

Data Integrity in 802.16 MAC

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Vladimir Yanover et al.

BreezeCOM

Atidim Technology Park, Bldg. 1

P.O. Box 13139, Tel-Aviv 61131, Israel

Voice: +972-36457834

Fax: +972-36456290

E-mail: vladimiry@breezecom.co.il

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Data Integrity in 802.16. MAC

Naftali Chayat, Vladimir Yanover,

Inbar Anson

BreezeCOM

Data Integrity functionality

¥ Fragmentation / Assembling

¥ Concatenation

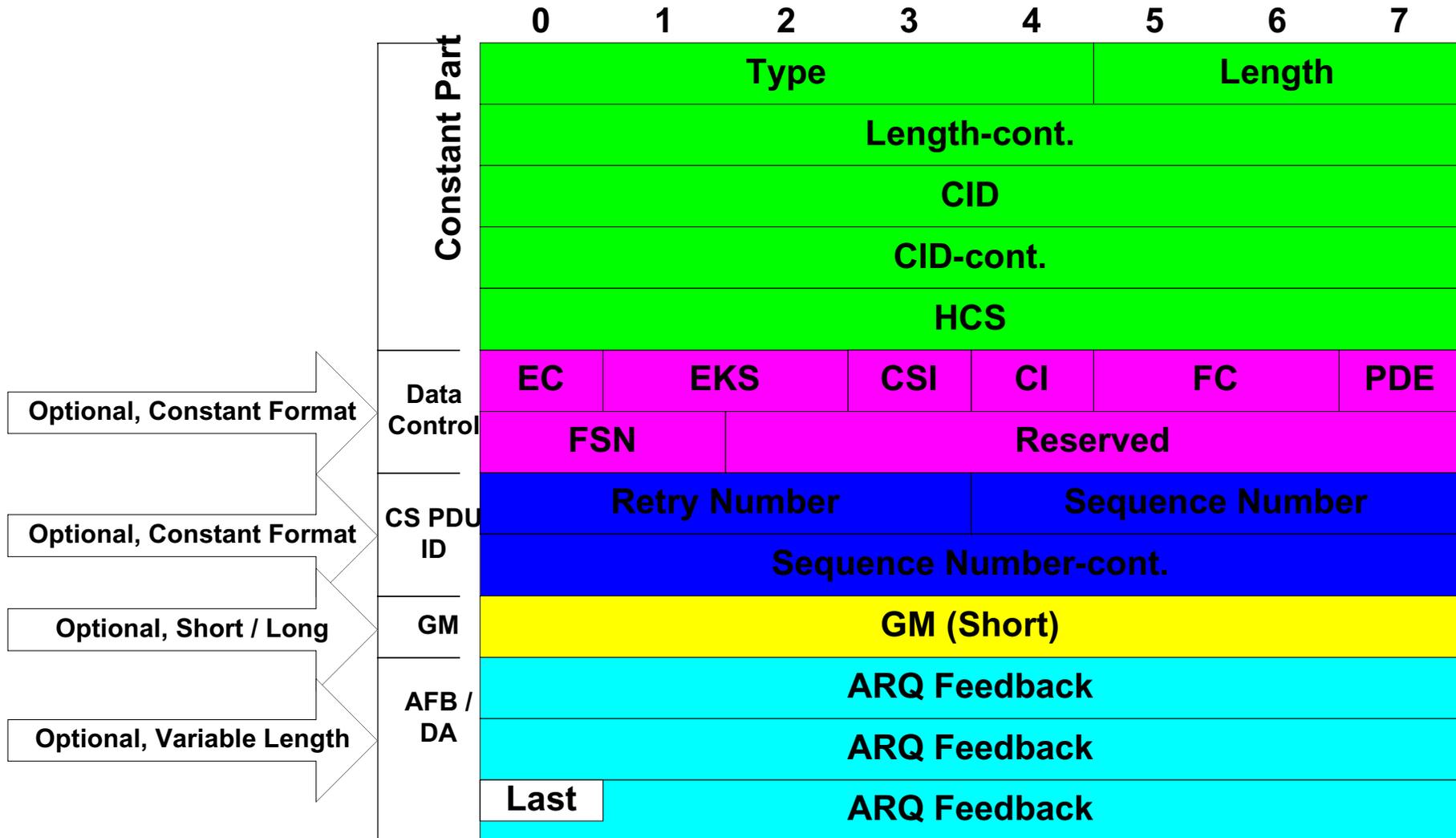
¥ Integrity check

¥ ARQ (Retransmissions)

Identification of MSDUs

- ∕ MAC assigns to each MSDU received from the Convergence Layer a sequence number (MPDU sequence Number = MSN) in the interval from 0 to $2^{12}-1$
- ∕ The way the transmitter cares on the non-ambiguity of the sequence numbers is out of the standard's scope

General MAC Headers Format



Fragmentation

∴ Reasons

- Lack of the frame time when allocating the air time to the given MSDU
- High BER that requires employing integrity check for smaller data blocks

∴ Once applied, the fragmentation of the given MSDU never changes

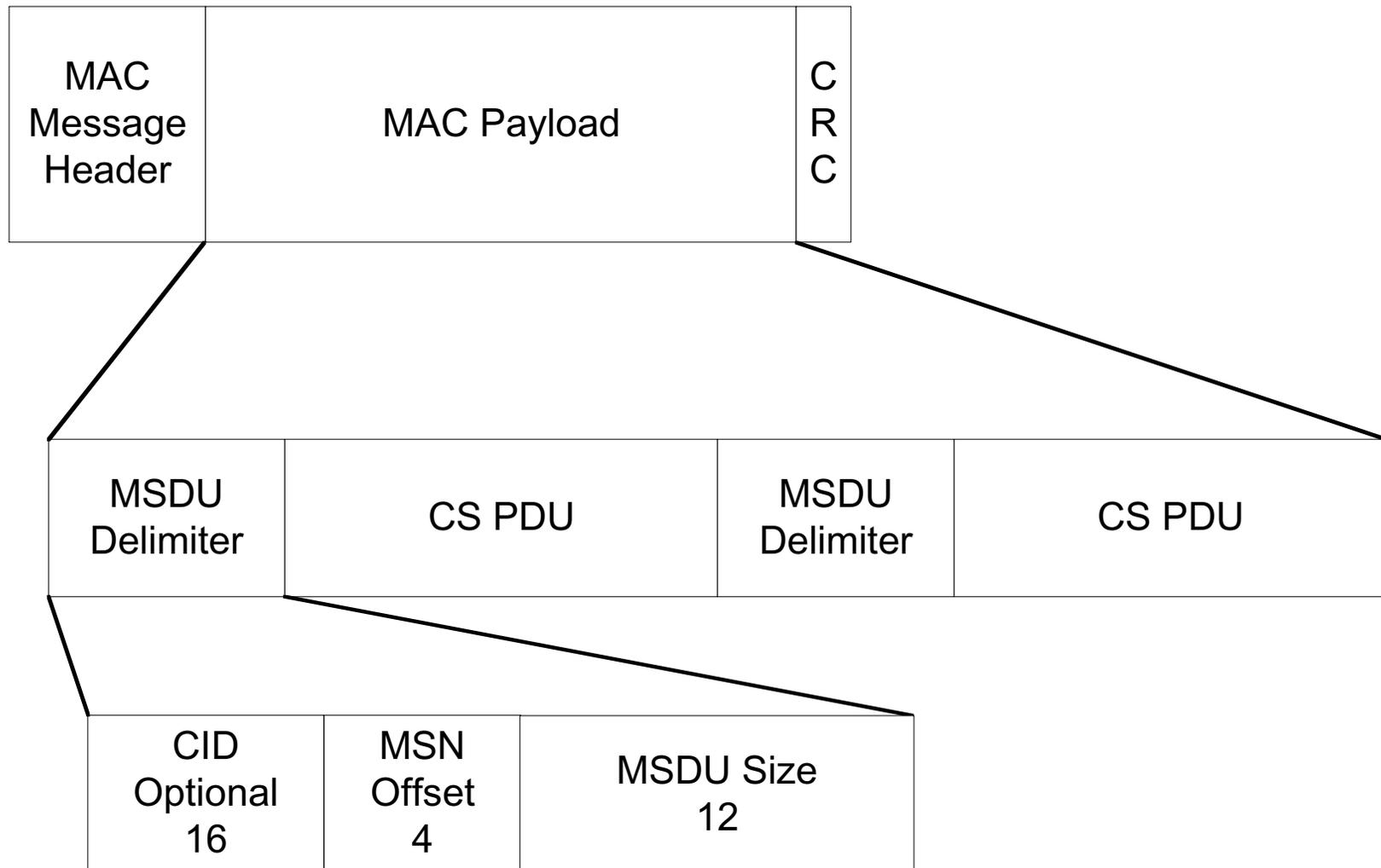
Fragmentation-cont.

¥ Fragment Control code (FC):

- 00 = non-fragmented MPDU
- 01 = last fragment
- 10 = first fragment
- 11 = continuing (middle) fragment

Concatenation of Small CS PDUs into a Single MAC Message

Purpose: decrease PHY overhead



Concatenation-cont.

⌘ Message Type = Data

⌘ New flags in MAC header :

—CONC = 1 if the given message includes concatenated CS PDUs

—TDM = 1 if each MSDU delimiter contains CID

⌘ MAC payload is always a non-fragmented CS PDU

⌘ (If for this connection ARQ is enabled)

—sequence number = (sequence No from MAC header) + (MSN Offset)

Concatenation-cont.

The MAC Header Fields

- ¥ EC, EKS —used for all CS PDUs
- ¥ FC = 00 (non-fragmented)
- ¥ CI = 1 means CRC presence at the end of MAC message
- ¥ PDE = 0 (N/A)

Requirements to ARQ

- ⌘ Should be implemented at MAC layer, for both DL and UL
- ⌘ A possibility to enable / disable ARQ function for each connection separately
- ⌘ The tools used by the ARQ mechanism (like change in frame formats) have to add zero or negligible overhead to the connections with ARQ disabled
- ⌘ ARQ on the level of CS PDU fragments should be supported

Requirements to ARQ

- ∄ Selective retransmissions should be employed
- ∄ Possibility for piggybacking the ARQ related info (e.g. ACK) onto the MAC messages
- ∄ Algorithm should provide group ACKs
- ∄ Discard algorithm should operate at the level of CS PDUs

Proposed ARQ Related Signaling Format

- ¥ Responds to all above requirements
- ¥ A part of MAC header (variable size)
- ¥ May be both standalone and piggybacked on the message of any type
- ¥ Flexible: Short .. Long

ARQ Feedback / Discard Info

AFB Short Format = 8 bits

Last	Mode	Reserved
1	3	4

Acknowledges all the MAC messages received in the current frame

AFB Medium Format = 32 bits

CID	Last	Mode	SerNo
16	1	3	12

For the given CID acknowledges all the CS PDUs with sequence numbers < SeqNo

AFB Long Format = 48 bits

CID	Last	Mode	SerNo	Mask
16	1	3	12	16

For the given CID acknowledges the fragments of the CS PDU messages with sequence numbers = SeqNo

Discard Info = 32 bits

CID	Last	Mode = 101	SerNo
16	1	3	12

(Sent by the transmitter). Informs the receiver that the CS PDU with the sequence numbers < SeqNo were discarded