10GBASE-T
PAR 5 Criteria
Draft

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Broad Market Potential

- **Broad set of application**
- **Multiple vendors, multiple users**
- **Balanced cost, LAN vs. attached stations**

Broad Market Potential

The past half decade has seen the continuing strong growth of network traffic encompassing the entire breadth of data communications, from the desktop to the WAN. At the same time, the speed and capacity of the elements making up the network have also grown at an impressive rate. The driving force has been the pervasive adoption of IT technology by enterprises and the many uses of the internet; the enabling factor has been the continuing advance in semiconductor technology resulting in ever increasing processing speed and abundant inexpensive data storage capacity. There is no indication that these trends are about to wane; if anything, they are likely to accelerate.

One result of these trends has been the steady migration of LAN speeds upward to 100 Mb/s (100BASE-TX) today, and an accelerating trend toward 1000 Mb/s (1000BASE-T). As with the previous Ethernet standards, a given user speed brings with it requirements for higher speeds at points of data aggregation.

Broad Market Potential

During the same period, the density of computer devices (servers, switches, routers and storage modules) located in data centers has increased by orders of magnitude. These devices need to be interconnected at the highest speeds practicable

The cost of the computing devices at the desktop and in data centers continues to fall, due largely to improving silicon manufacturing efficiencies. These lowered station costs are best balanced by twisted pair copper media LANs.

Virtually all desktop applications and a substantial portion of the backbone and computer room interconnects since the early days of Ethernet operate on twisted pair copper wiring, demonstrating customer preference for this media whenever applicable. 10GBASE-T will continue this trend into the next generation of Ethernet.

Compatibility with IEEE Standard 802.3

- **Conformance with CSMA/CD MAC, PLS**
- **Conformance with 802.2**
- **Conformance with 802 FR**

Compatibility with IEEE Standard 802.3

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

In a manner similar to the 100BASE-TX and 1000BASE-T standards, a new Physical Layer (PHY) will be defined for operation at 10G/s over structured copper cabling. Use of installed cabling conforming to ISO/IEC 11801 will be emphasized.

802.3 Auto-Negotiation will be supported, further enhancing compatibility with installed UTP solutions.

The Management Information Base (MIB) for 10GBASE-T will maintain compatibility with the current 802.3 MIB, allowing a consistent management model at all operating speeds.

Conformance with 802.2 is provided by the overlying 802.3ae MAC sub-layer.

The proposed standard will conform to the 802 Functional Requirements Document, with the possible exception of the Hamming distance.

The 10GBASE-T PHY will conform to the XGMII specified in the 802.3ae standard.

Distinct Identity

- **Substantially different from other 802.3 specs/solution**
- **Unique solution for problem**
- **Easy for document reader to select relevant spec**

Distinct Identity

The proposed standard is a 10Gb/s upgrade for 802.3 users based on the 802.3 CSMA/CD MAC.

It is the only standard that will follow the structured UTP cabling definitions in present or future editions of ISO/IEC 11801, offering upgrade paths for present Ethernet users.

The proposed standard will be formatted as a new clause to the 802.3 standard.

Technical Feasibility

- **Demonstrated Feasibility**
- **Proven Technology**
- **Confidence in Reliability**

Technical Feasibility

Presentations given to 802.3 have demonstrated the technical feasibility of 10Gb/s signaling using structured UTP wiring which follows the general characteristics specified in ISO/IEC 11801. It is anticipated that specifications within the ISO/IEC 11801 document may require some augmentation. Presentations of companies manufacturing copper cabling and connecting hardware have likewise confirmed that any required additional specifications or modifications are readily available. Qualification testing of installed cable plants will probably be required.

The technology to be utilized in the realization of the 10GBASE-T PHY will rely heavily on previous 802.3 standards; 100BASE-TX, 100BASE-T2 and 1000BASE-T. It is recognized that since the inception of work on the 1000BASE-T standard approximately six years ago, the relevant technologies have greatly advanced at every level. As an example, the basic clock rate of ordinary Personal Computers have jumped from under 100Mhz to 2000Mhz currently and are estimated to reach at least 4000Mbhz at the expected time of introduction of 10GBASE-T. Likewise, the basic feature size of silicon CMOS based semiconductor chips has dropped from around 0.6 micrometers to 0.13, and will further drop to at least 0.09 in the relevant time period. The resulting circuit density, which rises as the inverse square of the feature size, will by then have increased by a factor of about forty.

Technical Feasibility

The dramatic increase in silicon implementation parameters has been matched by the progress in the available modeling, simulation, design and verification tools. These tools are routinely used to accurately predict the performance of complex communication channels, especially those using advanced DSP technologies. Based on these tools, xx companies have verified the feasibility of the proposed standard.

The extensive computer simulations have been supported by the measurement of the properties of cables and network hardware in both laboratory and field environments.

Further confidence in the validation process has been gained by the excellent field performance of 1000BASE-T standard devices, which were initially developed using similar but much less mature techniques than those currently in use.

Economic Feasibility

- Cost factors known, reliable data
- Reasonable cost for performance expected
- Total installation costs considered

Economic Feasibility

The implementation of the 10GBASE-T PHY device is estimated to require the approximate complexity level 1.5 times of the currently available four-channel 1000BASE-T chip. The experience curve of the semiconductor industry practically guarantees the future reduction of the size, and hence the cost, of implementation. In production, the 10GBASE-T PHY device. is projected to meet the 3x cost versus 10x performance guidelines applied to previous advanced Ethernet standards.

The use of structured UTP cabling for the standard also insures its economic feasibility, especially when the installed base of copper cabling is used.