

# Start-of-Frame Alignment Within 66-bit Block

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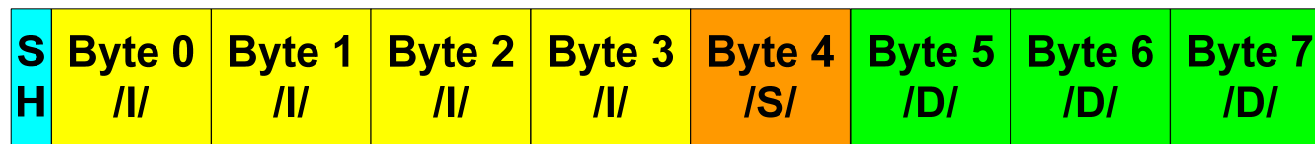
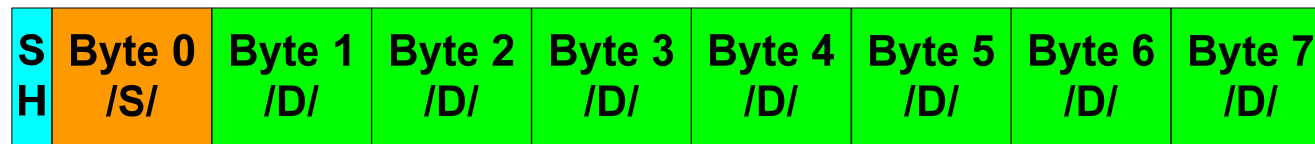
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# Overview and Definitions

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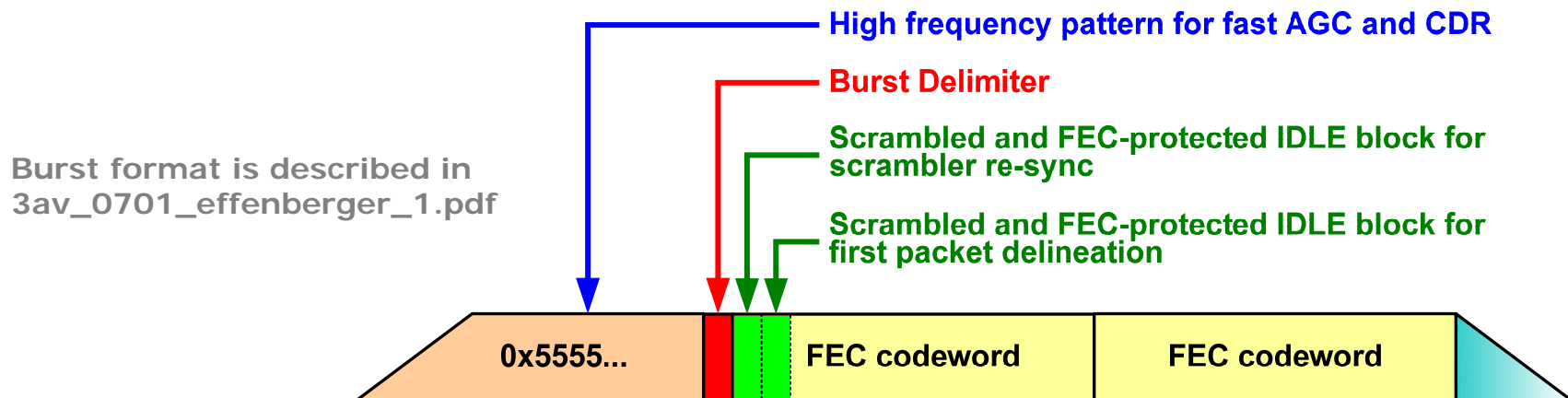
- In PCS, two 36-bit XGMII words are combined into one 72-bit vector ( $\text{tx\_raw}\langle 71:0 \rangle$ ).
- $\text{tx\_raw}\langle 71:0 \rangle$  is then encoded into 66-bit block
- In XGMII word, /S/ is always aligned to lane 0.
- Within 66-bit block, /S/ may appear in byte 0 or byte 4.

## 66-bit block



# Position of /S/ Affects Grant Size

- FEC coverage starts two 66-bit clocks ahead of the block containing /S/
  - First block of IDLEs is to synchronize the scrambler
  - Second block IDLEs is required for proper SOP detection

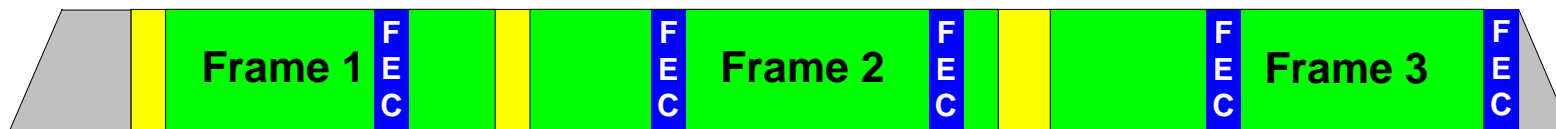


- When /S/ is located in position 4, the transmission length increases by 4 bytes
- MPCP does not know if /S/ will happen to be in position 0 or in position 4 when it is time to transmit, so **MPCP must always report 4 extra bytes**

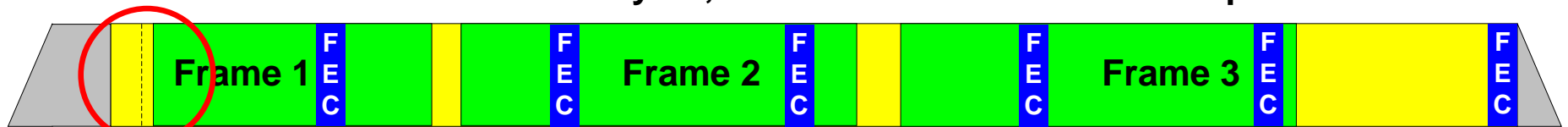
# Effect of Reporting Extra Bytes (1)

- If queued frames fit in  $N$  FEC codewords with less than 4 spare bytes left, then adding 4 extra bytes would require the OLT to additionally allocate full FEC codeword
- In reality, the first /S/ may end up in byte 0, and the ONU would still only send  $N$  codewords, however the OLT would allocate  $N+1$  codewords according to previous REPORT

3 frames fit in  $N$  FEC codewords with less than 4 bytes to spare



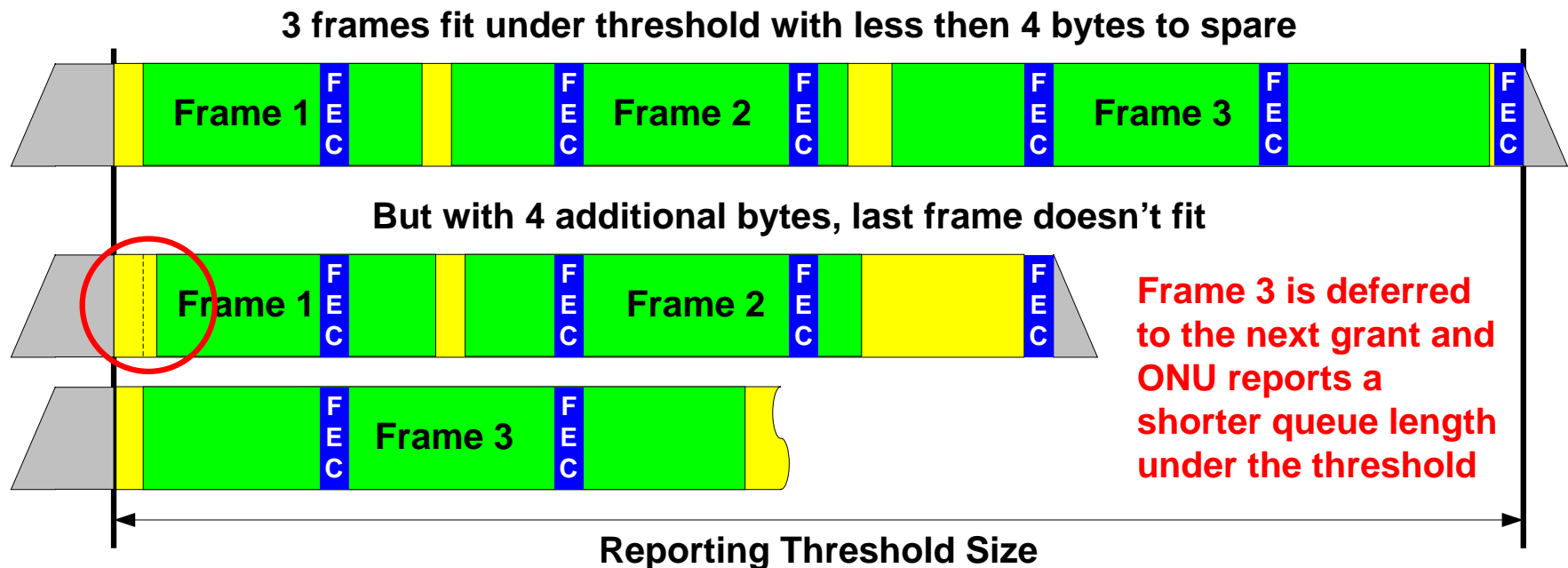
But with 4 additional bytes, an additional codeword is required



Extra (and almost empty) codeword is transmitted

# Effect of Reporting Extra Bytes (2)

- If queued frames fit in  $N$  FEC codewords with less than 4 spare bytes left, and these  $N$  codewords add up exactly to the reporting threshold, then adding 4 extra bytes would make the last frame not fit in the current grant
- The ONU will not include the last frame in its REPORT and the OLT will grant a smaller slot. The last frame will wait for the next grant.

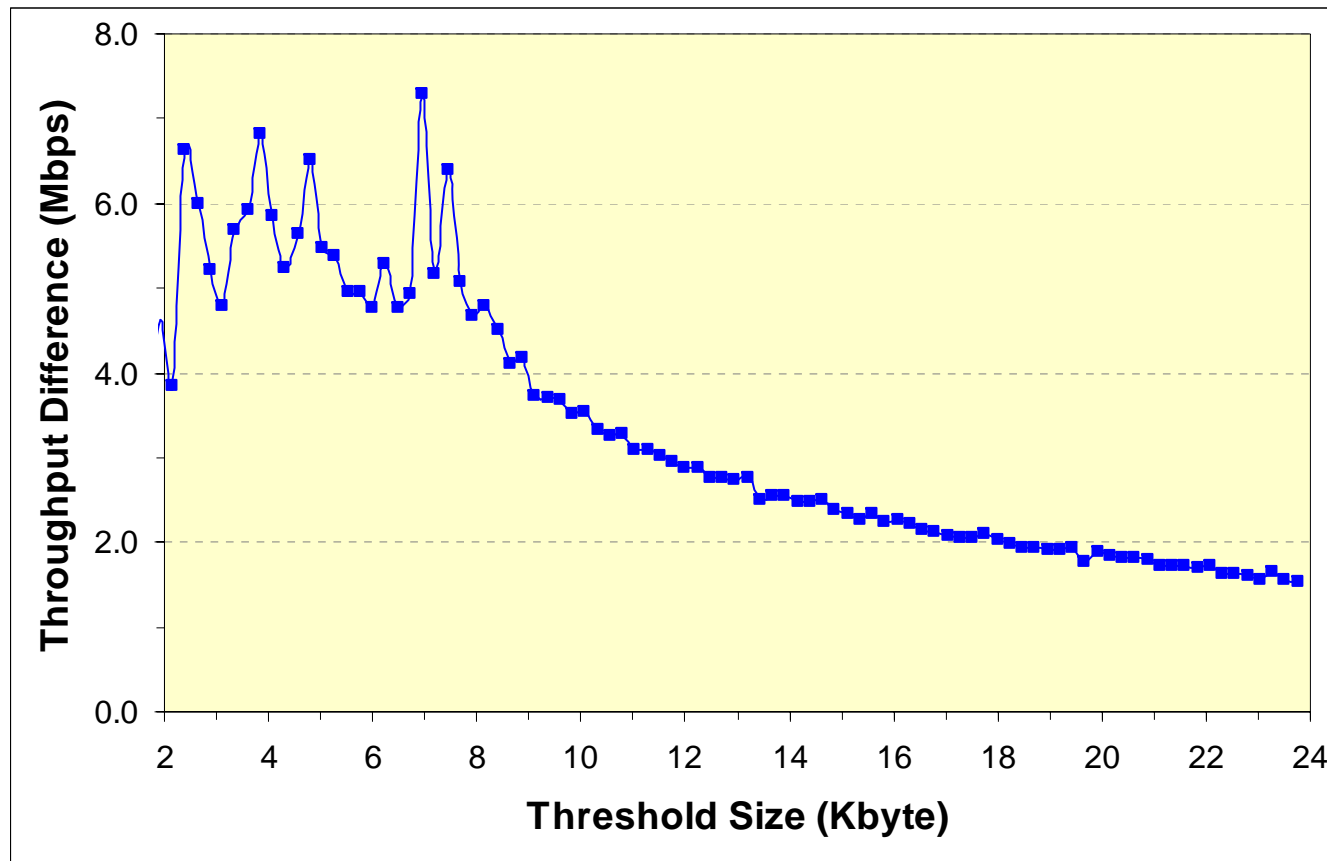


# Simulation Results

- The graph shows throughput gain due to alignment of the /S/ character

## Simulation parameters

- Threshold sizes varied from 7 to 100 FEC codewords (from 1.68 to 24 Kbytes).
- 10 million packets were transmitted for each threshold size.
- System was under heavy load, i.e., there was unlimited supply of packets in each queue.
- Packets followed empirical tri-modal distribution as shown in [http://www.ieee802.org/3/efm/public/jul01/presentations/sala\\_1\\_0701.pdf](http://www.ieee802.org/3/efm/public/jul01/presentations/sala_1_0701.pdf).



# Opinion Poll

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- Aligning the /S/ character saves up to 8 Mbit/s of bandwidth, but requires slightly more complicated state machine to re-package tx\_raw<71:0> vectors.
- No aligning /S/ characters results in a loss of up to 8 Mbit/s, but allows a simpler state machines

I prefer to align /S/ \_\_\_\_\_

I prefer to not align /S/ \_\_\_\_\_