

# IEEE 802.3 WG Closing Plenary Report

IEEE 802.3  
100 Gb/s Backplane and Copper Cable  
Study Group

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Force10 Networks  
San Francisco, CA, USA, July 2011

# Reflector and Web

- To subscribe to the 100GCU reflector, send an email to:

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- Task Force web page URL:

<http://www.ieee802.org/3/100GCU/index.html>

# Study Group Private Area

- URL: <http://www.ieee802.org/3/100GCU/private/index.html>
  - Username: XXXXXX
  - Password: XXXXXXXXX
- Write it down...
- Note - The drafts within are posted for your review only, and neither the drafts nor access information should be copied or redistributed to others in violation of document copyrights.

# This Week's Progress

- $\approx$  120 Attendees
- Review of project documentation by other WGs
  - 1 Comment received
  - Responded to comment
  - Updated PAR - submission data to NesCom
- Motion to extend Study Group passed by voice vote without objection

# Review of Project Documentation

- Posted by Jon Rosdahl, Vice Chair on behalf of 802.11
  - Reference: <https://mentor.ieee.org/802.11/dcn/11/11-11-0997-00-0000-802-11-comments-on-pending-802-pars-march-2011.ppt>
- Comment:

General Comment on the length of time from Initial Sponsor Ballot to Projected Completion Date for RevCom....general rule of thumb is that for amendments, that this be at least 6 months.
- Response (see dambrosia\_01\_0711.pdf).

The submitted dates for expected submission for initial sponsor ballot (Item 4.2) and expected submission to RevCom (Item 4.3) were based on initial estimates. Based on comment, the submission date to RevCom has been updated to be Feb 2014 for the March 2014 Standards Board Meeting.

  - Motion to approve updated PAR:  
All (y/n/a): 120 / 0 / 2, 802.3 (y/n/a): 73 / 0 / 0

# Project Documentation

- All submitted documentation pending IEEE 802.3 WG approval:
  - PAR - Submitted PAR\* –  
[http://www.ieee802.org/3/100GCU/par\\_a\\_0511.pdf](http://www.ieee802.org/3/100GCU/par_a_0511.pdf)
  - 5 Criteria – Submitted Responses –  
[http://www.ieee802.org/3/100GCU/5C\\_0511.pdf](http://www.ieee802.org/3/100GCU/5C_0511.pdf)
  - Adopted Objectives –  
[http://www.ieee802.org/3/100GCU/objectives\\_0511.pdf](http://www.ieee802.org/3/100GCU/objectives_0511.pdf)
- Note – PAR updated to reflect change of RevCom submissions date at July 11 Plenary.

# Objectives

- Support full-duplex operation only
- Preserve the 802.3 / Ethernet frame format utilizing the 802.3 MAC
- Preserve minimum and maximum FrameSize of current 802.3 standard
- Support a BER of better than or equal to  $10^{-12}$  at the MAC/PLS service interface
- Define a 4-lane 100 Gb/s backplane PHY for operation over links consistent with copper traces on “improved FR-4” (as defined by IEEE P802.3ap) or better with lengths up to at least 1m.
- Define a 4-lane 100 Gb/s PHY for operation over links consistent with copper twin-axial cables with lengths up to at least 5m.

# Motion

- Change the fifth objective to:
- Define a 4-lane 100 Gb/s backplane PHY for operation over links consistent with copper traces on “improved FR-4” (as defined by IEEE P802.3ap or better materials to be defined by the Task Force) with lengths up to at least 1m.
- Mover: M. Dudek  
Second: M. Li

Technical (> 75%)

Y: 43, N: 7, A: 21

Motion passes



# Objectives (as amended)

- Support full-duplex operation only
- Preserve the 802.3 / Ethernet frame format utilizing the 802.3 MAC
- Preserve minimum and maximum FrameSize of current 802.3 standard
- Support a BER of better than or equal to  $10^{-12}$  at the MAC/PLS service interface
- Define a 4-lane 100 Gb/s backplane PHY for operation over links consistent with copper traces on “improved FR-4” (as defined by IEEE P802.3ap or better materials to be defined by the Task Force) with lengths up to at least 1m.
- Define a 4-lane 100 Gb/s PHY for operation over links consistent with copper twin-axial cables with lengths up to at least 5m.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group objectives, as per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 76 / 0 / 1
- Motion Passes

# PAR - Title

- Physical Layer specifications and Management parameters for 100 Gb/s operation over Backplanes and Copper Cables

# PAR - Scope

- The scope of this project is to specify additions to and appropriate modifications of IEEE Std 802.3 to add 100 Gb/s 4 lane Physical Layer (PHY) specifications and management parameters for operation on backplanes and twinaxial copper cables.

# PAR - Purpose

- This document will not include a purpose clause.
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
  
- Online PAR Form no longer requires a purpose statement when the draft will not include a purpose clause.

# PAR - Need

- Rapid growth of server, network, and internet traffic is driving the need for higher data rates over backplanes and high density, low cost twinaxial copper cables.
  - IEEE Std 802.3 does not currently support 100Gb/s operation on backplane media.
  - There is a market need for a lower cost, lower power, and higher density solution for twinaxial copper cables than 100GBASE-CR10.

# Broad Market Potential

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**a) Broad sets of applicability.**

**b) Multiple vendors and numerous users.**

**c) Balanced costs (LAN versus attached stations).**

- Ethernet has become widely deployed as a preferred backplane solution. Examples include Modular Servers and Enterprise and Telecom Network Equipment. Ethernet is also widely deployed over twinaxial copper cables for both intra-rack and inter-rack connections.
- Internet, cloud, and higher performance computing applications, along with advances in processors, server virtualization and converged networking, are driving the need for higher bandwidth blade and rack server connections. Increasing the backplane data rate to 100 Gb/s and providing cost effective 100 Gb/s rack server solutions are required to maintain pace with new demands.
- 120 participants attended the “100 Gb/s Ethernet Electrical Backplane and Twinaxial Copper Cable Assemblies” Call-For-Interest, representing at least 43 companies. This level of interest indicates that a standard will be developed by a large group of vendors and users.
- A 100 Gb/s Ethernet interface will maintain a favorable cost balance for backplane and twinaxial copper cable applications.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group Broad Market Potential Criterion, per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
  
- 802.3 Voters (Y/N/A): 74 / 0 / 0
- Motion Passes



# Compatibility

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- **IEEE 802 defines a family of standards. All standards should be in conformance with the IEEE 802.1 Architecture, Management, and Interworking documents as follows: IEEE 802. Overview and Architecture, IEEE 802.1D, IEEE 802.1Q, and parts of IEEE 802.1F. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1.**
- **Each standard in the IEEE 802 family of standards shall include a definition of managed objects that are compatible with systems management standards.**
- **Compatibility with IEEE Std 802.3**
- **Conformance with the IEEE Std 802.3 MAC**
- **Managed object definitions compatible with SNMP**
  
- As an amendment to IEEE Std 802.3, as amended by IEEE Std 802.3ba-2010, the proposed project will remain in conformance with the IEEE 802 Overview and Architecture, the bridging standards IEEE Std 802.1D and IEEE Std 802.1Q, and clause 80 introduced by IEEE Std 802.3ba-2010.
- The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC.
- The proposed amendment will conform to the 100 Gb/s Media Independent Interface (CGMII) specified by IEEE Std 802.3ba-2010.
- The project will include a protocol independent specification of managed objects with SNMP management capability to be provided in the future by an amendment to or revision of IEEE P802.3.1.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group Compatibility Criterion, per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
  
- 802.3 Voters (Y/N/A): 74 / 0 / 0
- Motion Passes

# Distinct Identity

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- a) Substantially different from other IEEE 802 standards.**
  - b) One unique solution per problem (not two solutions to a problem).**
  - c) Easy for the document reader to select the relevant specification.**
  - d) Substantially different from other IEEE 802.3 specifications/solutions.**
- There is no standard that supports Ethernet on backplane media at operating speeds of 100 Gb/s. While IEEE Std 802.3ba-2010 does include a specification for 100 Gb/s Ethernet on twinaxial copper cables (100GBASE-CR10) the cables are bulky and relatively costly due to the fact that they are constructed with twenty twinaxial wire pairs.
  - The standard will define at most one PHY for each medium.
  - The proposed amendment to the existing IEEE 802.3 standard will be formatted as a collection of new clauses, making it easy for the reader to select the relevant specification.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group Distinct Identity Criterion, per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 72 / 0 / 0
- Motion Passes

# Technical Feasibility

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- a) Demonstrated system feasibility.**
- b) Proven technology, reasonable testing.**
- c) Confidence in reliability.**

- Systems with an aggregate bandwidth of greater than or equal to 100 Gb/s have been demonstrated and deployed in operational networks.
- The proposed project will build on the array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation.
- Component vendors have presented data on the feasibility of the necessary components for this project. Proposals, which either leverage existing technologies or employ new technologies, have been provided.
- The reliability of Ethernet components and systems can be projected in the target environments with a high degree of confidence.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group Technical Feasibility Criterion, per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 71 / 0 / 1
- Motion Passes

# Economic Feasibility

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- a) Known cost factors, reliable data.**
- b) Reasonable cost for performance.**
- c) Consideration of installation costs.**

- The cost factors for Ethernet components and systems are well known. The proposed project may introduce new cost factors which can be quantified.
- Prior experience in the development of backplane and twinaxial physical layer specifications for Ethernet indicates that the specifications developed by this project will entail a reasonable cost for the resulting performance.
- 100 Gb/s backplane and twinaxial copper links will make it possible to achieve the desired density, power and cost targets for computer systems and network equipment.
- In consideration of installation costs, the project is expected to use proven and familiar media, including electrical backplanes, and twinaxial copper cabling technology.
- Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.

# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group Economic Feasibility Criterion, per 0711\_100GBCU\_close\_report.pdf
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 75 / 0 / 0
- Motion Passes



# Motion

- Move that 802.3 approve the 100 Gb/s Backplane and Copper Cable Study Group PAR, per par\_a\_0511.pdf ([http://www.ieee802.org/3/100GCU/par\\_a\\_0511.pdf](http://www.ieee802.org/3/100GCU/par_a_0511.pdf))
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 76 / 0 / 0
- Motion Passes

# Motion

- Move that the 802.3 Working Group submit the IEEE P802.3bj PAR and 5 Criteria to the 802 Executive Committee for consideration at the July 2011 Plenary Session.
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 73 / 0 / 0
- Motion Passes

# Motion

- Move that the 802.3 Working Group request that the LMSC Chair pre-submit the IEEE P802.3bj PAR to NESCOM for consideration at the September 2011 meeting, remaining on the agenda subject to July 802 EC approval.
- Technical ( $\geq 75\%$ )
- Moved by: John D'Ambrosia on behalf of the Study Group
- Second N/A
- 802.3 Voters (Y/N/A): 74 / 0 / 1
- Motion Passes

# WG Motion

- Move that IEEE 802.3 extends the 100 Gb/s Backplane and Copper Cable Study Group
- Moved by John D'Ambrosia on behalf of the Study Group
- Second N/A
- (>50%)
- 802.3 Voters (Y/N/A): 76 / 0 / 0
- Motion Passes

# Thank You!

# IEEE 802.3 100 Gb/s Backplane and Copper Cable Study Group

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Backup Slides

Baseline definition of “improved FR-4” recorded in goergen\_01a\_0511.pdf, slide 23.

## Definition: “Improved FR-4” as defined by IEEE P802.3ap

- Improved FR-4 (Mid Resolution Signal Integrity):
  - 100Mhz:  $Dk \leq 3.60$ ;  $Df \leq .0092$
  - 1Ghz:  $Dk \leq 3.60$ ;  $Df \leq .0092$
  - 2Ghz:  $Dk \leq 3.50$ ;  $Df \leq .0115$
  - 5Ghz:  $Dk \leq 3.50$ ;  $Df \leq .0115$
  - 10Ghz:  $Dk \leq 3.40$ ;  $Df \leq .0125$
  - 20Ghz:  $Dk \leq 3.20$ ;  $Df \leq .0140$
- Temperature and Humidity Tolerance (0-70degC, 10-90% non-condensing):
  - Dk: +/- .04
  - Df: +/- .001
- Resin Tolerance (standard +/-2%):
  - Dk: +/- .02
  - Df: +/- .0005

23

IEEE802.3 100Gb/s Ethernet Electrical Backplane and Twinaxial Copper Cable Assemblies Study Group

23

Joel Goergen (goergen\_01a\_0511.pdf) provided historical perspective on definition of FR-4, based on IEEE P802.3ap, plus added recommendations. Future ad-hoc anticipated.