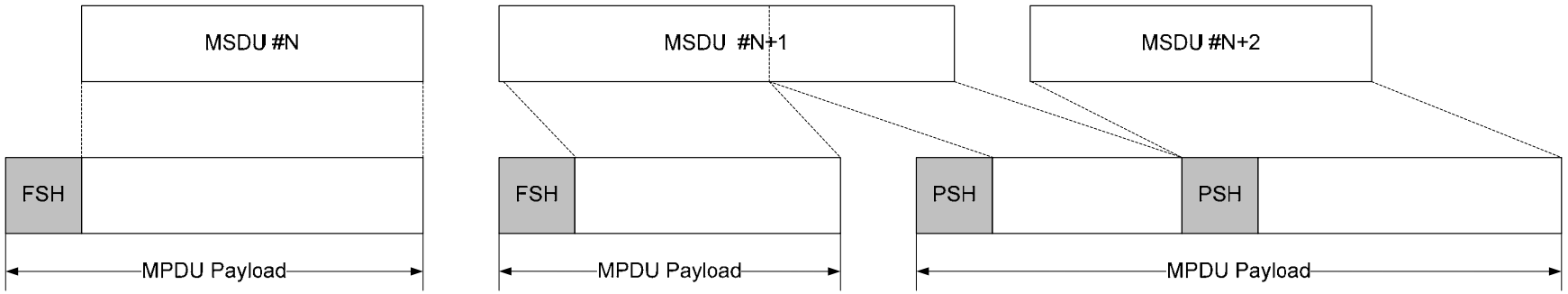
Notice:

Release:

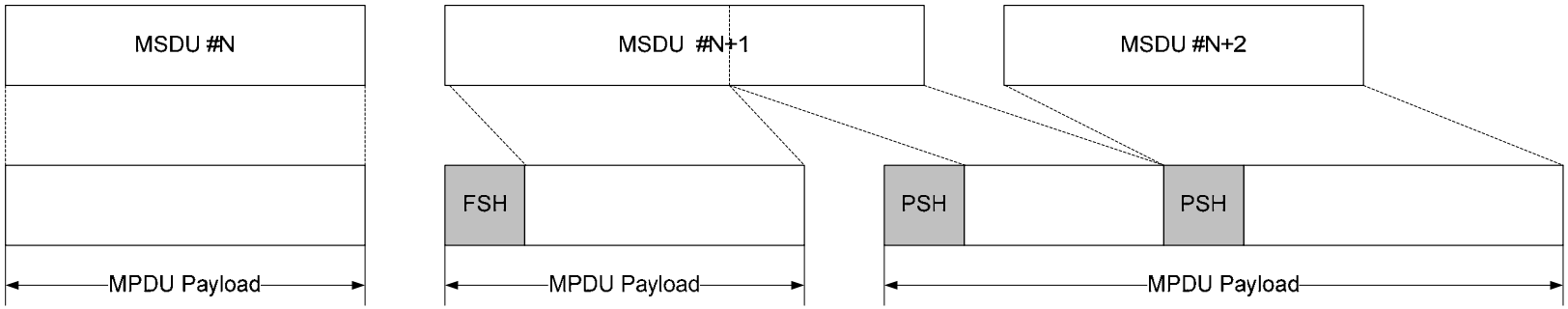
Patent Policy:

SDU Fragmentation/Packing in 16e

- MAC SDUs (MSDUs) are transmitted in sequence
- MSDU 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



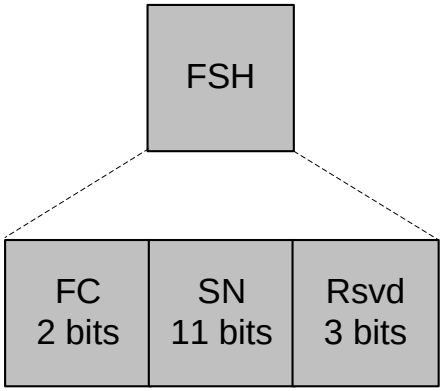
ARQ Connection

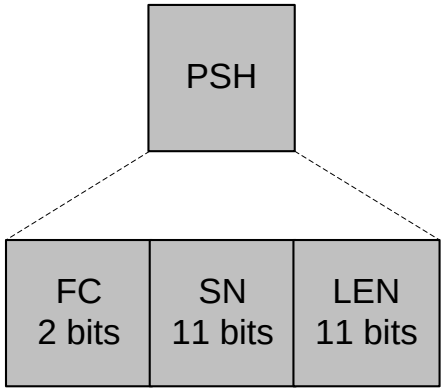


Non-ARQ Connection

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

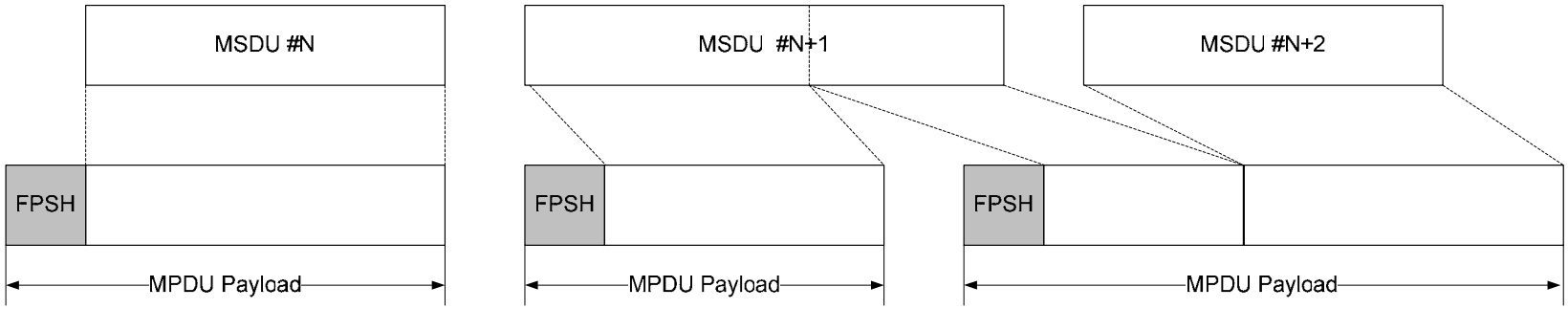




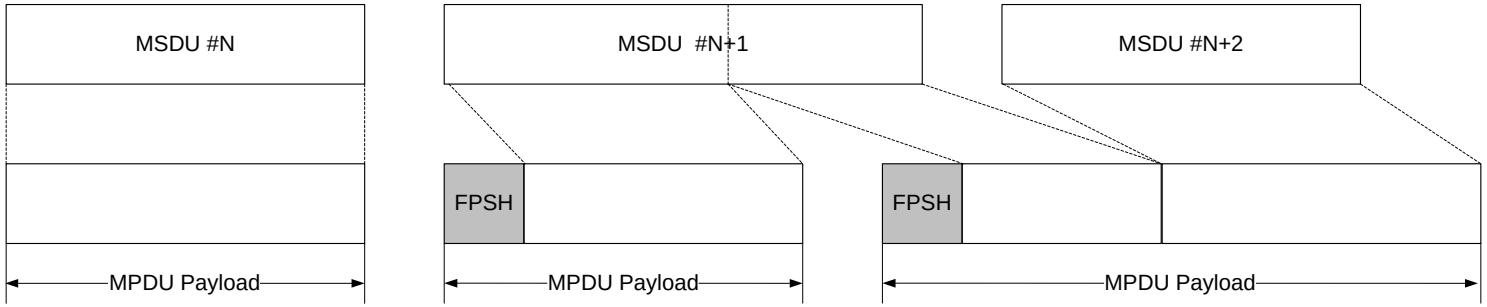
FC	Fragment
00	Unfragmented SDU
01	Last Fragment
10	First Fragment
11	Continuing Fragment

SDU Fragmentation/Packing Scheme for 16m

- MAC SDUs (MSDU) are transmitted in sequence
- MSDU can be fragmented
- MAC PDU payload is formed by packing one or more SDU/SDU fragments
  - Unified Fragmentation & Packing Subheader (FPSH)
  - One FPSH per MPDU payload



ARQ Connection

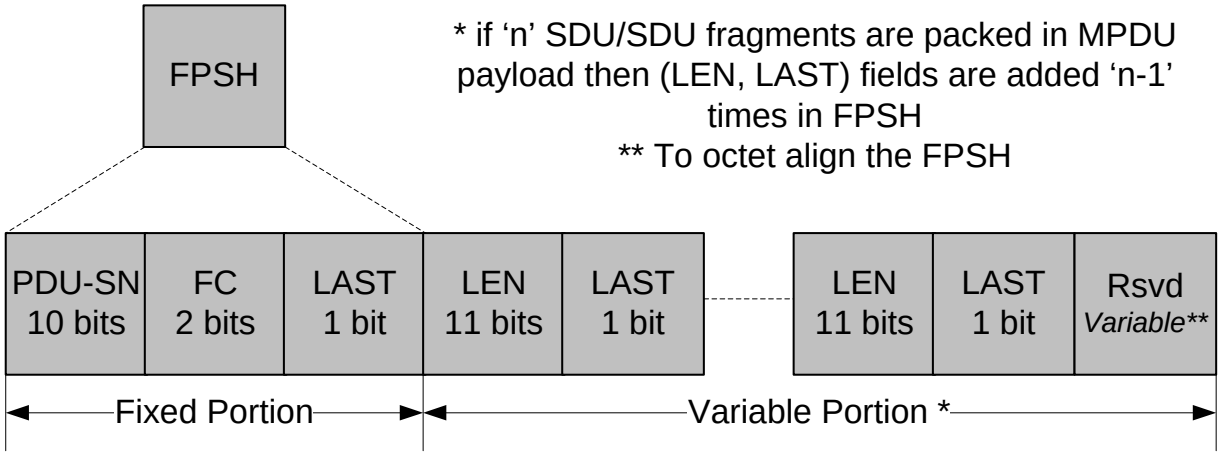


Non-ARQ Connection

(FPSH can be added to Unfragmented SDU if HARQ reordering is required or PDU-SN is used for Encryption)

SDU Fragmentation/Packing Scheme for 16m - FPSH

- Sequence Number (PDU-SN) is assigned to each MPDU
  - Smaller size can be chosen for non ARQ connection
- Fragmentation Control bits are added once per MPDU payload
  - Redefined to take advantage of in sequence transmission of SDU/SDU fragments
- Length Field is optimised



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

FC	Meaning	Examples
00	The first byte of data after FPSH is the first byte of a MAC SDU. The last byte of data after FPSH is the last byte of a MAC SDU.	One or Multiple Full SDUs packed in an MPDU
01	The first byte of data after FPSH is the first byte of a MAC SDU. The last byte of data after FPSH 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 after FPSH is not the first byte of a MAC SDU. The last byte of data after FPSH 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 after FPSH is not the first byte of a MAC SDU. The last byte of data after FPSH 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

Overhead Comparison-16e vs. Proposed 16m Scheme

Scenario	PDU-SN Size	16e Overhead (in bits)	16m Overhead (in bits)	Overhead Reduction
MPDU payload with one SDU/SDU fragment	11	16	16	0%
	3	8	8	0%
	12	16	16	0%
MPDU payload with two SDU/SDU fragment	11	48	32	33%
	3	32	24	25%
	12	64	32	50%
MPDU payload with three SDU/SDU fragment	11	72	40	44%
	3	48	32	33%
	12	96	40	58.33%

Proposed text change in SDD (1/3)

[Insert the following text in section 10 in IEEE 802.16m-08/003r4]

---------- Text Starts ----------

10.x SDU Fragmentation & Packing

IEEE 802.16m supports fragmentation of MAC SDU into one ore more MAC PDUs and also allows the packing of one or more SDUs/SDU fragments in a single MAC PDU to facilitate the efficient use of available bandwidth relative to QoS requirements of a connection's service flow. The fragmentation and packing scheme and header used for the same is shown in figure x. The fragmentation and packing header is shown in figure y. The new definition for fragmentation control bits is given in table-x.

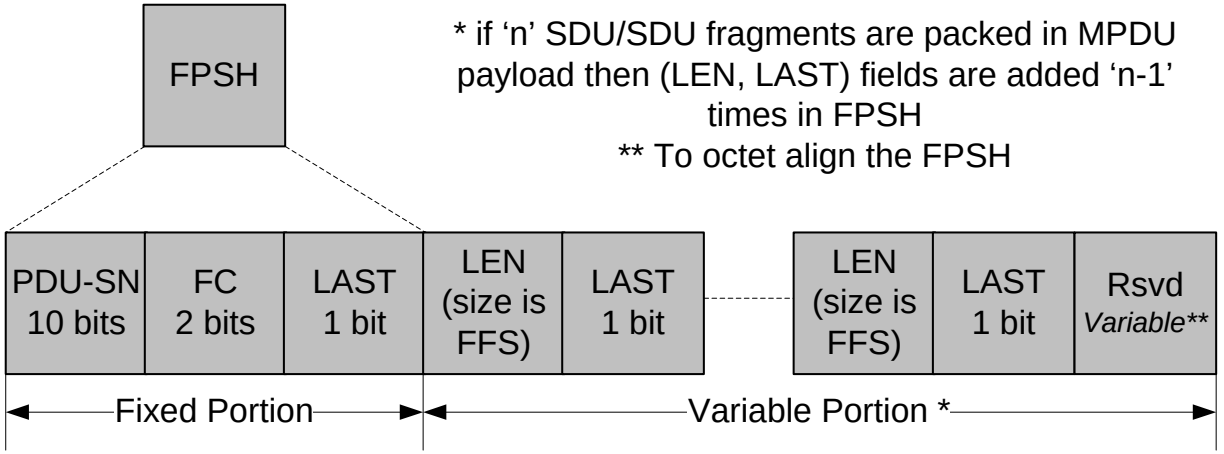
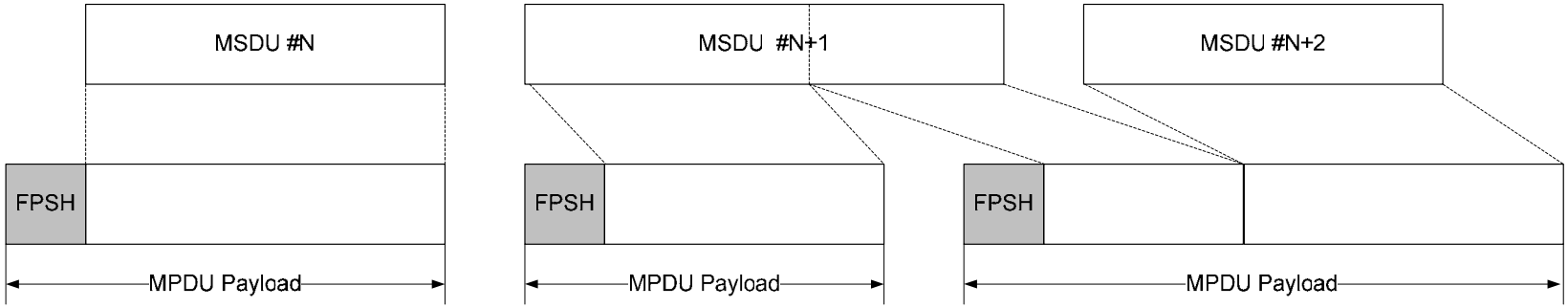
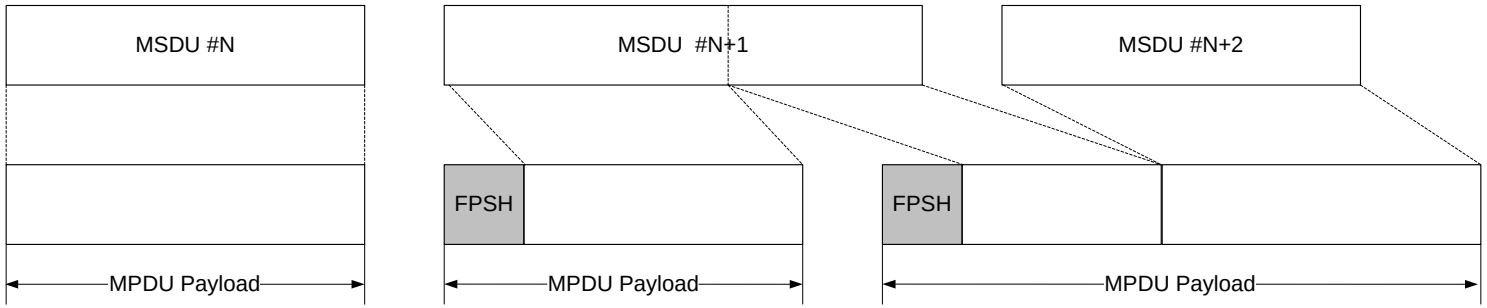


Figure y: SDU Fragmentation & Packing Sub-header for 16m

Proposed text change in SDD (2/3)



ARQ Connection



Non-ARQ Connection

(FPSH can be added to Unfragmented SDU if HARQ reordering is required or PDU-SN is used for Encryption)

Figure x: SDU Fragmentation/Packing for 16m

Proposed text change in SDD (3/3)

FC	Meaning	Examples
00	The first byte of data after FPSH is the first byte of a MAC SDU. The last byte of data after FPSH is the last byte of a MAC SDU.	One or Multiple Full SDUs packed in an MPDU
01	The first byte of data after FPSH is the first byte of a MAC SDU. The last byte of data after FPSH 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 after FPSH is not the first byte of a MAC SDU. The last byte of data after FPSH 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 after FPSH is not the first byte of a MAC SDU. The last byte of data after FPSH 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-x: Fragmentation Control Info

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