Frame FEC in EPON Technical Proposal

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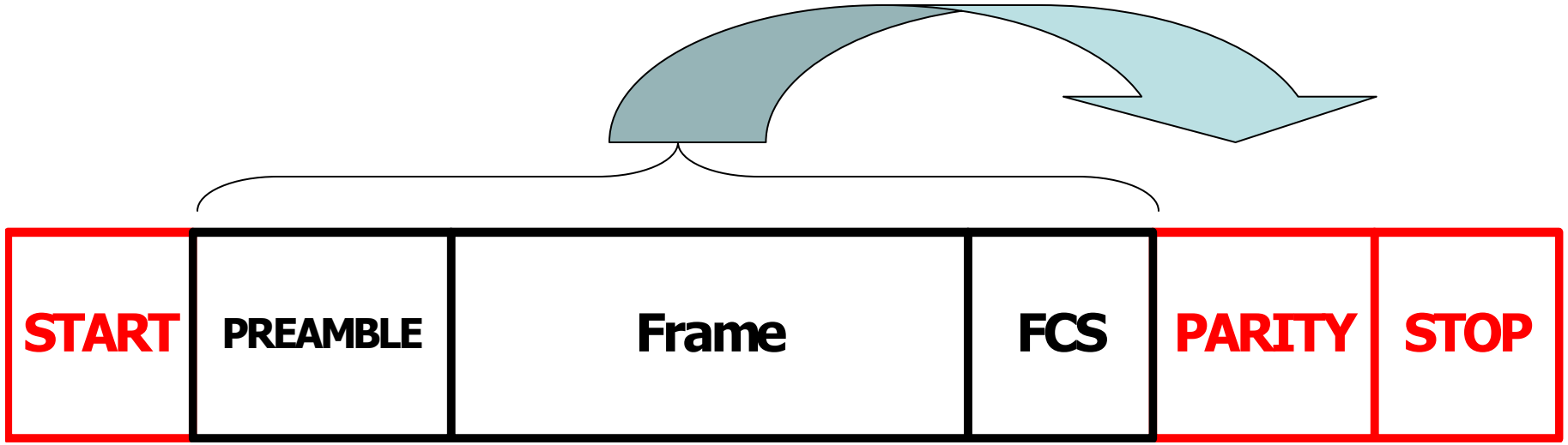
Proposal

- Frame based FEC proposal for enhanced performance
- Location of FEC in Ethernet stack
- Clarification of receive, transmit, and synchronization algorithm

- Proposal elaborates on **khermosh_1_0102.pdf**

Encoding

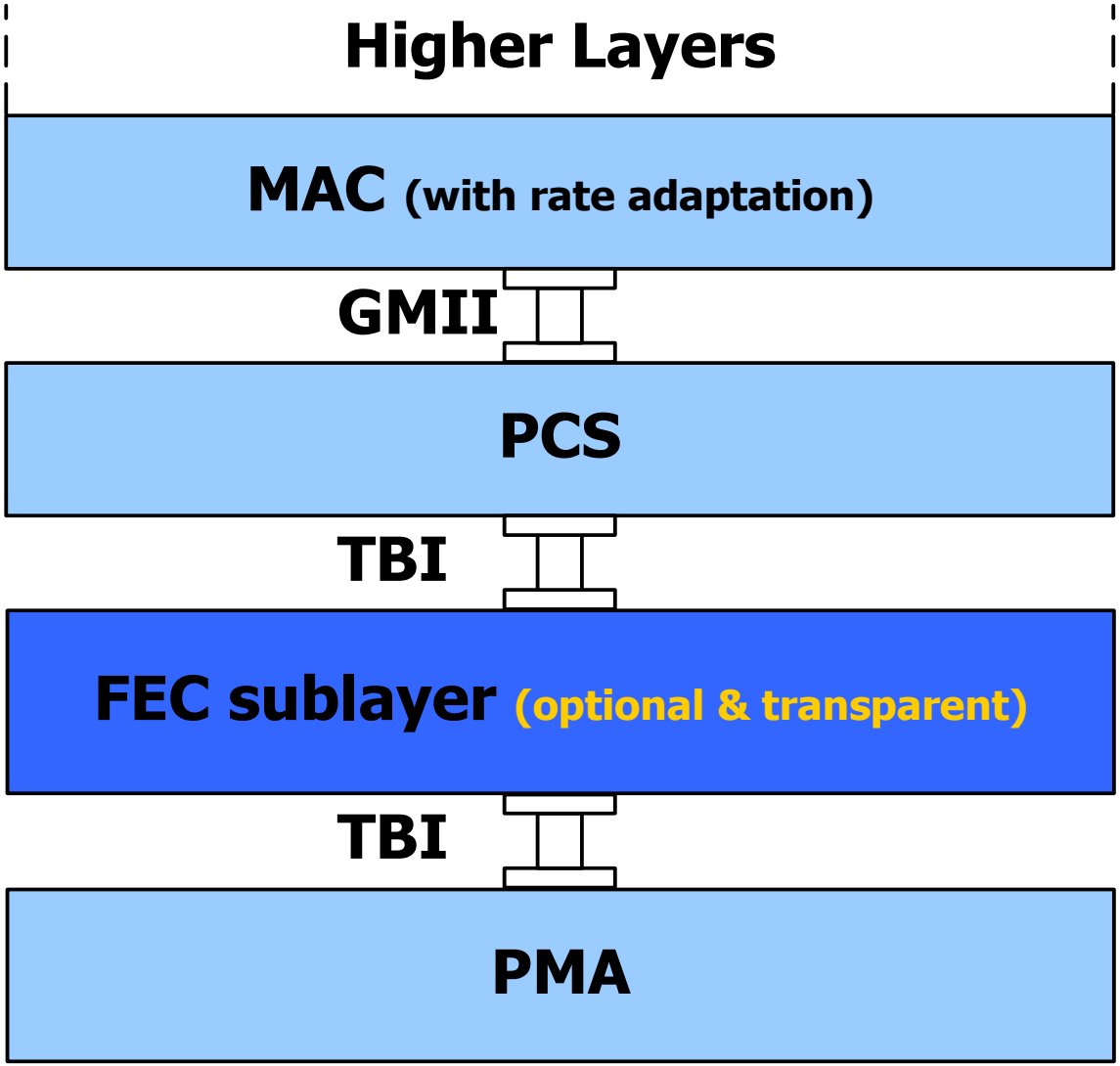
- Parity check bytes added at the end of the frame
- All of the frame is encoded including the preamble, Ethernet header and FCS
- Shortened last frame – using virtual zero padding
- Idles are not protected



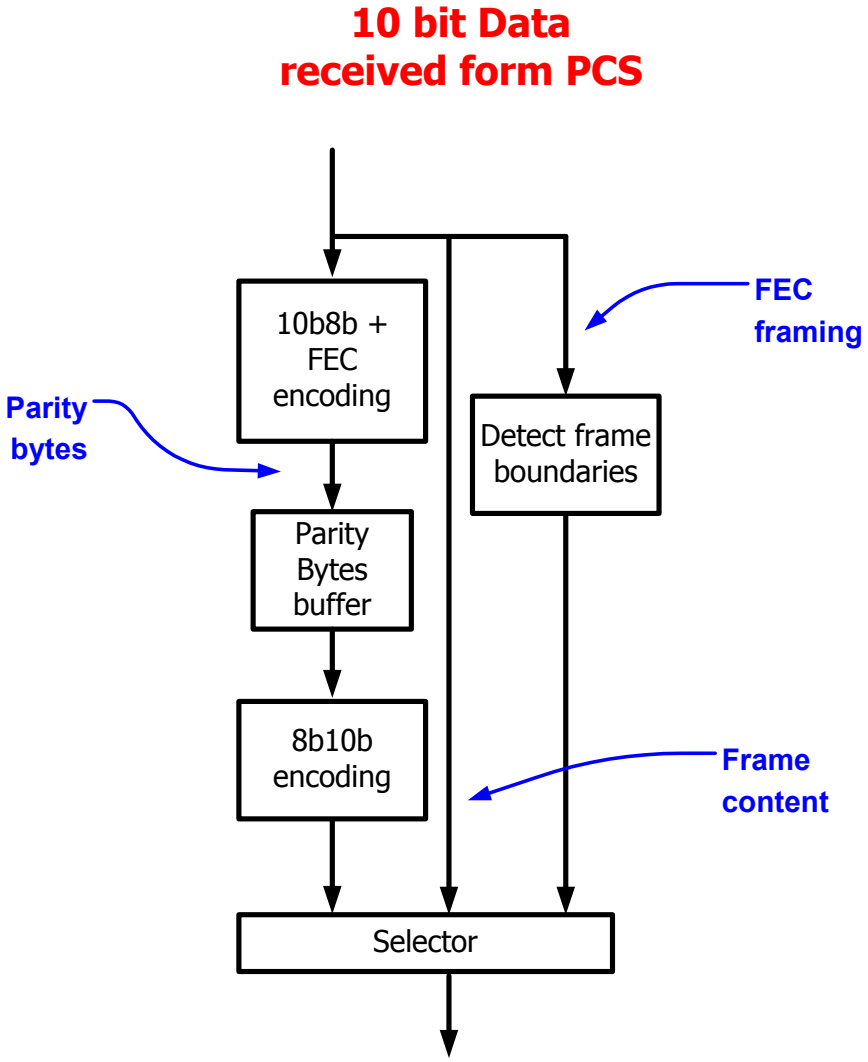
FEC Rate Adaptation

- Receiver (FEC to MAC):
  Replaces FEC coding with idles
- Transmitter (MAC to FEC):
  Idles inserted between frames adapting MAC rate.
  - IPG stretching similar to 802.3ae
  - Well known ratio between the frame size to size of additional parity

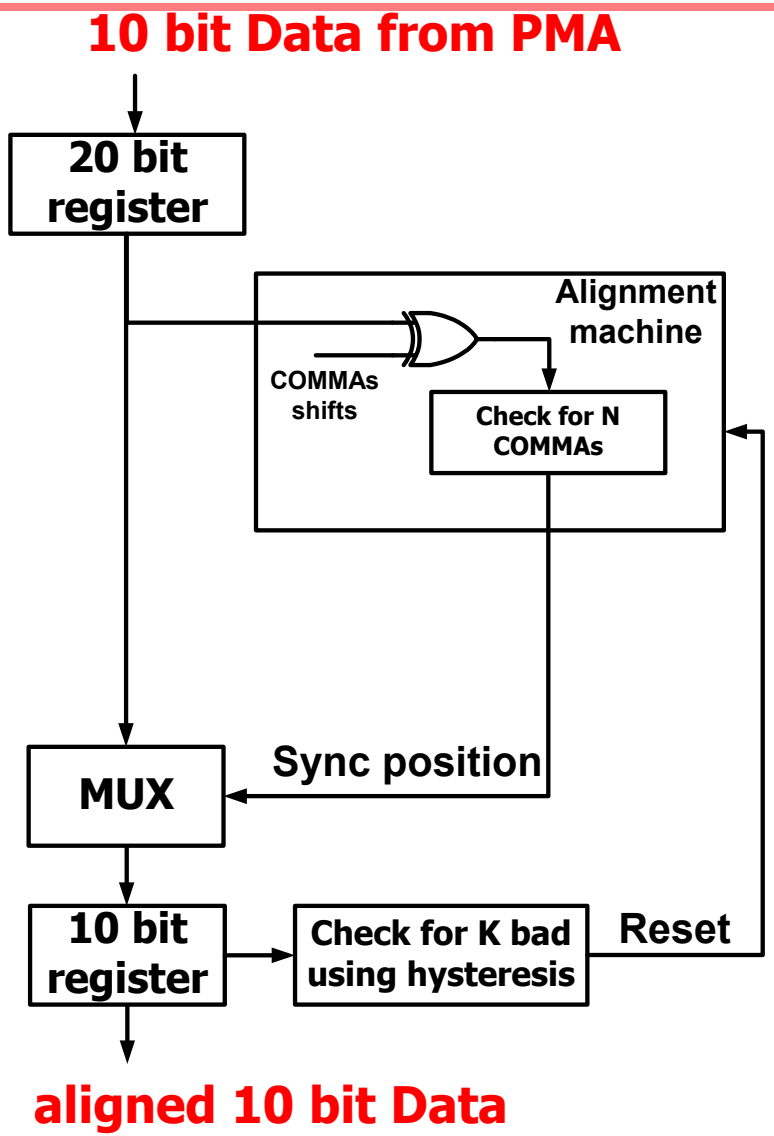
FEC Layering in Ethernet



FEC Sub-layer - Tx

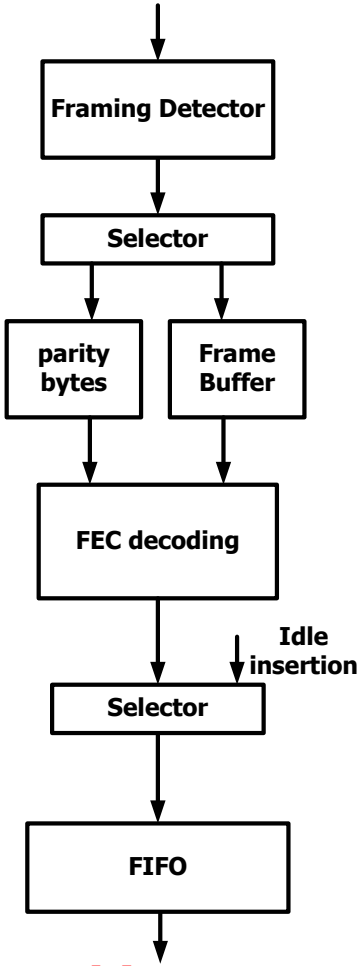


FEC Sub-layer – Rx Byte Alignment



FEC Sub-layer - Rx

aligned 10 bit Data



10 bit Data to PCS

Byte alignment in F-FEC

- Byte alignment performed outside PMA
  - Comma detect is disabled in PMA for FEC
- FEC sublayer syncs on Idle phase
  - A few Idles maintain very low false lock probability $P_{false\_lock}=P_e^n$
  - Idles are guaranteed at start of burst and during regular transmission
  - Byte alignment is fast
- Use of long hysteresis for sync loss

Probability for Lock Errors

- Probability for a Single error in Comma is 1e-3
- Acquisition is performed following detection of 7 commas
  - The probability for false acquisition is (1e-3)^7

- Probability for acquisition loss
  - Following 7 sequential bad words (with hysteresis) the probability is in the order of (1e-3)^7 – one in every 250,000 years

Summary

- FEC framing compatible with legacy Ethernet introduced in **khermosh_1_0102.pdf**

- Layering proposed below PCS maintaining same 1000Base-X PCS and PMA reusing TBI
- PMA to operate with byte alignment disabled
- FEC layer performs byte alignment
- Framing makes use of idle period between frames to hold parity
- MAC stretches the IPG as in 802.3ae