
Information Technology - Scheduled Transfer - Reliable Transport Profile (ST-RTP)

Secretariat: National Committee for Information Technology Standardization (NCITS)

This is an internal working draft of T11, a Technical Committee of Accredited Standards Committee NCITS. As such, this is not a completed standard. **Caution:** At this stage this document is a work in progress and is not considered technically correct or complete by the T11.1 Task Group. The contents **will** be modified as a result of comments received during the review process. This document is made available for review and comment only.

Permission is granted to members of NCITS, its technical committees, and their associated task groups to reproduce this document for the purposes of NCITS standardization activities without further permission, provided this notice is included. All other rights are reserved. Any duplication for commercial or for-profit use is prohibited.

ABSTRACT

This American National Standard specifies limitations and requirements that may be accepted within the Scheduled Transfer (ST) protocol in order to facilitate interoperability for reliable data transports.

Contacts: T11.1 Chair and Technical Editor

Roger Ronald
Power Micro Research
Suite 1100
1411 East Campbell Road
Richardson, Texas 75081
Voice: 972-437-9461
FAX: 972-994-0888
E-mail: rronald@pmr.com

T11.1 Vice-Chair

Don Woelz
Genroco
255 Info Highway
Slinger, W 53086
Voice: 414-644-2505
FAX: 414-644-6667
E-mail: don@genroco.com

Other Points of Contact:

	<u>T11 Chairman</u> Kumar Malavalli Brocade Communications 1901 Guadalupe Parkway San Jose, CA 95131	<u>T11 Vice-Chairman</u> Edward L. Grivna Cypress Semiconductor 2401 East 86th Street Bloomington, MN 55425	<u>NCITS Secretariat</u> NCITS Secretariat, ITI 1250 Eye Street, NW Suite 200 Washington, DC 20005
Voice:	408-487-8156	612-851-5046	202-737-8888
FAX:	408-524-8601	612-851-5087	202-638-4922
E-mail:	kumar@brocade.com	elg@cypress.com	ncitssec@itic.nw.dc.us

T11.1 E-mail Reflector (for HIPPI technical discussions and notifications of web changes)

Internet address for subscription to the HIPPI reflector: Majordomo@nscsco.network.com
Messages should contain a line stating... subscribe hippy <your e-mail address>
Internet address for distribution via the HIPPI reflector: hippy@nscsco.network.com

T11 E-mail Reflector (for T11 meeting notices, agendas, etc.)

Internet address for subscription to the T11 reflector: Majordomo@nscsco.network.com
Messages should contain a line stating... subscribe T11 <your e-mail address>
Internet address for distribution via the T11 reflector: t11@nscsco.network.com

Web Sites:

HIPPI Standards Activities <http://www.hippi.org/>
T11 Activities <http://www.t11.org/>
NCITS <http://www.ncits.org/>

T11 Document Distribution

Global Engineering
15 Inverness Way East
Englewood, CO 80112-5704
Voice: 303-792-2181 or 800-854-7179
FAX: 303-792-2192

PATENT STATEMENT

CAUTION: The developers of this standard have requested that holder's of patents that may be required for the implementation of the standard, disclose such patents to the publisher. However, neither the developers nor the publisher have undertaken a patent search in order to identify which, if any, patents may apply to this standard.

As of the date of the publication of this standard and following calls for the identification of patents that may be required for the implementation of the standard, no such claims have been made. No further patent search is conducted by the developer or the publisher in respect to any standard it processes. No representation is made or implied that licenses are not required to avoid infringement in the use of this standard.

Change Management

Notes will be placed in this section to give the reader the big picture with respect to changes. Almost all changes will also have change bars in the document body, although repetitive minor spelling or punctuation errors may be done with changes bars turned off, if the number of changes is too large and the quantity of change bars would tend to hide, rather than flag, significant changes.

Technical changes are flagged with **bold** text in this section.

Comments on version 0.2

This version incorporates changes made at the October, 1999 meeting in Ft. Lauderdale, FL. Since the first revision was very preliminary, there are many formatting and technical changes.

- All of this page and the next two (ANSI Cover page and boilerplate) are new (no change bars on the next two pages)
- Title and some wording were changed on the front page to warn readers that this document is still early in the work process
- One description of RTP was plugged into the front page description, the foreword, the ANSI abstract, and the introduction.
- The tables were substantially edited and split into three sections; one for general characteristics, one for connection characteristics, and one for data transfer characteristics. All material in the tables should be completely revalidated and reviewed.

Comments on version 0.3

This version incorporates changes made at the December, 1999 meeting in Reno, NV.

Table changes continue as marked by change bars. Give that the tabular format does not leave much, if any, opportunity for any confusion as to the nature of the changes, they will not be itemized here (in the change list) until after a fairly high level of confidence and document maturity has been reached.

Comments on version 0.4

This version incorporates changes made at the February, 2000 meeting in Huntington Beach, CA.

Table changes continue as marked by change bars.

American National Standard
for Information Technology –

Scheduled Transfer -
Reliable Transport Profile (ST-RTP)

Secretariat

Information Technology Industry Council (ITI)

Approved , 200x

American National Standards Institute, Inc.

Abstract: This American National Standard specifies limitations and requirements that may be accepted within the Scheduled Transfer (ST) protocol in order to facilitate interoperability for reliable data transports.

American National Standard

Approval of an American National Standard requires verification by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgment of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give interpretation on any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

CAUTION: The developers of this standard have requested that holder's of patents that may be required for the implementation of the standard disclose such patents to the publisher. However, neither the developers nor the publisher have undertaken a patent search in order to identify which, if any, patents may apply to this standard.

As of the date of publication of this standard, following calls for the identification of patents that may be required for the implementation of the standard, no such claims have been received.

By publication of this standard, no position is taken with respect to the validity of this claim or of any rights in connection therewith. The known patent holder(s) has (have), however, filed a statement of willingness to grant a license under these rights on reasonable and nondiscriminatory terms and conditions to applicants desiring to obtain such a license. Details may be obtained from the publisher.

No further patent search is conducted by the developer or the publisher in respect to any standard in process. No representation is made or implied that this is the only license that may be required to avoid infringement in the use of this standard.

Table Of Contents

1	Scope	1
2	Normative references	1
2.1	Approved references	1
2.2	References under development	1
3	Definitions and conventions	2
3.1	Definitions	2
3.2	Editorial conventions	2
3.2.1	Binary notation	2
3.2.2	Hexadecimal notation	2
3.2.3	Bit/Byte naming conventions	2
3.2.4	Acronyms and other abbreviations	2
3.3	Applicability and use of this document	2
4	System overview	3
4.1	Environmental requirements beyond ST	3
5	Profile Settings	3

Tables

Table 1 -	General Behavior and Options	4
Table 2 -	Connection Behavior and Options.....	4
Table 3 -	Flags during Data Transfers	5
Table 4 -	Transfer Units	5
Table 5 -	Other Data Transfer Behaviors and Options.....	6

Foreword (This Foreword is not part of American National Standard X3.xxx-200x.)

This American National Standard specifies limitations and requirements that may be accepted within the Scheduled Transfer (ST) protocol in order to facilitate interoperability for reliable data transports.

This document includes annexes which are informative and are not considered part of the standard.

Requests for interpretation, suggestions for improvement or addenda, or defect reports are welcome. They should be sent to the National Committee for Information Technology Standards (NCITS), ITI, 1250 Eye Street, NW, Suite 200, Washington, DC 20005.

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Information Processing Systems, X3. Committee approval of the standard does not necessarily imply that all committee members voted for approval. At the time it approved this standard, the NCITS had the following members:

Karen Higgenbottom, Chairman (Acting)
Karen Higgenbottom, Vice-Chair
Monica Vago, Secretary

Organization Represented

Name of Representative

Technical Committee T11 on Device Level Interfaces, which reviewed this standard, had the following members:

Kumar Malavalli, Chairman
Ed Grivna, Vice Chairman

Task Group T11.1 on the High Performance Parallel Interface, which developed this standard, had the following participants:

Roger Ronald, Chairman and ST Profile Technical Editor
Don Woelz, Vice Chairman

Introduction

This American National Standard specifies limitations and requirements that may be accepted within the Scheduled Transfer (ST) protocol in order to facilitate interoperability for reliable data transports.

This Profile is an interoperability specification. The Profile provides implementation guidelines for systems manufacturers, system integrators, component manufacturers, and users seeking to design and select interoperable ST peripherals, hosts, and components. This Profile specifies which settings of the ST parameters and protocol options have been selected for interoperable implementation.

This Profile is not a certification document; conformance can only be assured by actual testing of interoperability with independently developed products that have the same Profile.

American National Standard for Information Technology –

Scheduled Transfer Reliable Transport Profile (ST-RTP)

1 Scope

This American National Standard specifies limitations and requirements that may be accepted within the Scheduled Transfer (ST) protocol (ANSI NCITS Project 1245-D) in order to facilitate interoperability for reliable data transports.

This Profile is an interoperability specification. The Profile provides implementation guidelines for systems manufacturers, system integrators, component manufacturers, and users seeking to design and select interoperable ST peripherals, hosts, and components. This Profile specifies which settings of the ST parameters and protocol options have been selected for interoperable implementation.

There should be no implication that this profile is suitable for all users or circumstances. Other mappings for the ST protocol are being developed and may be more suitable for a particular set of needs. Or, requirements may force implementors to operate outside of any profile definition.

This Profile is not a certification document; conformance can only be assured by actual testing of interoperability with independently developed products that have the same Profile.

This profile prohibits or requires features that are optional, and prohibits the use of some non-optional features in the referenced ANSI standards.

Internal characteristics of conforming implementations are not defined by this standard.

2 Normative references

The following standards contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard listed below.

Copies of the following documents can be obtained from ANSI: Approved ANSI standards, approved and draft international and regional standards (ISO, IEC, CEN/CENELEC, ITUT) and approved and draft foreign standards (including BSI, JIS, and DIN). For further information, contact ANSI Customer Service Department at 212-642-4900 (phone), 212-302-1286 (fax) or via the World Wide Web at <http://www.ansi.org>. Additional availability contact information is provided below as needed.

2.1 Approved references

None.

2.2 References under development

At the time of publication, the following referenced standards were still under development. For information on the current status of the document, or regarding availability, contact the relevant standards body or other organization as indicated. For more information about obtaining copies of this document or for more information of the current status of the document, contact National Committee for Information Technology Standards, 1250 Eye Street, NW, Suite 200, Washington, DC 20005, 202-626-5746.

ANSI NCITS T11.1, *Scheduled Transfer (ST)*,
Project 1245-D

3 Definitions and conventions

3.1 Definitions

Since this document does not allow any behavior that is not already specified by the Schedule Transfer protocol and the definitions of that document are included by reference, there are no new words to be defined herein.

3.2 Editorial conventions

In this standard, certain terms that are proper names of signals or similar terms are printed in uppercase to avoid possible confusion with other uses of the same words (e.g., DATA). Any lowercase uses of these words have the normal technical English meaning.

A number of conditions, sequence parameters, events, states, or similar terms are printed with the first letter of each word in uppercase and the rest lowercase (e.g., State, Source). Any lowercase uses of these words have the normal technical English meaning.

The word *shall* when used in this American National standard, states a mandatory rule or requirement. The word *should* when used in this standard, states a recommendation.

3.2.1 Binary notation

Binary notation is used to represent relatively short fields. For example a two-bit field containing a binary value of 10 is shown in binary format as b'10'.

3.2.2 Hexadecimal notation

Hexadecimal notation is used to represent some fields. For example a two-byte field containing a binary value of b'1100010000000011' is shown in hexadecimal format as x'C403'.

3.2.3 Bit/Byte naming conventions

In a parameter that uses multiple bytes, the most-significant byte is the lowest-numbered byte.

In a parameter that uses multiple bits, the most-significant bit is the highest-numbered bit.

3.2.4 Acronyms and other abbreviations

FTP	File Transfer Protocol
ST	Scheduled Transfer
WAN	Wide Area Network

3.3 Applicability and use of this document

Since the nature of this standard is a profile, the usual definitions of the following words do not apply.

Prohibited: If a feature is Prohibited, it means that it shall not be used with this profile. An implementation may use the feature to communicate with ST implementations when not using this profile.

This document does not prohibit the implementation of features, only their use between compliant implementations.

Required: If a feature or parameter value is Required, it means that it shall be used between compliant implementations. Compliant implementations are required to implement the feature. An implementation may use the feature or other features to communicate with non-compliant implementations.

Allowed: If a feature or parameter value is Allowed, it means that it may be used between compliant implementations. Compliant implementations are not required to implement the feature, but if they do, the feature shall be used as described in this document. Typically, the potential user of a feature may determine if the potential recipient supports that feature via a Required discovery process.

Invocable: If a feature or parameter value is Invocable, it means that it may be used between compliant implementations. Compliant implementations are required to implement the feature, and make available the use of the feature. Invocable is different than Allowable or Required in that an originator may invoke the feature if needed, but the originator is not required to invoke it, and may never need to.

Tables in the following clauses list features described in the ST protocol. These tables indicate whether the feature is Required, Prohibited, Invo-cable, or Allowed for compliance with this profile; or whether a parameter is Required to be a particular value or limited range of values for compliance with this profile.

Features or parameters that are not listed do not affect the interoperability of ST implementations.

The following legend is used for table entries in these clauses:

- 'P' the implementation is Prohibited from using the specified feature
- 'R' the implementation is Required to sup-port the specified feature
- 'A' use of the specified feature is Allowed
- 'I' the implementation may Invoke the speci-fied feature

4 System overview

This paragraph provides an overview of the struc-ture, concepts, and mechanisms used in this ST Reliable Transport Profile.

This ST Reliable Transport Profile is designed to support interoperability for applications that need the general ability to transfer data reliably between one another. One example might be a File Transfer Protocol (FTP) implemented on top of ST.

In exchange for providing interoperability, this pro-file reduces flexibility and may reduce performance over less constrained implementations. For exam-ple, this profile does not allow using variable Block sizes, a mode of ST operation that provides a dif-ferent method for flow control that might work bet-ter than consistent Blocks over a Wide Area Network (WAN).

Applications that require added flexibility will need to arrive at a different agreement:

- negotiations at the ANSI standards level can establish a new, more suitable profile; or

- negotiations between application develop-ers can establish a defacto working arrange-ment where consistency in settings and options is agreed upon; or
- negotiations between hardware can select the appropriate behavior of that hardware.

4.1 Environmental requirements beyond ST

This profile and the ST protocol make many of the same assumptions about underlying protocol lay-ers. For example, it is assumed that there is a mechanism whereby ST Messages are delivered from the sender to the receiver.

While some implementations of ST may be designed to work only with reliable underlying lay-ers, this specification does not make that assump-tion.

5 Profile Settings

Table 1 lists general characteristics and assigns behavior(s) or parameter value(s).

Table 2 lists connection characteristics and assigns behavior(s) or parameter value(s).

Table 3, table 4, and table 5 lists data transfer char-acteristics and assign behavior(s) or parameter value(s).

Table 1 - General Behavior and Options

Parameter or Characteristic	Setting	Note
Timeout on operation pairs as described in clause 10 of the ST specification	R	
Heartbeat Timer (keep-alive timer)	R	
Timer Settings	R	As specified by the Finite State Machines (FSMs) appendix in the ST specification
Push Semantics (i.e., ST Write Sequences.)	R	
Pull Semantics (i.e., ST Read Sequences)	P	
Persistent Memory	P	
Checksums for Messages other than Data STUs	A	
Option Payloads	A	
Slot accounting	R	
NOPs	P	

Note: the timer settings above point to an informative annex. Is this OK or is there a better place to point to? We use a reference to 10.3 in table 5.

Table 2 - Connection Behavior and Options

Parameter or Characteristic	Setting	Note
Party line connections (i.e., multiple connections from different points that use the same S_Port value and/or D_Port value.	P	
Interrupt bit set (I = b'1') on connection management Messages	R	
Silent bit off (T = b'0') on connection management Messages	R	
Out of Order Blocks (O=b'1')	R	Needed to allow retransmissions.
Minimum number of slots per connection.	16	This is the minimum value that ST-RTP allows for the I-Slots and R-Slots parameters (passed during the Request_Connection and Connect_Answer exchange).

Table 3 - Flags during Data Transfers

Parameter or Characteristic	Setting	Note
Silent (T = b'1') on all STUs, other than the last STU within a Block (L ≠ b'1')	R	
Silent (T = b'1') on the last STU within a Block (L = b'1')	P	
Interrupt (I = b'1') on any STU, other than the last STU within a Block (L ≠ b'1')	P	
Interrupt (I = b'1') on the last STU within a Block (L = b'1')	R	
Data Channel 1 Usage (D=b'01')	I	Subject to STU size limit of 4K bytes. Note: ST-RTP chooses a smaller limit than the ST specification in order to encourage leaving VC1 as a low latency channel.
Data Channel 2 Usage (D=b'10')	I	Subject to STU size limit of 128K bytes
Data Channel 3 Usage (D=b'11')	I	

Table 4 - Transfer Units

Parameter or Characteristic	Setting	Note
Variable Block Sizes	P	
Consistent Block Sizes	R	
Buffer size greater than Block size	I	
Block size greater than Buffer size	I	
Unlimited Transfer size	P	
Minimum number of CTS operations that must be sent during a Transfer	1	
Maximum number of CTS operations that can be outstanding	Limited only by the current number of receiver advertised slots	
Maximum number of CTS operations that must be received and acted upon	Equal to number of currently advertised slots	
Non-zero offsets	I	

Table 5 - Other Data Transfer Behaviors and Options

Parameter or Characteristic	Setting	Note
Checksums for Data STU Blocks	A	Trailing or leading checksums allowed.
Each STU within a Block must start at a higher address than the previous STU	R	Sending STUs containing data that is not in ascending buffer memory order is prohibited.
Data must be transferred to all bytes within a Block.	R	Gaps in tiling (areas not written by a STU) are prohibited.
Data must only be transferred to any byte within a Block once (except for retransmissions required by a retransmitted CTS)	R	Multiple writes to the same location, except in response to a retransmitted CTS, are prohibited.
Block Retransmission to correct errors	I	Sources of data must be able to retransmit data if a request for a previously transmitted Block is received (i.e., if a CTS is retransmitted).
Number of retransmits requested for a single Block before giving up on transfer	minimum of 2	At least 3 tries required for each Block.
Data transfer time-outs as specified in clause 10.3 of ST	R	
Opaque Data in Data Operations	P	
Request Status Response	R	Required when invoked by a Request Status or S=1 in Data STU or S=1 in RTS.
Bi-directional transfer capability	R	
Striping	P	