10BP Study Group

Proposed Changes to 802.3cg 10SPE PAR, CSDs and Objectives

George Zimmerman CME(*)

Peter Jones Cisco

Outline of changes proposed by presentation authors.

Summary

- Many references to “twisted pair”
  - replace with “single pair”
- Many references to “balanced cabling”
  - delete where possible or replace with “single-pair cabling” or “single-pair Ethernet”
- Explicitly call out intra-system control applications
- Explicitly call out full duplex point-to-point and half-duplex operation as options
- Incorporate the spirit of motion #16 from Charlotte, combining short reach and multidrop applications into a single PHY objective

PAR Changes

P802.3cg PAR (e

Fix title – “Single Balanced Twisted-pair” doesn’t fit with other changes.
GT: disputes statement “IEEE 802.3 does not currently support….” (e.g., 10BASE-2/5), to be discussed offline.

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

5.1 Approximate number of people expected to be actively involved in the development of this project: ~~30~~ 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, ~~on single balanced twisted-pair copper cabling~~ using a single pair of conductors.

5.5 Need for the Project: Applications such as those used in automotive and automation industries and intra-system control 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 pair of conductors ~~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~~ interface components 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 networks including enterprise and data center networking, automotive, other transportation, industrial, and building automation.

See previous “edits” slide for notes

P802.3cg PAR (clean)

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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 (edits)

No comments on this.

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.

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.

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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

Needs clear Distinct Identity, e.g., compared to existing 10M/100M/1G standards

Each proposed IEEE 802 LMSC standard shall provide evidence of a dist
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~~ for an Ethernet PHY ~~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.

Distinct Identity

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Technical Feasibi

Single pair vs balanced twisted single pair.

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~~ single 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.

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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~~ the 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~~ single-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~~ target environments.

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

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10BP changes
10SPE objectives changes as discussed last meeting

Objectives Changes

Single pair vs balanced twisted single pair.

Objectives (1- edits)

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). ~~over single balanced twisted-pair cabling.~~
8. Support 10 Mb/s single-pair Ethernet 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

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Motion #16 from Charlotte

Move that 802.3cg add the following objective:

> **Define a multi-drop PHY using Clause 4 half-duplex operation supporting up to at least 25m of balanced pair cabling in passive linear topologies.**

M: Kirsten Matheus S: David Brandt

Technical (>= 75%)

Y: 33 N:0 A:0

Motion Passes

Objectives (2a – edits)

11. Support optional half-duplex operation with all point-to-point PHYs
12. Support optional full-duplex operation with all point-to-point PHYs
13. Support optional Clause 4 half-duplex operation with all multi-drop PHYs
14. Define a PHY to support:
    a. Point-to-point operation over a single-pair link segment supporting up to four inline connectors for up to at least 15 m reach
    b. Optionally support multi-drop operation over a single-pair mixing segment supporting up to xxx nodes over up to at least 25m of wiring in passive linear topologies.
15. Define the performance characteristics of a single-pair link segment and a PHY to support point-to-point operation over this link segment supporting up to 10 inline connectors ~~using balanced cabling~~ for up to at least 1 km reach
16. ~~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~~

For O11/O12/O13 – merge O11 & O13?
All three optional and no base case is an issue, not coherent with existing 10M/100M/1G standards
Usage of " all ---- PHYs", only one MP PHY discussed, why use "PHYs"
Half duplex on long reach p2p - why do we want this? How do objectives reflect that this is not supported.
Full Duplex on long reach – different technology to half duplex?? – Don't support half duplex on long reach
O14a & b – does four inline connectors (O14a) also apply to O14b?
O14b – needs more detail here for multidrop mixing segment characteristics
Do we need a mixing segment tutorial – think about coax.

See previous “edits” slide for notes

Objectives (2a – clean)

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15. Define the performance characteristics of a single-pair link segment and a PHY to support point-to-point operation over this link segment supporting up to 10 inline connectors for up to at least 1 km reach

1.4.277 mixing segment: A medium that may be connected to more than two Medium Dependent Interfaces (MDIs).

Single pair vs balanced twisted single pair.
O17 – BER for 25m multidrop mixing segment.

Objectives (2b - edits)

16. 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
17. 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
18. Specify one or more optional power distribution techniques for use over the 10 Mb/s single-pair Ethernet ~~balanced twisted-pair~~ link segments, in conjunction with 10 Mb/s single-pair Ethernet ~~balanced twisted-pair~~ PHYs, ~~in the automotive and industrial environments~~

See previous “edits” slide for notes

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Thank You!