Options for the RS-encoded 25GE

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Introduction

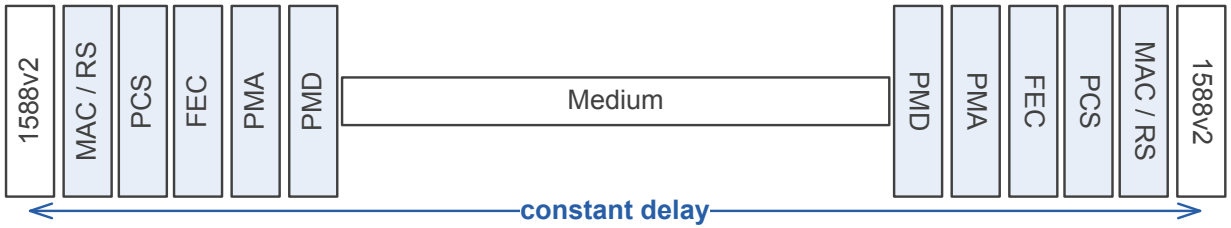
- A PCS/FEC baseline for 25GE was adopted at the Jan 2015 Interim meeting [1]
  - The adopted baseline defines two different formats, one without CWMs (no-FEC and CL74 FEC modes) and one with CWMs (RS10 FEC mode)
- An alternative approach, based on a unique format without CWMs, was proposed at the March 2015 Plenary meeting [2]
  - A detailed cost (and lock time) comparison of the two approaches is presented in [2]
- In this presentation we compare 3 different options for the RS-encoded 25GE
  1. CWMs belonging to the FEC sublayer – as per [1]
  2. CWMs belonging to the PCS – similar to 802.3bj
  3. No CWMs – as per [2]
- The comparison focuses on the interaction with
  a) 1588v2
  b) FlexE
  c) OTN

[1] http://www.ieee802.org/3/by/public/Jan15/baden_3by_01b_0115.pdf, Jan 2015, Atlanta

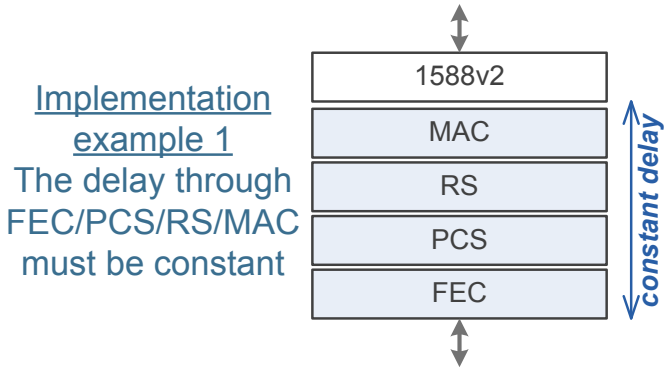
[2] http://www.ieee802.org/3/by/public/Mar15/slavick_3by_01a_0315.pdf, March 2015, Berlin

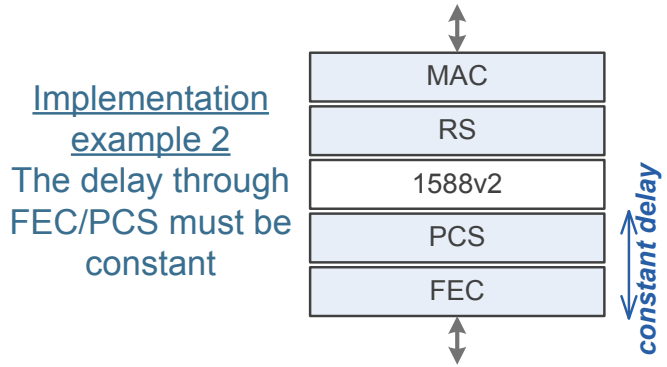
Interaction with 1588v2 (1 of 2)

- PTP relies on constant/known end-to-end packet delays between the Tx 1588v2 function and the Rx 1588v2 function



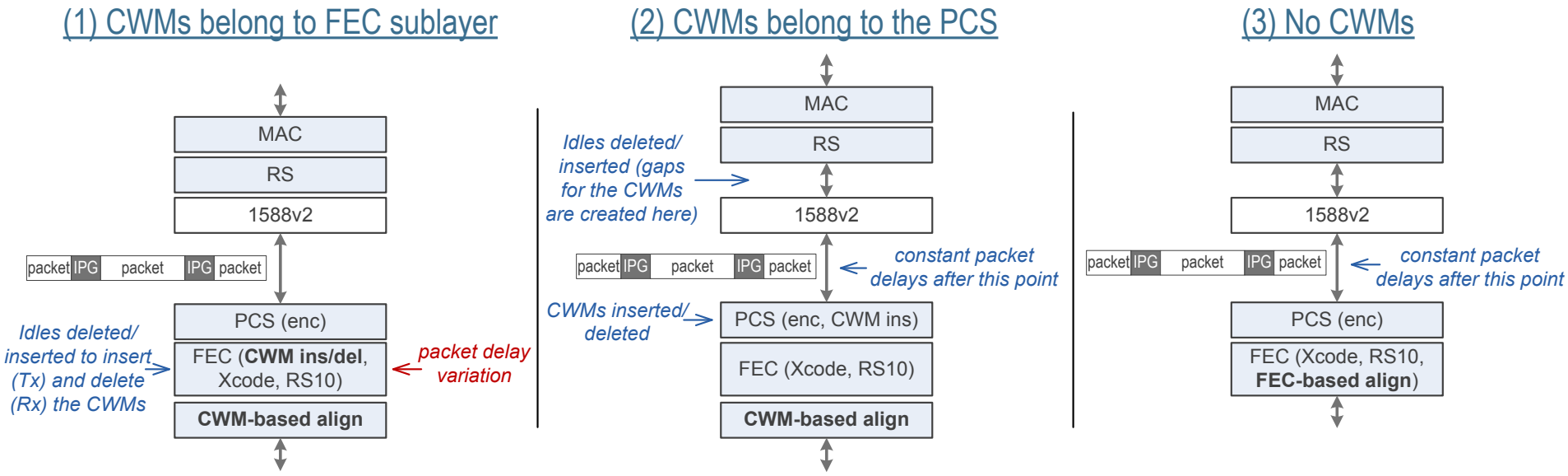
- Exact location of the 1588v2 function is an implementation choice





- A considerable amount of design effort is usually needed to minimize packet delay variation between the 1588v2 function and the device I/O (FIFO centering, etc.)
- A new PCS/FEC function that “moves the packets around” is not adequate for PTP

Interaction with 1588v2 (2 of 2)



- The 3 different options interact with 1588v2 as follows
  1. CWMs belonging to the FEC sublayer – as per [1]
     - This approach is not adequate for 1588v2 – Idle insertion/deletion results on packet delay variation
  2. CWMs belonging to the PCS
     - No problem if the 1588v2 function (implementation) “sees” to the CWM gaps - e.g. the 1588v2 function is disabled during the gaps
       - This is no different than what we do today for 100GE
  3. No CWMs – as per [2]
     - This approach is adequate for 1588v2

Interaction with FlexE (1 of 2)

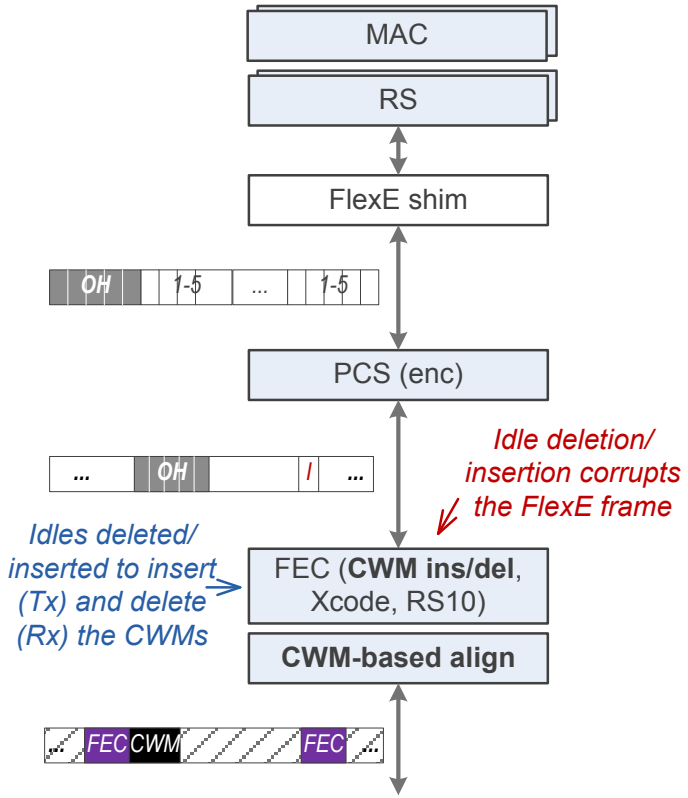
- A baseline text for FlexE was adopted at the 2Q15 OIF meeting in April'15 [3]
  - The specific frame format is for further study, options under consideration are described in [3] and [4]
- Two important concepts for FlexE (see [3] or [4]) are the use of
  - A fixed FlexE frame length
  - A fixed TDM structure (calendar) for the multiplexing of the Ethernet client streams into FlexE
- The 3 different options interact with FlexE as follows
  1. CWMs belonging to the FEC sublayer – as per [1]
     - The FEC sublayer deletes Idles belonging to the FlexE clients, corrupting the FlexE frame
  2. CWMs belonging to the PCS
     - No problem if the FlexE shim "sees" the CWM gaps - e.g. the FlexE shim is disabled during the CWM gaps
     - This is no different than what we plan to do in order to use 100GE as a server layer for FlexE
  3. No CWMs – as per [2]
     - No problem

[3] OIF contribution oif2015.127.01, 2Q15 OIF meeting, April 2015, Lisbon

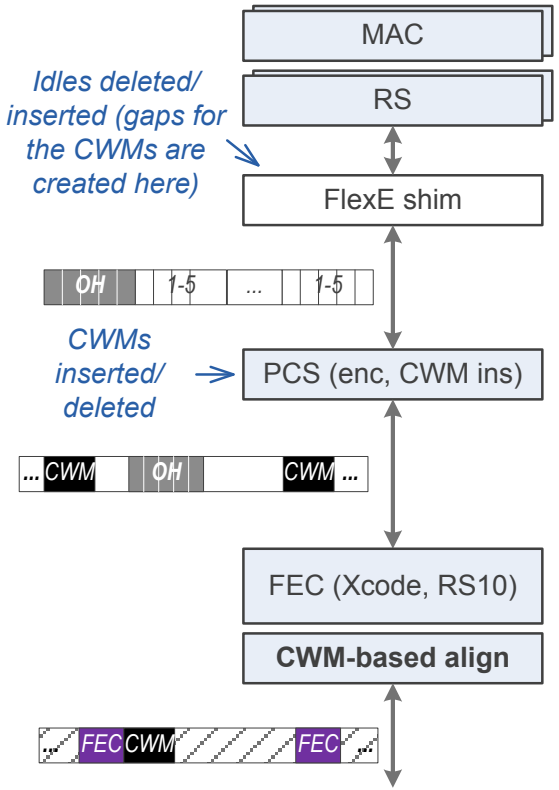
[4] OIF contribution oif2015.139.00, 2Q15 OIF meeting, April 2015, Lisbon

Interaction with FlexE (2 of 2)

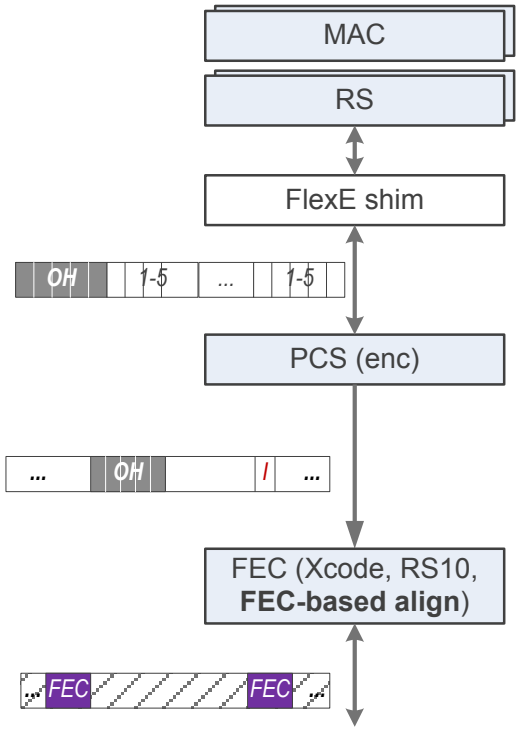
(1) CWMs belong to FEC sublayer



(2) CWMs belong to the PCS



(3) No CWMs

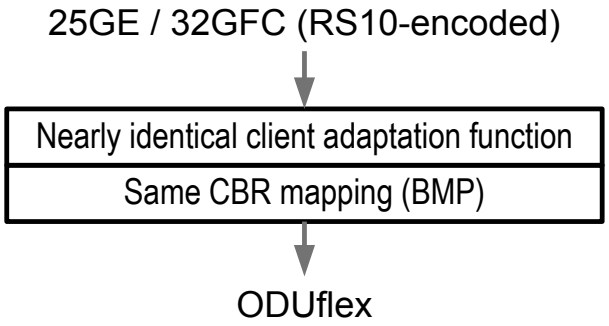


Interaction with OTN (1 of 2)

- To simplify the interconnection of FEC and non-FEC ports across OTN, ITU-T will probably define a single format for the mapping of 25GE into ODUflex
- As discussed in [5], the ideal case is if all 25GbE PMDs are encoded in a similar way – i.e. if all of them have CWMs or none of them do
- Majority of ports will be 10G/25G w/o CWMs (no-FEC & CL74 modes), therefore
  - adding CWMs to the no-FEC/CL74 modes is not an attractive option
  - for similarity with existing CBR adaptation functions (10GE into ODU2e, 32GFC into ODUflex), we can assume that ITU-T Q11 will favor the mapping of 25GE into the ODUflex as a 25.78125Gbps 66b-encoded stream without CWMs
- The 3 different options would interact with OTN as follows:
  1. CWMs belonging to the FEC sublayer – as per [1]
     - OTN client adaptation function needs to convert between the CWM and no-CWM formats (cost of CWMs)
     - Non ideal behavior – packet delay variation
     - Problematic if the 25GE port carries FlexE and the OTN equipment is FlexE-unaware
  2. CMs belonging to the PCS – same as above
  3. No CMs – as per [2]
     - Simplest OTN client adaptation function
     - Best behavior (packets are not move around)
- [5] http://www.ieee802.org/3/by/public/Jan15/trowbridge_3by_01_0115.pdf, Jan 2015, Atlanta

Interaction with OTN (2 of 2)

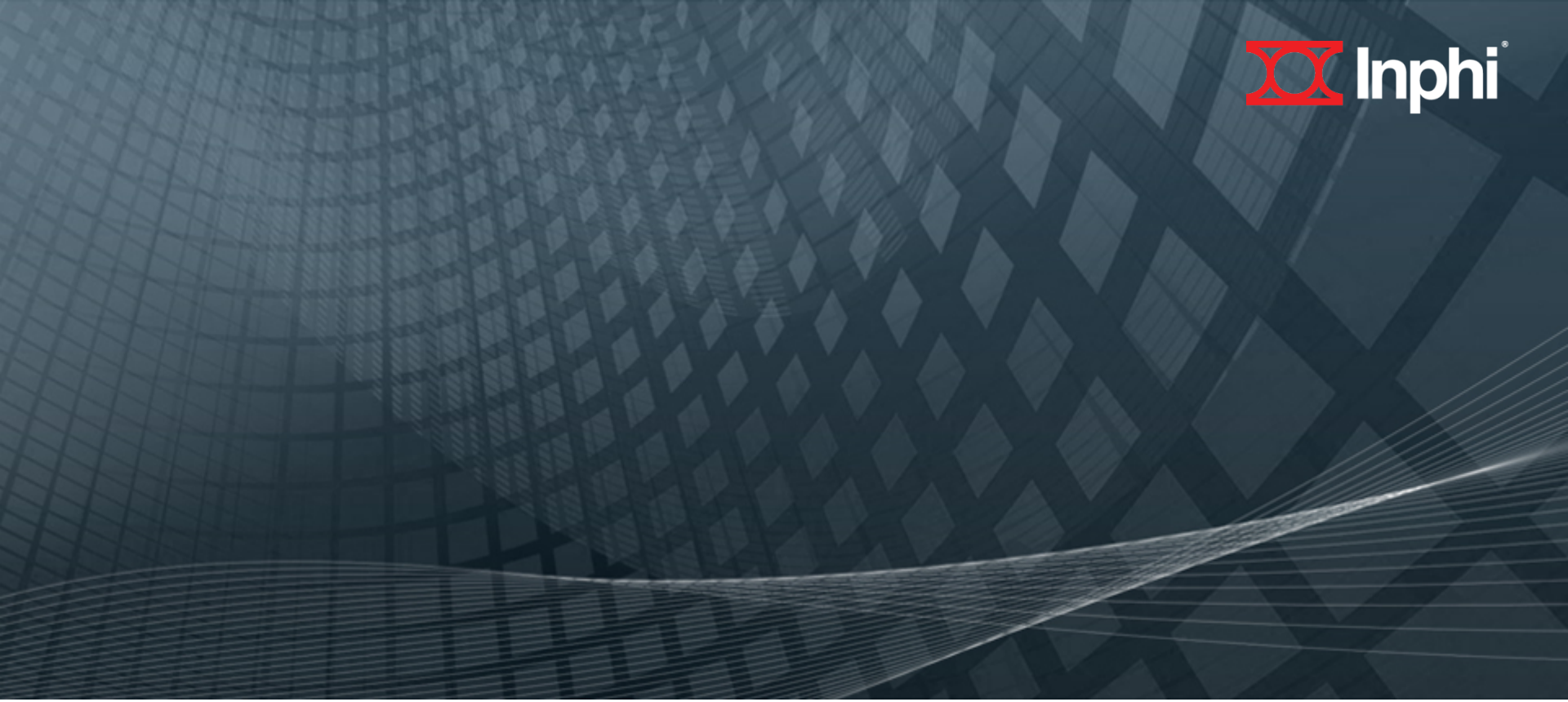
- Another advantage of the approach proposed in [2] is its similarity with 32GFC
  - The main difference between an RS-encoded 25GE defined as per [2] and 32GFC is the rate (25.78125 Gbps vs. 28.05 Gbps)
  - Many OTN muxponders will support multiple 25G-class clients on the same client port (e.g. 25GE, 32GFC and IB-25G), so the adaptation of an RS-encoded 25GE with no CWMs (as per [2]) would come virtually for free



Summary and Conclusion

- Based on the way the different formatting options interact with 1588v2, FlexE and OTN, the no-CWM approach [2] is the most attractive option for an RS10-encoded 25GE

	CWMs belong to FEC sublayer [1]	CWMs belong to PCS	No CWMs [2]
1588v2	Packet delays not preserved	Packet delays preserved (implementation dependent)	Packet delays preserved
FlexE	FlexE frame corrupted	FlexE frame not corrupted (implementation dependent)	FlexE frame not corrupted
OTN	More complex adaptation function (cost of CWMs) Packet delay variation		Simpler adaptation function Packet delays preserved 25GE/32GFC reuse



Thank You