IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet Task Force
Closing Report

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IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet Task Force

Project information

Task Force Organization

George Zimmerman, IEEE P802.3cg Task Force Chair

Jon Lewis, IEEE P802.3cg Task Force Secretary

Peter Jones, Architecture Ad Hoc Chair

Valerie Maguire, IEEE P802.3cg Chief Editor

Task force web and reflector information

Reflector information: http://www.ieee802.org/3/cg/reflector.html

Home page: http://ieee802.org/3/cg/index.html

PAR: http://www.ieee802.org/3/cg/IEEE_P802_3cg_PAR_071216.pdf

CSD: https://mentor.ieee.org/802-ec/dcn/16/ec-16-0216-00-ACSD-802-3cg.pdf

Objectives: http://www.ieee802.org/3/cg/objectives_10SPE_111016.pdf

Approved timeline:
http://www.ieee802.org/3/cg/adopted_802d3cg_timeline_0517.pdf

Private area: http://ieee802.org/3/cg/private/index.html

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IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet Task Force

Activities this week

- Met Mon. 3/5 afternoon and all day Tuesday 3/6
  - 86 total attendees (Monday 74, Tuesday 73)
- Major items discussed, decisions made and actions
  - Resolved 193 comments on draft 1.1
  - Adopted initial draft of mixing segment specification
  - Adopted MDI fault tolerance spec (related to powering)
  - Chartered and initiate draft 1.2 review
  - Reviewed contributions related to:
    - EMC characteristics of 10BASE-T1S
    - Data rate vs. frame rate fairness
  - Reviewed Liaison letters from TIA TR42.7 and ISO/IEC SC25 WG3
    - Decided to defer discussion of any response until May interim
  - Confirmed objectives, PAR and CSD modifications and comments proposed in conjunction with 10 Mb/s Backplane Ethernet Study Group

802.3cg PAR/CSD
Adopted Changes Summary

- Intra system use case (802.3 10BPE SG)
  - Explicitly call out intra-system control applications
  - Many references to “twisted pair”
    - replace with “**single balanced pair of conductors**”
  - Many references to “balanced cabling”
    - delete where possible or replace with “**single balanced pair of conductors”** or “**single-pair Ethernet**”
- Changed text legend

Bold Normal Shadow 10BPE SG – add Intra system

Bold Italics ***802.3cg 10SPE TF - Multidrop/Duplex***

Bold Underline **802.3cg 10SPE TF - Approved text clean ups**

Black ~~strikeout~~, underline Changes due to comments

PAR Changes

P802.3cg PAR adopted changes

2.1 Title: Standard for Ethernet Amendment: Physical Layer Specifications and Management Parameters for 10 Mb/s Operation and Associated Power Delivery **over a Single Balanced Pair of Conductors**

5.1 Approximate number of people expected to be actively involved in the development of this project: 50.

5.2.b. Scope of the project: Specify additions to and appropriate modifications of IEEE Std. 802.3 to add 10 Mb/s Physical Layer (PHY) specifications and management parameters for operation, and associated optional provision of power, **using a single balanced pair of conductors.**

5.5 Need for the Project: Applications such as those used in automotive and automation industries have begun the transition of legacy networks to Ethernet. This has generated **an intra-system control** need for a 10 Mb/s solution which will operate over **a single balanced pair of conductors**. IEEE 802.3 does not currently support 10 Mb/s over a **single balanced pair of conductors**, and a reduction in the number of **pairs of conductors and interface components** required for 10 Mb/s Ethernet will provide a basis for an optimized solution in these applications.

5.6 Stakeholders for the Standard: End-users, vendors, system integrators, and providers of systems and components (e.g., sensors, actuators, instruments, controllers, network infrastructure, user interfaces, and servers) for **networks including enterprise and data center networking,** automotive, other transportation, industrial, and building automation.

WG Motion

Move that the IEEE 802.3 Working Group

approve the modifications to the IEEE P802.3cg 10 Mb/s Single Balanced Pair Ethernet PAR, as shown in ec-18-0013-01-00EC-ieee-p802-3cg-draft-par-modification-request.pdf

M: Jon Lewis

- S: George Zimmerman
- Y: N: A:
- Motion Passes/Fails (Technical ≥ 75%)

CSD Changes

Managed Objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

a) The definitions will be part of this project.
b) The definitions will be part of a different project and provide the plan for that project or anticipated future project.
c) The definitions will not be developed and explain why such definitions are not needed.

The definition of protocol independent managed objects will be part of this project.

In addition, it is expected that the protocol-specific definition of managed objects will be added in a future amendment to an IEEE 802.3 Standard for Management.

UNCHANGED

Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

a) Will the WG create a CA document as part of the WG balloting process as described in Clause 13?
b) If not, explain why the CA document is not applicable

- A CA document is not applicable because the proposed project is not a wireless project.

UNCHANGED

Broad Market Potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

a) Broad sets of applicability.

b) Multiple vendors and numerous users.

Broad Sets of Applications:

10 Mb/s single-pair Ethernet in the automotive market will enable replacement of multiple legacy protocols with Ethernet, taking advantage of lower cost and throughput requirements than 100 Mb/s automotive Ethernet, furthering consolidation of legacy in-car networks in a homogeneous architecture.

10 Mb/s single-pair Ethernet in the industrial market will enable replacement of multiple legacy protocols with Ethernet in a number of market segments in industrial automation, with greater applicability than **100BASE-T1** and lower system cost than **10BASE-T.**

10 Mb/s single-pair Ethernet in the intra-system control market will enable replacement of multiple legacy protocols with Ethernet in a number of market segments including enterprise and data center networking and servers.

Multiple vendors and numerous users:

At the **original** Call for Interest, 79 individuals from 55 companies indicated they would support this project. These included companies from industrial automation, building automation, automotive, automotive OEMs, silicon, infrastructure, cabling, connector, and test equipment vendors.

At an additional Call for Interest held to add intra-system applications, 64 individuals from 43 companies indicated support. This included additional companies enterprise and data center networking and server vendors, and component suppliers to them.

Substantial Market Potential:

Data presented at the original CFI indicate a substantial market potential, e.g., the prediction for 2019 is 165 million total ports/year.

Data presented at the additional CFI indicate an addition of > 450 million ports/year.

Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

a) Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?

b) If the answer to a) is "no", supply the response from the IEEE 802.1 WG.

c) Compatibility with IEEE Std 802.3

d) Conformance with the IEEE Std 802.3 MAC

e) Managed object definitions compatible with SNMP

As a PHY amendment to IEEE Std 802.3, the proposed project will remain in conformance with IEEE Std 802, IEEE Std 802.1AC, and IEEE Std 802.1Q.

As a PHY amendment to IEEE Std 802.3, the proposed project will use MII, and follow the existing format and structure of IEEE 802.3 protocol-independent specification of managed objects.

The proposed amendment will conform to the IEEE 802.3 MAC.

The project will include a protocol independent specification of managed objects. In addition, it is expected that the protocol-specific definition of managed objects will be added in a future amendment to an IEEE 802.3 Standard for Management.

UNCHANGED

Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

Substantially different from other IEEE 802.3 specifications / solutions.

There is no IEEE 802.3 standard for an Ethernet PHY **using a single balanced pair of conductors at a 10 Mb/s data rate**.

The project may define multiple PHYs, but will define only a single PHY per maximum link segment distance.

The new proposed standard will define optional power delivery supporting the new 10 Mb/s single-pair operation and distances. In contrast, IEEE P802.3bu only defines power delivery with physical parameters compatible with 100BASE-T1, 1000BASE-T1, or without a data entity.

Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

a) Demonstrated system feasibility.
b) Proven similar technology via testing, modeling, simulation, etc.
c) 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.

Ethernet over a single balanced pair of conductors has been proven both technically and operationally in deployments at rates from 2 Mb/s up to **2.5 Gb/s.**

Single-pair power delivery has been proven technically feasible under IEEE P802.3bu. Implementation of single-pair powering for this project is feasible using a range of existing technologies.

Component vendors, including PHY vendors, cabling vendors and systems vendors have presented data on the feasibility of the necessary components for this project. Proposals which leverage existing technologies have been provided.

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

The project targets two PHYs with reaches of approximately 15 m and 1000 m, respectively.

Economic Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

a) **Balanced costs (infrastructure versus attached stations).**
b) **Known cost factors.**
c) **Consideration of installation costs.**
d) **Consideration of operational costs (e.g., energy consumption).**
e) **Other areas, as appropriate.**

The 10 Mb/s **single-pair** Ethernet interface **to be defined** by this project will maintain a favorable cost balance for applications operating over **a single balanced pair of conductors**.

As a PHY project providing rate reduction over a single pair and extending the single pair Ethernet networking to longer-reach and lower-cost applications, there will be a balance of costs for infrastructure vs. attached stations.

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 the **100BASE-T1 and 1000BASE-T1** 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 legacy networks requiring specialized components, expertise, and gateways in the targeted markets **is anticipated to result** in a significant drop in both installation and operational costs.

Overall costs are **anticipated to be** minimized by introducing Ethernet network architecture, management, and software into the **target environments**.

Migrating **intra-system control**, automotive, and automation networking to Ethernet **is anticipated to result** in a significant improvement in system **cost/**performance.

WG Motion

Move that the IEEE 802.3 Working Group approve the IEEE P802.3cg CSD “Managed Objects”, “Coexistence”, “Broad Market Potential”, “Compatibility”, “Distinct Identity”, “Technical Feasibility”, and “Economic Feasibility” responses, as per ec-18-0014-02-00EC-ieee-p802-3cg-draft-csd-modifications.pdf .

- M: Jon Lewis
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- Motion Passes/Fails (Technical ≥ 75%)

Proposed Modified Objectives (1 of 3)

1. Preserve the IEEE 802.3/Ethernet frame format at the MAC client service interface.
2. Preserve minimum and maximum frame size of the current IEEE 802.3 standard.
3. Support a speed of 10 Mb/s at the MAC/PLS service interface.
4. Do not preclude meeting FCC and CISPR EMC requirements
5. Support for optional single-pair Auto-Negotiation
6. Support optional Energy Efficient Ethernet
7. Support 10 Mb/s **single-pair Ethernet** operation in automotive environments (e.g. EMC, temperature).
8. Support 10 Mb/s **single-pair Ethernet** operation in industrial environments (e.g. EMC, temperature).
9. Do not preclude the ability to survive automotive and industrial fault conditions (e.g. shorts, over voltage, EMC, ISO16750)
10. Do not preclude working within an Intrinsically Safe device and system as defined in IEC 60079

Proposed Modified Objectives (2 of 3)

11.Define performance characteristics of the following:

a. A link segment with a **single balanced pair of conductors** supporting up to 4 inline connectors for up to at least 15 m reach

b. A mixing segment with a single balanced pair of conductors supporting up to at least 8 nodes, for up to at least 25 m reach

c. A link segment with a **single balanced pair of conductors** supporting up to 10 inline connectors for up to at least 1 km reach

12.Define a PHY:

a. Supporting point-to-point half-duplex operation over the 15 m link segment

b. Optionally supporting full-duplex operation over the 15 m link segment

c. Optionally supporting half-duplex multi-drop operation over the 25 m mixing segment

13.Define a PHY:

a. Supporting point-to-point full-duplex operation over the 1 km link segment

Proposed Modified Objectives (3 of 3)

14. Support fast-startup operation using predetermined configurations which enables the time from power_on**=FALSE to a state capable of transmitting and receiving valid data to be less than 100ms
15. Maintain a bit error ratio (BER) at the MAC/PLS service interface of less than or equal to:
    a. 10^{-10} on link segments up to at least 15m
    b. 10^{-10} on mixing segments up to at least 25m
    c. 10^{-9} on link segments up to at least 1000m
16. Specify one or more optional power distribution techniques for use in conjunction with 10 Mb/s single-pair Ethernet PHYs over one or more of the single-pair segments

WG Motion

Move that the IEEE 802.3 Working Group

approve the IEEE P802.3cg objectives, as per slides 17 to 19 of 0318_cg_close_report.pdf

- M: Jon Lewis
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IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet Adopted timeline

- ✓ January 2017 – First Task Force meeting
- ✓ July 2017 – Objectives Finalized, Draft 0.1 (skeleton), all baselines presented
- ✓ September 2017 – Baselines selected, draft 0.9 for Task Force Review
- ✓ **November 2017 –Last features selected - Task Force Review D1.0**

  Nov:D1.0, Jan:D1.1, ~~*possible Feb 2018 extra off-cycle interim, D1.2*~~

- ➢ March 2018 – Complete Task Force Review(D1.2~~/1.3~~) *[Task Force review to continue]*
- **May 2018 – Draft 2.0, enter working group ballot** (2 recircs: July:D2.1, Sept:D2.2) *[Probably at least July]*
- **Nov 2018 – D3.0 – enter Sponsor ballot** (2 recircs Jan'19:D3.1, Mar'19:D3.2)
- **June 2019 Standards Board approval**

[NOTE: only 1 meeting cycle slack spread between WG ballot and Sponsor Ballot]

Questions?

Thank you!