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

Secretariat: National Committee for Information Technology Standardization (NCITS)

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### **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.

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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.

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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.

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.

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## Table Of Contents

<b>1</b>	<b>Scope</b> .....	<b>1</b>
<b>2</b>	<b>Normative references</b> .....	<b>1</b>
2.1	Approved references .....	1
2.2	References under development .....	1
<b>3</b>	<b>Definitions and conventions</b> .....	<b>2</b>
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
<b>4</b>	<b>System overview</b> .....	<b>3</b>
4.1	Environmental requirements beyond ST .....	3
<b>5</b>	<b>Profile Settings</b> .....	<b>3</b>

## Tables

Table 1 -	General Behavior and Options .....	3
Table 2 -	Connection Behavior and Options.....	4
Table 3 -	Flags during Data Transfers .....	4
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-199x.)

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

<b>FTP</b>	File Transfer Protocol
<b>ST</b>	Scheduled Transfer
<b>WAN</b>	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 profiles.

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 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	

**Table 1 - General Behavior and Options**

Parameter or Characteristic	Setting	Note
Persistent Memory	P	
Checksums for Messages other than Data STUs	A	
Option Payloads	A	
Slot accounting	R	
Minimum number of slots	16	
NOPs	A	

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

**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)	P	
Option Payloads during connection	A	
Interrupt (I = b'1') on connection management Messages	R	
Silent (T = b'0') on connection management Messages	P	

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

**Table 3 - Flags during Data Transfers**

Parameter or Characteristic	Setting	Note
Silent (T = b'1') on any STU, other than the last STU within a Block (L ≠ b'1')	A	
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')	R	
Interrupt (I = b'1') on the last STU within a Block (L = b'1')	R	

**Table 3 - Flags during Data Transfers**

<b>Parameter or Characteristic</b>	<b>Setting</b>	<b>Note</b>
Out of Order Blocks (O=b'1')	R	Needed to allow retransmissions.
Data Channel 1 Usage (D=b'01')	I	Subject to STU size limit of 4K bytes
Data Channel 2 Usage (D=b'10')	I	Subject to STU size limit of 64K bytes
Data Channel 3 Usage (D=b'11')	I	

**Table 4 - Transfer Units**

<b>Parameter or Characteristic</b>	<b>Setting</b>	<b>Note</b>
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 can be received and acted upon	4	
Minimum number of CTS operations that must be sent during a Transfer	1	
Maximum number of CTS operations that can be sent	No more than 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**

<b>Parameter or Characteristic</b>	<b>Setting</b>	<b>Note</b>
Checksums for Data STU Blocks	A	Trailing or leading checksums allowed.
Sending STUs containing data that is not in ascending buffer memory order	P	Each STU within a Block must start at a higher address than the previous STU
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
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	