

# 802.3br IET Proposal

## Architecture and Encapsulation

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# Objectives Review

- ✓ 1. Preserve the IEEE 802.3 Ethernet frame format at the MAC.
- ✓ 2. Preserve minimum and maximum MAC frame size of the current IEEE 802.3 standard.
- ✓ 3. Use the Clause 4/Annex 4A MAC without alteration.
- ✓ 4. Require no changes to PHYs.
- ✓ 5. Support full duplex operation only.
- ✓ 6. Preserve MAC/PLS service interface.
- ✓ 7. Do not degrade Mean Time to False Packet Acceptance (MTTFPA) at the MAC Service Interface.
- ✓ 8. The latency to initiate the transmission of an express frame shall be less than two times the minimum packet size plus IPG.

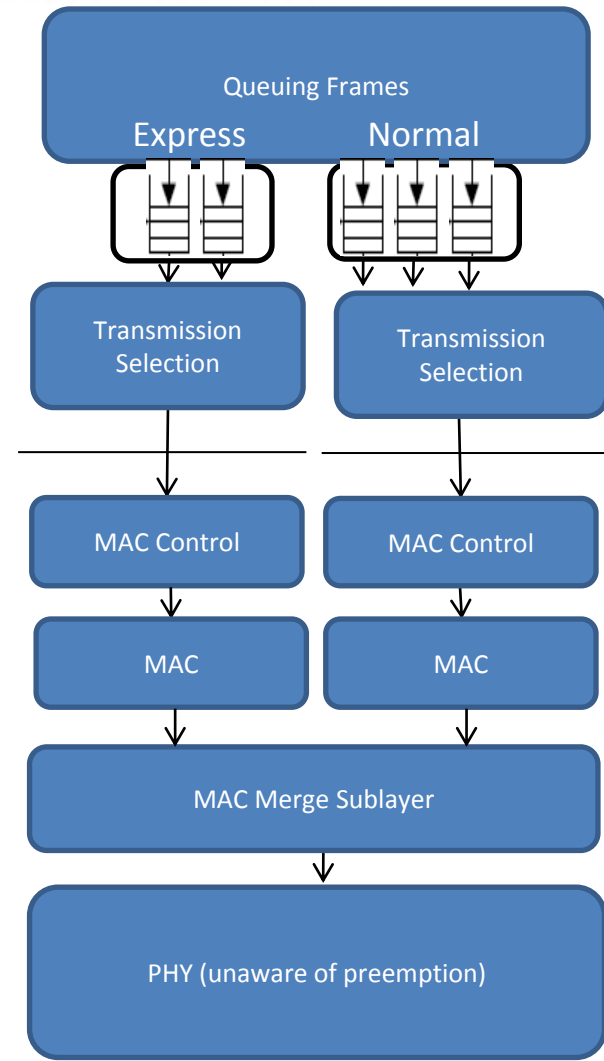
# Objectives Review

9. Assure that both ends of the link support Interspersing Express Traffic (IET) mode before enabling it.
  - To be handled in Negotiation Proposal; this proposal doesn't interfere with achieving the objective.
- ✓ 10. Provide a primitive at the MAC client service interface to inhibit the transmission of non-express frames.
- ✓ 11. Provide two MAC client service interfaces at each end of the IET link, as the means to distinguish between the express and the non-express frames.
- ✓ 12. Minimum IET frame size shall be greater than or equal to 64 bytes.
- ✓ 13. IET frames will be constructed such that they will not be recognized as valid MAC frames by a non-IET-capable device.

# MAC MERGE ARCHITECTURE

# MAC Merge layer encapsulation goals

- Preserve frame integrity
  - No increase in undetected errors
- Indicate which MAC receive frame belongs to
- Minimize impact on throughput
- Transparent to existing non-deprecated PHYs



# Terminology

- Express frame – frames with the lowest latency
- Normal frame – frames that are not Express frames.
- Mframe -- A transmitted unit from MAC Merge that includes both whole frames and fragments of preemptable frames – Mframe
  - Which stands for MAC Merge frame – a unit that looks like a frame at the PHY layer but may contain a whole frame or a fragment of a MAC layer preemptable frame. I'm leaning toward this one.

# Hold Primitive need

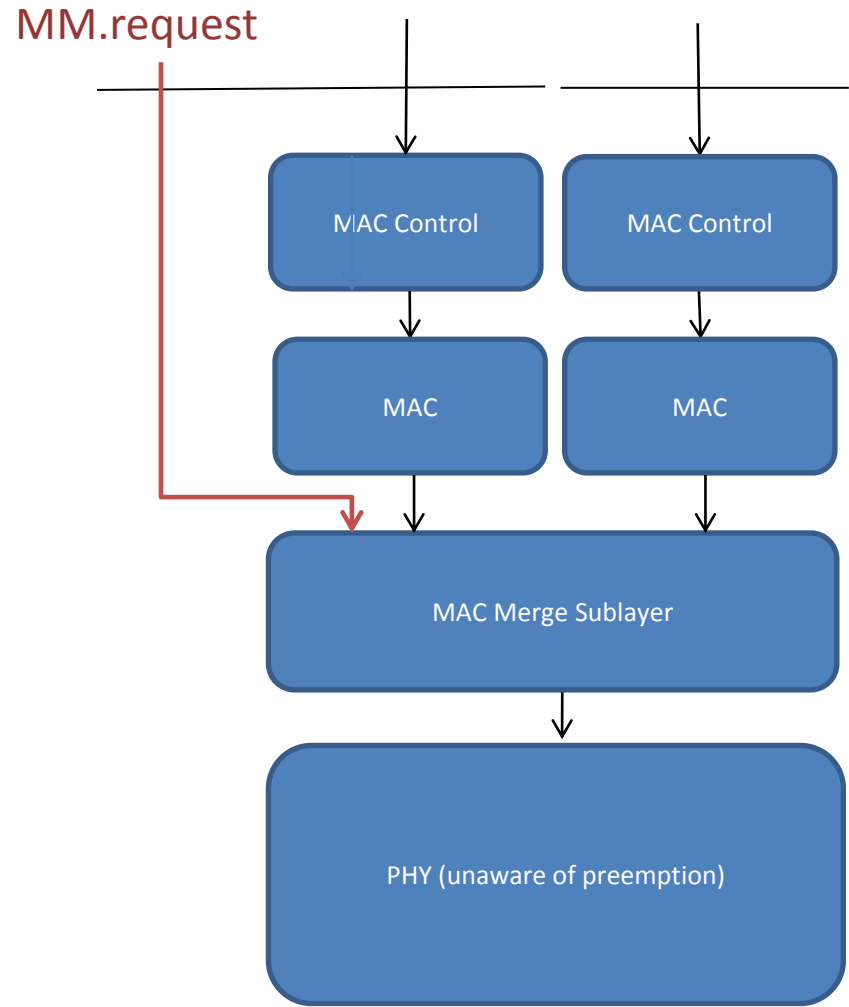
A hold primitive allows:

- A MAC Client that has a schedule for Express traffic to preempt Normal frames before the scheduled Express traffic arrives. When the scheduled frame arrives, it can be transmitted immediately.
- EPON MAC Control to preempt a frame near the end of the Gate and send a Report before the end of the Gate.



# MM.Request from MAC Client

- MM.request: Primitive to carry the indication to Hold (i.e. preempt any frame in transmission and prevent the start of new frames) or release the normal transmission path

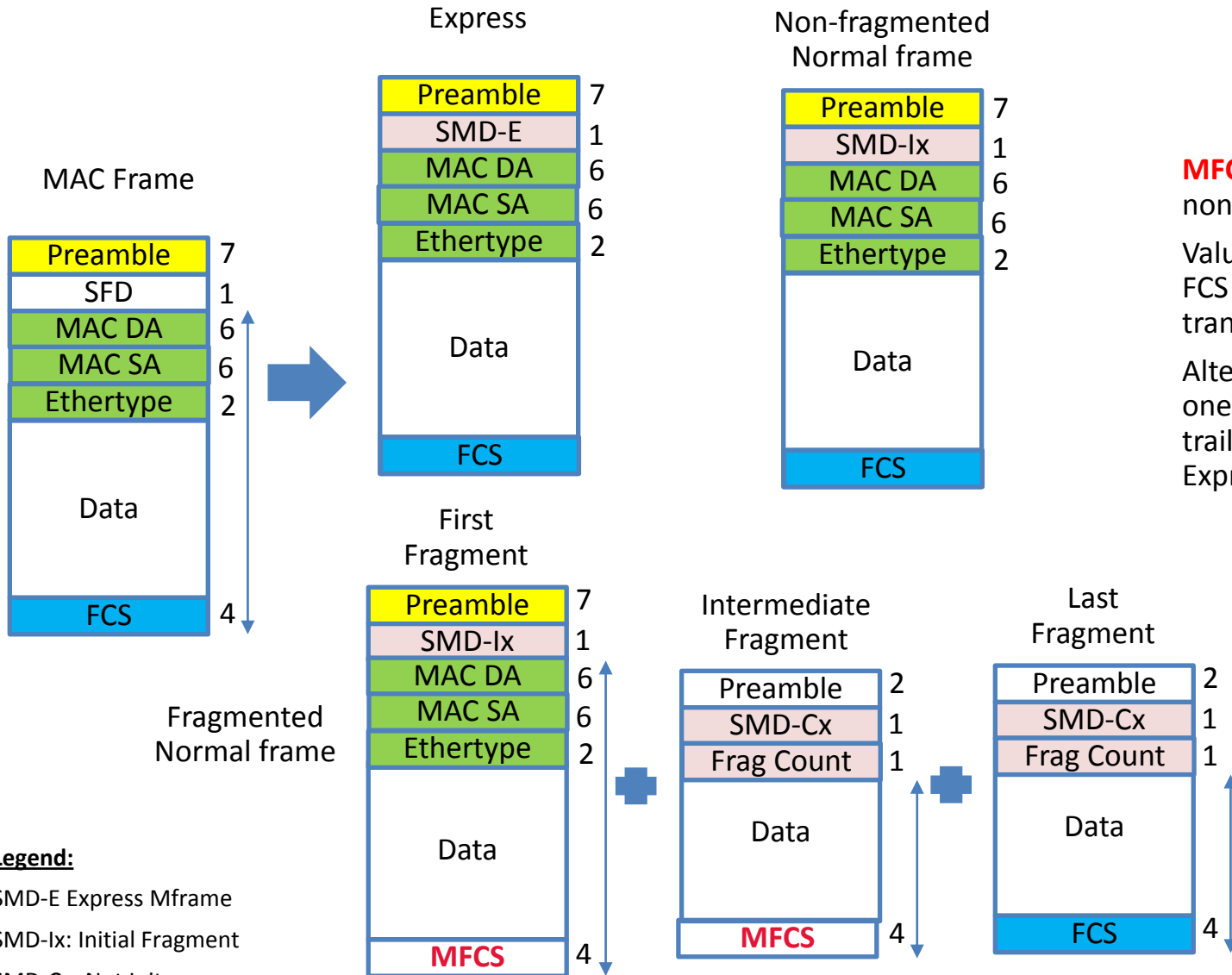


# MM.request(hold\_req)

- hold\_req parameter takes one of two values:
  - hold – asserts hold variable in MAC Merge sublayer
  - release – clears hold value in MAC Merge sublayer
- MAC Merge preempts whenever hold = TRUE or IET MAC PLS\_DATA.request has a bit to transmit.

# MFRAME FORMAT

# Mframe format



**MFCS** is the CRC of a non-final fragment.

Value is the same as the FCS of the frame bytes transmitted XOR FF00

Alternatively, could use a one-byte fragmentation trailer on each non Express Mframe

PHY compatibility lower bound  
Frag HDR + error detect

**Legend:**

- SMD-E Express Mframe
- SMD-Ix: Initial Fragment
- SMD-Cx: Not Init (Continue) Fragment

# Mframe format elements

- Preamble
  - Minimize use of preamble bytes for non-initial fragments
  - Provide at least 2 bytes of preamble for fragments
    - The 1000BASE-X PHY can drop up to 2 bytes of preamble and insert the SFD over another byte. In practice, implementations only drop 1 and many delay the start of preamble rather than drop and only overwrite 1 byte (similar to 10GBASE-X alignment)
    - Open issue: use full or shortened preamble for 10 Mbps PHYs?
- Identify Mframe as Express or start of a Normal frame or a later fragment of a Normal frame
- Protection for reassembly errors when an Mframe is lost
  - Frame number – circular count from 0 to 3
  - Fragment number – circular count from 0 to 3
- Identify last Mframe of a Frame
  - Mark end of Normal Mframe

# Fragment size constraints

- Preempted fragment size will be no smaller than 64 bytes
  - Therefore a packet less than 127 bytes will not be preempted.
- To simplify implementation, non-final fragments will have an alignment constraint
  - That is, their payload will be a multiple of a set number of octets
  - For initial draft, leave TBD the alignment size as some multiple of 8 octets between 8 and 64 octets

# Mframe start

- For start of non-initial fragments
  - Insert 2 bytes of preamble followed by
  - SMD byte (Start Mframe Delimiter)
  - Frag byte (Fragment count)
- Normal Frame start and Express frame
  - Replace SFD with SMD
- SMD values have Hamming distance 4 from each other
- Frag values have Hamming distance 4 from each other

# SMD and Count byte encodings

Mframe type	Frame #	SMD
SMD-E	NA	0x55
SMD-Ix Preemptable frame start	0	0x66
	1	0xCC
	2	0xFF
	3	0x33
SMD-Cx Non-initial fragment	0	0xE1
	1	0xD2
	2	0x1E
	3	0x2D

Frag Count	Frag
0	0x66
1	0xCC
2	0xFF
3	0x33

To comply with objective 13, 0xAA isn't used  
Objective 13: IET frames will be constructed such that they will not be recognized as valid MAC frames by a non-IET-capable



# Frame and Mframe CRC

- Frame CRC is generated by the MAC over the same frame bits as always. It is not altered by the MAC Merge sublayer
- MAC Merge layer calculates the Mframe CRC which it adds to any non-final fragment Mframes. Mframe CRC on a fragment is calculated over the bytes of the frame transmitted up to the end of the current Mframe. It is the same as the MAC CRC calculation XOR'ed with FF00

# Fun with CRCs

- IEEE 802.3 inverts the calculated CRC and appends the result to the frame.
- Transmitting MAC Merge sublayer could invert the second two bytes of the intermediate CRC result (the CRC computed over the bytes of the MAC frame that have been transmitted so far) at the end of non-final fragments.
- Receiving MAC Merge sublayer runs a CRC calculation as the frame is received. When an Mframe ends, it compares the calculated value with the
  - If the difference between that and the last 4 bytes of the Mframe is 0xFFFF, it's the end of a MAC frame
  - If the difference between that and the last 4 bytes of the Mframe is 0x00FF, it's a non-final fragment.

Thank You.

Questions or Comments?

# Motion

- To use this proposal as a baseline for the architecture and Mframe format in the draft.

Yes:

No:

Abstain

Moved: Albert Tretter

Second: Pat Thaler

Unanimously approved.