Minutes

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

Plenary Meeting
March 12-14, 2019
Vancouver, BC, Canada

Prepared by Kent Lusted

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IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – March 12, 2019

Prepared by Kent Lusted

IEEE P802.3ck 100 Gb/s, 200 Gb/s and 400 Gb/s Electrical Interfaces Task Force meeting convened at ~8:05 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/19_03/agenda_3ck_01a_0319.pdf

David Law appointed Kent Lusted as the Vice-Chair for the IEEE 802.3ck Task Force, subject to confirmation by the Task Force.

Motion #1:
Move to confirm Kent Lusted as the IEEE 802.3ck Task Force Vice Chair.
M: Mark Nowell
S: Rich Mellitz
Y: 45 N: 0, A: 0
Motion passes!

Beth Kochuparambil thanked Kent Lusted for serving in this position.

Motion #2:
Move to approve the agenda:
- Moved by: Mike Dudek
- Second by: Rita Horner
- Passed by voice without opposition

Chair noted that the January 2019 minutes were posted shortly after the meeting. Chair noted that typos and attendance mixup was found in the original posting. The edited update was posted to the website weeks ago. Chair asked if there were any other corrections or modifications to be noted. No one responded.

Motion #3:
Move to approve the January 2019 meeting minutes

- Moved by: Mike Dudek
- Second by: Steve Sekel
- 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/19_03/agenda_3ck_01a_0319.pdf

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

IEEE Patent Policy: Chair reviewed the 4 Patent-related slides contained in the agenda. Chair called 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 requirements for 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 email 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.

Goals for the meeting:
- Technical discussions working towards baseline consensus
- Adopt baselines where consensus is close or already formed
- Understand direction or next step towards baseline adoption in May

Chair noted that no liaison letters were received.

Chair reviewed the presentation schedule. Chair noted that she received late presentations from Mike Li and Chris Diminico. Chair noted that the contribution from Piers Dawe has not been received and will be stricken from the agenda at this time. Chair asked if there was opposition to the late presentations. No one responded. Chris Diminico asked that his presentation come after the contributions from Nathan Tracy and Tom Palkert. No objection.

Chair reviewed the future meeting dates.

Future Meetings:
- May 2019 Interim
  - Week of May 20, 2019 - Salt Lake City, UT, USA
- July 2019 Plenary
  - Week of July 15, 2019 - Vienna, Austria
- September 2019 Interim
  - Week of September 9, 2019 – Indianapolis, Indiana

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

Chair reviewed the proposed ad hoc meeting schedule. Chair will announce ad hoc dates over the email reflector.

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

Presentation #1:

"Editorial Considerations", Howard Heck on behalf of Matt Brown

See: http://www.ieee802.org/3/ck/public/19_03/brown_3ck_01_0319.pdf

- Vice-Chair thanked the editors and advisors for their willingness to work on the specification.
- Vice-Chair asked participants to include the relevant editor in their baseline proposal discussions. He also asked participants to continue working on baselines to make them as complete as possible in order to minimize the ambiguity for the editors.

Presentation #2:

"QSFP-DD 2m Cable Channels", Tom Palkert

See: http://www.ieee802.org/3/ck/public/19_03/palkert_3ck_01a_0319.pdf

- Updated version '01a' with additional supporters
- Discussed the proposed increase in assembly budget and the potential impacts.
- Discussed the need for a more realistic host end channel.
- Discussed the temperature impact to the bulk cable loss.
- The COM configuration sheet on slide 21 highlights in yellow the changes from COM v2.57 default values.

Presentation #3:

"100G OSFP Cable Assemblies", Nathan Tracy

See: http://www.ieee802.org/3/ck/public/19_03/tracy_3ck_01a_0319.pdf

- Updated version '01a' with additional supporters
- Discussed the expected impact of manufacturing deviation on the data.
- It was noted that a 2m 26AWG contribution was planned for a later date.
- There was a request to bring the worst case pair measured data.

Break at ~10:05 a.m. Resumed at ~10:25 a.m.

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

Presentation #4:

"Baseline proposal for copper twinaxial cable specifications", Chris Diminico

See: http://www.ieee802.org/3/ck/public/19_03/diminico_3ck_01_0319.pdf

- Discussed de-embedding and its implications.
- Discussed the need to continue working on the baseline details and refine the cable assembly baseline loss.

Presentation #5:
"Considerations for the Minimum COM Limit", Adam Healey
See: http://www.ieee802.org/3/ck/public/19_03/healey_3ck_01_0319.pdf
- Discussed that the TP0/TP5 reference point at the BGA balls and includes escape routing.
- Discussed the need to understand where the penalties go and if any penalties are missing.

Chair summarized key points from the copper cable related presentations: copper cable assemblies need more budget, SERDES and host have no budget to spare, alternatives exist to close the budget. Chair asked for participants to continue to discuss the topic and build consensus.

Chair asked participants to send straw poll requests to her and the Vice Chair.

Chair outlined the plans for the afternoon: C2M presentations and discussions.

Chair noted that 2 updated contributions have technical updates that she will be asking for approval to show.

Break at ~12:05 p.m. Resumed at ~1:35 p.m.

Presentation #6:
"100GEL C2M Channel Model Study Update", Hiroaki Kukita
See: http://www.ieee802.org/3/ck/public/19_03/kukita_3ck_01_0319.pdf
- Clarifying questions were asked and answered
- Presenter requested further questions be addressed via email
- Supporting s-parameters to be sent to chair for posting next week.

Presentation #7:
"100G C2M Channel Model Update", Jane Lim
See: http://www.ieee802.org/3/ck/public/19_03/lim_3ck_01a_0319.pdf
- Channels posted at
  http://www.ieee802.org/3/ck/public/tools/c2m/lim_3ck_01_0319_c2m.zip
- The ASIC ball pitch was assumed to be ~1mm. The thru-via has a 10mil stub after backdrilling.
- COM values on slide 9-10 are given for TP1a, not TP4.

Presentation #8:

"Draft Baseline Proposal for 100GAUI-1/200GAUI-2/400GAUI-4 C2M", Phil Sun

See: http://www.ieee802.org/3/ck/public/19_03/sun_3ck_03_0319.pdf

- Discussed the ERL and VEC values.

Presentation #9:

"Baseline Proposal for "100 Gb/s, 200 Gb/s, and 400 Gb/s Chip-to-Module Attachment Unit Interface", Mike Li

See: http://www.ieee802.org/3/ck/public/19_03/li_3ck_02b_0319.pdf

- Updated version '02b' with technical changes. The prior versions were held up due to the Chair's need to confirm a portion of the document. There was no opposition to hearing the updated version.
- Slide 20 was the HCB and MCB printed circuit board loss.
- Discussed the DC common mode input voltage requirement.

Adam Healey announced that IEEE 802.3 voters with badges that do not have the red "3" should go to registration and get new badges.

Break at ~3:25 p.m. Resumed at ~3:55 p.m.

Vice-Chair reminded participants to sign into the IEEE Meeting Attendance Tool and the attendance book. Chair noted that she intends to meet until 6:00 p.m.

Presentation #10:

"100GE/200GE/400GE C2M Simulation Update", Phil Sun

See: http://www.ieee802.org/3/ck/public/19_03/sun_3ck_01_0319.pdf

- It was noted that TP4 uses 2 precursors and TP1a results has 3 precursors.
- Discussed the module-side package parameter assumptions for Cd and Cp.

Presentation #11:

"C2M Simulation", Ali Ghiasi

See: http://www.ieee802.org/3/ck/public/19_03/ghiasi_3ck_01a_0319.pdf

- Updated version '01a' with technical changes. There was no objection to showing this update.

- Discussed the need to run end-end C2M simulations using the TXFFE values optimized for TP1a, not for the whole link.

Presentation #12:
"106 Gbps C2M Simulation Updates", Mike Li
See: http://www.ieee802.org/3/ck/public/19_03/li_3ck_01a_0319.pdf
- Updated version '01a' with a typo change.
- On slide 17, the eye diagrams with ST1 and SR1 use a non-IEEE package. There was a request to calculate the COM for this channels.

Vice Chair summarized key points from the discussion: two C2M baseline proposals were reviewed, several channels challenge all of the proposed reference receives, great progress and more work to do. Strawpolls and possible motions on C2M will be tabled to Thursday. Kent made a request for information from the floor for what is missing from the baselines: values for TBD, need common base for the module package.

Chair noted that Wednesday will be focused on Backplane and FEC. Chair announced a start time of 8:30 a.m. on Wednesday.

Break for the day at ~6:00 p.m.

IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – March 13, 2019

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.

Chair welcomed attendees.

Chair outlined the plans for the day: hear backplane and FEC presentations and hold discussions.

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

Chair noted that she received an updated presentation from Mau-Lin Wu with a technical update and will be asking for permission before his presentation.

Presentation #13:
"Baseline Proposal for 100, 200 and 400 Gb/s Backplane", Howard Heck
See: http://www.ieee802.org/3/ck/public/19_03/heck_3ck_02_0319.pdf
- Discussed the TX equalizer step size assumptions.
- Discussed a few errors on slide 12: 87.5ohm and 32mm package length. Author will send updated version with these corrections.

Presentation #14:
"COM Parameters Proposal for KR", Mau-Lin Wu
See: http://www.ieee802.org/3/ck/public/19_03/wu_3ck_01b_0319.pdf
- Updated version '01b' with technical changes. There was no objection.
- Discussed the TX FIR settings on slide 25.
- Similarities was seen between Mau-Lin's work and Howard's work
- Discussed feedback on the ranges and effects of some metrics tested

Presentation #15:

"Ethernet 106 Gb/s ERL Studies", Mike Li

See: http://www.ieee802.org/3/ck/public/19_03/li_3ck_03_0319.pdf

- Several audience members spoke up in support of this as a baseline, but acknowledged that more work is needed
- Discussed the proposed ERL limit.

Break at ~10:05 a.m. Resumed at ~10:30 a.m.

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

Presentation #16:

"Floating Tap Benefit for Backplane Channels", Howard Heck

See: http://www.ieee802.org/3/ck/public/19_03/heck_3ck_01_0319.pdf

- Discussed the tradeoff of floating taps vs. a larger number of taps.

Beth summarized the discussion on the backplane related presentations: heck_3ck_02_0319 was a good starting point, there is consensus to use ERL but proposal needs more work. She noted that Howard Heck intends to update his backplane baseline presentation with feedback from the floor for a possible straw poll or motion on Thursday.

Floor was opened for backplane discussion. Beth was working on straw poll language for backplane, particularly on reference receiver choices, for Thursday.

Presentation #17:

"Analysis of Potential Solutions for 100G CR/KR DFE Error Propagation", Louis Lu

See: http://www.ieee802.org/3/ck/public/19_03/lu_3ck_02_0319.pdf

- Discussed the feasibility of the list of solutions on slide 19.

Chair noted there there was a technical update to the presentation from Xiang He. She will be asking for permission to hear it.

Chair noted that there is a hard stop tonight of 6:00 p.m. due to the social event. She also noted that there was a potential late presentation related to the PCS/FEC baseline.

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

Break at ~12:10 p.m. Resumed at ~1:20 p.m.

Presentation #18:
"Error Statistics Analysis on 802.3ck Channels", Xiang He
See: http://www.ieee802.org/3/ck/public/19_03/he_3ck_01a_0319.pdf
- Updated version '01a' with technical changes. No objection.
- The error statistics are PAM4 symbols.
- There was a request to repeat the experiment with pre-coding turned on.

Presentation #19:
"RS(544,514) FEC performance for RR/CR 100G and 400G", Pete Anslow
See: http://www.ieee802.org/3/ck/public/19_03/anslow_3ck_01_0319.pdf
- Discussed ways to constrain the tap weights to minimize error propagation.
- Discussed interaction between tap weight constraints and channels. Discussed the channels used.

Presentation #20:
"New Insights on DFE Burst Error Impact for 100G KR/CR FEC", Ilya Lyubomirsky
See: http://www.ieee802.org/3/ck/public/19_03/lyubomirsky_3ck_01a_0319.pdf
- Updated version '01a' with changes. No objection.
- Discussed the impact of SNR on the error statistics.
- Discussed an interdependence of the tap weights from one another.

Break at ~2:35 p.m. Resumed at ~2:55 p.m.

Chair noted that she received a late presentation request from Mark Gustlin on PCS/FEC/PMA baseline proposal based on Task Force consensus. She will be asking for permission to hear it. She also intends to discuss Cd before breaking for the day and that Thursday's schedule was full.

Presentation #21:
"Error Statistics and 100GE FEC Schemes", Phil Sun
See: http://www.ieee802.org/3/ck/public/19_03/sun_3ck_02_0319.pdf
- Discussed the conditions of the work that was referenced on slide 4. More clarification may be needed.

Presentation #22:
"Elimination of DFE Error Propagation and Post-FEC Error Floor (Precoding 2.0)", Louis Lu

See: http://www.ieee802.org/3/ck/public/19_03/lu_3ck_01_0319.pdf
- Clarifying questions were asked and answered.

Chair provided a summary from the FEC and error related presentations: more study is needed for 100GBASE-CR1/KR1, options getting wider vs. narrower, lots of great work to date. Chair reminded participants of the goal of a baseline proposal adopted at the May 2019 interim meeting.

Chair asked if there was opposition to Mark Gustlin's late presentation showing consensus on the PCS/PMA/FEC baseline proposal. No one responded.

Presentation #23:
"PCS, FEC, and PMA sublayer Baseline Proposal", Mark Gustlin
See: http://www.ieee802.org/3/ck/public/19_03/gustlin_3ck_01_0319.pdf
- Discussed the inclusion of C2C.

Straw Poll #1:
I support adopting gustlin_3ck_01_0319
Y: 36 N: 0   A: 22

Motion #4:
Move to:
- Adopt Clause 119 as the PCS/FEC and Clause 120 as the PMA for all 200 Gb/s and 400Gb/s interfaces for this project (AUIs, backplane and copper cable interfaces).
- Adopt Clause 82 as the PCS, Clause 91 as the FEC RS(544,514), and Clause 135 as the PMA for 100 Gb/s Attachment Unit interface (Chip-to-module) for this project.

M: Mark Gustlin
S: Dave Ofelt
Technical (>=75%),
Y: 41   N: 0 A: 15
Results: passes 4:22 p.m.

The room count was 61.

Attendance straw polls:
I will attend the IEEE 802.3ck meetings at the May interim in Salt Lake City, UT, USA (week of May 20, 2019)
        Y: 39, M: 16
I will attend the IEEE 802.3ck meetings at the July Plenary in Vienna, Austria (week of July 15, 2019)
        Y: 36 , M: 16

Presentation #24:

"Correlation of On-Die Termination to C_d Value in COM Model", Mau-Lin Wu

See: http://www.ieee802.org/3/ck/public/19_03/wu_3ck_02_0319.pdf

- Discussed the results.

Presentation #25:

"Correlating COM's Excessive Capacitance C_Die Value to Measurements", Liav Ben-Artsi

See: http://www.ieee802.org/3/ck/public/19_03/benartsi_3ck_01_0319.pdf

- On slide 4, the scale was purposely not given. The X axis is time.
- It was noted that these waveform responses represents typical conditions.

Straw poll #2:

I would support a TX Cd value of:

    A: <100fF
    B: 110fF
    C: 130fF
    D: >130fF

{pick one}

A: 1 B: 14   C: 12   D: 5

The straw poll #2 was targeted for the host-side package parameters, not the module-side package.

Straw poll #3:

I would support a RX Cd value of:

    A: 85fF
    B: 110fF
    C: 130fF
    D: >130fF

{pick one}

A: 1   B: 18,   C: 15   D: 1

The straw poll #3 was targeted for the host-side package parameters, not the module-side package.

Presentation #26:

"Exploring System Noise for Usage in COM", Rich Mellitz

See: http://www.ieee802.org/3/ck/public/19_03/mellitz_3ck_01_0319.pdf

- Discussed the various noise elements.
- The eta_0 element as currently defined is not attenuated by the package.

Chair reminded participants to sign into IMAT.

Chair confirmed an 8:00 a.m. start time on Thursday. Chair reviewed the plans for Thursday: 3 late presentations (by Howard Heck, Phil Sun, and Piers Dawe), straw polls and motions. Chair asked if there was objection to hearing these presentations tomorrow. No one responded. Priority will be given towards baseline adoption.

Break for the day at ~6:00 p.m.

IEEE P802.3ck 100 Gb/s Electrical Lane Task Force – March 14, 2019

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.

Chair outlined the plans for the day: hear presentations, conduct straw polls, closing business.

Chair noted that she will prioritize presentations and discussions that progress the Task Force towards baseline adoption in May.

Presentation #27:
"ERL Feature Additions Required for C2M in COM 2.60", Rich Mellitz
See: http://www.ieee802.org/3/ck/public/19_03/mellitz_3ck_02_0319.pdf
- Discussed the various version of COM and the impact to the results.

Presentation #28:
"IEEE 802.3ck C2M Baseline Proposal", Phil Sun
See: http://www.ieee802.org/3/ck/public/19_03/sun_3ck_04a_0319.pdf
- Updated version '04a' with technical changes. No objection
- This is a co-authored presentation that combined the previous baselines in this space.
- It was noted that magenta text are values to be confirmed and will have notes in the draft.
- There was much discussion on the various proposed values. Changes would be incorporated into a future version.

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

Presentation #29:
"Baseline Proposal for 100, 200, and 400 Gb/s Backplane (Update)", Howard Heck
See: http://www.ieee802.org/3/ck/public/19_03/heck_3ck_03a_0319.pdf
- Updated version '01a' with technical changes. There was no objection.

- This is a co-authored presentation that combined feedback and input offline to the baseline presented on Wednesday. It was noted that the items in the presentation with circles highlight the changes from yesterday's presentation.
- There was much discussion on the various proposed values. Changes would be incorporated into a future version.

Chair summarized the status of the backplane baseline development and prior straw polls on the topic. She noted that she had not seen more development on the FFE proposal and the lack of a decision is delaying movement forward.

Straw poll #4:
I would support a backplane DFE-based COM reference receiver.
Yes: 40   No: 0   Abstain: 26
Room count: 71

Presentation #30:
"IEEE 802.3ck C2M Baseline Proposal", Phil Sun
See: http://www.ieee802.org/3/ck/public/19_03/sun_3ck_04b_0319.pdf
- An update from the feedback given in presentation #28
- Chair announced that we would have no discussion on the following straw poll

Straw Poll #5
I support adopting sun_3ck_04b_0319 as a partial C2M baseline.
Y: 57   N: 0   A: 5

Motion #5:
Move to adopt sun_3ck_04b_0319 as a C2M baseline.
M: Phil Sun
S: Mike Li
Technical (>=75%),
Y: 61 N: 0 A: 4
Results: passes 11:24 a.m.

Presentation #31:
"Baseline Proposal for 100, 200, and 400 Gb/s Backplane (Update)", Howard Heck
See: http://www.ieee802.org/3/ck/public/19_03/heck_3ck_03b_0319.pdf
- An update from the feedback given in presentation #29

- Chair announced that we would have no discussion on the following straw poll

Straw Poll #6:
I support adopting heck_3ck_03b_0319 as a backplane baseline.
Y: 50 N: 0   A: 8

Motion #6:
Move to adopt heck_3ck_03b_0319 as a backplane baseline.
M: Howard Heck
S: Phil Sun
Technical (>=75%),
Y: 49   N: 0 A: 10
Results: passes
During the discussion of the motion, it was noted on the floor that the contribution includes a DFE based reference receiver. Chair confirmed that the motion contains the entire document.

Chair reminded participants of the forthcoming ad hoc meetings. Details will be announced over the reflector.

Chair noted that the next meeting will be the May interim. The meeting dates for the May interim were not known at the time.

Straw Poll #7:
I support C2M reference receiver models that are:
      A: Higher performance/complexity (such as sun_3ck_03_0319 slide 7, candidate A, A2 & B)
      B: Lower performance/complexity (such as sun_3ck_03_0319 slide 7, candidate C & D)
A: 15   B: 7

Chair asked participants to continue to work towards baseline proposal adoption.

Motion #7:
Move to adjourn.
M: Mike Dudek
S: Pavel Zivny
Procedural (>50%)
Passes by voice without opposition.

Meeting adjourned at ~11:55 a.m.

Attendees

Last Name	First Name	Employer	Affiliation	12-mar-2019	13-mar-2019	14-mar-2019
Anslow	Pete	Ciena Corporation	Ciena Corporation		x	x
Baden	Eric	Broadcom	Broadcom	x	x	x
Bains	Amrik	Cisco	Cisco		x	
Baumgartner	Steven	Avera Semiconductor	Avera Semiconductor	x	x	x
Beauregard	Francois	Belden	Belden	x	x	
Ben Artsi	Liav	Marvell Semiconductor	Marvell Semiconductor	x	x	x
Best	Burrell	Samtec	Samtec	x	x	x
Bouse	David	Tektronix	Tektronix	x		
Brooks	Paul	Viavi Solutions	Viavi Solutions	x	x	
Cady	Ed	Luxshare	Luxshare	x	x	
Chalupsky	David	Intel	Intel	x	x	
Chen	C. C. David	Applied Optoelectronics	Applied Optoelectronics	x	x	
Dawe	Piers	Mellanox	Mellanox	x	x	x

DiMinico	Christopher	MC Communications/Panduit	MC Communications/Panduit	x	x	
Djahanshahi	Hormoz	microsemi	microsemi	x	x	x
Dudek	Mike	Marvell Technologies	Marvell Technologies	x	x	x
Ewen	John	Avera Semiconductor	Avera Semiconductor	x	x	x
Fukuoka	Takashi	Sumitomo	Sumitomo	x		
Ghiasi	Ali	Ghiasi Quantum	Ghiasi Quantum, Huawei	x		x
Gilb	James	GA-ASI, USD, Gilb Consulting	GA-ASI, USD, Gilb Consulting		x	x
Gustlin	Mark	Cisco	Cisco		x	
Hasharoni	Kobi	Dust Photonics	Dust Photonics	x		
He	Xiang	Huawei	Huawei	x	x	x
Healey	Adam	Broadcom Inc	Broadcom Inc	x	x	x
Heck	Howard	Intel	Intel	x	x	x
Hegde	Raj	Broadcom	Broadcom	x	x	x
Holden	Brian	Kandou Bus	Kandou Bus	x	x	x
Horner	Rita	Synopsys	Synopsys	x	x	

Ingham	Jonathan	Foxconn Interconnect Technology	Foxconn Interconnect Technology		x	x
Irwin	Scott	MoSys	MoSys	x		
Ishibe	Kazuhiko	Anritsu	Anritsu		x	x
Jackson	Ken	Sumitomo	Sumitomo		x	x
Johnston	Margaret	Cadence	Cadence	x	x	
Kabra	Lokesh	Synopsys	Synopsys		x	
Kareti	Upen Reddy	Cisco	Cisco	x	x	x
Kimber	Mark	Semtech	Semtech	x	x	
Klempa	Mike	UNH-IOL	UNH-IOL	x	x	x
Kochuparambil	Beth	Cisco	Cisco	x	x	x
Kukita	Hiroaki	Yamaichi Electronics	Yamaichi Electronics	x	x	
Lambrecht	Frank	Gigamon Inc	Gigamon Inc	x	x	x
Levin	Alex	Microsoft	Microsoft	x	x	x
Li	Mike	Intel	Intel	x	x	x
Lim	Jane	Cisco	Cisco	x	x	

Liu	Hai-Feng	Intel	Intel			x
Lu	Yuchun	Huawei	Huawei	x	x	
Lusted	Kent	Intel	Intel	x	x	x
Lyubumirsky	Ilya	Inphi	Inphi		x	x
Malicoat	David	Senko	Senko	x	x	
Manor	Dor	Mellanox	Mellanox	x	x	x
Matoglu	Erdem	Amphenol	Amphenol	x	x	x
McMillan	Larry	Western Digital	Western Digital		x	
Mellitz	Richard	Samtec	Samtec	x	x	x
Murphy	Sean	Texas Instruments	Texas Instruments	x	x	x
Nakamoto	Edward	Spirent Communications	Spirent Communications	x	x	
Nicholl	Shawn	Xilinx	Xilinx		x	x
Oberg	Mats	Marvell	Marvell	x	x	x
Ofelt	David	Juniper Networks	Juniper Networks	x	x	x
Palkert	Tom	Molex - MACOM	Molex - MACOM	x	x	x

Pardo	Carlos	KDPOF	KDPOF			x
Pham	Phong	US Conec	US Conec	x		
Piehler	David	Dell EMC	Dell EMC	x		x
Pozzebon	Dino	microsemi	microsemi	x	x	x
Rabinovich	Rick	Keysight Technologies	Keysight Technologies	x	x	x
Rennie	David	Synopsys	Synopsys	x	x	x
Sayre	Edward	Samtec	Samtec	x	x	x
Sekel	Steve	Keysight Technologies	Keysight Technologies	x	x	x
Shrikhande	Kapil	Innovium	Innovium	x	x	x
Shuai	Jialong	Huawei	Huawei	x	x	x
Slavick	Jeff	Broadcom Limited	Broadcom Limited	x	x	x
Sommers	Scott	Molex	Molex	x	x	x
Stassar	Peter	Huawei	Huawei			x
Stone	Rob	Broadcom	Broadcom	x	x	x
Summers	Robert	Maxim Integrated	Maxim Integrated		x	x

Sun	Phil	Credo	Credo	x	x	x
Tailor	Bharat	Semtech	Semtech	x	x	
Takahara	Tomoo	Fujitsu Laboratories	Fujitsu Laboratories		x	x
Tooyserkani	Pirooz	Cisco	Cisco	x	x	x
Tracy	Nathan	TE Connectivity	TE Connectivity	x	x	x
Trowbridge	Steve	Nokia	Nokia			x
Ulrichs	Ed	Source Photonics	Source Photonics		x	x
Umnov	Alexander	Corning	Corning		x	
Welch	Brian	Cisco	Cisco	x	x	x
Wu	Mau-Lin	MediaTek	MediaTek	x	x	x
Zambell	Andrew	Amphenol	Amphenol	x	x	
Zebian	Sara	Google	Google	x	x	x
Zhang	Geoffrey	Xilinx	Xilinx	x	x	x
Zhang	Kevin	IDT	IDT	x	x	x