Meeting Minutes

Group: IEEE 802.3 100G-EPON Task Force

Event: Task Force Plenary meeting

Date: **From**: 25 Jul, 2016 **To**: 27 Jul 2016

Location: San Diego CA USA

25 July 2016

1:05 PM – The meeting was called to order by the Working Group Chair. Duane Remein volunteered to serve as recording secretary. The Chair held Introductions and gave the opening report.

Motion #1
Approve the agenda for Task Force meeting to be held July 25-27, 2016, in San Diego located in file http://www.ieee802.org/3/ca/public/meeting_archive/2016/07/agenda_3ca_1_0716.pdf
Moved: Marek Hajduczenia Seconded: Phil Miguelez
Procedural > 50% Passed by voice without opposition

Motion #2
Approve the meeting minutes from Task Force meeting held May 24-25, 2016, in Whistler, BC, in file: http://www.ieee802.org/3/ca/public/meeting_archive/2016/05/minutes_unapproved_3ca_0516.pdf
Moved: Duane Remein Seconded: Alan Brown
Procedural > 50% Passed by voice without opposition

The Chair reviewed meeting decorum, the Task Force reflector & WEB page, and IEEE Organization & Bylaws. The IEEE patent policy was read.

1:17 PM –A call for patents was made. No response was received.

The Chair reviewed the IEEE process, goals for meeting, and future meeting (Ft. Worth in Sept., San Antonio Nov.) polls were taken.

Presentations and Discussion

1:30 AM –Presentations

All presentation information is formatted as follows:

Title	**Author/Presenter**	**Affiliation**
Notes		
file_name		
25/50/100G PON optical vendor input	**Ed Harstead**	**Nokia**

This presentation summarized input received from various optical component vendors to questions posed by the presenter. Questions covered laser cost, launch power, extinction ratio, wavelength tolerance, channel spacing, wavelength blocking filter cost.
harstead_3ca_1a_0716.pdf

25G power budget: 2nd iteration, downstream
Ed Harstead **Nokia**
This presentation suggested parameter values for launch power, and extinction ratio based on the data presented in harstead_3ca_1a_0716.pdf.
harstead_3ca_2_0716.pdf

Unification of 25G receiver sensitivity for 100G EPON
Hanhyub Lee **ETRI**
This presentation examined the values provided for receive sensitivity in previous contributions and found a wide variance in sensitivity versus extinction ratio. It was suggested that common experimental conditions be selected for all future contributions.
lee_3ca_2_0716.pdf

Component Capabilities for NG-EPON **John Johnson** **Broadcom**
This presentation examined BOSA cost/complexity in going from 10/10G to 25/10G and finally 25/25G capability.
johnson_3ca_2_0716.pdf

Further consideration of 25G DML transmission (including temperature dependency)
Naruto Tanaka **Sumitomo Electric**
This presentation reviewed impact of extinction ratio vs temperature and launch power on the total dispersion penalty for DML transmitters.
tanaka_3ca_1_0716.pdf

The Impact of Differential Pre-coding on 25-Gb/s EDB, NRZ, and NRZ-NFC
Dekun Liu **Huawei Technologies**
This presentation provided input on potential issues using pre-coding (see houtsma_3ca_1_0516.pdf) on some potential receiver technologies depending on the dispersion present. It was suggested that a decision on pre-coding be deferred.
liu_3ca_5_0716.pdf

Proposal for 25Gb NRZ PMD **Yong Guo** **ZTE Corporation**
This presentation suggested optical budget parameters for both downstream and upstream. The downstream wavelength plan suggested is in the O+ band (~1340 / 800GHz spacing) and upsteam plan is in the O- band (also 800 GHz spacing)
guo_3ca_1_0716.pdf

100G-EPON Configurations **Glen Kramer** **Broadcom**
This presentation provided an architectural overview showing that, by specifying a 100 Gbps system, 50 Gbps or 25 Gbps systems can be included by omitting features (channels) of the 100 Gbps system. This

presentation was first shown on a conference call held on 6/23/16.
kramer_3ca_1_0716.pdf

25G- to 50G- to 100G-EPON Upgrade Scenarios

Glen Kramer **Broadcom**

This presentation expanded on the concepts provided in kramer_3ca_1_0716.pdf to show how capacity could be expanded through various upgrade scenarios. It was also argued that the "1+4" model was higher cost then the "1+3" model.
kramer_3ca_2_0716.pdf

25G/50G/100G EPON architectures: 1+3 vs. 1+4

Bill Powell **Nokia**

This presentation compared "1+4" vs"1+3" architectures.
powell_3ca_1_0716.pdf

6:22 PM – recessed for the day.

25 July 2016

8:03 AM – reconvened. After a short discussion on the implications of 1+3 vs 1+4 on the standardization process the TF continued presentations.

Considerations for 100G EPON Standardization

James Zhang (presented by Phil Miguelez, Comcast) **China Telecom**

This joint presentation covered deployment requirements and development preferences from the perspective of China Telecom and Comcast.
zhang_3ca_1_0716.pdf

The Needs for Standalone 25G EPON **Eugene Dai** **Cox Communications**

This presentation argued that a 4x25G system should be allowed, assuming that all 25G channel operate on the same wavelength.
dai_3ca_3_0716.pdf

100G EPON wavelength plan consideration **Dekun Liu** **Huawei Technologies**

This presentation examined the guard band and spectrum width necessary for an uncooled laser. It was suggested that a 10nm guard band is needed while a 16nm spectral width is challenging for extended temperature.
liu_3ca_3_0716.pdf

25G/50G/100G EPON wavelength plan: if all wavelengths in O-band

Ed Harstead **Nokia**

This presentation explored wavelength plans and suggested placing one channel (low cost 25G) in O-Band (upstream & downstream) and remaining 3-4 channels in S/C/L Bands.
harstead_3ca_3_0716.pdf

Consideration on optical crosstalk and required wavelength block filter for receiver

Tomoyuki Funada **Sumitomo Electric**

This presentation examined WDM filter requirements given 800GHz channel spacing. The conclusion was that such filters are feasible for both ONU and OLT.
funada_3ca_1_0716.pdf

Consideration of WDM filter loss for 100G EPON

Hanhyub Lee ETRI

This presentation considered the wavelength filter required for the 100G system. It was noted that the target channel insertion loss figures for LAN-WDM filters is 1.5 dB. Also it was concluded that the WDM filter losses need to be included in the 100G optical budget.
lee_3ca_1_0716.pdf

LD cost comparison for typical wavelength plans

Wanhui (Wilson) He Accelink Technologies Co., Ltd.

This presentation reviewed several wavelength plans. The conclusions are that all upstream channels should all be in the O-Band, a 1+3 architecture is preferred and a cooled DML with a 6 nm spectrum width is preferred.
he_3ca_1_0716.pdf

12:07 PM – recessed for lunch, reconvened at 1:35 PM.

Four-wave mixing impact in O-band Dekun Liu Huawei Technologies

This presentation provided an analysis of four wave mixing (FWM) simulation results for 100, 200 & 400 GHZ channel spacing. The conclusion is that, for these very close channel spacing's in O-Band there would be some potential for issues with FWM. The effects of FWM will be insignificant outside the zero dispersion band (~1300-1320) and with launch power < ~10 dBm and with larger channel spacing's (≥ ~800GHz).
liu_3ca_1_0716.pdf

Four-wave mixing in O-band for 100G EPON

John Johnson Broadcom

This presentation was first provided for the conference call on July 6 2016. The material covers FWM in the O-Band from a theoretical point of view considering fiber properties, phase matching, launch power, polarization, and channel spacing.
johnson_3ca_1_0716.pdf

Analytical investigation of FWM for O-band multi-channel transmission

Hwan Seok Chung ETRI

This presentation gave an analysis of FWM. The conclusion is that for Channel spacing's greater than 400 GHz crosstalk due to FWM should be less than 30 dB.
chung_3ca_1_0716.pdf

De-skew Method for 100G EPON Downstream Channels

Duane Remein Huawei Technologies

This presentation illustrated a mechanism to deskew data from an ONU by aligning FEC CWs at the transmitter and measuring the FEC CW arrival time at the receiver. The mechanism could be extended

to account for skew greater than one FEC CW by using a modified sync word in the FEC CW. The measured skew can then be used to realign the data leaving the OLT PHY.
yin_3ca_1_0716.pdf

Fragmentation - one option **Duane Remein** **Huawei Technologies**
This presentation outlined a method of upstream channel bonding with fragmentation by striping data in FEC CW blocks in a fragmentation layer above the RS (or included in the RS). Fragment markers would be used to identify which channel(s) contain fragments for the LLID. It was noted that the receiver will need buffering sufficient to hold one max size frame (minus one fragment) for each LLID handled by the OLT.
remein_3ca_3_0716.pdf

Bonding with FEC codewords **Frank Effenberger** **Huawei Technologies**
This presentation outlined a method of upstream channel bonding with fragmentation by striping data in FEC CW blocks in the PHY. The PHY would determine which lanes to use by monitoring multiple MII interfaces (1 each 25GMII, 50GMII, and 100GMII).
effenberger_3ca_2_0716.pdf

Channel Bonding in Reconciliation Sublayer (Upstream Direction)
Glen Kramer **Broadcom**
This presentation detailed a channel bonding solution based on marking each FEC CW in a modified RS layer. Marking consisted of a Sequence number and an LLID value.
kramer_3ca_3_0716.pdf

6:15 PM recessed for the day

25 July 2016

8:07 AM – reconvened, continued presentations.

2D Scheduling for 100G EPON **Eugene Dai** **Cox Communications**
This presentation discussed scheduling in both time (current 10G-EPON model) and across some number of channels.
dai_3ca_1_0716.pdf

Two-color Grants for 100G EPON Channel Bonding
Eugene Dai **Cox Communications**
This presentation suggested grants only be issued in two sizes; small & large.
dai_3ca_2_0716.pdf

100G EPON downstream solution analysis and comparison
Dekun Liu **Huawei Technologies**
This presentation examined several options for operating in S/C/L-Bands using Electrical Duo Binary and Optical Duo Binary modulation. Comparison cost for each option was provided using an O-Band NRZ scheme as baseline cost (x). The conclusion was that EDB is the lowest cost (~1.7x) whereas both NRZ (O-Band) and ODB are about the same (~2.3x).
liu_3ca_4_0716.pdf

100G EPON coexistence discussion **Dekun Liu** **Huawei Technologies**

This presentation explored several options to specify coexistence between 25G upstream and 10G upstream. The conclusion was that a WDM mechanism is preferred.

liu_3ca_2_0716.pdf

Objectives **Duane Remein** **Huawei Technologies**

This presentation suggested a clarification to the objective specifically calling for coexistence with 10/10G-EPON and not 10/1G-EPON.

remein_3ca_1_0716.pdf

802.3ca Terms & Definitions **Glen Kramer** **Broadcom**

This presentation suggested some naming conventions.

kramer_3ca_4_0716.pdf

A rough workplan "nudge" to 100G, 50G, and 25G NGEPON

Mark Laubach **Broadcom LDT**

This presentation from the floor addressed a work plan that the Task Force can follow to progress the work needed to complete.

laubach_3ca_1_0716.pdf

12:05 PM recessed for lunch. Reconvened at 1:33 PM.

Motion #3

The Task Force agrees that "10G-EPON" in our Objectives means 10/10G-EPON and specifically does not include 10/1G-EPON. Furthermore, "concurrent operation" applies to either TDM or WDM coexistence.

Moved: Duane Remein Seconded: Marek Hajduczenia

For: 25 Against: 0 Abstain: 2

Technical ≥ 75% Passed

At the time of Motion #3 there were 29 people in the room.

Motion #4

Accept upstream channel bonding in Reconciliation Sublayer as presented in kramer_3ca_3c_0716.pdf with the modification that includes just-in-time FEC codeword prefetch. Develop similar mechanism for downstream. This motion supersedes motion #6 from Macau.

Moved: Glen Kramer Seconded: Duane Remein

For: 22 Against: 1 Abstain: 4

Technical ≥ 75% Passed

Motion #5

The 802.3ca standard shall specify wavelengths for 25G, 50G, and 100G systems in O-band.

Moved: Marek Hajduczenia Seconded: Kevin Noll

For: 0 Against: 100 Abstain: 0

Technical ≥ 75% Motion Tabled by Motion #6

Motion #6
Motion to Table motion #5
Moved: John Johnson Seconded: Dekun Liu
For: 15 Against: 8 Abstain: 1
Procedural > 50% Passed

Straw Poll # 1
The 802.3ca standard shall specify wavelengths for 25G, 50G, and 100G systems in O-Band.
Yes: 15
No: 0
Not enough information: 9

Those voting "Not enough information" in Straw Poll #1 suggested the following information is needed to make a decision.

1) Exact (detailed) wavelength plan including support for coexistence (TDM or WDM).
2) Full cost comparison between all O-Band and other solutions.
3) More consensuses in presentations.
4) Dispersion compensation analysis of all solutions.
5) Full power budget for full 100G system (including mux losses) and what is needed to close the gap.

Straw Poll # 2
I prefer:
1+3 solution: 17
1+4 solution: 3
Need more information: 7

Motion #7
All 25G ONUs and 25G OLTs shall use the same wavelength pair, which is also used by 100G ONUs and 100G OLTs.
Moved: Glen Kramer Seconded: Phil Miguelez
For: 16 Against: 6 Abstain: 3
Technical ≥ 75% Failed

Straw Poll # 3
100G EPON wavelength plan should consider the cost optimization of 25G and 100G simultaneously.
Agree: 22
Disagree: 0
No opinion: 2

Motion #8
A proposal on wavelength plan in Task Force should consider 25G EPON and 100G EPON simultaneously.
Moved: Dekun Liu Seconded: David Li
For: Against: 100 Abstain:
Technical ≥ 75% Motion tabled by Motion #9

Motion #9
Motion to table motion #8.
Moved: Duane Remein Seconded: Marek Hajduczenia
Procedural > 50% Passed by voice without opposition

Motion #10
Accept names for the PHYs as shown in kramer_3ca_4a_0716.pdf, slide #7.
Moved: Glen Kramer Seconded: Duane Remein
For: 24 Against: 0 Abstain: 0
Technical ≥ 75% Passed

Wavelength Plan Inventory as of 7/27/16 Glen Kramer Broadcom LDT
The Task Force jointly compiled this list of potential wavelength plans. Several participants volunteered to provide full details on each plan outlined by the next meeting.
kramer_3ca_5_0716.pdf

The Chair gave a closing report.

Proposal of evaluation condition of 25 Gbps APD receiver
Hanhyub Lee ETRI
This presentation outlined parameters which need to be determined in order to properly assess the PMD optical specifications for NG-EPON.
lee_3ca_2_0716.pdf

Motion #11
Move to adjourn.
Moved: Frank Effenberger Seconded: Mark Laubach
Procedural > 50% Passed by voice without opposition

6:22 PM The meeting was adjourned.

The following presentations were submitted for the meeting but, for the reasons given were not presented. All are available on the Task Force Web site.

PMD call for contributions Frank Effenberger Huawei Technologies
This presentation, covered in a conference call, was not given in order to save time during the face to face meeting.
effenberger_3ca_1_0716.pdf

Dispersion Tolerance Measurements @ 1330 nm 25G NRZ/Duobinary with DML
Vincent Houtsma Nokia Bell Labs
This presentation was provided for reference only and was not reviewed during the meeting.
houtsma_3ca_1_0716.pdf

FWM Simulations in O-band Dora van Veen Nokia Bell Labs

This presentation was provided for reference only and was not reviewed during the meeting.
van_veen_3ca_1_0716.pdf

Co-existence with Legacy & NG-EPON **Moonsoo Park** **KT**
This presentation was not reviewed as the author was unable to attend the meeting.
park_3ca_1_0716.pdf

Draft Material for RS **Duane Remein** **Huawei Technologies**
This presentation was deferred by the author indefinitely.
remein_3ca_2_0716.pdf

Attendance

Family Name	Given Name	Affiliation	25-Jul	26-Jul	27-Jul	Meeting Days
Brown	Alan	CommScope	x	x	x	3
Chang	Ayla	Huawei	x			1
Chang	Frank	Inphi	x	x		2
Chung	Hwan Seok	ETRI	x	x	x	3
Dai	Eugene	Cox Communication	x	x	x	3
Effenberger	Frank	Huawei	x	x	x	3
Funada	Tomoyuki	Sumitomo	x	x	x	3
Gong	Zhigang	O-Net	x			1
Guo	Yong	ZTE Corp	x	x	x	3
Hajduczenia	Marek	Charter	x	x	x	3
Harstead	Ed	Nokia	x	x	x	3
He	Wanhui (Wilson)	Accelink	x			1
Howald	Robert	Comcast		x	x	2
Ishibe	Kazuhiko	Anritsu	x	x		2
Johnson	John	Broadcom LTD.	x	x	x	3
Knittle	Curtis	CableLabs	x	x	x	3
Kramer	Glen	Broadcom LTD.	x	x	x	3
Lackner	Hans	QoSCom GmbH	x			1
Laubach	Mark	Broadcom LTD.	x	x	x	3
Lee	Hanhyub	ETRI	x	x	x	3
Li	David	Ligent	x	x	x	3
Li	Weiqi	II-VI Photonics	x	x		2
Liu	Dekun	Huawei	x	x	x	3
Liu	Quan	KITT/CAICT		x	x	2
Lokhandwala	Moiz	Charter / Time Warner Cable	x		x	2
Miguelez	Phil	Comcast	x	x	x	3
Mooney	Paul	Sprint	x			1
Noll	Kevin	Charter / Time Warner Cable		x	x	2
Parsons	Earl	CommScope	x	x	x	3
Peters	Michael	Sumitomo	x	x	x	3
Powell	Bill	Nokia	x	x	x	3
Remein	Duane	Huawei	x	x	x	3
Salinger	Jorge	Comcast	x	x	x	3
Suzuki	Ken-Ichi	NTT	x	x	x	3
Tanaka	Naruto	Sumitomo	x	x	x	3
Tucker	Ryan	Charter	x	x	x	3
Umnov	Alexander	Corning	x	x	x	3