Paradoxes in EPoC

…and the way out

Eugene DAI PhD, Cox Communications

IEEE 802.3 Plenary Meeting

802.3bn EPON Protocol over Coax Task Force

November 11th -15th

Dallas, USA

Supports

- Jorge Salinger Comcast

Where are we?

- The targeted time frames for completing EPoC baseline have been missed more than once
  - The main tract has made more progress towards having a baseline
  - Lack of progress in TDD tract could delay 802.3bn
- The market opportunities for EPoC could be missed
  - EPoC is a “transition” to EPON/FTTH with HFC infrastructure
  - There are compete specifications that increases the bandwidths of HFC
- The causes of the difficulties we are facing need to be analyzed

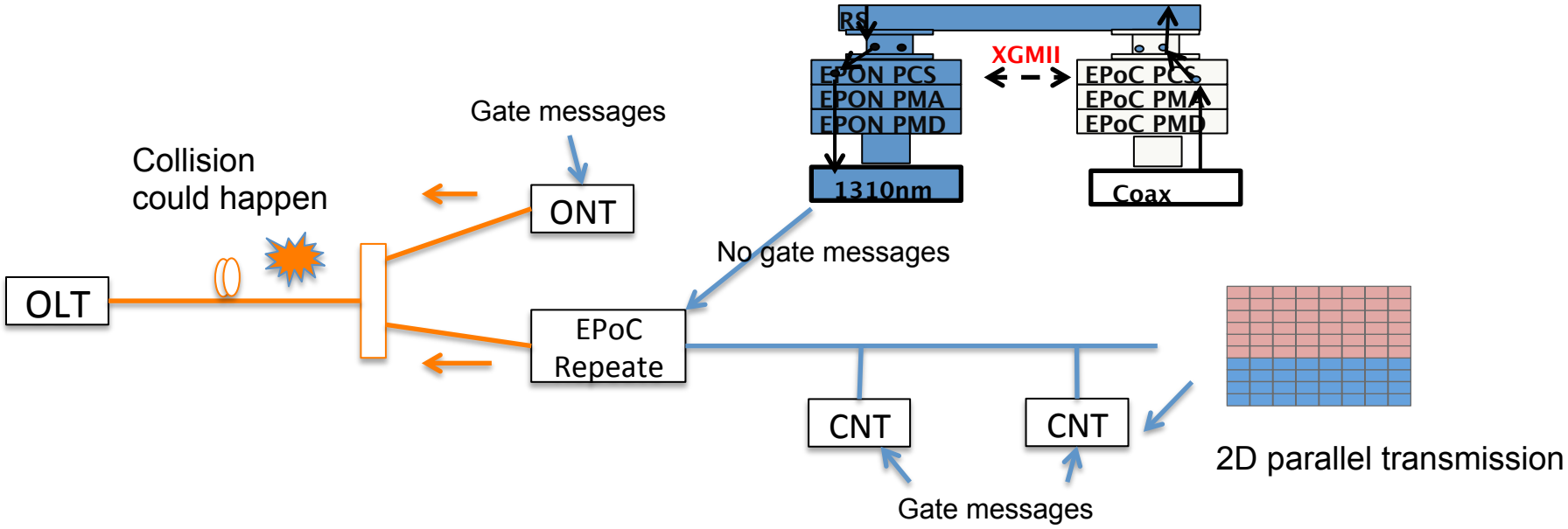
Path and destination

- The 2nd Objective from the EPoC SG output document: Maintain compatibility with 1G-EPON and 10G-EPON, as currently defined in IEEE Std. 802.3 with minimal augmentation to MPCP and/or OAM if needed to support the new PHY.
- The destination – “maintain compatibility with 1G-EPON and 10G-EPON”
- The path – “minimal augmentation to MPCP and/or OAM”
- Does the “path” leads to the “destination”?

PHY and system

- The 802.3bn is a PHY only standard; however, system implementations do matter
- At another organization that studies the system implementations, two system architectures are studied
  - Repeater and Bridge
- The comparison of “objective 2” with the repeater/bridge implementations leads to interesting conclusions.

EPoC Repeater and co-existence



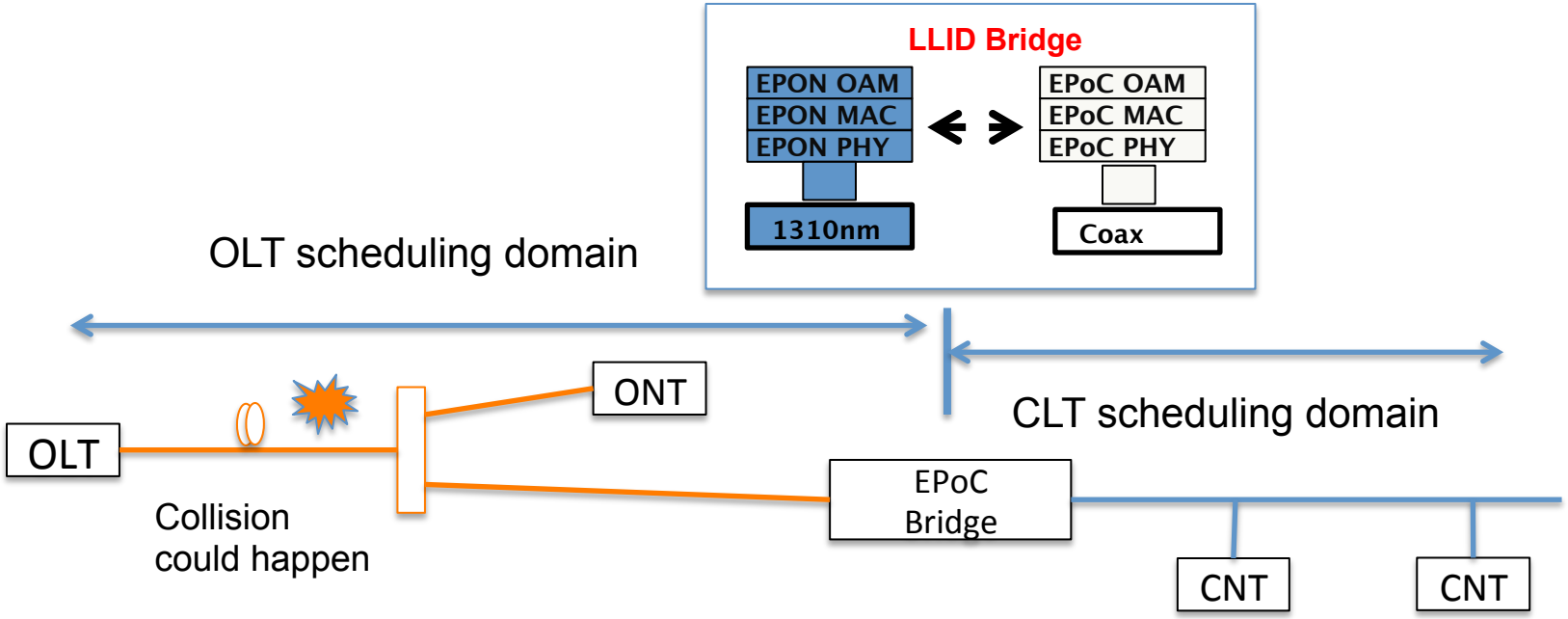
- No gate messages at upstream optical TX at repeater
- Optical signal from a repeater could collide with optical signals of an ONT or another repeater on the same ODN

Even if EPON MPCP is kept as is without any change, repeater architecture can not guarantee compatibility/coexistence with EPON/10G EPON (assuming 1D -> 2D mapping)

Paradox 1

- There is no need to augment MPCP for EPoC repeater, however, the compatibility/coexistence of EPoC with EPON/10G EPON can NOT be guaranteed
- Conclusions:
  - We may have unrealistic expectations for EPoC “repeater” on compatibility/coexistence
  - Or, we may have to introduce TDMA as an option if coexistence is required

EPoC Bridge and co-existence



- CLT(coax) and OLT(optical) are on two separated scheduling domains
- Even with "maximum" MPCP/MAC augmentation on CLT, compatibility/ co-existence of EPoC with EPON will NOT be affected

"Minimum augmentation" places unnecessary restrictions on the EPoC bridge.

Paradox 2

- Augmentations to MPCP is needed for the EPoC bridge, but the compatibility/coexistence of EPoC with EPON/10G EPON is not a problem
- Conclusions:
  - We may have unnecessarily tied our hands with “minimum augmentation” for EPoC “bridge”
  - More efficiencies and flexibilities for FDD and TDD EPoC bridges could be achieved without affects the compatibility/coexistence

MPCP augmentation and compatibility

- There is no direct link between augmentation to MPCP and the “compatibility/coexistence” of EPoC with EPON for either “repeater” or “bridge” architectures
- In bridge case, we may have unnecessarily tied our hands with “minimum augmentation”.
  - TDD only works in bridge mode
  - TDD needs more changes in MPCP
  - Open the door for MPCP changes will benefit to both TDD and FDD bridge architectures
- In the repeater case, we may have unrealistic expectation on the compatibility/coexistence.

The way out of the paradoxes I

- EPoC in FDD mode doesn't need changes in MPCP, most of the works today at 802.3bn are towards FDD
  - Accelerate the works for time to the market
  - Relax the requirements on coexistence; or, allow TDMA as an option
- Propose EPoC phase I – "Time to the market" FDD (no changes or minimum changes on MPCP)
  - Accept limitation on efficiency for simplicity, such as SMP, fewer code words, 1d->2D mapping, etc.
    - Ethernet started as a best effort protocol…
  - Accept limitations on coexistence
  - Shorten the time frame for completing phase I

The way out of the paradoxes II

- EPoC TDD mode (supported only by bridge) need changes to MPCP/MAC
  - However, the changes of MPCP in the bridge scenario does not affect coexistence
  - Therefore, we should not unnecessarily restrict ourselves
  - Bridged EPoC could be more efficient due to the benefit MPCP/MAC changes besides the support of TDD
  - The lack of progresses in TDD track could slow down the 802.3bn; the market opportunities of EPoC could be missed
  - Propose EPoC phase II that targets optimizing for EPoC bridge mode to support TDD with less restrictions on modifying MPCP/MAC
    - Besides support TDD, we could consider MMP, more code words, 2D scheduling, TDMA , etc.

Conclusions

- There is no direct link between augmentation to MPCP and the “compatibility/coexistence” of EPoC with EPON – “Objective 2” needs modification; at least this fact should be awarded of.
- We should aware the limitation of “PHY only” approach in EPoC standard
- We may have overly restricted ourselves with the “minimum augmentation” of MPCP from having an optimum EPoC bridge solution for TDD and more efficient FDD solution.
- In the repeater case, we may have to lower the expectation on the compatibility/coexistence and focus on the solution for simplicity and time to the market.

Motion

- Separate 802.3bn into phase I and phase II
- EPoC phase I – “Time to the market” FDD with no changes of MPCP or minimum argumentation of MPCP
  - Accept limitations on efficiency and coexistence for simplicity and time to the market
  - SM,1d->2D mapping, one channel with hooks for multiple channels…
  - Shorten the time frame for completing phase I
- EPoC phase II - targets optimizing EPoC TDD and bridge mode with less restrictions on modifying MPCP/ MAC
  - TDMA could be considered
  - MMP, 2D scheduling etc., could be considered
  - Better efficiencies could be achieved by impose less restrictions

Thanks