IEEE 802.3 EPoC Study Group

Task Force Work Load
and
Diligence on Proposed Extra Effort

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PAR, Criteria, and Objectives

- Excellent work so far by a large number of SG participants
  - Getting clarity on a number of issues for this SG
  - Focused on SG output
- However becoming clear, that the Task Force work load being asked on two major work items, exceeding previous consensus:
  - Asking for additional operating mode: half-duplex
  - Asking for a PHY specification per media type,
    - Also, open ended, one, two….?
- Is the extra work too much for the Task Force?
- What additional information is needed to validate adding extra work to the Task Force?

Review: CFI Scope set with 802.3

"Proposed scope of study:

A new PHY for operating the EPON protocol over Coaxial Distribution Networks ("EPoC")

- Up to 10 Gbps downstream / Up to 10 Gbps upstream
  - Support symmetric and asymmetric full-duplex deployments
- Focused project
- No substantive changes to other EPON sublayers
  - Anticipate additional OAM messages for configuration, monitoring, etc."

- **Scope: existing operating mode "full-duplex" and one PHY**

First Objective Passed in Hawaii

"Specify a PHY to support subscriber access networks using the EPON protocol and operating on point-to-multipoint RF distribution plants comprised of all-coaxial cable or hybrid fiber/coaxial media.

– Y: 45 N: 0 A: 0"

- **Consensus: "A PHY" and "all-coaxial cable or hybrid fiber/coaxial media".**

Work Load Impact

- **Anticipating approximately 2.5 years to approved standard**
  - **U.S. cable industry has stated they would deploy now if available**
  - **We have a lot of work to accomplish for just one PHY**
- **However, SG is receiving proposals for extra work in the Criteria consensus effort and other contributions**
  - **An additional operating mode for EPON: half-duplex, unknown impact**
  - **Additional PHYs per media types: unspecified differences and work**
- **There has been no impact study on Task Force Effort**
  - **Likely at least 2x-3x original effort**
  - **What is impact on draft standard schedule?**

Work Load Impact

- Keeping to "best" TF schedule should have priority
- Variety of options for maintaining "best" schedule:
  - Stick to existing consensus of one operating mode and one PHY
    - It is the current scope of work
    - Do extra work after priority work is complete
  - Go back to 802.3 and ask for consideration of extra effort
    - But don't stall FDD/One-PHY
    - If extra effort approved, merge or do after priority work is complete
  - Ignore now and let Task Force sort it out
    - Least preferable: can significantly burden TF initial productivity
    - Lack of "impact aware" consensus
  - Just say "no" to the extra effort
    - Stick to priority work only

Impact? How much extra work?

- What is the impact of the extra work?
  - Insufficient visibility and validation in contributions
- TDD has been "hiding under the coat tails" of FDD
- It is time to hear the details and validation for why the extra work should be added to the Task Force Load
- One quick approach is to see if TDD can stand on its own for EPoC
  - Then SG can determine how to proceed going forward

Clause 4 and 56 on "Half-Duplex"

- **Clause 4, Section 4.1.1 mentions Half Duplex**
  - ***"In half duplex mode, stations contend for the use of the physical medium, using the CSMA/CD algorithms specified."***
    - **Original CD (baseband voltage threshold exceeded) hard in an RF environment**
- **Clause 56, Section 56.1 Overview**
  - ***"An important characteristic of EFM is that only full duplex links are supported"***
- **TDD is not CSMA/CD and has no precedence for EFM**
  - **Asking for half-duplex EPON MAC**
  - **Asking for half-duplex link**
- **This doesn't mean EPOC using TDD over Coax can't be done in IEEE 802.3**
  - **We really need to hear more substantiating market validation and technical diligence on impact to EPON**

Why add extra work for the Task Force?

- **Respecting TDD is essential**
  - **Improve understanding of essentials and impact for that approach**
  - **Does the SG want the TF to take on the extra work?**
    - **Is it even possible to merge with FDD/single PHY work?**
  - **If yes, then when at same time or after first priority is completed?**
- **Should (re) examine TDD versus the CFI**
  - **How would the CFI be answered differently if TDD were included?**
- **Should examine TDD versus 5 Criteria stand-alone**
  - **E.g. no full-duplex, answer if TDD were the only operating mode**
  - **Also maintain compatibility with CFI commitments**
  - **Will create better understand of TDD needs and issues**

Market Motivation for CFI: EFM over Fiber

- The original motivation for the EPoC CFI came from desire of cable operators already using EPON over fiber to extend their same EPON to over Coax
  - At the time: no present solutions
- TDD seems to be spawning from existing EoC approaches wanting to move from LAN to EFM access networks
  - HomePlug AV
  - MOCA
  - HINOC
  - Proprietary approaches in progress for EPON + EoC
  - At the time: several solutions, two specification organizations
- Validation question:
  - Has the market window passed for an IEEE EPoC TDD solution?

Original intent: No OLT Hardware Changes

- One aspect of the approach used in the CFI is to permit EPON chipset vendors to use existing OLT PON chipsets
  - i.e., changes predicted to be limited to software only
- Vendor's observation: premature to add TDD to Study Group output without a sufficiently detailed impact study
  - Current TDD proposals imply hardware changes
  - Vendors need to determine exact impact on their hardware
  - Then, an "impact aware" consensus process

Back to CFI Content Comparison

- In the section on Market Potential
  - Probably should bring back that study slide on EoC in China
  - Given existing deployments, what is IEEE TDD EoC potential?
    - In China
    - R.O.W.
- In the section on High Level Concept
  - Need to see straw architectural assumptions for a TDD mode
    - What layers are affected?
  - What is impact on EPON systems for the existing services?:
    - 1588v2 and cellular backhaul
    - MEF services for business
    - Triple-play for residential
  - Haven't heard how TDD impacts these achieving these goals:
    - Concerns about impact on delay, delay variation, and relative cost and therefore subsequent burden on Task Force to overcome

Back to CFI Content Comparison

- **In the section on High Level Concept**
  - **TDD only works in passive spectrum on cable networks**
    - **Does the plant have to be "touched" in any way to make TDD work better?**
      - **If so, is that work unique to TDD or can be made to work for FDD?**
        - » **e.g. for high-split TDD and FDD, both require a diplexer**
  - **How does TDD accomplish:**
    - **Flexible provisioning**
    - ***"work[ing] around existing services"***
    - ***"The EPoC PHY would need to be flexible and permit re-provisioning to make use of more RF spectrum as it is made available by the cable operator"***

Summary on CFI Content Comparison

- **TDD may have different answers to the goals and requirements expressed in the CFI**
  - **Need to bring out clearly**
- **Then see if FDD and TDD can even share the same goals**

5 Criteria as a Stand Alone

- During the course of 5 Criteria and objectives development, TDD interests have proposed:
  - A different MAC operating mode from FDD
  - A different PHY for a “passive” cable media type
- No contributions on MAC impact or extra PHY validation
  - What happens to delay, delay variation, etc.?
  - What are the specific differences that motivate an additional PHY?
- Perhaps asking for a TDD-only set of answers to the 5 Criteria with supporting contributions is a fast approach?
  - Need sufficient detail and validation to support criteria items

Other questions on TDD impact to Cable and EPON

- **TDD co-existence on cable plant with existing services:**
  - **What changes to the plant are required?**
  - **How does TDD meet future re-provisioning of services and spectrum?**
- **On existing OLT chips and systems?**
- **On existing EPON system performance with regards to delay, delay variation, packet bursts for meeting:**
  - **MEF scenarios and any limitations for business services**
  - **Triple-play services for residential**
  - **Any limits on upstream concatenated burst lengths?**

Other questions on TDD impact to Cable and EPON

- **What impact does additional delay and wider transmit channel in TDD have on packet memory, relative cost, and power in the ONU/CNU?**
- **What is the solution and relative cost impact for maintaining 1588 v2 (and other) clock synchronization?**
- **What are relative cost impact on CNU receivers over FDD approach in “long reach” passive networks when close neighbors are at high output level?**
- **What is impact on discovery and auto-negotiation?**

Other questions on TDD impact to Cable and EPON

- What is the impact on the scheduler for just TDD mode?
- If a manufacturer were to create a “transparent repeater” product, (e.g. “CMC” on Mark’s “Slide 19”s)
  - How does OLT manage FDD and TDD scheduling on same PON?
  - If a TDD ”span” were added to PON, how are existing PON services impacted? Are there any interaction issues?
  - Any limitation to multiple TDD “spans” on same PON? E.g. multiple CMC’s on same PON, each with “community” of TDD CNU’s
- How does TDD scale and adjust with different and evolving symmetric and asymmetric service load requirements?
  - Any additive relative cost on CNU transmitter over FDD approach?

Closing

- This contribution is about increasing the understanding of proposed additions to the Study Group scope
  - Being very clear about impacting Task Force work load is needed
  - Time until completion of draft standard is crucial
  - Clarity in SG likely improves clarity of PAR/Criteria/Objectives when being reviewed, less questions and delays
- This contribution raises the question of: do the current proposals asking for an additional MAC operating mode as well as an additional PHY create a distinct identity for the TDD approach?
  - If yes, then a new “EPON using TDD over Coax” CFI is likely prudent
- The feasibility of EPON MAC operate with TDD has not been proven
  - No detailed technical analysis of any kind
  - No prototype of any kind
  - Therefore, it is too immature to start any standard work
- Regardless, increasing understanding EPON system impact and performance of the TDD approach is necessary
  - Too much is unclear
  - Passing to TF to sort this out will burden and complicate their effort

Thank You