10GEPON FEC Framing Adhoc Technical Status

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Agenda

1) Summary of adhoc discussions on upstream framing and lock
    a) behaviour of OLT and ONU
    b) ONU PCS behaviour
2) Open Issues on Upstream
3) Downstream
4) Motion

Burst mode behaviour – OLT and ONU

- At the start of the burst the ONU transmits a binary 010101… pattern ("s*ync pattern*") to facilitate clock recovery and gain control at OLT receiver.

- To establish byte-level and FEC-codeword-level synchronization, the ONU transmits a 66bit Barker-like sequence (which must have high Hamming distance from all shifts of "itself concatenated with the sync pattern"). The specific bit sequence is TBD. We call this sequence the *delimiter*.

- The OLT receiver searches for the delimiter in the received datastream with a certain tolerated number of bit errors. Upon detecting the delimiter, the OLT knows the byte and codeword alignment of the incoming datastream.

- The datastream of FEC codewords (consisting of a series of scrambled 66b blocks containing user data followed by FEC parity also contained in 66b blocks) begins immediately following the delimiter.

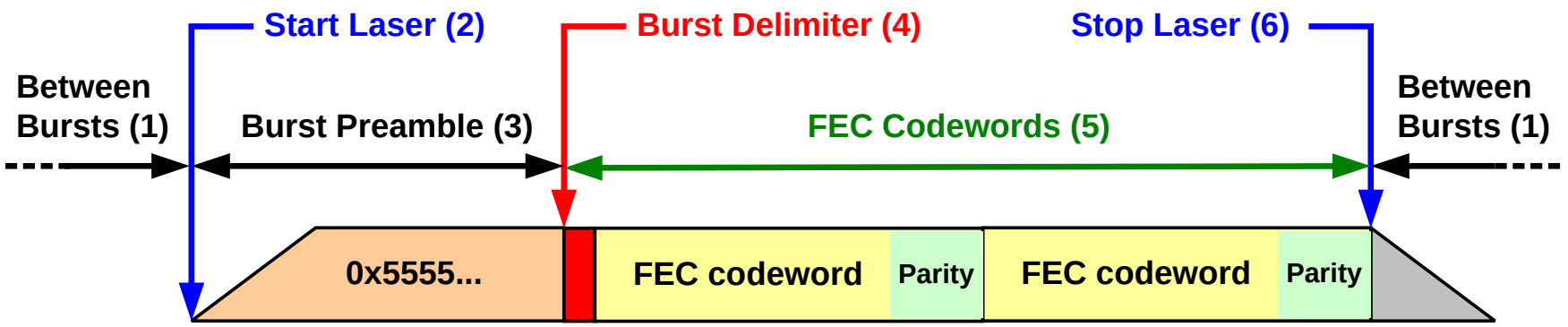
- The FEC-encoded datastream begins with a sufficient number of leading IDLEs so as to initialize the OLT receiver's self-synchronous scrambler.

Burst phases

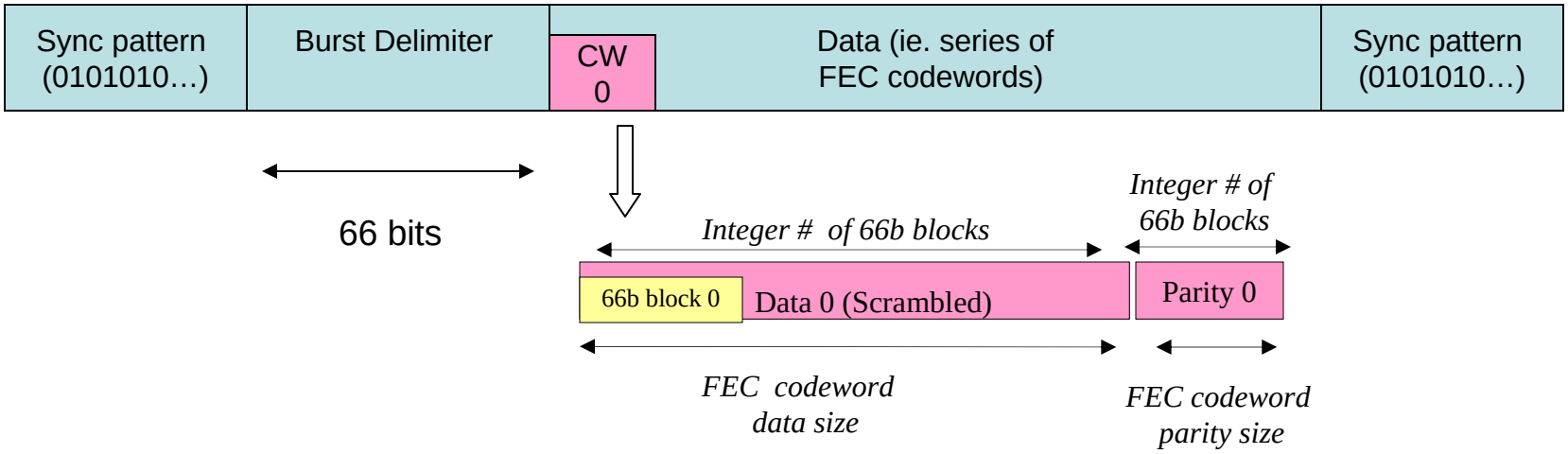
There are six phases in the burst lifetime:

1. Between bursts
2. Turning the transmitting laser on
3. Transmitting the sync pattern
4. Transmitting the delimiter
5. Transmitting data (with FEC parity)
6. Turning the transmitting laser off

These phases are cyclical.



Details of Burst Elements



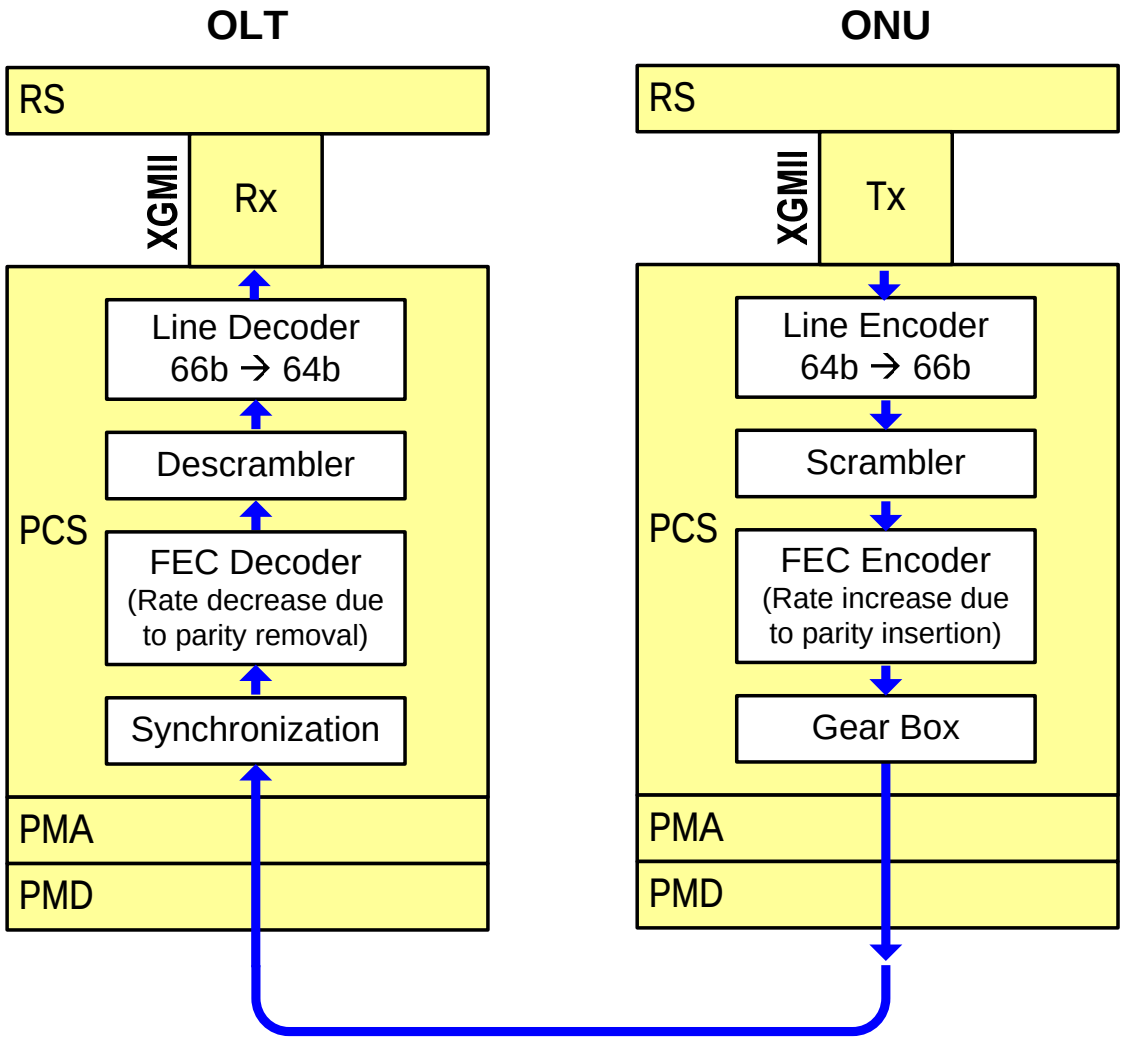
ONU PCS behaviour

- Streaming FEC is applied at the lowest layer (ie. scrambled 66b blocks are input to FEC encoder)
- The ONU PCS continues to transmit to the PMA between bursts
- The ONU PCS initiates the burst initialization and transmission cycle when it determines that burst data is arriving from the MAC layer.
  - Since lead time is necessary for laser stabilization, the PCS layer delays all the data that it receives from the MAC (cf. “data detector” in 802.3ah)
- ONU PCS maintains awareness of the amount of time needed for:
  - Laser on stabilization
  - Worst-case OLT receiver calibration (ie. how long to transmit the sync pattern after laser stabilization)
- ONU PCS completes the burst cycle (by turning laser off) following transmission of a complete FEC block to the PMA when no more burst data is pending.

FEC location in PCS

Note: Data detector placement is an open issue and so the data detector (which activates laser on/off) is not shown.

Additional functional blocks may be added as state diagrams are refined.



Open Issues

System Issues:

1) What are the events that trigger the ONU PCS to invoke laser on/laser off (and by implication the start and end of burst)?

   a) Arrival of an XGMII code containing a non-IDLE code to the top of the PCS (laser on); and all IDLEs (laser off)

   or

   b) Arrival (to the bottom of the PCS) of a series of 66b blocks with 2bit sync headers which imply the presence of user frame data (laser on); and absence of frame data (laser off)

2) What alignment should the PCS perform during burst initialization?

   a) Only align the FEC codeword stream to the start of the data burst (ie. the leading IDLEs will occur in the first 66b block of the first FEC codeword)

   or

   b) In addition to aligning the FEC codeword stream to the start of the burst, align the 66b block stream also (so that the FEC codeword will include precisely the requisite number of leading IDLEs)

Open Issues(2)

PCS Design/Specification Issues:

a) Placement of Data Detector
   - Depends on decision regarding trigger event

b) Assignment of functionality to blocks within the PCS
   - Our new functionality in a single functional block? or more than one?

c) State diagrams
   - Unified state diagram for burst control? or is there more than one process?

Motion

To accept the scheme outlined in slides 3-7 of this presentation as the baseline scheme for upstream FEC framing and synchronization

Y: 28

N: 0

A: 8

Motion

To accept as a baseline scheme the FEC codeword structure depicted in the illustration on slide 5 for the downstream - so that the FEC codeword structures on the upstream and downstream are identical.

Y: 27

N: 0

A: 9