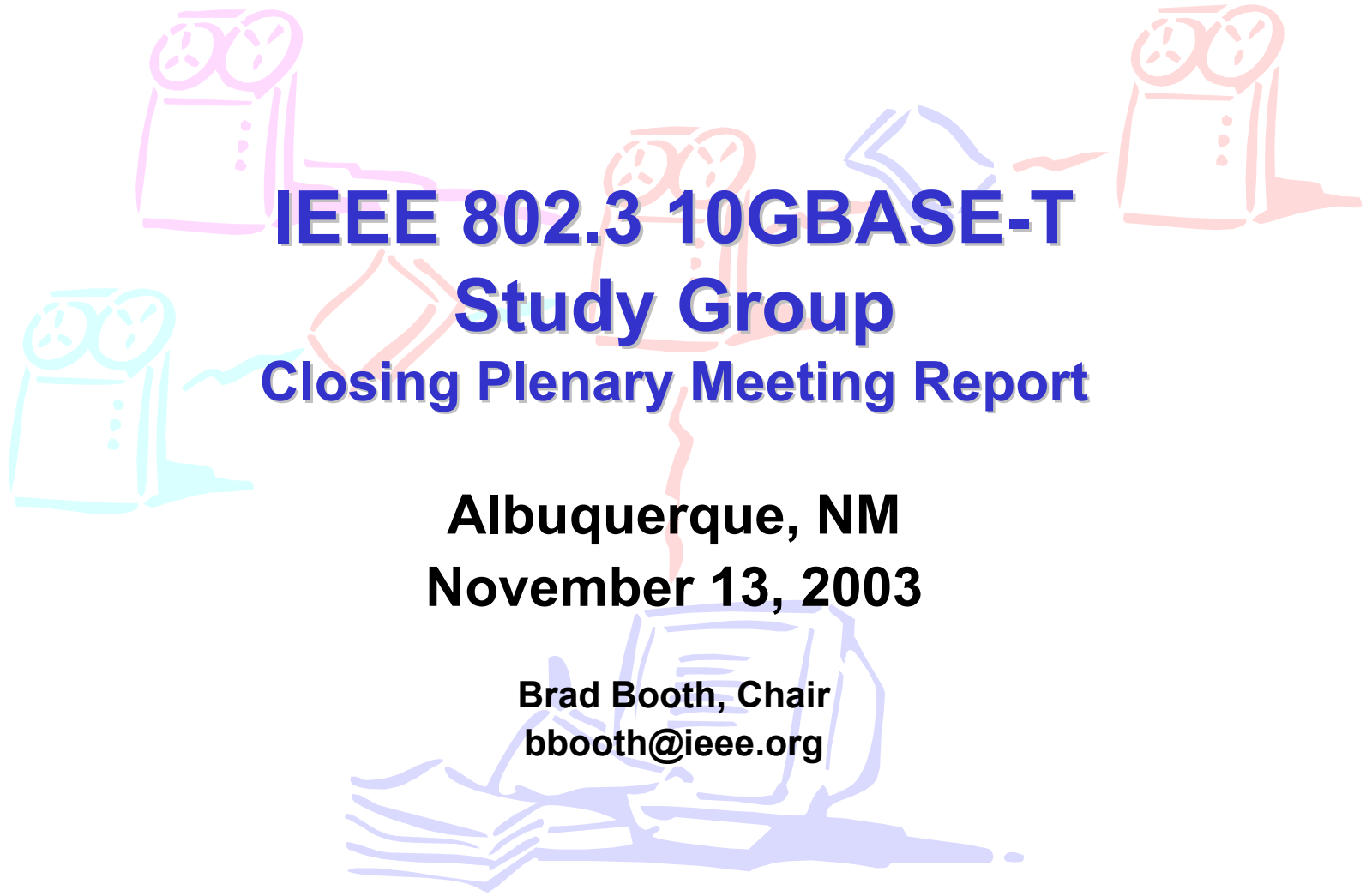


IEEE 802.3 10GBASE-T Study Group

Closing Plenary Meeting Report

Albuquerque, NM

November 13, 2003

Brad Booth, Chair
bbooth@ieee.org

Plans for the Week

- 10GBASE-T Tutorial
  - Tonight, 6:30pm in Ballroom A
- Address comments on PAR, 5 Criteria and Objectives
  - Primarily focused on clarification
    - PAR Scope
    - Compatibility with 802.1
- Have 6 presentations
- Formulate responses to ISO/IEC and TIA liaison letters
- Seek 802.3 approval of PAR, 5 Criteria & Objectives

Accomplishments

- PAR, 5 Criteria and Objectives
  - Modified the scope of the PAR
  - Slight modifications to 5 Criteria
    - Balanced cost in Broad Market Potential
    - 802.1 addition to Compatibility
- Liaison letters
  - Generated response to TIA TR42
  - Generated response to ISO/IEC JTC 1/SC 25/WG 3
- Presentations

Presentations

- Mike Bennett; “10GBASE-T: Broad Market Potential in Data Centers”
- Chris Di Minico; “Data Center Design Considerations”
- Bernie Hammond; “Feasibility of Augmented Category 6 UTP Cabling Supporting 100m 10GBase-T Channels”
- Ron Nordin, Paul Vanderlaan; “Alien Crosstalk Mitigation Technique Update”
- Mohsen Kavehrad; “Transmission Strategies for 10GBase-T over 100m of Cat-5e / 6 Copper Wiring”
- Sailesh Rao, “A 4D-PAM8 Proposal for 10GBASE-T”
- Brad Booth, “Comments on PAR, 5 Criteria and Objectives”

SG Motions

- To modify the PAR Scope
  - Passed (48/0/1; .3-23/0/1)
- To add 802.1 to 5 Criteria Compatibility
  - Passed (45/0/1; .3-24/0/0)
- To add “balanced cost” to 5 Criteria Broad Market Potential
  - Passed (42/1/5; .3-26/1/1)
- To forward liaison letters to TR 42 and ISO/IEC
  - Passed (51/0/0; .3-27/0/0)
- To have 802.3 approve 10GBASE-T Objectives
  - Passed (56/0/0; .3-32/0/0)

SG Motions (cont.)

- To have 802.3 approve the amended 10GBASE-T 5 Criteria and forward to the SEC for approval
  - Passed (54/0/1; .3-26/0/1)
- To have 802.3 approve the amended 10GBASE-T PAR and forward to the SEC and NesCom for approval
  - Passed (54/0/0; .3-28/0/0)
- To request ability to have interim meetings
  - Unanimous by voice
- To request ability to send liaison letters to TR42 and ISO/IEC after an interim meeting
  - Approved by voice

Motion: Objectives Approval

- **Move that:**
  802.3 approve the 10GBASE-T Objectives document, per objectives_1_0903.pdf.

- **M: B. Booth on behalf for the Study Group**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 64 N: 0 A: 7**
- **PASSES**

Objectives

- Preserve the 802.3/Ethernet frame format at the MAC Client service interface
- Preserve min. and max. frame size of current 802.3 Std.
- Support full duplex operation only
- Support star-wired local area networks using point-to-point links and structured cabling topologies
- Support a speed of 10.000 Gb/s at the MAC/PLS service interface
- Select copper media from ISO/IEC 11801:2002, with any appropriate augmentation to be developed through work of 802.3 in conjunction with SC25/WG3
- Support Clause 28 auto-negotiation
- Support coexistence with 802.3af
- To not support 802.3ah (EFM) OAM unidirectional operation
- Meet CISPR/FCC Class A

Objectives (cont.)

- Support operation over 4-connector structured 4-pair, twisted-pair copper cabling for all supported distances and Classes
- Define a single 10 Gb/s PHY that would support links of:
  - At least 100 m on four-pair Class F balanced copper cabling
  - At least 55 m to 100 m on four-pair Class E balanced copper cabling
- Support a BER of 10^-12 on all supported distances and Classes

Motion: 5 Criteria Approval

- **Move that 802.3 approve the 10GBASE-T 5 Criteria as per 5Criteria_1_1103.pdf, and that 802.3 forward the 10GBASE-T 5 Criteria to the RevCom for approval**
- **M: B.**
- **S: N/A**
- **Techni (>75%)**
- **802.3 Voters: Y: N: A:**
- **PASSES/FAILS**

Divided

Motion: Broad Market Potential

- **Move that**
  802.3 approve the 10GBASE-T 5 Criteria Broad Market Potential as amended within 10GBT_closing_1103.

- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 56 N: 0 A: 9**
- **PASSES**

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.

Eventually exhibit similar cost balance as 802.3ab (1000BASE-T) for LAN devices vs. attached stations.

Motion: Compatibility

- **Move that**
  802.3 approve the 10GBASE-T 5 Criteria Compatibility, as per 5Criteria_1_1103.pdf.

- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 62 N: 0 A: 4**
- **PASSES**

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 802.1 and 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.

Motion: Distinct Identity

- **Move that**
  802.3 approve the 10GBASE-T 5 Criteria Distinct Identity, as per 5Criteria_1_1103.pdf.

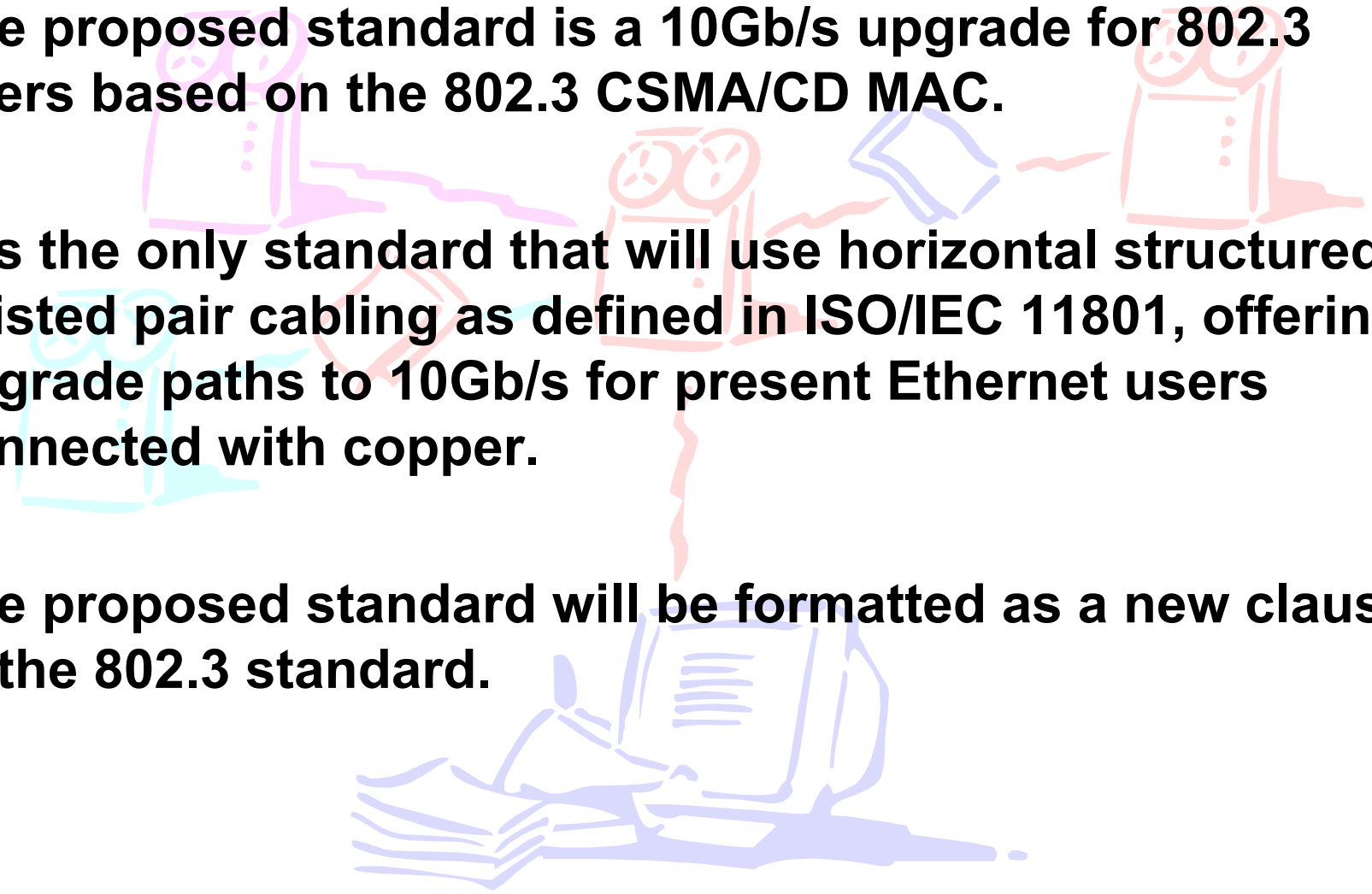
- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 60 N: 1 A: 5**
- **PASSES**

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.



Motion: Technical Feasibility

- **Move that**
  802.3 approve the 10GBASE-T 5 Criteria Technical Feasibility, as per 5Criteria_1_1103.pdf.

- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 57 N: 2 A: 6**
- **PASSES**

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.

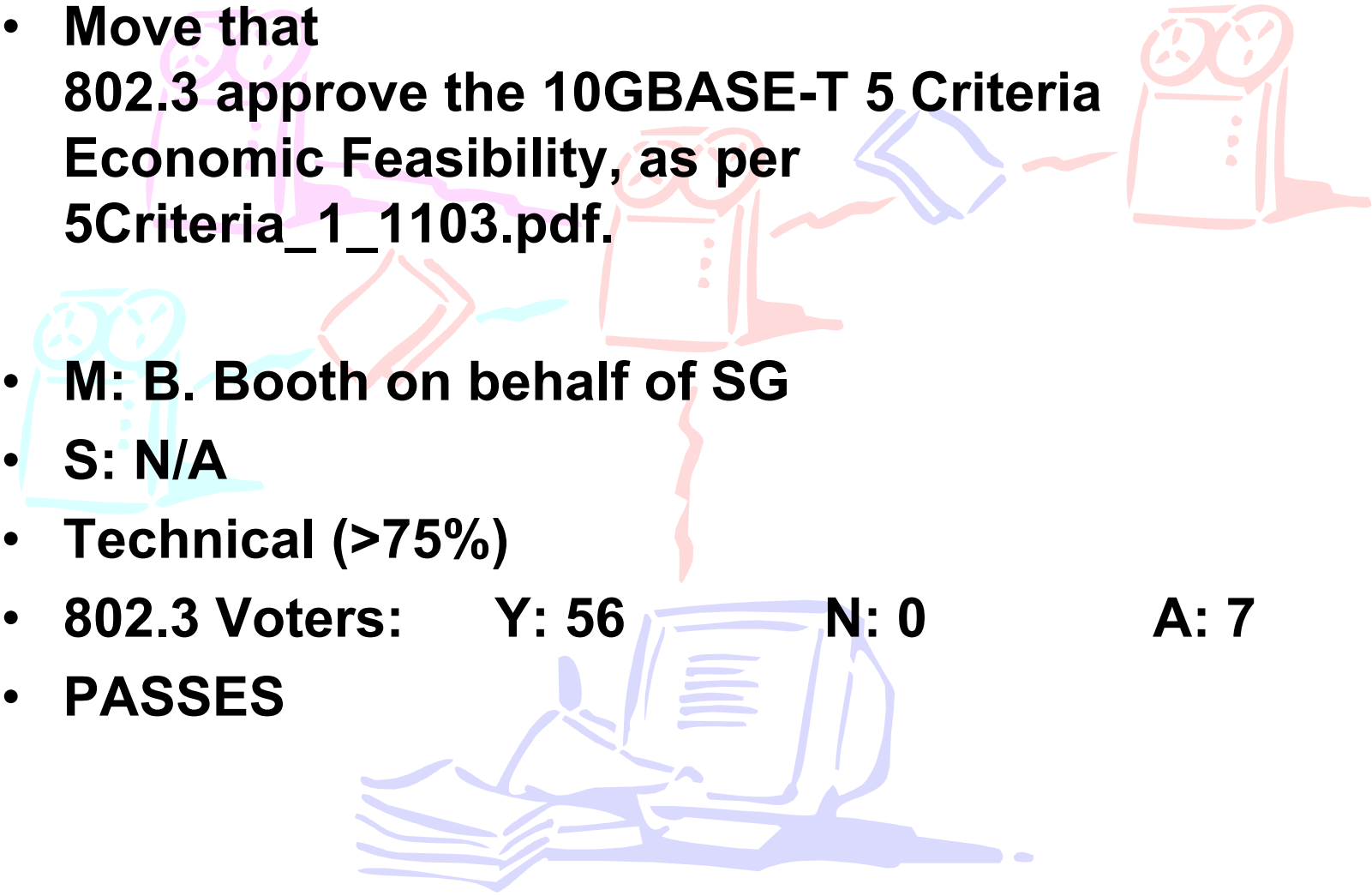
The technology to be utilized in the realization of the 10GBASE-T PHY will rely heavily on previous 802.3 standards; 100BASE-TX and 1000BASE-T. It is recognized that the relevant technologies have greatly advanced at every level since the inception of work on the 1000BASE-T standard approximately six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

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

Motion: Economic Feasibility

- **Move that**
  802.3 approve the 10GBASE-T 5 Criteria Economic Feasibility, as per 5Criteria_1_1103.pdf.

- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 56 N: 0 A: 7**
- **PASSES**



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.

Motion: 5 Criteria Approval

- **Move that**
  802.3 WG forward the 10GBASE-T 5 Criteria to the 802 SEC for approval.

- **M: B. Booth on behalf of SG**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 62 N: 0 A: 3**
- **PASSES**

Motion: PAR Approval

- **Move that:**
  802.3 WG approve the 10GBASE-T PAR, as per par_1_1103.pdf, and forward the PAR to the 802 SEC and NesCom for approval (please consider for approval under continuous process).

- **M: B. Booth on behalf of the Study Group**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: 64 N: 0 A: 2**
- **PASSES**

Motion: Liaison Letters

- **Move that**
  802.3 approve and forward the two Liaison Response letters, with appropriate edits by the Chair, (TIA TR-42 & ISO/IEC 11801 JTC 1/SC 25/WG 3) drafted by the Cabling Ad Hoc.
  - **TIA TR42: tia_1_1103.pdf**
  - **ISO/IEC: iso_1_1103.pdf**

- **M: B. Booth on behalf of Study Group**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: N: A:**
- **PASSES/FAILS**

Motion: Liaison Letters

- **Move that**
  802.3 approve and forward the two Liaison Response letters, with appropriate edits by the Chair, (TIA TR-42 & ISO/IEC 11801 JTC 1/SC 25/WG 3) drafted by the Cabling Ad Hoc.
  - **TIA TR42: tia_1_1103.pdf**
  - **ISO/IEC: iso_1_1103.pdf**

- **M: B. Booth**
- **S: A. Flatman**
- **Technical (>75%)**
- **802.3 Voters: Y: 56 N: 0 A: 1**
- **PASSES**

Motion: Interim Meeting

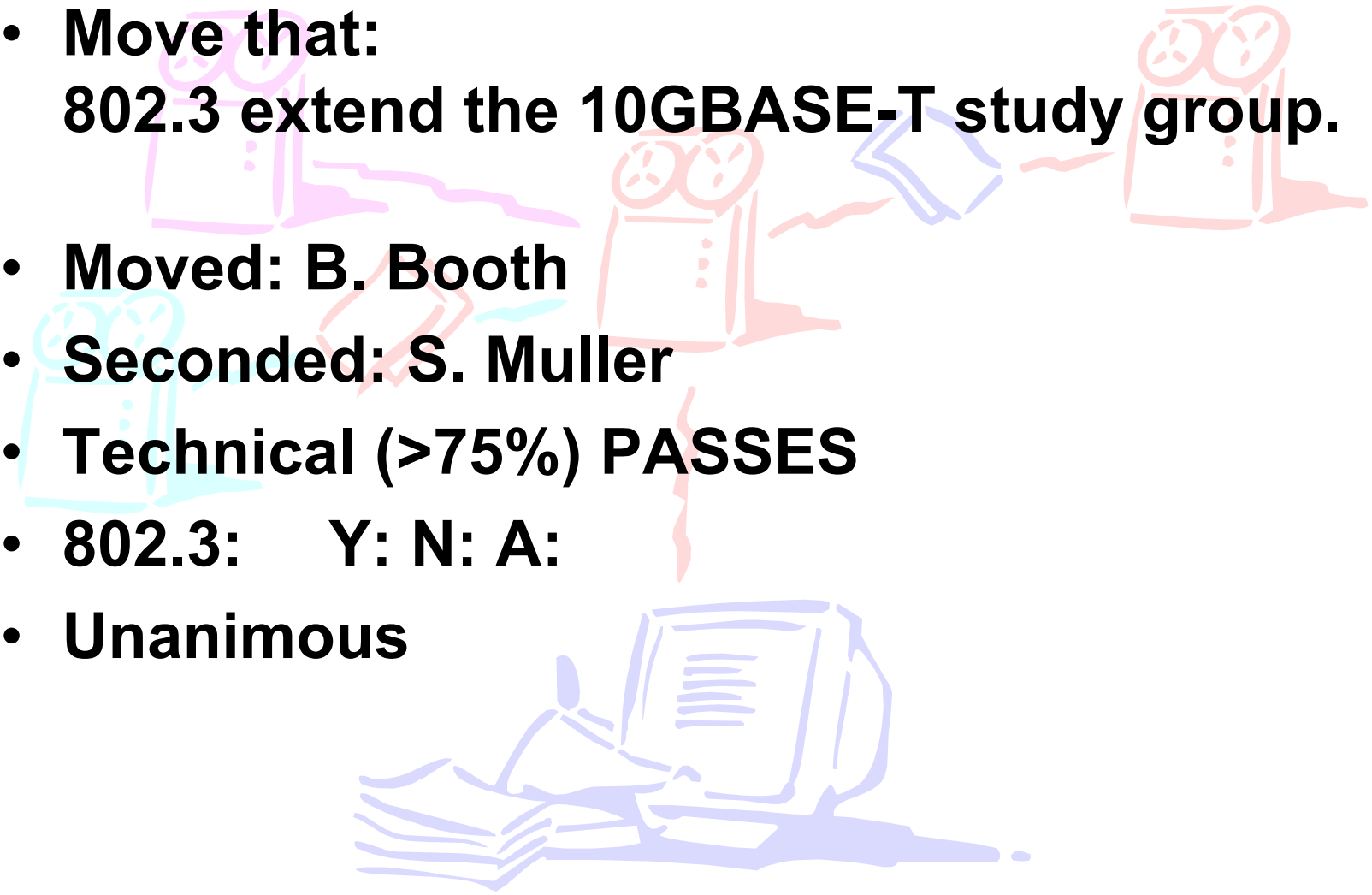
- **Move that:**
  The 802.3 WG to approve 10GBASE-T Interim meeting(s).

- **M: B. Be[illegible]up**
- **S: N/A**
- **Technic[illegible]**
- **802.3 Vo[illegible] N: A:**
- **PASSES/FAILS**

Withdrawn

Motion: Extend

- **Move that:**
  802.3 extend the 10GBASE-T study group.
- **Moved: B. Booth**
- **Seconded: S. Muller**
- **Technical (>75%) PASSES**
- **802.3: Y: N: A:**
- **Unanimous**



Motion: Liaison Request

- **Move that**
  The 802.3 WG permit forwarding additional 10GBASE-T approved liaison letters relating to the definition of the cabling [illegible] TIA TR-42 and ISO [illegible] BASE-T interim [illegible]

Withdrawn

- **M: B. Bo[illegible] the Study Group**
- **S: N/A**
- **Technical (>75%)**
- **802.3 Voters: Y: N: A:**
- **PASSES/FAILS**

Future Meetings

- **January 2004 Interim:**
  - **Week of the 12th**
  - **Vancouver, BC**
  - **Hosted by IEEE 802**
  - **Fairmont Hotel Vancouver**

- **March 2004 Plenary:**
  - **Week of the 15th**
  - **Orlando, FL**
  - **Hilton Hotel @ Walt Disney World**

Thank You!