# Reduced Twisted Pair Gigabit Ethernet PHY

**IEEE 802.3 Ethernet Working Group**

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**November 15, 2012**

**San Antonio, TX**

# Reflector and Web

- To subscribe to the RTPGE reflector, send an email to:
    **_ListServ@ieee.org_**

    with the following in the body of the message (do not include "<>"):
    **_subscribe_** **stds-802-3-RTPGE** **_<yourfirstname> <yourlastname>_**

- Send RTPGE reflector messages to:
    **stds-802-3-RTPGE** **_@listserv.ieee.org_**

- Study Group web page URL:
    **www.ieee802.org/3/RTPGE/index.html**

# Progress this week

- Met in Tuesday and Wednesday part of each day
- ~30 people in the room
- Heard 4 presentations from automotive link segment and EMC ad hocs
- Ad hoc work continued
  - Progress on automotive link segment topology
  - BMW and Delphi to submit assembly materials to UNH-IOL to assist in characterizing current usage
  - Agreement on test fixture I/O option [SMA-IDC] to establish common channel reference for measurements

# Progress this week

- Objectives unchanged from September interim
- Responded to comments from 802 EC members
- Responded to NesCom comment
- Modified response to 5 Criteria Compatibility in response to comment from EC members
  - Did not change any other Criteria
- Modified PAR to address comment from EC members
- EC comment was to undo unintended consequences of March 2012 EC change to 5 Criteria compatibility resulting in NesCom comment
- Worked with Jon Rosdahl, 1$^{st}$. Vice-Chair of 802.11 and NesCom Chair to craft response

# Draft Objectives (1 of 2)

- Preserve the IEEE 802.3/Ethernet frame format at the MAC client service interface.

- Preserve minimum and maximum frame size of the current IEEE 802.3 standard.

- Support full duplex operation only.

- Support a speed of 1 Gb/s at the MAC/PLS service interface.

- Maintain a bit error ratio (BER) of less than or equal to $10^{-10}$ at the MAC/PLS service interface

- Support 1 Gb/s operation in automotive & industrial environments (e.g. EMC, temperature).

- Define optional Energy-Efficient Ethernet

# Draft Objectives (2 of 2)

- **Define the performance characteristics of an automotive link segment and a PHY to support point-to-point operation over this link segment with less than three twisted pairs supporting up to four inline connectors using balanced copper cabling for at least 15m for the automotive link segment.**

- **Define the performance characteristics of optional link segment(s) for the above PHY for industrial controls and/or automation, transportation (aircraft, railway, bus and heavy trucks) applications with a goal of at least 40m reach**

- **Define optional startup procedure which enables the time from power_on=FALSE to valid data to be less than 100ms**

# Broad Market Potential

## I. Broad sets of applicability
## II. Multiple vendors and numerous users
## III. Balanced costs (LAN versus attached stations)

Multiple vendors and numerous users

– At the Call for Interest, 65 individuals from 42 companies indicated they would support this project. These included automotive companies, automotive OEMs, silicon and cabling vendors, (among others)

- In 2012 approximately 82 million cars and light trucks will be produced
- 12 million premium segment cars and 45 million middle segment cars
- The prediction for 2019 is 115 million total with 15 million premium and 60 million middle segment.

– Data presented indicates hundreds of millions ports/year for Ethernet in automotive by 2018-22.

– The Industrial Automation solutions currently have about 100 million installed Ethernet nodes on the market, with a growth of about 43% per year. A transition from fieldbus communication networks to Ethernet is on the way and new applications in industrial automation are expected.

Balanced Cost (LAN versus attached solutions)

– The Reduced Twisted Pair Gigabit Ethernet interface will maintain a favorable cost balance for in-vehicle applications operating over twisted pair copper cables.

# Compatibility

IEEE 802 LMSC defines a family of standards. All standards should be in conformance : IEEE Std 802, IEEE 802.1D, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 Working Group. In order to demonstrate compatibility with this criterion, the Five Criteria statement must answer the following questions. Each standard in the IEEE 802 family of standards shall include a definition of managed objects that are compatible with systems management standards.

> a) Does the PAR mandate that the standard shall comply with IEEE Std 802, IEEE Std 802.1D and IEEE Std 802.1Q?
>
> b) If not, how will the Working Group ensure that the resulting draft standard is compliant, or if not, receives appropriate review from the IEEE 802.1 Working Group

I. Compatibility with IEEE Std 802.3
II. Conformance with the IEEE Std 802.3 MAC
III. Managed object definitions compatible with SNMP

- As an amendment to IEEE Std 802.3, 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.

- The proposed amendment will conform to the full-duplex operating mode of the IEEE 802.3 MAC.

- The proposed amendment will conform to the Gigabit Media Independent Interface (GMII).

- 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

- ~~The PAR mandates the resulting standard will comply with IEEE Std 802, IEEE Std 802.1D, and IEEE Std 802.1Q.~~

# Distinct Identity

**I. Substantially different from other IEEE 802 standards**
**II. One unique solution per problem (not two solutions to a problem)**
**III. Easy for the document reader to select the relevant specification**
**IV. Substantially different from other IEEE 802.3 specifications/solutions.**

- There is no standard that supports Ethernet over fewer than four twisted copper wire pairs at an operating speed of 1 Gb/s.

- The standard will define one PHY.

- 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.

# Technical Feasibility

**I. Demonstrated System Feasibility**
**II. Proven Technology**
**III. Confidence in reliability**

- 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 leverage existing 1000BASE-T technologies have been provided.

- The reliability of Ethernet components and systems can be projected in the target environments with a high degree of confidence.

# Economic Feasibility

**I. Known cost factors, reliable data**
**II. Reasonable cost for performance**
**III. 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 other twisted pair copper physical layer specifications for Ethernet indicates that the specifications developed by this project will entail a reasonable cost for the resulting performance.

- The reduction in the number of pairs and resulting weight reduction for the targeted markets will result in a significant drop in overall costs. The improved ease of installation will likely reduce costs.

# Draft PAR (IEEE P802.3bp)

- http://ieee802.org/3/RTPGE/P802_3bp_PAR.pdf

# Motion #13

Approve the IEEE P802.3bp RTPGE PHY Project Objectives

M: S. Carlson

S: K. Matheus

Technical (>=75%)

Y:      N:      A:

Passed by voice without opposition

# Motion #14

Approve the IEEE P802.3bp RTPGE PHY Project response to the Broad Market Potential criterion

M: S. Carlson

S: T. Hogenmüller

Technical (>=75%)

Y: 77 N: 0   A: 5

# Motion #15

Approve the IEEE P802.3bp RTPGE PHY Project response to the Compatibility criterion

M: S. Carlson

S: J. D'Ambrosia

Technical (>=75%)

Y: 78 N: 1   A: 3

# Motion #16

Approve the IEEE P802.3bp RTPGE PHY Project response to the Distinct Identity criterion

M: S. Carlson

S: B. Booth

Technical (>=75%)

Y: 76 N: 0   A: 2

# Motion #17

Approve the IEEE P802.3bp RTPGE PHY Project response to the Technical Feasibility criterion

M: S. Carlson

S: M. Tazebay

Technical (>=75%)

Y: 76 N: 0   A: 2

# Motion #18

Approve the IEEE P802.3bp RTPGE PHY Project response to the Economic Feasibility criterion

M: S. Carlson

S: B. Booth

Technical (>=75%)

Y: 75 N: 0   A: 3

# Motion #19

Approve the IEEE P802.3bp RTPGE PHY PAR

M: S. Carlson

S: G. Thompson

Technical (>=75%)

Y: 76 N: 0   A: 0

# Motion #20

Extend the Reduced Twisted Pair Gigabit Ethernet PHY Study Group until the next plenary session

Moved by Steve Carlson on behalf of the Study Group

(>50%)

Y: 82 N: 0   A: 0

# Future Work

- Meet at the January 21 - 25 2013 Interim
  - Hyatt Regency Phoenix, AZ
  - Hosted by Luxtera
- Continue work on automotive link segment performance characteristics and EMC

# Thank you!