Per-Packet Metadata in Preamble and SFD

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P802.3dt PAR Scope

- During the PAR approval process, the project scope wording changed for per-packet metadata
- Proposed PAR scope wording in Nov. 2025:

> **5.2.b Scope of the project:** The scope of the project is the specification of additions and modifications to IEEE Std 802.3 to support the optional exchange of metadata:
> 1) In Ethernet packets, or
> 2) Independent of Ethernet packets by Ethernet Physical layers that operate at MAC data rates of 50 Gb/s and above.

- Final approved PAR scope wording:

> **5.2.b Scope of the project:** The scope of the project is the specification of additions and modifications to IEEE Std 802.3 to support the optional exchange of metadata through a physical layer service access point transferred: 1) in the preamble field of packets, or 2) in physical layer ordered sets, for MAC data rates greater than or equal to 50Gb/s, independent of packets.

MAC Packet Format

- 7 octets of preamble
  - 0x55 … 0x55
- followed by 1 octet SFD
  - 0xd5
- followed by frame
  - MACDA, etc.

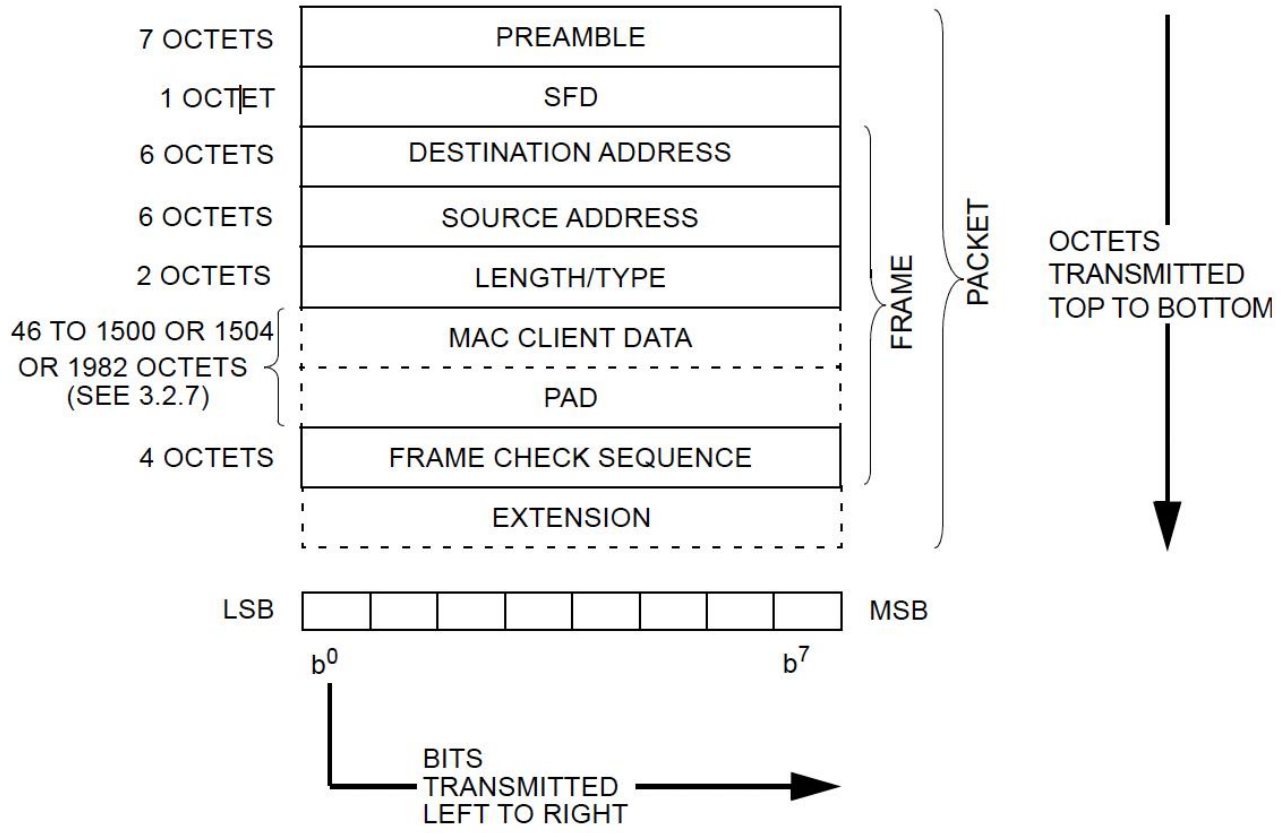
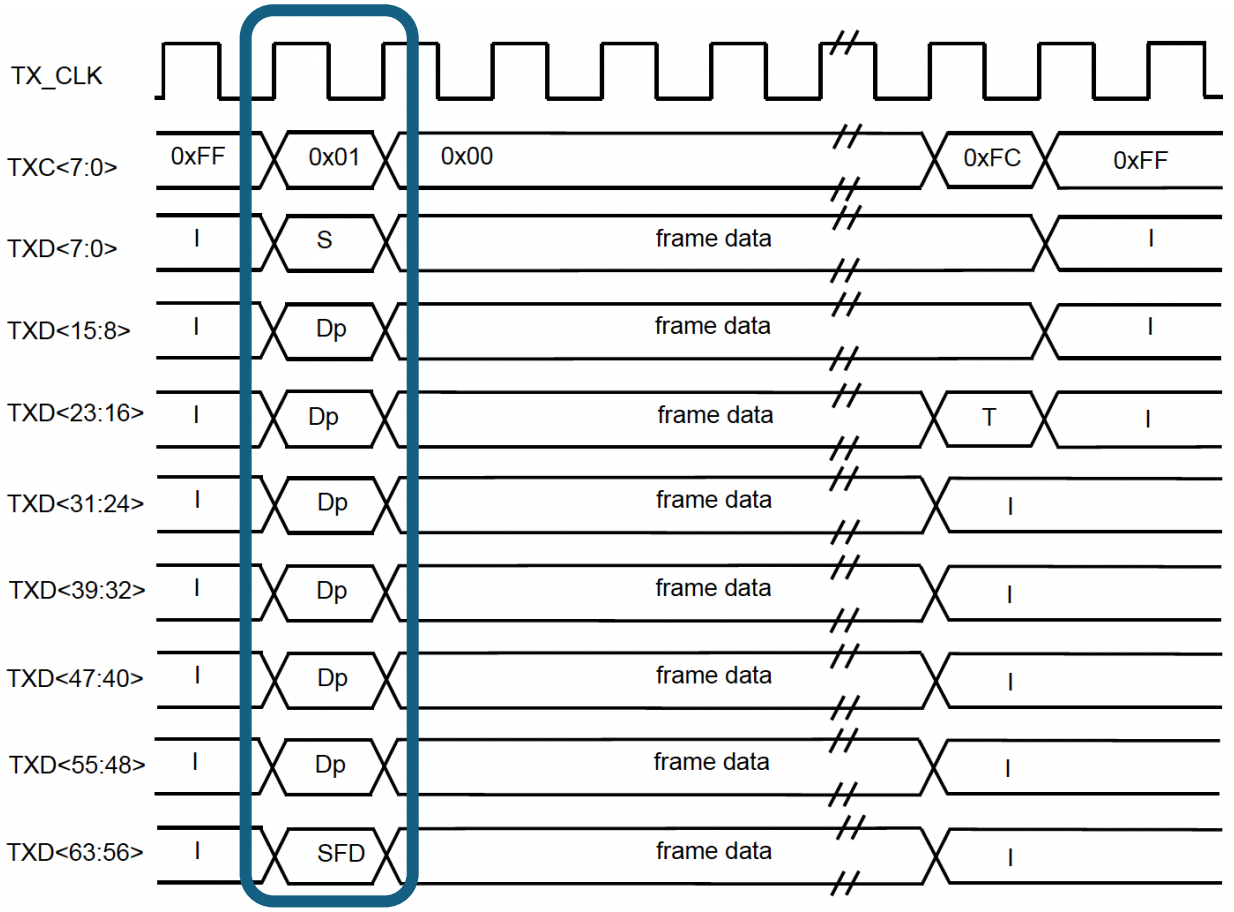


Figure 3–1—Packet format

RS Conversion for Start control character

- **81.2.2** Preamble and start of frame delimiter:

  On transmit, the RS converts the first data octet of preamble transferred from the MAC into a Start control character. On receive, the RS converts the Start control character into a preamble data octet.



I: Idle control character, S: Start control character, Dp: preamble Data octet, T: Terminate control character, SFD: Start of Frame Delimiter

Figure 81–5—Normal frame transmission

PCS 64B/66B coding for Start block

- PCS translates start character, /S/, to block type field value 0x78

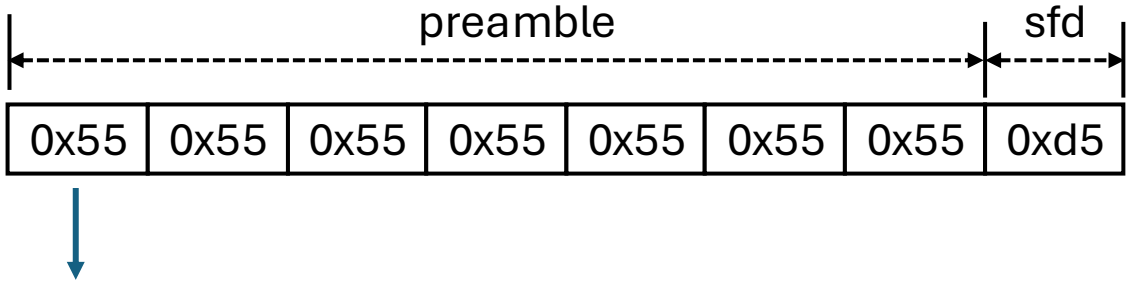
The rest of preamble and SFD are opaque data to PCS.

Input Data	Sync	Block Payload							
Bit Position: / Data Block Format:	0 1	2							65
$D_0\ D_1\ D_2\ D_3\ D_4\ D_5\ D_6\ D_7$	01	D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7
Control Block Formats:		Block Type Field							
$C_0\ C_1\ C_2\ C_3\ C_4\ C_5\ C_6\ C_7$	10	0x1E	C_0	C_1	C_2	C_3	C_4	C_5	C_6	C_7
$S_0\ D_1\ D_2\ D_3\ D_4\ D_5\ D_6\ D_7$	10	0x78	D_1	D_2	D_3	D_4	D_5	D_6	D_7
$T_0\ C_1\ C_2\ C_3\ C_4\ C_5\ C_6\ C_7$	10	0x87		C_1	C_2	C_3	C_4	C_5	C_6	C_7
$D_0\ T_1\ C_2\ C_3\ C_4\ C_5\ C_6\ C_7$	10	0x99	D_0		C_2	C_3	C_4	C_5	C_6	C_7
$D_0\ D_1\ T_2\ C_3\ C_4\ C_5\ C_6\ C_7$	10	0xAA	D_0	D_1		C_3	C_4	C_5	C_6	C_7
$D_0\ D_1\ D_2\ T_3\ C_4\ C_5\ C_6\ C_7$	10	0xB4	D_0	D_1	D_2		C_4	C_5	C_6	C_7
$D_0\ D_1\ D_2\ D_3\ T_4\ C_5\ C_6\ C_7$	10	0xCC	D_0	D_1	D_2	D_3		C_5	C_6	C_7
$D_0\ D_1\ D_2\ D_3\ D_4\ T_5\ C_6\ C_7$	10	0xD2	D_0	D_1	D_2	D_3	D_4		C_6	C_7
$D_0\ D_1\ D_2\ D_3\ D_4\ D_5\ T_6\ C_7$	10	0xE1	D_0	D_1	D_2	D_3	D_4	D_5		C_7
$D_0\ D_1\ D_2\ D_3\ D_4\ D_5\ D_6\ T_7$	10	0xFF	D_0	D_1	D_2	D_3	D_4	D_5	D_6	

Figure 82–5—64B/66B block formats

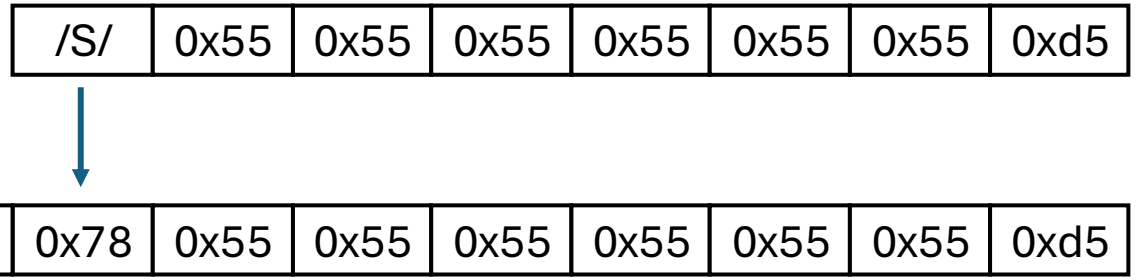
Preamble and SFD translations

- MAC Preamble+SFD:



- RS convertion to xMII:

(/S/ = 0xFB)



- PCS 66-bit block:

- SFD octet is not needed
  - /S/ character and 66-bit block type field identify the start of a packet
  - SFD octet is redundant for PHYs that use RS and 64B/66B coding

Summary

- Preamble and SFD make up the PCS 66-bit start block
  - /S/ character and 66-bit block type field identify the start of a packet
  - SFD octet is not necessary for normal frame transmission
- Current project scope (PAR) allows for per-packet metadata in preamble, but not the SFD.
  - Effectively in 6 of the 8 octets of the PCS start block
  - The first octet of the preamble is needed for 64B/66B coding
- Per-packet metadata should be allowed to use the SFD octet
  - Thus, allowing for 7 octets of per-packet metadata in the PCS start block instead of only 6 octets.

Suggested course of action

- Update 802.3dt PAR scope to allow for per-packet metadata to use both the packet preamble and SFD
  - Change PAR scope from:

"The scope of the project is the specification of additions and modifications to IEEE Std 802.3 to support the optional exchange of metadata through a physical layer service access point transferred: 1) in the preamble field of packets, or 2) in physical layer ordered sets, for MAC data rates greater than or equal to 50Gb/s, independent of packets."

  - To:

"The scope of the project is the specification of additions and modifications to IEEE Std 802.3 to support the optional exchange of metadata through a physical layer service access point transferred: 1) in the preamble and SFD fields of packets, or 2) in physical layer ordered sets, for MAC data rates greater than or equal to 50Gb/s, independent of packets."