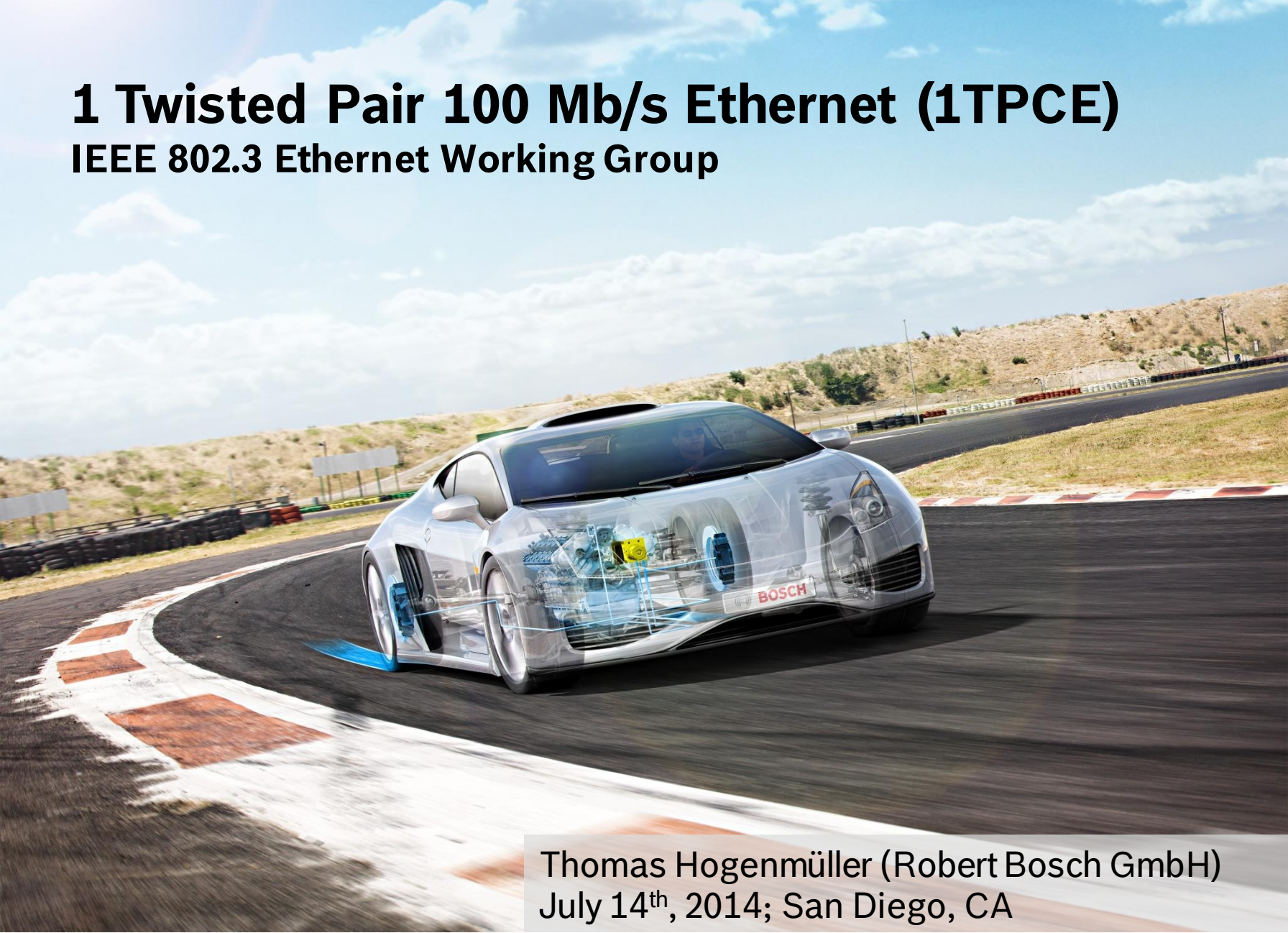
1 Twisted Pair 100 Mb/s Ethernet (1TPCE)

IEEE 802.3 Ethernet Working Group



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Reflector and Web

- To subscribe to the 1TPCE reflector, follow the process on website:
  - http://www.ieee802.org/3/1TPCESG/reflector.html
  - 125 subscribers

- You may read the previous mail traffic on this website:
  - http://www.ieee802.org/3/1TPCESG/email/thrd1.html

- Study Group web page URL:
  - http://www.ieee802.org/3/1TPCESG/index.html

1TPCE SG Meeting in May 2014

- Prior Norfolk interim meeting 4 consensus building ad hoc phone conferences were held
- Met on Monday and Thursday May 12th and 13th in Norfolk
- About 40 people in the room
- Drafted PAR, CSD and objectives
- 2 technical presentations
- 1 presentation on deployed 100 Mb/s OABR PHY
- Straw polls and discussions to reach consensus on PAR, CSD, objectives
- All Motions approved with overwhelming majority: PAR, CSD and objectives
- Requested David Law, 802.3WG chair to pre-submit the PAR and CSD (and objectives) to the 802.3 WG and 802 EC
- Special Thanks to Peter Scruton UNH, who act as the recording secretary

Title and Scope

- P802.3bw
- Title:
  - Standard for Ethernet Amendment Physical Layer Specifications and Management Parameters for 100 Mb/s Operation over a Single Balanced Twisted Pair Cable (100BASE-T1)
- Scope:
  - The scope of this project is to specify additions to and appropriate modifications of IEEE Std 802.3 Standard for Ethernet to add a point-to-point full duplex 100 Mb/s Physical Layer (PHY) specifications and management parameters for operation over single twisted pair balanced cabling.

Broad Market Potential

A standards project authorized by IEEE 802 LMSC shall have a broad market potential. Specifically, it shall have the potential for:

a) **Broad sets of applicability.**
b) **Multiple vendors and numerous users.**

Broad Sets of Applications:

- 100 Mbit/s Automotive Ethernet is a rapidly growing market, driven by two factors:
  - New bandwidth-consuming in-car applications (cameras, collision avoidance, infotainment, etc.)
  - Consolidation of legacy in-car networks into the new homogenous Electronic Architecture
- Other applications include
  - Transportation (e.g. trains, busses, airplane cabins, traffic control systems, etc.) and similar applications
  - Industrial automation solutions using Ethernet for factory and process automation including instrumentation control and measurements.
- The 1 Twisted Pair 100 Mbit/s interface will improve the favorable cost balance for in-vehicle applications operating over single twisted pair balanced cabling.

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Multiple vendors and numerous users:

- At the Call for Interest, the presentation shown was supported by 145 individuals (71 affiliated with automotive, 13 affiliated with industrial automation, 37 affiliated with semiconductor industry)
  - In 2014 approximately 95 million cars and light trucks will be produced
  - 13 million premium segment cars and 50 million middle segment cars
  - The prediction for 2019 is 115 million total with 15 million premium and 60 million middle segment.
- Data presented at CFI indicate hundreds of millions ports/year for single twisted pair Ethernet (with significant share for 100 Mb/s) 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.

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 (see Managed Objects)**

- 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 802.3-2012 the proposed project will use MII, and follow the existing format and structure of IEEE 802.3 MIB definitions by providing 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 with SNMP management capability to be provided in the future by an amendment to or revision of IEEE Std 802.3.1.

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 one balanced twisted pair at an operating speed of 100Mb/s.
- The standard will define one PHY.
- The proposed amendment to the existing IEEE 802.3 standard will be formatted as a single new PHY clause, with minor additions to existing clauses, as appropriate.

Technical Feasibility

The project is technically feasible within its time frame. The following items demonstrate technical feasibility:

a) **Demonstrated system feasibility.**
b) **Proven similar technology via testing, modeling, simulation, etc.**
c) **Confidence in reliability [Removed from IEEE 802 CSD Nov 2013]**

- Full-duplex operation over unshielded twisted pair has been proven both technically and operationally in deployments of 1000BASE-T and 10GBASE-T in excess of 100 Mb/s per pair. Approved on-going work in 40GBASE-T and 1000BASE-T1 is extending the capability.
- The principle of building a 100 Mb/s single twisted pair PHY that meets automotive environment requirements, including EMC, has been proven both technically and operationally feasible by the deployment of OPEN Alliance BR PHY, operating 100 Mb/s over a single twisted pair, in production vehicles since 2013.
- Systems and infrastructure supporting Ethernet operation over twisted pair cabling have been deployed by the tens of billions at speeds ranging from 1 Mb/s to 100Gb/s. The proposed project will build on Ethernet component and system design experience and the broad knowledge base of Ethernet network operation.

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.**

- As this project is focused on a single balanced twisted pair as the media, there would likely be no difference in direct costs for infrastructure vs. attached stations. The advantages of Ethernet LAN technology in the target market, however, make the LAN solution far superior to directly attached stations.
- The cost factors for Ethernet components operating on single balanced twisted pair and systems are well known. The proposed project is expected to enable reductions in the cost of both the attached station and the infrastructure in single twisted pair applications.
- The reduction in the number of pairs and resulting weight reduction for the targeted markets will result in a significant drop in installation and operational costs.

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d) **Consideration of operational costs (e.g. energy consumption).**
e) **Other areas, as appropriate.**

- In consideration of operational costs, the project has adopted a goal to support optional lower power modes, which will help reduce operational costs and environmental footprint.
- Overall costs are minimized by introducing Ethernet network architecture, management, and software into the automotive environment.

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 the 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 definition of SNMP managed objects, through reference to the protocol independent managed objects provided by this project, will be added in a future amendment to, or revision of, IEEE Std 802.3.1 IEEE Standard for Management Information Base (MIB) Definitions for Ethernet.

1 Twisted Pair 100 Mb/s Ethernet Objectives

- Support 100 Mb/s operation in automotive environments (e.g. EMC, temperature) over a single balanced twisted pair.
- Provide electrical interoperability with existing single balanced twisted pair 100 Mb/s client interface (OABR* PHY).
- 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 100 Mbit/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.
- Do not preclude the ability to survive automotive fault conditions (e.g. shorts, over voltage, EMC, ISO16750)
- 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.
- Support optional operation with run-time configuration; by allowing time from power_on**=FALSE to a state capable of transmitting and receiving valid data to be up to TBD.

*http://www.ieee802.org/3/1TPCESG/public/BroadR_Reach_Automotive_Spec_V3.0.pdf
**Condition that is true until such time as the power supply for the device has reached the operating region

1 Twisted Pair 100 Mb/s Ethernet Objectives

- The resulting standard will not preclude single pair auto-negotiation.
- 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 four inline connectors using balanced cabling for at least 15 m reach.

Goals for the week

- Meet Tuesday 13:30 and Wednesday 9:00
- Review the marginal differences between BroadR-Reach Specification 3.0 and 3.2
- Refinement on following objective:
  - Support optional operation with run-time configuration; by allowing time from power_on**=FALSE to a state capable of transmitting and receiving valid data to be up to TBD.

- Respond to questions on PAR, CSD and objectives from 802.3 WG
- Request Task Force status from 802.3 WG at closing plenary
- Request SG extension
- Plan for next meeting

- http://www.ieee802.org/3/1TPCESG/public/P802_3bw_PAR_220514.pdf