EPoC TDD – A proposal for DS Transmission and related timing

Steve Shellhammer and Andrea Garavaglia (Qualcomm)

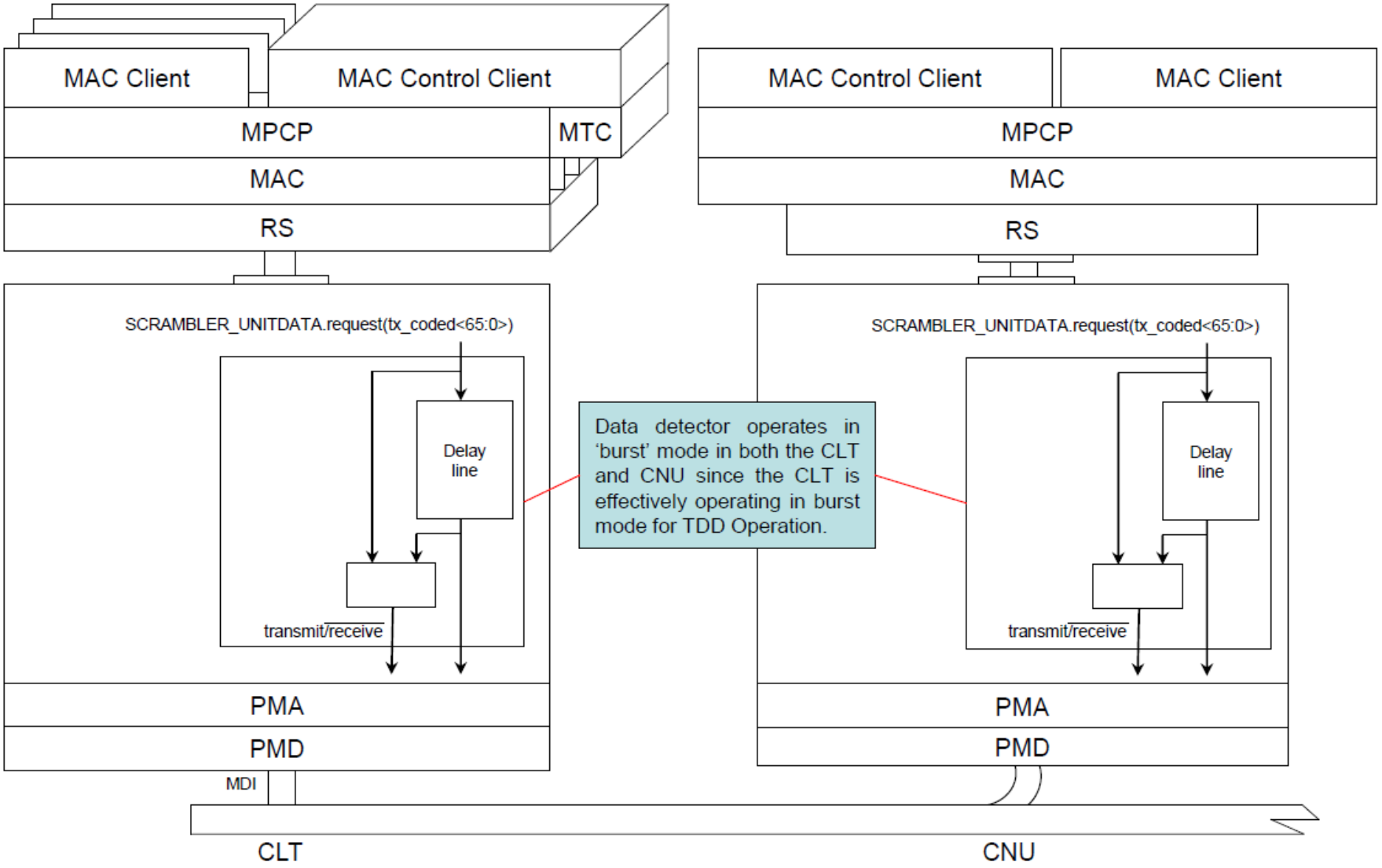
Background and Scope

- During the IEEE 802.3bn meeting held in Victoria, PCS aspects for TDD mode have been illustrated with particular attention to signaling to the PMD layer of transmission/reception bursts and use of data detector [1]

- Some issues have been highlighted and proposed solutions were further discussed during the meeting, with constructive proposals

- This presentation illustrates how those issues could be addressed, capturing the understanding of the author from the discussion – the present proposal can be capture within the scope of the PCS sub-layer Clause, while focusing on the TDD DS aspects
  - For upstream, some issues are common to FDD and TDD

TDD Transmission – PCS Impact (re-cap)



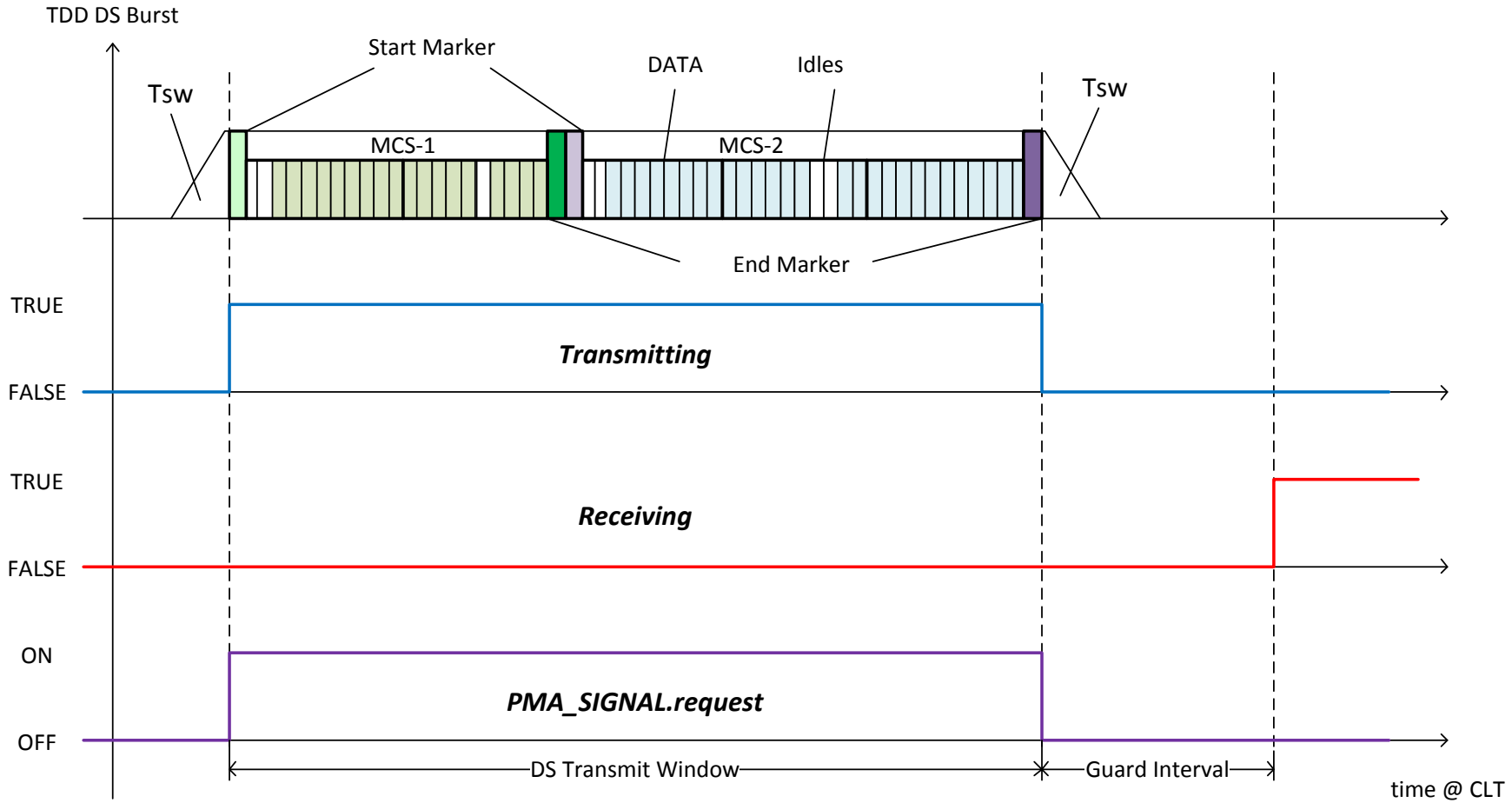
Multipoint MAC Control – from [2] "IEEE 802.3 Architecture" – law_01a_1112.pdf

TDD DS Transmission – CLT PCS Impact

- The CLT PCS needs to trigger the switch between DS (TX) to US (RX) mode (and vice versa) of the PMD
  - When the DS window is open the PHY layer can transmit
  - When the US window is open the PHY layer shall not transmit

- Data detector in the PCS needs to identify the DS and US windows and provide signal to PMA for switching between TX/RX
  - Can be derived from 10G-EPON specification, Clause 76.3.2.5, applying to the CLT in DS the same principles applied for US burst in ONU
  - Input process for data detector derived from figure 76-16
  - Output process for data detector derived from figure 76-17, in particular from 76-17(a) for FDD and 76-17(b) for TDD

TDD Downstream – Signals



- Clock recovery and gain control achieved via OFDM pilots – no Sync Pattern
- Burst delimiter and EOB replaced by Start and End markers

Issues with data detector in TDD DS

- The TDD cycle is configured and therefore the transmitter in the CLT shall remain ON all the time during the DS Transmit Window
  - In case of no data, this may not happen as the data detector can misinterpret that and wrongly trigger the PMD signal
  - Can happen at the beginning, middle and end of burst

- In all cases, it may cause malfunctioning of the OFDM PHY, which remains aligned with OFDM symbols/time interleaving
  - For example, sequence of idles in the middle of a DS burst triggers TX OFF earlier than configured window
  - The timer to activate RX will count down and RX will be not aligned with the US transmit window
  - In addition, CLT MAC can still provide data for DS as part of the TDD window, which will potentially turn ON the transmitter

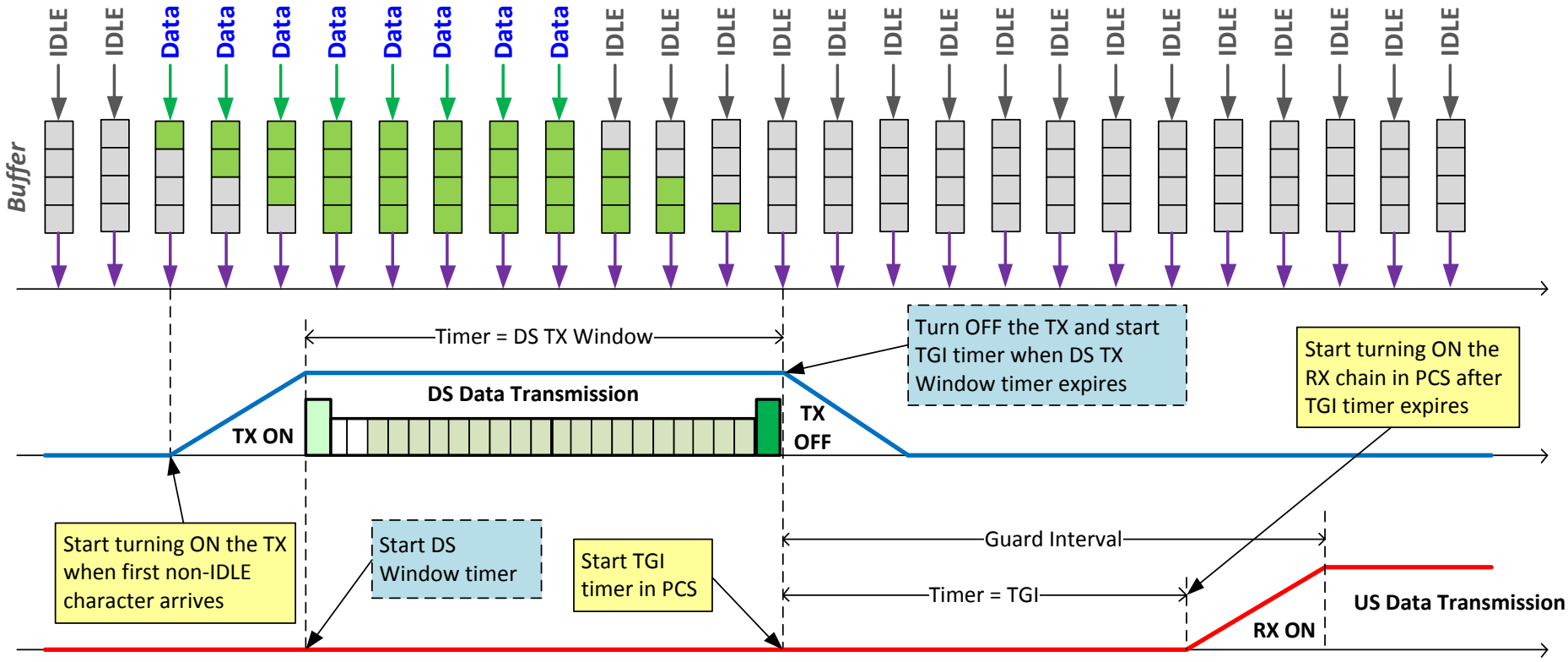
A proposed way forward

To prevent these issues, some additional mechanisms are proposed for the data detector for TDD DS

- TDD DS burst always starts when the first non-idle character arrives
- Possible lack of data at the beginning of a burst is prevented by sending a GATE message with no grant, as done in 10G-EPON for synchronization (see Clause 77.3.6.1, first paragraph)
  - In case there are data, the GATE causes no issues
  - In case there are no data, the GATE is timely sent as being the only available packet for transmission at multi-point control
- To prevent lack of data issues at the middle or at the end of the TDD DS burst, the TX ends after the precise duration of the DS Transmit window, which is a configured number of OFDM symbols counted from TX ON instant (see next slide)

The simple solution here described is proposed for TDD mode design

TDD Downstream – Data Detector view



- Data detector to command TX ON at the CLT – TX ends with configured delay after TX gets ON (DS TX Window, configured) and then RX starts with configured delay after the transmitter is OFF (TDD Guard interval, depending on max RTT)

Data Detector – see also kramer_1_0903.pdf [6]

References

[1] **garavaglia_3bn_03a_0513**: “EPoC TDD – Data Detector and Downstream PCS Considerations” – Andrea Garavaglia and Patrcik Stupar (Qualcomm)

[2] **law_01a_1112**: “IEEE P802.3bn Architecture” – Juan Montojo (Qualcomm), David Law (HP), Marek Hajduczenia (ZTE), Ed Boyd (Broadcom)

[3] **garavaglia_02a_1112**: “Further Details on TDD” – Andrea Garavaglia (Qualcomm)

[4] **garavaglia_02a_0113**: “ EPoC TDD (baseline proposal)”, Andrea Garavaglia and Patrick Stupar (Qualcomm)

[5] **hajduczenia_3bn_01_0513**: “ IEEE Draft P802.3bn / D0.10 – Clause 101”, Marek Hajduczenia (ZTE)

[6] **kramer_1_0903**: “Data Detector”, Glen Kramer