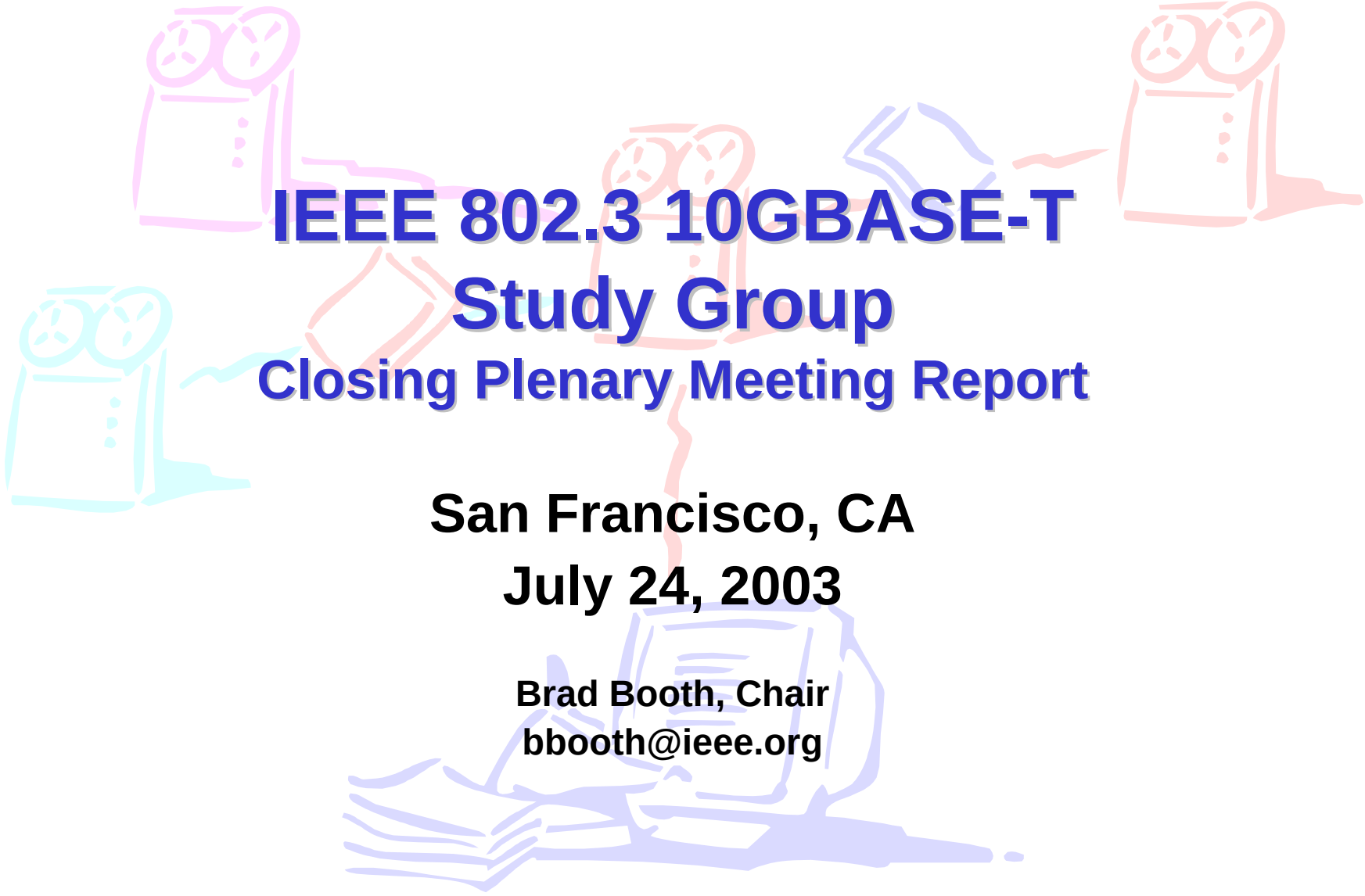

IEEE 802.3 10GBASE-T Study Group

Closing Plenary Meeting Report

San Francisco, CA

July 24, 2003

Brad Booth, Chair
bbooth@ieee.org

Presentations

- AbuGhazaleh; Alien NEXT, IL Effect on Channel Capacity
- Bohbot; 10GBASE-T Alien Crosstalk Measurements on Cat.5e
- Nordin & Vanderlaan; Alien Crosstalk Mitigation Technique
- Dinh; Magnetics for 10GBase-T
- Flatman; Installed Horizontal Cabling Length Distribution
- Cohen; Proposed Cabling Specifications for 100% 10Gbps Coverage
- Cobb; Extending Category 5e Limits
- Powell; Impact of Insertion Loss Notch on PAM-10 Transceiver
- Powell; Feasibility Study on High Speed Transmission over UTP Cables
- Yousefi; Multi Rate PHY
- Spencer; Analog Front Ends for Ethernet on Copper
- Parhi; Interleaved Trellis Coded Modulation and Decoding
- Babanezhad; 10GBASE-T Line Signaling
- Aldana; Receiver Based Alien Crosstalk Mitigation
- Di Minico; 10GBASE-T Cabling Baseline Proposal

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Of Interest

- **Alien Crosstalk**
  - **Mitigation techniques, measurement data**
- **Multi-rate PHY proposal**
  - **Sets the reach at 100m for Class D, E and F cabling**
  - **Data rate over cabling would be 2.5G, 5G and 10G respectively**
  - **Pro: Makes use of all installed D, E and F cabling**
  - **Con: Possible modifications to the MAC sublayer**
- **10G PHY proposal**
  - **Sets the data rate at 10Gb/s for Class D, E and F cabling**
  - **Reach shortens for lower grade cabling**
  - **Pro: No modifications to the MAC sublayer, data rate set**
  - **Con: Not all installed D, E and F cabling can be used**

Future Meetings

- **September, 2003:**
  - **Portonovo, Italy**
  - **Interim meeting**
  - **Hosted by Aethra**
  - **www.advancedcongressi.it**

- **November, 2003:**
  - **Albuquerque, NM**
  - **Plenary meeting**

Accomplishments

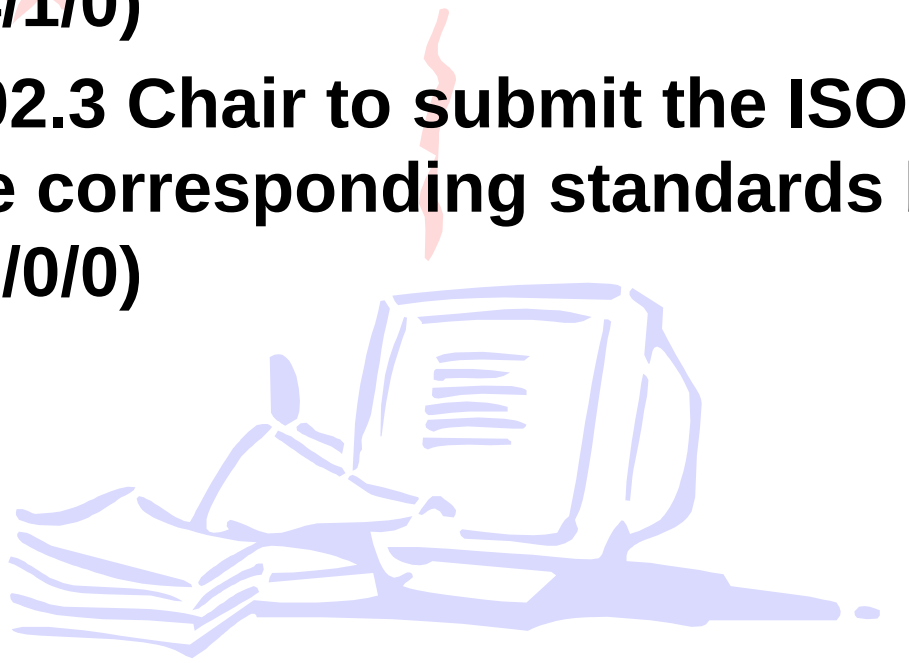
- **Refine and enhance PAR, 5 Criteria and Objectives**
  - **Draft PAR and 5 Criteria were refined (to be shown)**
  - **Objectives not altered**
- **Liaison letters**
  - **Tabled TIA TR42 response**
  - **Generated liaison letter response for ISO/IEC JTC 1/SC 25/WG 3**

SG Motions

- **Nominate Jeff Warren to be the permanent recording secretary for 10Gbase-T SG and subsequent Task Force. → Passed (acclimation)**
- **Adopt the TIA liaison response letter developed by the SG Ad Hoc. → Tabled (31/18)**
- **Motion to accept the ISO liaison letter. → Passed (47/0/5)**
- **Accept Broad Market Potential Criteria. → Passed (57/6/5)**
- **Accept the Compatibility with IEEE Standards Criteria. → Passed (43/10/10)**
- **Accept the Distinct Identity Criteria. → Passed (54/0/10)**

SG Motions (cont.)

- **Accept the Technical Feasibility Criteria. → Passed (49/14/7)**
- **Accept the Economic Feasibility Criteria. → Passed (44/6/6)**
- **Accept the PAR as amended at this meeting. → Passed (34/1/0)**
- **Request 802.3 Chair to submit the ISO liaison letter to the corresponding standards body. → Passed (33/0/0)**



SG Motions (cont.)

- **Motion to approve the PAR and 5 Criteria as written and to request the 802.3 chair to forward same to the LMSC Executive Committee and NESCOM for consideration in December, with the understanding that if Executive Committee and 802.3 approval is not received, the PAR will be removed from the NESCOM agenda . → Passed (29/2/1)**
- **Motion to request an extension for the 10GBASE-T study group from the SEC. → Passed (acclimation)**

802.3 Motion #1

- **Move that:**
  The 802.3 Chair to submit the ISO liaison letter to the corresponding standards body.

- **Moved: B. Booth on behalf of 10GBASE-T SG**
- **Seconded: N/A**
- **Technical (>75%) PASSES**
- **802.3: Y: 56 N: 1 A: 4**

Excerpt of letter

To: Dr. Walter von Pattay; Secretary JTC 1/SC 25/WG 3
Cc: (Abbreviated)
Re: Liaison report to IEEE 802.3 on 10G Developments

Thank you for your informative liaison letter 3N638.

The 802.3 working group of the IEEE LAN-MAN Standards Committee has initiated a study group to investigate 10 Gigabit Ethernet operation on 4-pair 100 ohm horizontal copper cabling as specified in ISO/IEC 11801 2nd edition. The initial frequency range of interest is: 1 MHz <= f <= 625 MHz. In addition, the study group is investigating alien crosstalk impairments. The study group would appreciate the assistance of ISO/IEC in this effort. The information provided will be utilized in simulation modeling to validate the technical feasibility.

We look forward to continued cooperation between our respective organizations.

Sincerely,
Yada yada yada… ;-)

802.3 Motion #2

- **Move that:**
  The 802.3 chair to forward PAR and 5 Criteria from the September Interim meeting to the LMSC Executive Committee and NESCOM for consideration in December, with the understanding that if Executive Committee and 802.3 approval is not received, the PAR will be removed from the NESCOM agenda.

- **Moved: B. Booth on behalf of the 10GBASE-T SG**
- **Seconded: N/A**
- **Technical (>75%) FAILS**
- **802.3: Y: 30 N: 14 A: 15**

Broad Market Potential

Current trends suggest the steady migration of LAN speeds from 100 Mb/s (100BASE-TX) today toward 1000 Mb/s (1000BASE-T). In particular, as the density of computer devices (servers, switches, routers and storage modules) located in data centers and enterprise networks increases, so will the demand for higher speeds at data aggregation points. Additionally, there is an increasing demand for high performance servers to support bandwidth intensive applications such as CAD/CAM, digital animation, storage and cluster computing. Clearly there is a need for a low cost 10Gb/s solution that will utilize twisted pair copper infrastructure.

Interest in 10GBASE-T has been demonstrated by the attendance of more than 69 vendor and user representatives at technical meetings at the November 2002 Plenary, attendance at subsequent Interim meetings, and by participation in an email forum devoted to facilitating technical development in this area. 34 companies have indicated they will participate in the technical development of a standard for 10GBASE-T. This level of commitment indicates that the standard will be supported by multiple vendors, and that there will be a wide variety of equipment available to support 10 gigabit speed applications on twisted pair copper links.

Compatibility w/ IEEE Std. 802.3

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

In a manner similar to the 100BASE-TX and 1000BASE-T standards, a new Physical Layer (PHY) will be defined for operation at 10Gb/s over structured copper cabling.

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.

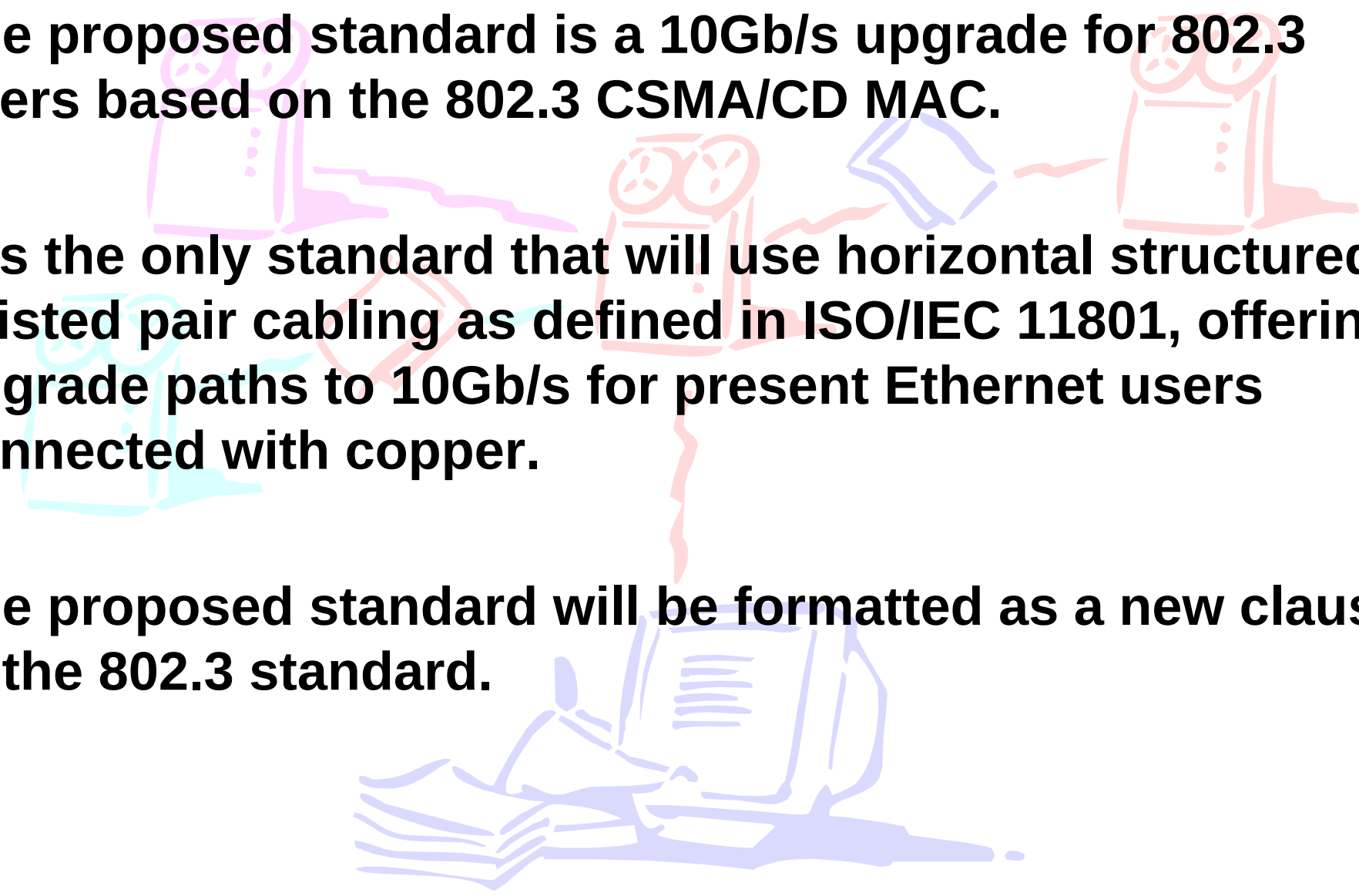
The proposed standard will not support the OAM unidirectional mode specified in P802.3ah. The proposed standard will support co-existence with 802.3af.

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 use horizontal structured twisted pair cabling as defined in ISO/IEC 11801, offering upgrade paths to 10Gb/s for present Ethernet users connected with copper.

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



Technical Feasibility

Presentations made to the 10GBASE-T Study Group illustrate the technical feasibility of 10Gb/s signaling using structured twisted pair cabling as defined by ISO/IEC 11801. These presentations covered all aspects of feasibility including simulation and theoretical analysis based on proven technology of 1000BASE-T, known cabling technology, and state of the art process technology; and demonstrated that there is sufficient channel capacity for the transmission of 10Gb/s.

The study group acknowledges that 10Gb/s operation is achievable on Class D and Class E cabling and augmentation of their specifications is required to higher frequencies for performance parameters such as insertion loss and the addition of alien crosstalk characterization. The study group also agrees that the 10Gb/s operation is achievable on Class F cabling. The channel models are supported by the measurement of the properties of cables and network hardware in both laboratory and field installations.

The technology to be utilized in the realization of the 10GBASE-T PHY will rely heavily on previous 802.3 standards; 100BASE-TX and 1000BASE-T. It is recognized that the relevant technologies have greatly advanced at every level since the inception of work on the 1000BASE-T standard approximately six years ago.

This study group has received contributions from PHY, system and cabling vendors; end users; and industry/academic experts.

Economic Feasibility

The implementation of a single 10GBASE-T PHY device is estimated to require an approximate complexity level of 1.5 times the currently available quad 1000BASE-T chip. The experience curve of the semiconductor industry ensures 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 widespread use and low cost of installation of structured twisted pair cabling systems supports economic feasibility with regards to total cost of installation.

PAR

Logistics – PAR, 5-C's, and Objectives

- **September 10GBase-T SG Interim Meeting:**
  - **Last chance for the 10GBase-T Study Group to make minor modifications to the PAR, 5 Criteria, and Objectives.**
  - **If changes are made this is the version that shall be sent to both:**
    - **NesCom 50-days prior to their December 2003 meeting**
    - **SEC & 802.3 40-days prior to the November 2003 Plenary**
  - **Immediately after the September Interim send:**
    - **PAR to NesCom**
    - **PAR, 5 Criteria to SEC**
    - **PAR, 5 Criteria, and Objectives to 802.3**

Logistics – PAR, 5-C's, and Objectives

- **November IEEE Plenary Meeting:**
  - **The 10GBase-T SG responds to any 802 WG**
  - **802.3 affirms the potentially revised PAR, 5 Criteria, and Objectives during the 802.3 WG closing plenary.**
  - **The 802.3 Chair will request approval of the PAR & 5 Criteria during the Friday closing SEC meeting:**
    - **PAR to NesCom shall remain as is, otherwise substitute if modified**
    - **Revised PAR and 5 Criteria, to the SEC**
  - **NOTE: 802.3 has the ability to remove the previously submitted:**
    - **PAR from the Standards Board meeting.**
    - **PAR and 5 Criteria from the SEC closing meeting.**
  - **Request a final 10GBase-T SG extension to mitigate any delay by the Standards Board**
- **December Standards Board Meeting:**
  - **Hopefully the 10GBase-T PAR is approved.**
- **January 2004 Interim Meeting.**
  - **The 1st 10GBase-T Task Force meeting is held**

802.3 Motion #3

- **Move that:**
  802.3 extend the 10GBASE-T study group.
- **Moved: B. Booth on behalf of the 10GBASE-T SG**
- **Seconded: N/A**
- **Technical (>75%) PASSES**
- **802.3: Y: 51 N: 0 A: 4**

Thank You!