Changes to MAC and MACC in EPoC project

Marek Hajduczenia, PhD
ZTE Corporation
marek.hajduczenia@zte.pt

Supporters

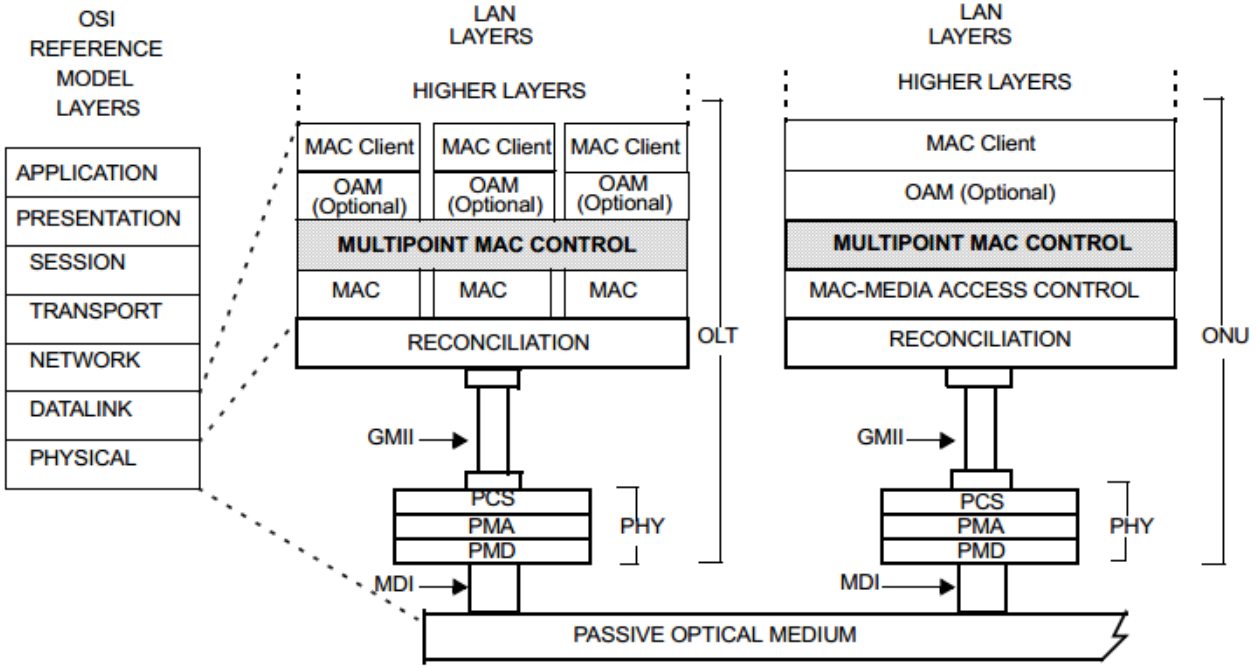
- Alan Brown, Aurora
- Ed Boyd, Broadcom
- Eugene Dai, Cox

“fixing” the MPCP – good or bad?

- MPCP is the primary target for optimization attempts, “fixing” and “improvements” in multiple directions
  - Something always can be done better, nicer or using more flexible message format
- However, in many such change attempts, the main purpose of MPCP is lost
  - It controls Multi-Point transmission in PON, as the name suggests, allowing stations to register and access services
  - It also facilitates data exchange, giving the central node a mechanism to grant transmission opportunities to individual CNUs and poll them for queue status
- MPCP is part of MAC Control
  - should be exposed to the minimum level of details about the underlying physical channel properties
  - In 10G-EPON, it is only aware of the upstream data rate supported by the device to allow DBA client* to calculate time slot size for REPORT and GATE messages.

* DBA client for EPON is defined in SIEPON (P1904.1)

MPCP facts



- MPCP is part of MAC Control
  - Its role is to control MAC behavior, by gating transmissions and handling MAC Control messages
  - MAC Control has no role in controlling PHY layer parameters – these should not be exposed to MAC Control

PHY and MPCP operation in EPoC

- PHY-only operation
  - CNU PHY goes online, initial (local) configuration of PHY parameters is performed to adapt PHY to target RF spectrum
  - PHY receiver is configured and enabled (via MDIO?), then move to PHY link information hunting (?)
  - Auto-negotiation with CLT PHY begins. CNU MAC is not yet active.
  - Link parameters between CNU and CLT are established. CNU switches to target configuration.
- MAC and PHY operation stage
  - Only when PHY layer link is established at target data rate, MAC is enabled on CNU and CLT (same process as for 10/100/1000 PHYs running on twisted pair medium)
  - MPCP, OAM, extended OAM discovery and registration processes are started

Changing MPCP role

- MPCP changes “seem” fairly easy
  - Just add new field here and there, fix codes, and we’re done
- Think about the bigger picture, though:
  - Objectives state clearly to limit changes to MPCP to “minimum augmentation” only
  - What “minimum” is, can be obviously argued in both directions
  - However, the function of MPCP and its role in EPoC must remain unchanged from EPON and Ethernet at large for EPoC to be part of Ethernet ecosystem
- MPCP kicks in only when link has been established
  - It should have no part in initial channel set up, link configuration, selection of carriers etc. – this is the role of PHY
  - The role of MPCP should remain the station discovery and bandwidth allocation once the link is established and operational

Changing MPCP messages and SDs

- Again, fairly easy target to shoot at
  - We have reserved fields, padding – plenty of space for innovation
  - A number of reserved OPCODEs available for MAC Control as well
- Impact of every such change
  - We have a very aggressive timeline for this project
  - Every change in MPCP State Diagrams (SDs) from EPON requires months, if not longer, of debugging, design and testing
  - That alone can put project timeline through the roof, not to mention so desired product availability
- Conclusions
  - We should avoid changes to MPCP message format and MPCP SD if we can live without them, even at the cost of decreased efficiency
  - Overall system efficiency is not dictated only by MPCP but combination of physical link, PHY definitions and ability to grant bandwidth. Such impact can be only assessed through simulation.

4 commandments for MPCP changes

- Please, don't …
  - Mix PHY link establishment with MPCP discovery
    - these are separate processes, executed at distinct times and with different purposes
  - Modify the role of MPCP in P2MP environment
    - station discovery on working PHY link and bandwidth allocation only
  - Solve PHY layer problems at MAC and MAC Control layers.
    - MAC should be PHY unaware as much as possible.
  - Bring in proposals for MPCP changes without clear motivation for them
    - We could have a separate project on such "improvements" but these are outside the scope of EPoC

Changes to MPCP – path forward ?

- Challenges for proposals for MPCP changes:
  - Demonstrate what is broken in current MPCP station discovery that it cannot work in EPoC. Do we need to change anything?
  - Demonstrate added value of ultra-precise bandwidth allocation in EPoC when 1G+ link capacity is available upstream
    - In 10G-EPON, certain inefficiencies were allowed for to simplify specification, design and limit changes to 1G-EPON MPCP
    - Consider similar approach in EPoC. 90% efficient link is not worth it, if it costs 10x more to build than 80% efficient link
- Proposals to change MPCP should be valued based on:
  - impact on efficiency (how much more bandwidth we get if we do it);
  - design complexity (how much more expensive it gets); and
  - timeline impact (how much longer it takes to get the project done)
  - resulting network delay

Changes to MPCP – path forward ? (cont'd)

- Backward compatibility with EPON is strongly desired:
  - Simpler equipment design, fewer bugs to root, quicker time to market
  - Reuse of existing platforms, e.g. DPoE, to manage ONUs and CNUs
  - The economic attractiveness of EPoC is in its similarity with EPON, and potential resulting volumes of CLT and CNUs – otherwise, how different is it from DOCSIS 3.1?

Bringing you Closer

Thanks!