IEEE 802.3 10 Mb/s Single Twisted Pair Ethernet (10SPE) Study Group Closing Report

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IEEE 802.3 10SPE Study Group
Study Group information

Study Group Organization

George Zimmerman, IEEE 802.3 10SPE Study Group Chair

Jon Lewis, IEEE 802.3 10SPE Study Group Secretary

Peter Jones, Architecture Ad Hoc Chair

Study Group charter:

to develop a PAR and CSD responses for 10Mb/s Single Twisted Pair Ethernet including optional power

Study Group web and reflector information

Reflector information: http://www.ieee802.org/3/10SPE/reflector.html

Home page: http://ieee802.org/3/10SPE/index.html

IEEE 802.3 10SPE Study Group Activities this week

- Met Tuesday Nov 8 all day, and Wednesday Nov 9, afternoon
- Heard 10 presentations on CSD support and Objectives
- Major items discussed:
  - Requirements and technical feasibility for twisted-pair PHYs and power in Intrinsically Safe environments
  - Examples of technical feasibility for twisted-pair PHYs at 1km
  - Examples of technical feasibility for powering, including multi-drop topologies
  - Approve additional objectives, updated PAR based on comments
- Pre-submitted documents: (see this presentation for updates)
  - PAR: https://mentor.ieee.org/802-ec/dcn/16/ec-16-0152-00-00EC-ieee-p802-3cg-draft-par.pdf
  - CSD|5C]: https://mentor.ieee.org/802-ec/dcn/16/ec-16-0153-00-00EC-ieee-p802-3cg-draft-csd.pdf
  - Objectives: http://www.ieee802.org/3/10SPE/objectives_10SPE_091316.pdf

Summary of Study Group Motions

September SG Meeting:

Motion to adopt PAR text (presubmitted):	Y: 34 N: 0 A: 4
Motions to adopt CSD responses:	
All except Broad Market potential:	Y: 34 N: 0 A:0
Broad Market potential:	Y: 31 N: 0 A:0
Adopt Objectives (#1-8 in following):	Y 29 N:0 A:0

November SG Meeting:

Motion to adopt change to PAR text:	Y: 46 N:0 A:0
Motions to adopt remaining objectives:	Y: 49 N:0 A:0

Study-Group Adopted Objectives (1)

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 operation in automotive environments (e.g. EMC, temperature) over single balanced twisted-pair cabling.
8. Support 10 Mb/s operation in industrial environments (e.g. EMC, temperature) over single balanced twisted-pair cabling.
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

Study-Group Adopted Objectives (2)

11. Define the performance characteristics of a link segment and at least one PHY to support operation over this link segment with single twisted pair supporting up to four inline connectors using balanced cabling for at least 15 m reach
12. Define the performance characteristics of a link segment and a PHY to support point-to-point operation over this link segment with single twisted pair supporting up to 10 inline connectors using balanced cabling for at least 1 km reach
13. 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
14. Maintain a bit error ratio (BER) at the MAC/PLS service interface of less than or equal to 10^{-10} on link segments up to at least 15m, and 10^{-9} on link segments up to at least 1km
15. Specify one or more optional power distribution techniques for use over the 10 Mb/s single balanced twisted-pair link segments, in conjunction with 10 Mb/s single balanced twisted-pair PHYs, in the automotive and industrial environments

Revised Study-Group Adopted Objectives (2)

11. Define the performance characteristics of a link segment and a PHY to support operation over this link segment with single twisted pair supporting up to four inline connectors using balanced cabling for up to at least 15 m reach
12. Define the performance characteristics of a link segment and a PHY to support point-to-point operation over this link segment with single twisted pair supporting up to 10 inline connectors using balanced cabling for up to at least 1 km reach
13. 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
14. Maintain a bit error ratio (BER) at the MAC/PLS service interface of less than or equal to 10^{-10} on link segments up to at least 15m, and 10^{-9} on link segments up to at least 1km
15. Specify one or more optional power distribution techniques for use over the 10 Mb/s single balanced twisted-pair link segments, in conjunction with 10 Mb/s single balanced twisted-pair PHYs, in the automotive and industrial environments

WG Motion

Move that 802.3 approve the IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet objectives, as per slides 5 and 7 of 1116_10M_stp_close_report.pdf

M: G. Zimmerman

S: P. Jones

Y: N: A: (Technical ≥ 75%)

P802.3cg PAR (as changed)

2.1 Title: Standard for Ethernet Amendment: Physical Layer Specifications and Management Parameters for 10 Mb/s Operation over Single Balanced Twisted-pair Cabling and Associated Power Delivery

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, on single balanced twisted-pair copper cabling.

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 a need for a 10 Mb/s solution which will operate over single balanced twisted-pair cabling. IEEE 802.3 does not currently support 10 Mb/s over a single twisted-pair medium, and therefore a reduction in the number of wire pairs and magnetics required for 10 Mb/s twisted-pair 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 automotive, other transportation, industrial, and building automation.

http://www.ieee802.org/3/10SPE/public/Nov2016/P8023cg_par_091116.pdf

Changes to presubmitted PAR

Per comment from 802.11:

Change 5.2.b. as shown:

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, on single balanced twisted-pair copper cabling. ~~Define methodology for the optional provision of power to connected Data Terminal Equipment (DTE) for use with IEEE 802.3 10 Mb/s single-pair interfaces.~~

5.5 Change IEEE 802.3 to IEEE Std. 802.3

Change 5.6 as shown:

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 automotive, other transportation, industrial~~, factory, process~~, and building automation.

8.1 – add “5.2b – IEEE Std 802.3 – IEEE Standard for Ethernet”.

WG Motion

Move that 802.3 approve the IEEE P802.3cg 10 Mb/s Single Twisted Pair Ethernet PAR, in http://www.ieee802.org/3/10SPE/public/Nov2016/P8023cg_par_091116.pdf

M: G. Zimmerman

S: L. Winkel

Y: N: A: (Technical ≥ 75%)

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.

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.

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 100 Mb/s single-pair Ethernet and lower system cost than 10 Mb/s two-pair Ethernet.

Multiple vendors and numerous users:

At the 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.

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

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 that supports Ethernet over a single balanced twisted pair at an operating speed of 10 Mb/s.

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.

Full-duplex operation over a balanced twisted pair has been proven both technically and operationally in deployments at rates from 2 Mb/s up to 10 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.

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 twisted-pair Ethernet interface defined by this project will maintain a favorable cost balance for applications operating over twisted pair copper cables.

As a PHY project providing rate reduction over a single twisted 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 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 legacy networks requiring specialized components, expertise, and gateways in the targeted markets will result in a significant drop in both installation and operational costs.

Overall costs are minimized by introducing Ethernet network architecture, management, and software into the automotive environment.

Migrating automotive and automation networking to Ethernet results in a significant improvement in system price/performance.

WG Motion

Move that 802.3 approve the 10 Mb/s SPE (P802.3cg) CSD “Managed Objects”, “Coexistence”, “Broad Market Potential”, “Compatibility”, “Distinct Identity”, “Technical Feasibility”, and “Economic Feasibility” responses, as per 1116_10M_stp_close_report.pdf

M: G. Zimmerman

S: M. McCarthy

Y: N: A: (Technical ≥ 75%)

WG Motion

Move that the IEEE 802.3 Working Group request the extension of the 10 Mb/s Single Twisted Pair Ethernet Study Group.

M: G. Zimmerman on behalf of the Study Group

Y: N: A: (Procedural ≥ 50%)

Next Steps

- Continue Ad Hoc conference calls
  - Next call scheduled 16 November
- If PAR is approved, the Task Force to hold its first meeting at 802.3 January Interim (Huntington Beach, CA, week of Jan 9)
- Else, will meet as the study group

- Prepare response to Liaison from TIA TR42 (TR42-2016-10-160b_to_IEEE_802d3) at January Interim, prior to next TIA TR42 meeting

Questions?

Thank you!