

Approved Minutes
IEEE 802.3cm 400 Gb/s over Multimode Fiber Task Force
During IEEE 802.3 Interim Meeting Week
May 21-22, 2018
Pittsburgh, PA, US
Prepared by Mabud Choudhury

Group Name: IEEE 802.3cm 400 Gb/s over Multimode Fiber Task Force
Date/Location: Monday & Tuesday, May 21-22, 2018. Pittsburgh, PA, US
Chair: Robert Lingle, Jr.
Recording Secretary: Mabud Choudhury
Meeting Participants: Attendance is listed in Appendix A

Call to order:

IEEE 802.3cm 400 Gb/s over Multimode Fiber (400G over MMF) Task Force (TF) meeting was convened at 8:33 am Eastern Daylight Time/EDT (UTC -4), Monday, May 21, 2018 by David Law, 802.3 Working Group Chair.

Mr. Law welcomed attendees to the IEEE 802.3 400G over MMF TF meeting.

David Law appointed Mabud Choudhury as the recording secretary for the IEEE 802.3 400G over MMF TF meeting.

As announced at March 2018 Plenary, David Law intends to appoint Robert Lingle, Jr. as the Chair of the IEEE 802.3cm 400 Gb/s over Multimode Fiber Task Force.

Motion #1:

Move to confirm Robert Lingle, Jr. as the IEEE 802.3cm 400 Gb/s over Multimode Fiber Task Force Chair

- Moved by Mike Dudek
- Seconded by Paul Kolesar
- Y: 22 N: 0 A: 1 (>= 75% by rule)
- Motions Passes!

Mr. Law turned the meeting over to Task Force Chair Robert Lingle, Jr.

The Chair called for introductions and affiliations, the participants introduced themselves, and the Chair then proceeded with the agenda.

Presentation #1:

Title: "IEEE P802.3cm 400G over MMF Task Force Agenda and General Information"

Presenter: Robert Lingle, Jr., Chair

http://www.ieee802.org/3/cm/public/May18/agenda_802.3cm_01a_0518.pdf

Chair reviewed Agenda.

Chair read aloud and reviewed IEEE-SA Meeting Guidelines, including patent policy, and IEEE 802 Participation Policy. There were no questions from group based on guidelines and policy review.

Mr. Lingle provided Task Force information, access to the home page and reflector.
Chair announced appointments of and thanked Task Force Editors: Jonathan King, Finisar - SR8 & Chief Editor and Jonathan Ingham, FIT – SR4.2 clause, and Recording Secretary: Mabud Choudhury, OFS.

Mr. Lingle reminded everyone to sign-in via IMAT on-line attendance (Interim meeting password provided) and to sign-in on Attendance Sheet.

Chair reviewed ground rules, role of the Chair, overall IEEE structure, important bylaws, rules, & references links, overall IEEE 802.3 standards process indicating successful completion of Study Group phase and focusing in on Task Force phase.

Mr. Lingle reviewed the timeline goals of completing D1.0 by November 2018, D3.0 by November 2019 and completing standard by June 2020. Discussion about timeline moving expeditiously to meet market window for standard, while ensuring that the standard is technically complete and correct.

Mr. Lingle informed the Task Force group that PAR for the “400G over MMF Task Force” was approved by IEEE-SA on May 14. He reviewed the key Objectives approved by the 802.3 Working Group.

Mr. Lingle provided Ad Hoc report, summarizing 4 teleconference meetings since March Plenary.

Chair reviewed goals for the week:

- Get ALL issues needing debate, relevant to our two objectives, on the table for discussion
- Measure consensus on proposals and issues
- Attempt to adopt proposals that appear to have consensus

Big Ticket items:

- 400GBASE-SR8 PMD type baseline
- 400GBASE-SR4.2 PMD type baseline

Motion #2:

Move to approve the Agenda, Slide 2 of

http://www.ieee802.org/3/cm/public/May18/agenda_802.3cm_01a_0518.pdf

- Moved by John Abbott
- Seconded by Paul Neveux

Motion approved by voice vote without objection.

Motion #3:

Move to approve meeting minutes, previously posted, from March 22-23 Study Group meeting, per Slide 19 of

http://www.ieee802.org/3/cm/public/May18/agenda_802.3cm_01a_0518.pdf

- Moved by Paul Kolesar
- Seconded by Paul Neveux

Motion approved by voice vote without objection.

Schedule for Monday, May 21 and Tuesday, May 22, 2018 was reviewed.

Future meeting dates and locations were reviewed.

Presentation #2:

Title: “400 Gb/s 100-m 8-pair MMF objective baseline proposal”

Presenter: Paul Kolesar

http://www.ieee802.org/3/cm/public/May18/king_3cm_01b_0518.pdf

Presented baseline proposal for a retimed PMD to address the 802.3cm objective “Define a physical layer specification that supports 400 Gb/s operation over 8 pairs of MMF with lengths up to at least 100m.”

Leveraging 200GBASE-SR4 optical technology and content of clause 138.

The version of contribution presented included assumed use of 200GBASE-SR4 FEC (defined in 802.3cd), to enable 100 m reach. Based on discussion, the updated assumption is use of FEC defined in 802.3bs to enable 100 m reach.

Also, based on discussion, AUI-16 was added to proposed changes to Clause 138.

Clause by clause changes were presented reviewed and discussed.

Break at 10:11 am EDT (UTC -4). Resumed meeting at 10:40 am EDT.

Presentation #3:

Title: “Port Mappings and Optical MDIs for Eight-Lane Form Factors”

Presenter: Jeffery Maki

http://www.ieee802.org/3/cm/public/May18/maki_3cm_01_0518.pdf

Presented optical MDIs and electrical data input to optical port mappings for eight-lane form factors – QSFP-DD, COBO 8 lane and OSFP – as foundation and reference for 400G-SR8 PMD MDIs.

General discussion followed.

Presentation #4:

Title: “400G-SR8 MDI Definition and Lane Assignments”

Presenter: Steve Swanson

http://www.ieee802.org/3/cm/public/May18/swanson_3cm_01b_0518.pdf

Presentation focused on 400G-SR8 MDI and lane assignments to support breakout applications.

Original presentation showed breakout to 2x100GbE SR4; author updated presentation (per link above) to remove reference to 2x100GbE.

Reviewed and discussed pros and cons of dual-row 12f MPO vs. single-row 16f MPO – proposed 2 MDIs for 400G-SR8.

Compatibility of proposed dual-row 12f MPO to structured cabling discussed.

General discussion followed.

Presentation #5:

Title: “400GBASE-SR8 MDI Choices”

Presenter: Paul Kolesar

http://www.ieee802.org/3/cm/public/May18/kolesar_3cm_01_0518.pdf

The contribution detailed three 400GBASE-SR8 MDI choices with a focus on structured cabling compatibility.

How array polarity works in TIA-568 was described and discussed.

Three MDI choices:

1. Tx row + Rx row, 24f MPO (Rx over Tx, like SR10 opt. A and Tx over Rx, like SR16),
2. Single row MPO-16 (Tx then Rx, like QSFP-DD)
3. “Dual DR4” 24f MPO (Tx, blank, Rx, like QSFP-DD)

were presented in terms of overall pros and cons and discussed.

Break for lunch at 12:20 pm EDT (UTC -4). Resumed meeting at 1:34 pm EDT.

Presentation #6:

Title: “Towards a baseline proposal for a 400 Gb/s optical PMD supporting four MMF pairs”

Presenter: Jonathan Ingham

http://www.ieee802.org/3/cm/public/May18/ingham_3cm_01_0518.pdf

A baseline proposal for “400GBASE-SR4.2” based on RS(544,514) FEC-supported 26.5625 GBd PAM4 modulation was presented.

The technical feasibility and broad market potential of a four-fiber-pair MMF PMD at 400 Gb/s was reviewed.

Bi-directional WDM transmission with required operating range of 0.5 m to 70 m OM3, 0.5 m to 100 m OM4 and 0.5 m to 150 m OM5 was presented and discussed.

Two-wavelength solution with transmit center wavelength ranges of 847 to 863 nm and 900 to 916 nm was presented and discussed.

Presentation #7:

Title: “400G-SWDM4.2 choices”

Presenter: Jonathan King

http://www.ieee802.org/3/cm/public/May18/king_3cm_02_0518.pdf

Presented options for 400GBASE-SR4.2, focusing on some key choices:

1. Wavelengths: 850 nm and 880 nm, or 850 nm and 910 nm
2. Directionality: Co-directional or Bi-directional

Proposed and discussed 850 nm and 880 nm wavelengths and Co-directional approach.

Discussion about PHY vendors that can handle “crossover” and FEC backward compatibility with 100G BiDi modules already in the field.

Break at 2:47 pm EDT (UTC -4). Resumed meeting at 3:33 pm EDT.

Presentation #8:

Title: “Preliminary Evaluation of OFCS Hazards for VCSEL-MMF Channels”

Presenters: Jose Castro

http://www.ieee802.org/3/cm/public/May18/castro_3cm_02_0518.pdf

Provided introduction and background on laser safety and IEC 60825 series of standards that define the accessible emission limits for each laser class, laser requirements including labeling and guidelines for safe operation. Noted that IEC 60825 standards are changing and are subject to interpretation at various points.

Presented and discussed preliminary version for spreadsheet calculator for Accessible Emission Limit (AEL), Maximum Power for Hazard 1 or 1M, Hazard level. Agreed to post spreadsheet after addressing some questions raised in the meeting.

Evaluated and discussed hazard levels for 400G BASE-SR4.2 based on current IEC 60825-2 standard.

Review of Updated Presentation #2:

Paul Kolesar and Jonathan King reviewed the updated version of their presentation, “400 Gb/s 100-m 8-pair MMF objective baseline proposal”

http://www.ieee802.org/3/cm/public/May18/king_3cm_01b_0518.pdf to add AUI-16 and to assume reuse of 802.3bs KP FEC.

Straw Poll #1:

- I would support inclusion of the following connector in the MDI specifications for 400GBASE-SR8:
 - A) MPO-12 two-row with all Tx on one row and all Rx on other row (as currently used for SR10 and SR16)
 - B) MPO-16 (as currently included in QSFP-DD, not including lane numbers)
 - C) MPO-12 two-row, where half Tx and half Rx are on each row (as currently included in QSFP-DD, not including lane numbers)
- Chicago Rules – vote for as many as you support
- A) 15 B) 32 C) 24
- Room Count: 34

Straw Poll #2:

- I would support inclusion of the following number of MDIs for 400GBASE-SR8:
 - A) 1
 - B) 2
 - C) 3
- Chicago Rules – vote for as many as you support
- A) 18 B) 25 C) 4
- Room Count: 34

Motion #4:

- Move to adopt content of http://www.ieee802.org/3/cm/public/May18/king_3cm_01b_0518.pdf as baseline for the 8-pair PHY objective
 - Moved by: Paul Kolesar
 - Seconded by: Jonathan King
 - Y: 31 N: 0 A: 2 (Technical, >= 75%)
 - Motion Passes!
 - Room Count: 33

Motion #5:

- Move the inclusion of the following connectors in the MDI specifications for 400GBASE-SR8
 - A) MPO-16 (as currently included in QSFP-DD, not including lane numbers)
 - B) MPO-12 two-row, where half Tx and half Rx are on each row (as currently included in QSFP-DD, not including lane numbers)
- Moved by: Steve Swanson
- Seconded by: Jonathan King
- Y: 24 N: 4 A: 2 (Technical, >= 75%)
- Motion Passes!
- Room Count:

Straw Poll #3:

- I would support a baseline proposal for 400GBASE-SR4.2 that includes a first wavelength near 850nm and a second wavelength near
 - A) 880 nm
 - B) 910 nm
- Chicago Rules – vote for as many as you support
- A) 20 B) 18
- Room Count: 32

Straw Poll #4:

- I would support a baseline proposal for 400GBASE-SR4.2 that is based on an optical multiplexing architecture that is
 - A) Co-directional
 - B) Bi-directional
- Chicago Rules – vote for as many as you support
- A) 21 B) 22
- Room Count:

Straw Poll #5:

- For the second wavelength for 400GBASE-SR4.2
 - A) I would not support 880 nm
 - B) I would not support 910 nm
 - C) I need more information
- Only vote for one
- A) 8 B) 3 C) 12
- Room Count: 33

Straw Poll #6:

- For the optical multiplexing architecture for 400GBASE-SR4.2
 - A) I would not support Co-directional
 - B) I would not support Bi-directional
 - C) I need more information
- Only vote for one
- A) 3 B) 3 C) 18
- Room Count:

At 5:15 pm EDT (UTC -4), Robert Lingle, Jr. placed himself in discussion queue and requested Mike Dudek to temporarily act as Chair. Mr. Lingle resumed as Chair at 5:23 pm EDT.

Break for the day at 5:52 pm EDT.

Tuesday, May 22, 2018

Call to order:

Robert Lingle, Jr., Study Group Chair, convened second day of meeting at 8:32 am Eastern Daylight Time/EDT (UTC -4)

Presentation #9:

Title: "Optical Link Model for PAM-4 Multimode Channels with equalizers"

Presenter: Jose Castro

http://www.ieee802.org/3/cm/public/May18/castro_3cm_01_0518.pdf

Presentation proposed a link model for PAM-4 signals over multimode fiber. Goal is to develop a link model that is an open, portable tool – a common language. Not necessarily the most accurate and not intended as a transceiver design tool.

Extensive technical discussions, as it relates to proposed link model, on FEC, previous worst-case eye opening method vs. proposed statistical eye amplitude method, MPN, modal noise, baseline wander, eye skew, equalizers, need for experimental data validation, creating error bar, etc.

Discussion on Equation (D.1) from Slide 25 of presentation with request for additional background on derivation of equation. Potential typo for Equation (C.5), Slide 21.

Discussion on whether to form Modelling Ad Hoc. Final decision was not to form Ad Hoc group since there are no project objectives to develop a link model.

There was positive feedback on developing a link model as a teaching tool and common language.

The Chair indicated that he would allow meeting time for future presentations and collaborations to link model topic.

Review of Straw Polls and Technical Motions:

http://www.ieee802.org/3/cm/public/May18/straw_polls_and_technical_motions_3cm_0518.pdf

Straw polls and Technical Motions from previous day were reviewed.

The straw polls indicated the need for consensus building to 400 Gb/s over 4 pairs objective, 400G-SR4.2 PMD baseline.

The Chair urged the group to engage in consensus building via ad hoc meetings, reflector discussions, in-person engagement to meet goal of successfully passing motion for 400G-SR4.2 PMD baseline for July 802 Plenary 802.3cm Task Force meeting.

Motion #6:

Move to Adjourn:

- Moved by: Jonathan King
- Seconded by: Paul Kolesar
- Approved by voice vote without objection (Procedural > 50%)

The Meeting was adjourned at 11:25 am, EDT (UTC -4), Tuesday, May 22, 2018.

Next Meeting:

Next in-person IEEE 802.3cm Task Force meeting is scheduled for week of July 9th, 2018 for IEEE 802 Plenary, San Diego, CA, US.

Appendix A: Attendees at the IEEE 802.3 400 Gb/s over Multimode Fiber Task Force, 21-22 May, 2018.

35 individuals signed in over both days.

34 signed in on Monday, 21 May, 2018. 25 signed in on Tuesday, 22 March, 2018.

	Last Name	First Name	Employer	Affiliation	21-May-2018	22-May-2018
1	Abbott	John	Corning, Inc.	Corning, Inc.	x	x
2	Baca	Rich	Microsoft	Microsoft		x
3	Balemarthy	Kasyapa	OFS	OFS	x	x
4	Bhatt	Vipul	Finisar	Finisar	x	x
5	Castro	Jose	Panduit Corp.	Panduit Corp.	x	x
6	Chen	David	AOI	AOI	x	
7	Choudhury	Mabud	OFS	OFS	x	x
8	Dawe	Piers	Mellanox	Mellanox	x	
9	Dudek	Mike	Cavium	Cavium	x	
10	Filip	Jan	Maxim Integrated	Maxim Integrated	x	
11	Goldberg	Jonathan	IEEE	IEEE	x	
12	Hasharoni	Kobi	DustPhotonics	DustPhotonics	x	x
13	Ingham	Jonathan	Foxconn Interconnection Technology	Foxconn Interconnection Technology	x	x
14	King	Jonathan	Finisar	Finisar	x	x
15	Kolesar	Paul	CommScope	CommScope	x	x
16	Kukita	Hiroaki	Yamaichi	Yamaichi	x	x
17	Lingle	Robert	OFS	OFS	x	x
18	Maki	Jeffery	Juniper Networks	Juniper Networks	x	
19	Masuda	Takeo	OITDA/PETRA	OITDA/PETRA	x	x
20	Murray	Dale	LightCounting	LightCounting	x	x
21	Murty	Ramana	Broadcom	Broadcom	x	x
22	Neveux	Paul	Superior Essex	Superior Essex	x	x
23	Palkert	Tom	Molex/Macom	Molex/Macom	x	
24	Parsons	Earl	CommScope	CommScope	x	x
25	Pham	Phong	US Conec	US Conec	x	x
26	Piehler	David	Dell EMC	Dell EMC	x	x
27	Pimpinella	Rick	Panduit Corp.	Panduit Corp.	x	x
28	Sayre	Edward	Samtec	Samtec	x	
29	Swanson	Steve	Corning, Inc.	Corning, Inc.	x	x
30	Vanderlaan	Paul	Berk-Tek	Berk-Tek	x	x
31	Wessels	Rob	CommScope	CommScope	x	x
32	Xi	Huang	Huawei	Huawei	x	
33	Young	Adrian	Leviton	Leviton	x	x
34	Young	James	CommScope	CommScope	x	x
35	Zivny	Pavel	Tektronix	Tektronix	x	
					34	25