Approved Minutes

# IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force

Plenary Meeting
July 11-12, 2018
San Diego, CA, USA

Prepared by Kent Lusted

# Table of Contents

# IEEE P802.3 100 Gb/s Electrical Lane Study Group – July 11, 2018

*Prepared by Kent Lusted*

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~8:30 a.m., by Beth Kochuparambil, IEEE 802.3ck Task Force Chair.

Beth welcomed attendees.

Introductions were made.

Chair reviewed agenda in http://www.ieee802.org/3/ck/public/18_07/agenda_3ck_01_0718.pdf

**Motion #1:**
Move to approve the agenda:

- Moved by: Thananya Baldwin
- Second by: Mark Gustlin
- Passed by voice without opposition

Chair noted that the May minutes were posted shortly after the meeting. Recording Secretary noted that he received no requests for corrections or modifications to the posted minutes. Chair asked if there were any other comments on the minutes. No one responded.

**Motion #2:**
Move to approved the May 2018 meeting minutes

- Moved by: Thananya Baldwin
- Second by: Nathan Tracy
- Passed by voice without opposition

Chair reminded participants to observe meeting decorum. Called for members of the press. No one indicated. Photography and recording are not permitted.

Chair reviewed the ground rules for the meeting.

Chair reviewed the IEEE structure.

Chair reviewed the Bylaws and Rules slides in
http://www.ieee802.org/3/ck/public/18_07/agenda_3ck_01_0718.pdf

Chair asked if there was anyone unfamiliar with the Bylaws or Rules. No one responded.

**IEEE Patent Policy**: Chair reviewed the Patent related slides on the 4 slides contained in the agenda. Chair calls for potentially essential patents. No one responded. Chair read the Guidelines for IEEE WG meetings. No one responded.

**Chair advised the WG attendees that:**

- The IEEE's patent policy is described in Clause 6 of the *IEEE-SA Standards Board Bylaws*;
- Early identification of patent claims which may be essential for the use of standards under development is strongly encouraged;
- There may be Essential Patent Claims of which the IEEE is not aware. Additionally, the IEEE, the WG, nor the WG chair can ensure the accuracy or completeness of any assurance or whether any such assurance is, in fact, of a Patent Claim that is essential for the use of the standard under development.

No one responded.

Chair reviewed the slide with a statement on the participation in IEEE 802 Meetings. Chair noted that by participating in the IEEE 802 meeting, that participants accept these requirements. Chair asked if there were questions about the participation requirements. No one responded.

Chair reviewed the IEEE 802.3 Standards Process.

Chair reviewed the approved project documents.

Reviewed the reflector and web information for the Task Force in the agenda deck.

Chair reviewed the attendance procedures. Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Chair provided a summary of the Task Force status.

Chair reviewed the adopted objectives.

Goals for the meeting:

- Continue technical discussion leading to baseline proposals
- Lay the ground work for baseline creation

Chair reviewed the Big Ticket items:

- C2M budget and analysis
- COM Architecture

There was a request to have the presentations posted a few work days prior to the start of the meeting. Chair noted that she tries to post presentations on the Thursday prior to the meeting week. The US holiday on Wednesday, 4 July, interfered with this meeting's posting schedule.

Chair reviewed two proposed timelines, slides 22 and 23, in
http://www.ieee802.org/3/ck/public/18_07/agenda_3ck_01_0718.pdf

Chair noted that a liaison from OIF was received. Chair noted that it is a shared draft that is to be restricted to IEEE 802.3 participants only. Chair displayed the attachment (see: http://www.ieee802.org/3/private/liaison_docs/OIF/OIF_to_IEEE_802d3_CEI_112G_Jul_2018_att1.pdf) Chair asked if there was objection to deferring a response until a later meeting when more substantial decisions have been made. No one responded.

Chair reviewed the presentation schedule. Chair noted that there was a request to extend the lunch break to accommodate the World Cup.

Chair reviewed the future meeting dates.

Future Meetings:
- September 2018 Interim
    - Week of September 9, 2018 -- Spokane, WA, USA
- November 2018 Plenary
    - Week of November 11, 2018 - Bangkok, Thailand
- January 2019 Interim
    - Week of January 14, 2019 - TBA

Anyone interested in hosting a meeting should contact the Chair or Steve Carlson.

Chair announced that there will be hoc meetings before the September interim meeting. The ad hocs will be coordinated with the P802.3cd Task Force. The first meeting is tentatively scheduled for July 25. Details will be announced over the email reflector.

**Presentation #1:**
"RS Symbol Muxing Option for 802.3ck", Mark Gustlin
See: http://www.ieee802.org/3/ck/public/18_07/gustlin_3ck_01_0718.pdf
- Clarifying questions were asked and answered.

**Presentation 2:**
"Server NIC Trace Lengths", Kent Lusted

See: http://www.ieee802.org/3/ck/public/18_07/lusted_3ck_01a_0718.pdf

- Kent noted that he was giving the presentation as a Task Force participant, not as the Recording Secretary or Task Force Vice-Chair.
- Clarifying questions were asked and answered
- There was a request for LAN on motherboard trace lengths.

Break at ~9:40 a.m. Resumed at ~10:00 a.m.

**Presentation #3:**
"100Gb/s C2M Channel Simulation", Toshiaki Sakai
See: http://www.ieee802.org/3/ck/public/18_07/sakai_3ck_01_0718.pdf

- There is a reflection in the BGA region due to the breakout limitations of the package.
- The analysis uses the contributor's own reference receiver; the model is on page 29.
- The EH5 and EW5 on slide 21 include the package and Cd.
- Discussed the need to study the impact of the different 8-lane connectors.

**Presentation #4:**
"100Gb/s/lane Chip-to-Module Interface Simulation Analysis", Adam Healey
See: http://www.ieee802.org/3/ck/public/18_07/healey_3ck_01b_0718.pdf

- Updated version '01a' with more channel descriptions. Chair asked if there was objection. No one responded.
- Updated version '01b' with corrections to the results due to a copy/paste error in the 01a creation.
- The HCB is implied in all of the channels listed, but not explicitly called out.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Break at ~11:50 a.m. Resumed at ~1:40 p.m. after the end of the World Cup Game between England and Croatia.

Chair reminded participants to sign into the IEEE Meeting Attendance Tool and sign the attendance book.

Chair asked participants to hold questions on the Ghiasi and Lim presentations to the end of both presentations.

**Presentation #5:**
"Dual Port Type MDI", Ali Ghiasi
See: http://www.ieee802.org/3/ck/public/18_07/ghiasi_3ck_01a_0718.pdf

- Discussed the challengs of using COM for host normative specification.

**Presentation #6:**
"100GEL C2M Channel Reach Update", Jane Lim
See: http://www.ieee802.org/3/ck/public/18_07/lim_3ck_01b_0718.pdf

- Updated version '01b' with additional supporters
- The BER target of 1E-6 is based on the author's requirement to have margin over the 1E-5 PMD requirement.
- BGA pitch assumption is 1mm.
- The routing assumption has 256 lanes.

Chair reviewed the plans for the rest of the day: discussion and straw polls.

**Straw Poll #1:**
I would support the port type direction of…

A: Universal port only (interoperable Optical and passive DAC)
B: Asymmetric ports (two different host loss for each end of the cable - IE: A side, B side)
C: Dual Ports (optics only port and interoperable Optical/DAC - IE: Port Type 1, Port Type 2)
D: Universal C2M port only (interoperable Optical and active copper cable)
E: More information

(chicago rules)
A: 26 B: 17 C: 34 D: 13 E: 46
Room count 94

During the discussion of straw poll #1, the Chair provided the following interpretation:

- Universal port only is intended to mean that a port can support optical modules and passive copper cable, and that the host loss is likely limited by the copper cable
- Asymmetric port is intended to mean that one end of a link would have more host loss than the other.
- Dual ports is intended to mean that there are 2 types of ports: one that supports optics only and one that supports passive cable and optics
- C2M port only means that there is no passive copper cable support.

Break at ~3:30 p.m. Resumed at ~3:45 p.m.

Chair asked participants to send straw poll requests to her and the Vice-Chair for tomorrow's meeting.

**Presentation #7:**

“Lower Power 100G PAM4 Receiver Alternative Based on Balanced Equalization Approach”, Jeff Twombly
See: http://www.ieee802.org/3/ck/public/18_07/twombly_3ck_01a_0718.pdf

- Updated ‘01a’ with additional channel information on a 30dB channel.
- There was a request to normalize the tap weights.
- Discussed the challenge of conformance testing a transmitter with a large number of taps.
- It was noted that the TX tap weights are currently determined experimentally thru BER optimization.

**Presentation #8:**
“Reference Architecture Proposals and Channel Data”, Rich Mellitz and Howard Heck
See: http://www.ieee802.org/3/ck/public/18_07/mellitz_3ck_01_0718.pdf

- There was a request to run the experiments on more cable channels.
- It was noted that the RXFFE is after the CTLE in the Annex 93A flow diagram.

Chair announced a start time of 8:45 a.m on Thursday.

Chair noted that she had asked Matt Brown to prepare a contribution with an editorial considerations. Chair asked if there was opposition to hearing it. No one responded. Chair noted that Matt Brown had accepted the offer to be the Chief Editor.

Chair reviewed the plans for Thursday: editorial consideration presentation, discuss timelines, discussion & straw polls, and next steps.

Attendance straw polls:

- I will attend the IEEE 802.3ck meetings at the September interim in Spokane, WA, USA (week of September 10, 2018)
  Y: 50 , M: 17
- I will attend the IEEE 802.3ck meetings at the November Plenary in Bangkok, Thailand (week of November 11, 2018)
  Y: 34 , M: 23

Break for the day at ~5:15 p.m.

# IEEE P802.3 100 Gb/s Electrical Lane Study Group – July 12, 2018

*Prepared by Kent Lusted*

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~8:45 a.m., by Beth Kochuparambil, IEEE 802.3ck Task Force Chair.

Beth welcomed attendees.

**Presentation #9:**
"Editorial Considerations", Matt Brown
See: http://www.ieee802.org/3/ck/public/18_07/brown_3ck_01_0718.pdf

- Discussed that the AUIs could be a single proposal.
- It was noted that a baseline proposal for PCS & PMA should be added to the list.
- Discussed the potential draft impact of an AUI training protocol.

Chair reminded participants to sign the attendance book.

**Presentation #10:**
"Timeline Discussion", Beth Kochuparambil
See: http://www.ieee802.org/3/ck/public/18_07/kochuparambil_3ck_01_0718.pdf

- Reviewed three potential timelines.
- Chair indicated that the timeline would be considered in either September or November.

Adee Ran provided an overview of straw polls that he wanted to take.

**Straw Poll #2:**
For the chip-to-module host package model, we should consider trace lengths up to

A: 15 mm
B: 20 mm
C: 25 mm
D: 30 mm
E: need more information

(Chicago rules)
A: 6, B: 6, C: 9, D: 20, E: 28

There were several oppositions to proceeding with the straw polls due to a lack of information on each option.

Break at ~9:55 a.m. Resume at ~10:35 a.m.

Adee Ran noted changes to the straw polls back on feedback during the break.

**Straw Poll #3:**
For the chip-to-module electrical host transmitter I would support:

A: Fixed equalization (as in 120E)
B: Programmable equalization controlled by management (as in 120D)
C: Programmable equalization with a training/startup protocol (as in 136)
D: Need more information

(Chicago Rules)
A: 3, B: 6, C: 1, D: 47
Room count: 65

**Straw Poll #4:**
For the C2M Module reference receiver I would support

A: CTLE + DFE/FFE suitable for handling the C2M channel (i.e. symmetrical specs for host and module)
B: CTLE only , with long FFE in the host TX (i.e. asymmetric specs)
C: Need more information

(choose one)
A: 4, B: 3, C: 45

Adee Ran noted that he intends to send an email to the reflector requesting a list of the information participants would like to have.

Chair displayed a list of action items and topics that the Task Force needs to address. (see: )
Chair noted that she will be reaching out to participants to champion baselines and address the action items. There were requests to add:

- More power analysis for all interfaces and PHY types, not just C2M.
- COM reference receiver and optimization flows
- Determine feasibility of COM parameters for silicon and packages
- Package crosstalk.

Chair asked participants to review the list, find an item of interest, and make a contribution.

Adee Ran posed questions to the Task Force. For package length, participants wanted more information on host side high/low density examples, trace route assumptions & conditions, example package S-param max/min. For equalization control & asy/sym electrical specs for C2M, participants wanted more information on environmental effects on channel variance & training impact, training time expectations, cost/power tradeoffs, system benefits/impacts.

Chair reviewed the future meeting locations. Chair noted that ad hocs will be announced over the email reflector soon.

Chair reminded participants to sign the attendance book.

Chair noted that the agenda was complete.

**Motion #3:**
Move to adjourn.
M: Dave Ofelt
S: Jeff Slavick
Procedural (>50%)
Passes by voice

Meeting ended at ~11:30 a.m.

# Attendees

| P802.3ck 100GEL Task Force, July 2018 | | | | 11-Jul-18 | 12-Jul-18 |
|---|---|---|---|---|---|
| Last Name | First Name | Employer | Affiliation | Wednesday | Thursday |
| Anslow | Pete | Ciena Corporation | Ciena Corporation | x | x |
| Baca | Rich | Microsoft | Microsoft | x | x |
| Balasubramonian | Venugopal | Marvell | Marvell | x | x |
| Baldwin | Thananya | Keysight Technologies | Keysight Technologies | x | x |
| Baumgartner | Steven | Global Foundries | Global Foundries | x | x |
| Beauregard | Francois | Belden | Belden | x | x |
| Booth | Brad | Microsoft | Microsoft | x | |
| Bouda | Martin | Fujitsu | Fujitsu | x | x |
| Braun | Ralf-Peter | Deutsche Telekom | Deutsche Telekom | | x |
| Brooks | Paul | Viavi Solutions | Viavi Solutions | x | x |
| Brown | Matt | MACOM | MACOM | x | x |
| Butter | Adrian | Global Foundries | Global Foundries | x | x |

| | | | | | |
|---|---|---|---|---|---|
| Cady | Ed | Luxshare | Luxshare | x | x |
| Calvin | John | VTM | VTM | x | x |
| Carlson | Craig | Cavium | Cavium | x | x |
| Chalupsky | David | Intel | Intel | x | |
| Chang | Jacky | HPE | HPE | x | x |
| Chen | C. C. David | Applied Optoelectronics | Applied Optoelectronics | x | x |
| Chuang | Keng Hua | HPE | HPE | x | x |
| Coenen | Robert | Interoptic | Interoptic | x | x |
| Cui | Zhenwei | Huawei | Huawei | x | x |
| Dawe | Piers | Mellanox | Mellanox | x | x |
| DiMinico | Christopher | MC Communications/Panduit | MC Communications/Panduit | x | x |
| Dudek | Mike | Marvell Technologies | Marvell Technologies | x | x |
| Estes | Dave | Spirent Communications | Spirent Communications | x | |
| Filip | Jan | Maxim Integrated | Maxim Integrated | x | |
| Ghiasi | Ali | Ghiasi Quantum, Huawei | Ghiasi Quantum, Huawei | x | |
| Gopalakrishnan | Karthik | Inphi | Inphi | x | |

| | | | | | |
|---|---|---|---|---|---|
| Gorshe | Steve | microsemi | microsemi | | x |
| Gustlin | Mark | Xilinx | Xilinx | x | x |
| Hajduczenia | Marek | Charter | Charter | | x |
| Hasharom | Kobi | Dust Photonics | Dust Photonics | x | |
| Haynes | Hayden | UNH-IOL | UNH-IOL | x | |
| Healey | Adam | Broadcom Limited | Broadcom Limited | x | x |
| Heck | Howard | Intel | Intel | x | x |
| Hegde | Raj | Broadcom | Broadcom | x | x |
| Holden | Brian | Kandou Bus | Kandou Bus | x | x |
| Horner | Rita | Synopsys | Synopsys | x | x |
| Ingham | Jonathan | Foxconn Interconnect Technology | Foxconn Interconnect Technology | | x |
| Ishibe | Kazuhiko | Anritsu | Anritsu | x | x |
| Jackson | Ken | Sumitomo | Sumitomo | x | x |
| Jimenez | Andrew | Anixter | Anixter | x | |
| Kabra | Lokesh | Synopsys | Synopsys | x | |

| | | | | | |
|---|---|---|---|---|---|
| Kareti | Upen Reddy | Cisco | Cisco | x | x |
| Kimber | Mark | Semtech | Semtech | x | x |
| Kiuchi | Hideki | JAE | JAE | x | x |
| Kochuparambil | Beth | Cisco | Cisco | x | x |
| LeCheminant | Greg | Keysight Technologies | Keysight Technologies | | x |
| Lee | JuneHee | Samsung | Samsung | x | |
| Levin | Alex | Microsoft | Microsoft | x | x |
| Lewis | Dave | Lumentum | Lumentum | x | x |
| Li | David | Hisense | Hisense | x | x |
| Li | Mike | Intel | Intel | x | x |
| Liang | Yongxuan | AOI | AOI | x | |
| Lim | Jane | Cisco | Cisco | x | x |
| Liu | Hai-Feng | Intel | Intel | x | x |
| Liu | Karen | Lightwave Logic | Lightwave Logic | x | x |
| Lusted | Kent | Intel | Intel | x | x |
| Maki | Jeffery | Juniper Networks | Juniper Networks | x | x |

| | | | | | |
|---|---|---|---|---|---|
| Malicoat | David | Senko/Aquantia | Senko/Aquantia | x | x |
| Marques | Flavio | Furukawa Electric | Furukawa Electric | x | x |
| Marris | Arthur | Cadence | Cadence | x | x |
| Martin | Arlon | Samtec | Samtec | x | x |
| Mazzini | Marco | Cisco | Cisco | x | |
| McMillan | Larry | Western Digital | Western Digital | x | |
| McSorley | Greg | Amphenol | Amphenol | x | x |
| Mein | John | Dust Photonics | Dust Photonics | x | |
| Mellitz | Richard | Samtec | Samtec | x | x |
| Moritake | Toshiyuki | JAE | JAE | x | |
| Muller | Shimon | Axalume | Axalume | x | |
| Murty | Ramana | Broadcom | Broadcom | x | |
| Nakamoto | Edward | Spirent Communications | Spirent Communications | x | x |
| Nishimura | Takeshi | Yamaichi Electronics | Yamaichi Electronics | x | |
| Nolan | John | Marvell | Marvell | x | |
| Ofelt | David | Juniper Networks | Juniper Networks | x | x |

| | | | | | |
|---|---|---|---|---|---|
| Pachon | Arturo | TE | TE | x | x |
| Palkert | Tom | Molex - MACOM | Molex - MACOM | x | x |
| Parthasarathy | Vasu | Broadcom | Broadcom | x | |
| Pepper | Gerald | Keysight Technologies | Keysight Technologies | x | x |
| Pimpinella | Rick | Panduit Corp. | Panduit Corp. | x | |
| Poelstra | Henry | Teledyne Lecroy | Teledyne Lecroy | x | x |
| Pozzebon | Dino | microsemi | microsemi | x | x |
| Rabinovich | Rick | Keysight Technologies | Keysight Technologies | x | x |
| Ran | Adee | Intel | Intel | x | x |
| Sakai | Toshiaki | Socionext | Socionext | x | x |
| Sayre | Edward | Samtec | Samtec | x | x |
| Schube | Scott | Intel | Intel | x | |
| Sekel | Steve | Keysight Technologies | Keysight Technologies | x | x |
| Shrikhande | Kapil | Innovium | Innovium | x | x |
| Slavick | Jeff | Broadcom Limited | Broadcom Limited | x | x |
| Sluyski | Mike | Acacia Communications | Acacia Communications | x | x |

| | | | | | |
|---|---|---|---|---|---|
| Sommers | Scott | Molex | Molex | x | |
| Sprague | Ted | Infinera | Infinera | x | x |
| Stassar | Peter | Huawei | Huawei | | x |
| Stone | Rob | Broadcom | Broadcom | x | x |
| Sun | Liyang | Huawei | Huawei | x | |
| Sun | Phil | Credo | Credo | x | x |
| Tailor | Bharat | Semtech | Semtech | x | |
| Takahara | Tomoo | Fujitsu Laboratories | Fujitsu Laboratories | | x |
| Takefman | Mike | Inphi | Inphi | x | x |
| Tamura | Kohichi | Oclaro | Oclaro | x | |
| Tooyserkani | Pirooz | Cisco | Cisco | x | x |
| Tracy | Nathan | TE Connectivity | TE Connectivity | x | |
| Twombly | Jeff | Credo | Credo | x | |
| Ulrichs | Ed | Source Photonics | Source Photonics | x | x |
| Welch | Brian | Luxtera | Luxtera | x | |
| Yang | Mengna | AOI | AOI | x | |

| | | | | | |
|---|---|---|---|---|---|
| Young | James | CommScope | CommScope | x | x |
| Yuchun | Lu | Huawei | Huawei | x | x |
| Zambell | Andrew | Amphenol | Amphenol | x | x |
| Zhang | Geoffrey | Xilinx | Xilinx | x | |
| Zivny | Pavel | Tektronix | Tektronix | x | x |