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# Proceedings of the First LAN-Transport Workshop

Report of the First Workshop for Local Area Network Implementors of the NBS Specifications of the International Standards Organization Transport Class 4 Protocol, the IEEE 802.2 Type 1 Class 1 Link Protocol, and the IEEE 802.3 10 Megabit CSMA/CD Specification

U.S. DEPARTMENT OF COMMERCE
National Bureau of Standards
Institute for Computer Sciences and Technology
Systems and Network Architecture Division
Washington, DC 20234

February 1 - 2, 1983



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NATIONAL BUREAU OF STANDARDS

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**NATIONAL BUREAU OF STANDARDS, Ernest Ambler, *Director***

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## ABSTRACT

The National Bureau of Standards Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a workshop for local area network implementors of these specifications. The workshop focused on implementation techniques and strategies so that a multi-vendor demonstration of these protocols can occur at a major computer conference in the 1984 time frame. This report documents the workshop and records implementation choices and agreements made by the participants.



Keywords: communication protocols; computer networks; local area networks; standards; transport protocol


## WORKSHOP SUMMARY

This report documents the first workshop for local area network implementors of the ICST specifications for the International Standards Organization (ISO) Transport Class 4 Protocol on IEEE 802 compatible local area networks. The workshop, held by ICST at the request of a number of companies, assembled 51 attendees from 29 organizations. It provided a forum for local network manufacturers to share ideas and learn about Class 4 implementations, to discuss and agree on a common set of options, and to foster a multi-vendor local network demonstration of Class 4 Transport on an 802 LAN at a major computer conference in 1984.

The workshop resulted in several agreements. The vendors concurred to use the IEEE P-802.3 10 megabit baseband CSMA/CD local area network for layer 1, IEEE P-802.2 type 1 class 1 logical link control service for layer 2, an octet of zeros representing a "null" network independent convergence protocol for layer 3 and the mandatory portions of the ICST specification of ISO Class 4 Transport for layer 4. These agreements allow for the reliable transmission of data among host computers and terminals used in the multi-vendor demonstration.

Applications such as messaging, file transfer, remote terminal access and others will use these protocols. Details concerning these applications will be discussed at the next workshop.

## WORKSHOP BACKGROUND

Computer network protocol standards that provide for the interconnection of a wide variety of computers, terminals, and special purpose systems are needed by computer manufacturers, vendors and users. To meet these needs, the International Organization for Standardization (ISO) has produced an open systems interconnection reference model for use as an aid in developing protocol standards. The reference model defines a 7 layer architecture in which protocol standards are developed.

In June of 1982, the ISO produced a draft proposal for Transport layer 4. The proposal is entitled "Information Processing Systems -- Open Systems Interconnection -- Transport Protocol Specification/ISO/TC97/SC16 n-1169." It contains English proses describing the protocol mechanisms for Transport Class 0 through Class 4 services.

The ICST has developed a formal description technique for defining protocol specifications and ICST applied the technique to the ISO Class 4 Transport. ICST uses the resulting specification as input to a compiler that produces about fifty percent of the protocol implementation automatically. The implementation is exercised and tested in an ICST laboratory for internal consistency and compliance with other protocol implementation.

The remainder of this report documents the workshop and records the agreements made during the two-day interchange of ideas.

LAN/Transport Workshop

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## MINUTES

February 1, 1983

8:30 a.m. Introduction and Opening Remarks

Mr. Robert Blanc, ICST, welcomed the attendees to the meeting and introduced the workshop chairman -- Mr. Mauris Graube.

Mr. Graube, Chairman of the IEEE 802 local area networks (LAN) standards committee, acknowledged a need for standard higher layer protocols. The ISO standards for higher layer protocols seem to be the most likely candidates to fill the need. However, Mr. Graube believes the current ISO transport protocol specification is too ambiguous -- more specifics need to be addressed.

After providing this background, Mr. Graube cited the following objectives for the workshop:

1) Agree upon a common set of options for Class 4 Transport,

2) Share ideas for Class 4 Transport implementation schemes, and

3) Establish a deadline for demonstrating a multi-vendor Class 4 capability over a local area network.

8:45 a.m. Introduction to ICST Transport Protocol Specification

Dr. John Heafner, ICST, provided an introduction to the ICST Transport Protocol Specification. The specification consists of six volumes:

1) Volume 1: Overview and Services,

2) Volume 2: Class 2 Transport Protocol Specification,

3) Volume 3: Class 4 Transport Protocol Specification,

4) Volume 4: Transport Service Specification,

5) Volume 5: Guidance to the Implementor, and

6) Volume 6: Guidance for Implementation Selection.

Volumes 1, 3, 4, and 5 were distributed. Volumes 2 and 6 are not pertinent to the workshop purpose at this time.

Dr. Heafner stated that the specification is undergoing editing and ICST expects to submit it for legal review in three to four weeks, prior to the Federal Register announcement. Dr. Heafner

affirmed the ICST intention to maintain interoperability with ISO transport and described the ICST Class 4 Transport as a superset of the ISO Class 4 Transport.

9:00 a.m. Overview of ICST Class 4 Transport

Mr. James Moulton, ICST, presented an overview of the details of the ICST Class 4 Transport protocol. The following topics were covered:

1) Overview of ISO Transport Class Structure,

2) Comparison of ISO and ICST Transports,

3) Overview of ICST Transport Services,

4) Transport Protocol Data Unit (TPDU) Structure,

5) TPDU Types, and

6) Protocol Mechanisms.

After Mr. Moulton's presentation, Dr. John Davidson, Ungermann-Bass, listed seven concerns with the proposed Transport protocol. These concerns were:

1) The minimum/maximum size for Transport protocol data units is too large,

2) The sequence space is 7 or 31 bits instead of a more usual 8 or 32 bits,

3) There appears to be no way to piggyback ACKs with Data,

4) The mechanism for reducing window size seems to be an unnecessary complication of the protocol,

5) The difference between expedited flow control and expedited acknowledgement is unclear,

6) There is no data length indication in the TPDU, and

7) There appears to be no way to address an end user.

In subsequent discussions, these seven concerns were addressed and Dr. Davidson was satisfied that the various viewpoints behind each concern were fully expressed.

11:30 a.m. Design Choices

Mr. John Burruss, BBN, identified several design issues that he believed were relevant to the workshop objectives. Mr. Burruss made suggested choices for each issue and the workshop attendees discussed the ramifications of those choices and, where appropriate,

suggested alternative solutions. The topics explored included:

1) How to implement transport in a host environment,

2) Acknowledgement strategy,

3) Retransmission intervals,

4) Timer values,

5) Flow control strategy, and

6) Addressing.

3:30 p.m. Mr. Jerry Linn, ICST, described the service that ICST provides to organizations interested in implementing Class 4 Transport. The services include:

1) Protocol specification documentation,

2) A reference implementation,

3) A specification compiler,

4) Test tools including:

   a) a scenario interpreter,
   b) an exception generator, and
   c) test scenarios and log files from tests, and

5) Cooperative testing.

4:00 p.m. Mr. Graube resumed the floor and asked how many vendors were interested in participating in a multi-vendor demonstration at a major computer conference in 1984. Twelve vendors were in favor of exploring the idea further. Mr. Graube suggested a list of topics to explore during the second day of the workshop. These topics included:

1) Class 2 or Class 4 Transport?

2) Addressing,

3) Criteria for acceptable connect request TPDUs,

4) Maximum TPDU size,

5) Sequence number format,

6) Expedited data,

7) Non-use of checksums,

8) Defaults for optional fields,

9) Quality for optional fields,

10) Concatenated TPDUs,

11) User data in connect/disconnect request TPDUs,

12) ERR TPDU,

13) Datagram Transport (Unit Data service option), and

14) Byte-ordering conventions.

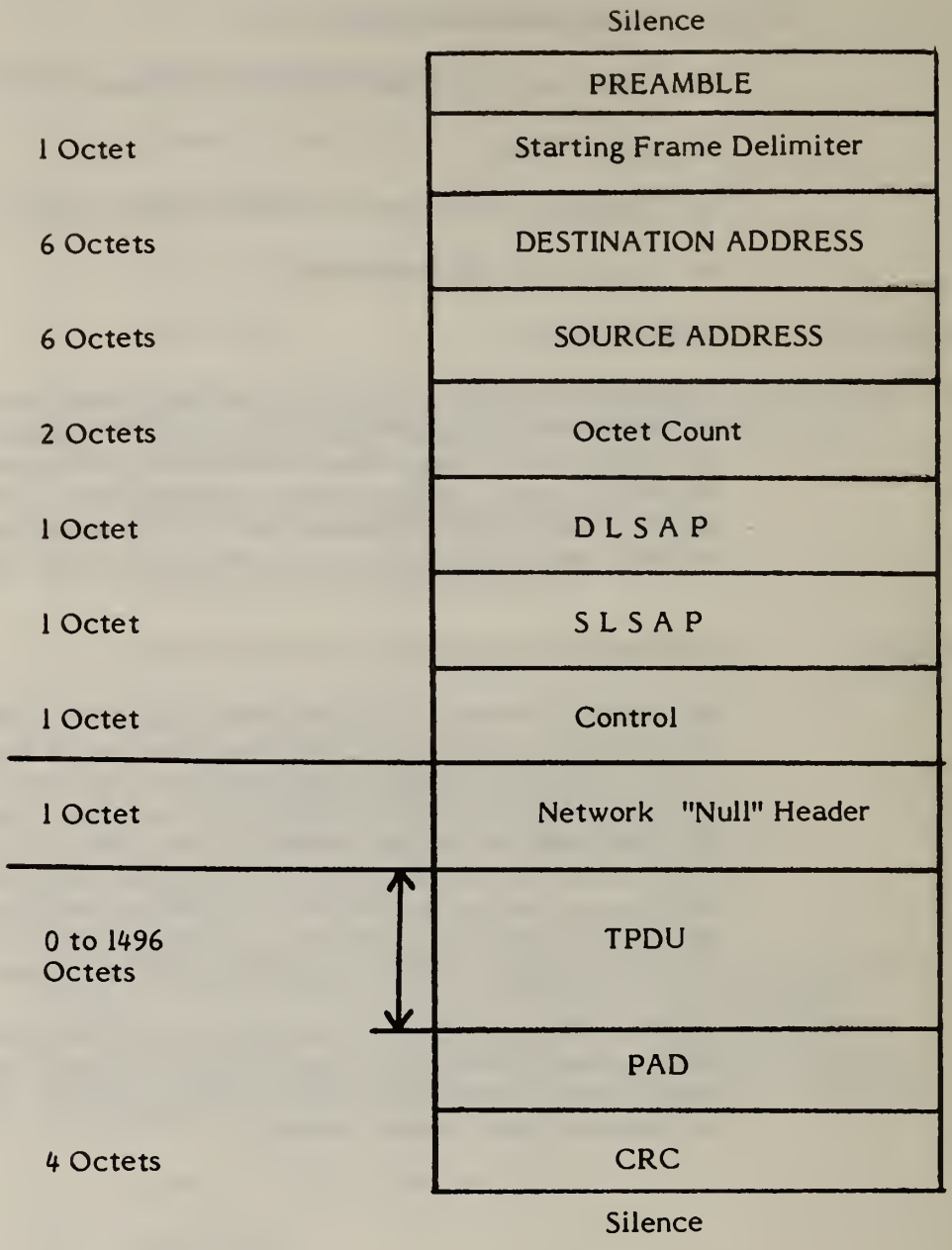
4:20 p.m. Network Layer

Mr. Ross Callon, BBN, reported upon the current Internet Protocol (IP) work in the standards arena. Mr. Callon proposed the use of a null network independent convergence protocol at layer three with a single octet as the network header (value of zero) for the multi-vendor demonstration. This is consistent with the 'null' header format in the current ANSI X3S3.3 IP proposals.

4:35 p.m. Physical and Link Layers

Mr. Robert Rosenthal, ICST, reported upon the current LAN standards work in the IEEE 802 Committee and in the ECMA TG 24 committee. Both groups maintain very close liaison and both groups have reached consensus on a number of issues including the three separate access methods at the physical layer. The access methods include CSMA/CD, Token Bus and Token Ring. Each access method utilizes its own physical medium specifications. Only the CSMA/CD and Token Bus methods are in "letter ballot"; the Token Ring method is still in IEEE 802 committee.

Mr. Rosenthal presented the current state of the IEEE 802 logical link control documentation, also in "letter ballot," and he illustrated the following link frame structure indicating where the proposed null network layer header would go:




Mr. Rosenthal discussed the types of service provided pointing out that both a connectionless datagram and a connection-oriented link service are available in IEEE 802.

Mr. Graube polled the attendees and discovered that the overwhelming majority were interested in basing the multi-vendor demonstration on a "null" network layer header as proposed; on only the connectionless type 1 class 1 IEEE 802 link service using 48 bit addressing; and,

on the IEEE 802 CSMA/CD access method using the 10 megabit/sec baseband coaxial cable specification.

5:00 p.m. Mr. Graube adjourned the meeting for the first day of the workshop.

## MINUTES

February 2, 1983

During the second day of the workshop, options for use in the 1984 demonstration were choosen, addressing was discussed, specific applications for the demonstration were selected, and future plans including the next meeting schedule and agenda were set.

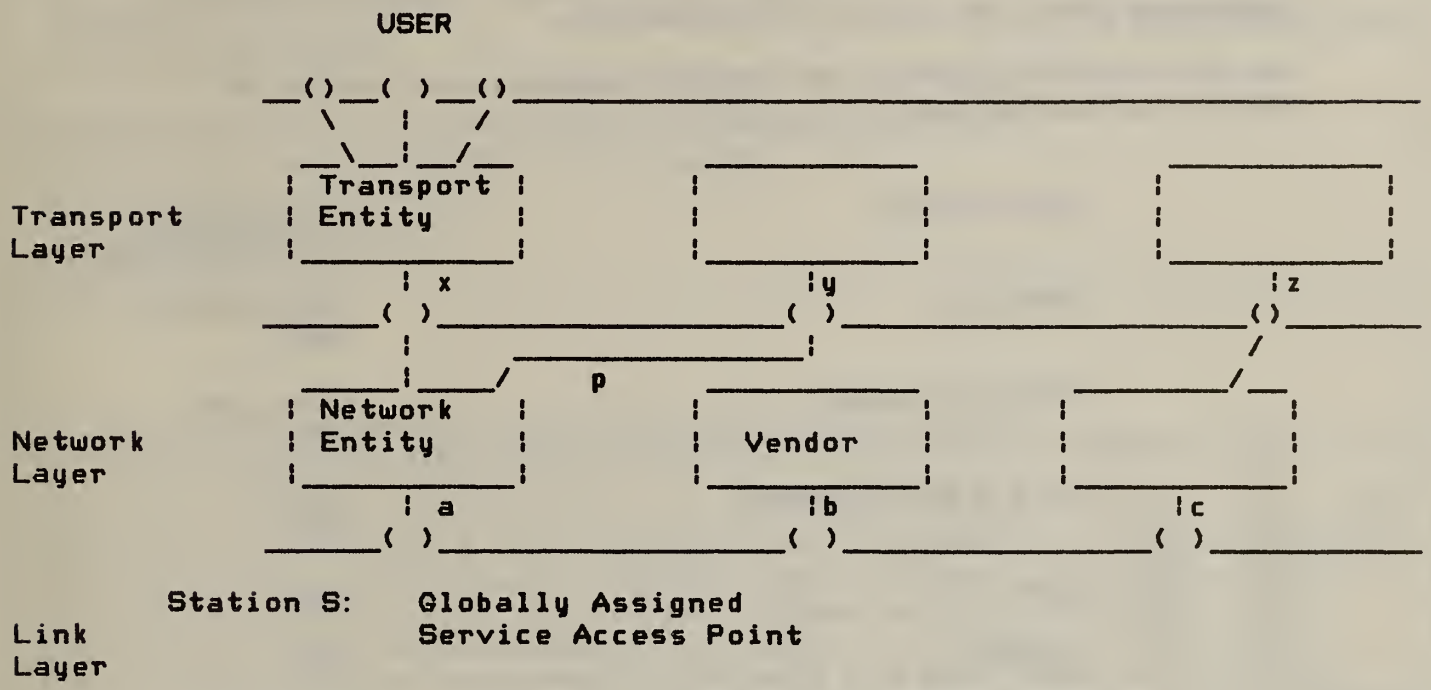
The list of topics presented at 4:00 p.m. on February 1 was revisited. Consensus was reached on the issues tabulated below.

| Issue | Choices | Consensus |
|---|---|---|
| Class Selection | Class 2, Class 4, both | Class 4 was choosen as appropriate since all participants expect to use the connectionless datagram type 1 class 1 link service. |
| Connection Acceptance Criteria | Data in CR<br>Data in DR<br>Quality of Service<br>Security Parameters | Do not use data<br>Do not use data<br>Not used<br>Not used |
| Maximum TPDU Size | The Maximum TPDU size is a power of 2. As shown on February 1, the IEEE 802 frame can be 1518; but, the link and network layer headers require 22 octets leaving 1496 octets for transport. | Use the negotiation scheme specified in Class 4 Transport. If 2048 octets is selected,it is understood that the maximum TPDU is 1496 octets. |
| Sequence Number | 7 bits or 31 bits | Participants will implement both lengths. A proposal to use 7 or 31 bits will be made and negotiated during connection establishment. Fourteen companies wanted 31 bits while only four wanted 7 bits. |

| Issue | Choices | Consensus |
|---|---|---|
| Expedited Data | The use of expedited data is application dependent. | Participants agreed to use the default. |
| Use of Checksums | The use of checksums is negotiated in the ISO specification. | Particpated agreed to use the checksum on the CR TPDU but all CR's will request that checksums not be used. Checksums will also be ignored in DT TPDUs. |
| Version Number | Use the value 1. | The sender of a CR will include the version number parameter, the receiver of a CR may choose to ignore it. The version number parameter value will be equal to 1. |
| Unimplemented or Unrecognized options | Ignore the option or return an ERR TPDU. | The version number may be ignored. Checksums default to the "no use option." The maximum TPDU default size is 128 octets. All unimplemented or unrecognized codes in CR and CC TPDUs will be ignored. All unimplemented or unrecognized codes in other TPDUs requires an ERR TPDU response. |
| Concatenated TPDUs | Blocking of multiple TPDUs is allowed in the ISO specifications. | All participants agree to receive blocked TPDUs. It is optional to send blocked TPDUs. |

| Issue | Choices | Consensus |
|---|---|---|
| Error TPDUs | Sending and receiving ERR TPDUs were discussed. | All implementations must be able to receive ERR TPDUs but they need not generate them. The ERR TPDU is useful for debugging and as an aid in intervendor compatibility and security. |
| Unit Data | The use of the Unit Data or Transport datagram facility was discussed. | The Unit Data option is not recommended for this demonstration. |
| Flow Control Conformation | The use of flow control conformation was discussed. | The transmission of the flow control conformation AK TPDUs by the DT transmitter is optional. However, a DT receiver must be able to recognize the receipt of flow control conformation AK TPDUs and act in accordance with the specification. This allows the data receiver to optionally use credit reduction. |
| Graceful Close | The use of Graceful Close was discussed. | The sender of a GR should not assume that the receiver is anything but ISO compatible. The receiver of a GR not implementing Graceful Close can close or return an error. |

Tony Lauck of Digital Equipment Corporation presented an addressing scheme consistent with the mechanisms proposed by the IEEE 802 logical link control committee and with the mechanisms required by Class 4 Transport. The following diagram helps illustrate the approach.




The transport entity x is addressed S.a.
The transport entity y is addressed S.a.p.
The transport entity z is addressed S.c. _

The suggestion was made to ask IEEE 802 for a Link Service Access Point LSAP "a" pointing to the null ISO network entity. Since the Network Entity is null, we assume it points to the Network Service Access Point "x." We assume that other non-null ISO network entities will contain mechanisms for pointing to other Network Service Access Points "y" and "z".

The TSAP identifier pointing to the USER is specified in the CR suffix parameter. The participants agreed to use an ASCII character string to represent the TSAP. The first octet of the string would be all zeros followed by an even parity "NBS..."

With consensus reached on addressing, Mr. Graube began a discussion on possible applications for the 1984 multivendor demonstration.

For each identified application, the interested companies were identified and tabulated as indicated below:

| APPLICATION | INTERESTED ORGANIZATION |
|---|---|
| Messaging | 3COM, DEC, NBI |
| ASCII File Transfer | Ford, DEC, TEC |
| ASCII on top of transport | Ford U-B |
| X.29 | ICL |
| Teletex | ICL |
| File service (binary) | DEC, Boeing |
| Phone | DEC |

5. Future plans

The next workshop is scheduled for May 5 and 6, 1983. It was obvious that the identified applications require a thorough "flushing-out". Specific application protocols neet to be defined. It was agreed that application proposals and specification of application protocols would be an agenda item at the next meeting.

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10. SUPPLEMENTARY NOTES

☐ Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)

The National Bureau of Standards Institute for Computer Sciences and Technology (ICST) has prepared specifications for the International Organization for Standardization's (ISO) Class 4 Transport Protocol. At the request of a number of companies, ICST organized a workshop for local area network implementors of these specifications. The workshop focused on implementation techniques and strategies so that a multi-vendor demonstration of these protocols can occur at a major computer conference in the 1984 time frame. This report documents the workshop and records implementation choices and agreements made by the participants.

12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)

communication protocols; computer networks; local area networks; standards; transport protocol

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