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NTCIP 2303:2001 v01.06

National Transportation Communications for ITS Protocol File Transfer Protocol Application Profile

December 2001

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The File Transfer Protocol Application Profile is based upon a Department of Defense Standardized Profile for the specification and implementation of the FTP Protocol; MIL-STD-2045-14504: 29 July 1994. The *NTCIP File Transfer Protocol – Application Profile* borrows heavily from that work and credit is due to the Data Communications Protocol Standards Technical Management Panel for publishing the standard and placing it in the public domain.

FOREWORD

This document uses only metric units.

This publication defines an application profile that is a combination of other profiles intended to meet specific requirements for reliable file transfers in a networked environment. This publication contains mandatory requirement statements that are applicable to all devices claiming conformance to this standard. This publication also contains optional and conditional requirements that may be applicable to a specific environment in which a device is used.

The text includes mandatory requirements in Annex A that are defined as normative.

For more information about NTCIP standards, visit the NTCIP Web Site at <http://www.ntcip.org>. For a hardcopy summary of NTCIP information, contact the NTCIP Coordinator at the address below.

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Approvals

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ITE – Software Standard; May 2001
NEMA – Standard; January 2001

History

From 1998 to 1999, this document was referenced as TS 3.FTP. However, to provide an organized numbering scheme for the NTCIP documents, this document is now referenced as NTCIP 2303. The technical specifications of NTCIP 2303 are identical to the former reference, except as noted in the development history below:

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updated headers, footers, and page numbers. All references to TS 3 Standard designations were changed to equivalent NTCIP Standard designations.

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INTRODUCTION

The context of the NTCIP is one part of the Intelligent Transportation Systems standardization activities covering base standards, profiles, and registration mechanisms.

- Base Standards define procedures and rules for providing the fundamental operations associated with communications and information that is exchanged over fixed-point communications links.
- Profiles define subsets or combinations of base standards used to provide specific functions or services. Profiles prescribe particular subsets or options available in base standards necessary for accomplishing a particular function or service. This provides a basis for the development of uniform, nationally recognized conformance.
- Registration Mechanisms provide a means to specify and uniquely identify detailed parameters within the framework of base standards and/or profiles.

Within the Joint AASHTO/ITE/NEMA NTCIP Committee, the Profiles Working Group is concerned with the methodology of defining profiles, and their documentation in Standards Publications. This standard defines an application profile for block or file transfers to and from roadside devices. The objective is to facilitate the specification of ITS systems characterized by a high degree of interoperability and interchangeability of its components.

In 1992, the NEMA 3-TS Transportation Management Systems and Associated Control Devices Section began the effort to develop the NTCIP. Under the guidance of the Federal Highway Administration's NTCIP Steering Group, the NEMA effort was expanded to include the development of communications standards for all transportation field devices that could be used in an ITS network.

In September 1996, an agreement was executed among AASHTO, ITE, and NEMA to jointly develop, approve, and maintain the NTCIP standards. In August 1997, the Joint Committee on the NTCIP formed a new working group to develop a method for organizing class profiles. The Profiles WG first met in September 1997.

After research into how national and international standards organizations combine protocols and standards to address all seven layer of the ISO-OSI Reference Model, the committee adopted the approach defined in the *NTCIP Profile Framework*. Following that approach, a protocol stack is specified by an application, transport, subnetwork profiles. An application profile addresses the application, presentation, and session layers. A transport profile addresses the transport and network layers. A subnetwork profile addresses the data link and physical layers. The *NTCIP File Transfer Protocol - Application Profile (AP-FTP)* is an application profile for use in center-to-roadside and center-to-center communications.

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NTCIP Profile Requirements List
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Section 1 GENERAL

1.1 SCOPE

This standard is applicable to traffic control and transportation devices concerned with operating in an Intelligent Transportation System. As an NTCIP application profile, it specifies a set of protocols and standards for the application, presentation, and session layers of the ISO - OSI Reference Model. This standard specifies a combination of Internet standards that collectively provide file transfer services over a connection-oriented transport service.

1.2 PROFILE-PROTOCOL-LAYER RELATIONSHIPS

This application profile specifies the provisions for the File Transfer Protocol. This profile provides connection-oriented file transfer services. The layers, base standards, and profile taxonomy that make up this profile are shown in Figure 1-1.

ISO Layers	Base Standard	Profile
APPLICATION LAYER	IAB STD 9 (FTP) IAB STD 3 (Internet Hosts)	FTP – Application Profile
PRESENTATION LAYER		
SESSION LAYER		

**Figure 1-1
FTP - Application Profile Relationship**

1.3 REFERENCES

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For draft revisions of this document, which are under discussion by the relevant NTCIP Working Group, and recommended revisions of the NTCIP Joint Committee, visit the World Wide Web at <http://www.ntcip.org>.

The following standards (normative references) contain provisions, which through reference in this text, constitute provisions of this Standard. Other documents and standards (other references) are referenced in these documents, which might provide a complete understanding of the structure and use of profiles. 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 editions of the standards listed below.

1.3.1 Normative References

Internet Activities Board
available via electronic file transfer
use anonymous FTP from
nic.ddn.mil or ds.internic.net

IAB STD 3 (*RFC 1122: 1989, Requirements For Internet Hosts - Communication Layers, RFC 1123: 1989, Requirements For Internet Hosts - Application and Support*)

IAB STD 9 (*RFC 959: October 1985, File Transfer Protocol (FTP)*).

1.3.2 Other References

Guide to Open System Specifications, European Workshop for Open Systems,
<http://www.ewos.be/goss/top.htm>, June 9, 1997

US-DOD Internet Related Standardized Profiles, DISA Internet Librarian, http://www-library.itsi.disa.mil/org/mil_std.html, October 31, 1997

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NTCIP 8003:2001 *NATIONAL TRANSPORTATION COMMUNICATIONS FOR ITS PROTOCOL
Profile Framework*

1.4 DEFINITIONS

For the purposes of this standard, the following definitions apply:

Application Layer: That portion of the OSI Reference Model (Layer 7) that provides access to the communications services.

data: Information before it is interpreted.

Data Link Layer: That portion of the OSI Reference Model (Layer 2) responsible for flow control, framing, synchronization, and error control over a communications link.

datagram: A self-contained unit of data transmitted independently of other datagrams.

end-application: A process or program using the communications stack.

end system: The source or destination of an information exchange.

host: (Internet usage) The physical and/or logical part of the end-system's application. A computer attached to one or more networks that supports users and runs application programs.

Intelligent Transportation Systems: A major national initiative to apply information, communication and control technologies in order to improve the efficiency of surface transportation.

intermediate system: A system that participates in an information exchange but is not the source or destination of the exchange.

Internet: A large collection of connected networks, primarily in the United States, running the Internet suite of protocols. Sometimes referred to as the *DARPA Internet*, *NSF/DARPA Internet*, or the *Federal Research Internet*.

Internet protocol: The network protocol offering a connectionless mode network service in the Internet suite of protocols.

Internet suite of protocols: A collection of computer-communication protocols originally developed under DARPA sponsorship.

internetwork: The ability of devices to communicate across multiple networks.

network: A collection of subnetworks connected by intermediate systems and populated by end systems.

Network Layer: That portion of an OSI Reference Model (Layer 3) responsible for data transfer across the network, independent of both the media comprising the underlying subnetworks and the topology of those subnetworks.

Open Systems Interconnection: An international effort to facilitate communications among computers of different manufacture and technology.

OSI Reference Model: A widely accepted structuring technique that provides an abstract representation of the communication process that is divided into seven basic, functional layers.

Physical Layer: That portion of an OSI Reference Model (Layer 1) responsible for the electrical and mechanical interface between communicating systems.

Presentation Layer: That portion of an OSI Reference Model (Layer 6) responsible for converting and organizing data from one format to another.

proforma: A guide provided in advance to prescribe form or describe items.

Session Layer: That portion of an OSI Reference Model (Layer 5) which manages a series of data exchanges between end-system applications.

subnetwork: A physical network within a network. All devices on a subnetwork share a common physical medium.

taxonomy: A classification scheme for referencing profiles or sets of profiles unambiguously.

TCP/IP Reference Model: An alternate to the OSI Reference Model that organizes the communications process into 4 layers. It consists of host-to-network, internet, transport, and application layers.

Transport Layer: That portion of an OSI Reference Model (Layer 4) which attempts to guarantee reliable data transfer between two end-systems, using flow control and error recovery, and may provide multiplexing.

1.5 ABBREVIATIONS AND ACRONYMS

The acronyms used in this Standard Publication are defined as follows:

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
AP	Application Profile
ASCII	American National Standard Code for Information Interchange
EBCDIC	Extended Binary Coded Decimal Interchange Code
FTP	File Transfer Protocol
IAB	Internet Architecture Board
IP	Internet Protocol
ISO	International Organization for Standardization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
NEMA	National Electrical Manufacturers Association
NTCIP	National Transportation Communications for ITS Protocol
OSI	Open Systems Interconnection
PICS	Protocol Implementation Conformance Statement
RFC	(Internet) Request for Comments
STD	(Internet) Standard
TCP	Transmission Control Protocol
TP	Transport profile
UDP	User Datagram Protocol

The abbreviations and acronyms used as FTP commands are:

ABOR	Abort
ACCT	Account
ALLO	Allocate
APPE	Append
CDUP	Change to Parent Directory
CWD	Change Working Directory
DELE	Delete
MKD	Make Directory
NLST	Name List
PASS	Password
PASV	Passive
PWD	Print Working Directory
REIN	Reinitialize
REST	Restart
RETR	Retrieve
RMD	Remove Directory
RNFR	Rename From
RNTO	Rename To
SMNT	Structure Mount
STAT	Status
STOR	Store
STOU	Store Unique

STRU Structure
SYST System

Section 2 CONFORMANCE

2.1 GENERAL REQUIREMENTS

Implementations claiming conformance to the File Transfer Protocol - Application Profile shall support the following elements as stated.

- a. All requirements in the remainder of Section 2 of this profile.
- b. All of the constraints specified in Annex A (normative) of this profile.
- c. All mandatory requirements of the standards referenced by this profile.

2.1.1 Data Transfer Functions

There are no additional requirements to the data transfer functions as specified in RFC 959, Section 3.

2.1.2 File Transfer Functions

There are no additional requirements to the file transfer functions as specified in RFC 959, Section 4.

2.1.3 Declarative Specifications

There are no additional requirements to the declarative specifications as specified in RFC 959, Section 5.

2.2 CONFORMANCE REQUIREMENTS

Implementations claiming conformance to this profile shall support the following as stated. Some requirements are predicated on whether an implementation operates as a client or server. A client is capable of initiating or sending FTP commands. A server is capable of responding or replying to FTP commands.

In applying the requirements, a user of the PICS must bear in mind that RFC 1123 Section 4.1.2.13, defines the commands and options that **MUST** be supported "except in cases where the underlying file system or operating system does not allow or support a particular command." In the case of a transportation road-side device, there may not be a file system or formal operating system.

2.2.1 Data Types

Except in cases where the underlying file or operating system does not allow or permit, an implementation shall support the ASCII Non-Print, Image, and Local 8 Bit Data Types. There are no additional requirements as specified in RFC 959, Section 3.1.1 and RFC 1123, Section 4.1.2.1 and Section 4.1.2.2.

2.2.2 Data Structures

There are no additional requirements for data structures other than those specified in RFC 959, Section 3.1.2 and RFC 1123, Section 4.1.2.3 and 4.1.2.4. Implementation of a record-structured file system is not required. However, if a record-structured file system is implemented, then transfer support of this organization is required.

2.2.3 Transmission Modes

There are no additional requirements as specified in RFC 959, Section 3.4.

2.2.4 Commands

2.2.4.1 Access Control Commands

RFC 1123, Section 4.1.3.1, references several experimental access control commands that were never adopted as standard. Support for these objects in that RFC is listed as "should." However, these commands have not been standardized and support for the experimental XCUP and XCWD access control commands is optional. Support of the equivalent, standardized CDUP and CWDD access control commands is required.

2.2.4.1.1 USER Command

There are no additional requirements to the USER command as specified in RFC 959, Section 4.1.1.

2.2.4.1.2 PASS Command

There are no additional requirements to the PASS command as specified in RFC 959, Section 4.1.1.

2.2.4.1.3 ACCT Command

There are no additional requirements to the ACCT command as specified in RFC 959, Section 4.1.1.

2.2.4.1.4 CWD Command

There are no additional requirements to the CWD command as specified in RFC 959, Section 4.1.1.

2.2.4.1.5 CDUP Command

There are no additional requirements to the CDUP command as specified in RFC 959, Section 4.1.1.

2.2.4.1.6 SMNT Command

There are no additional requirements to the SMNT command as specified in RFC 959, Section 4.1.1.

2.2.4.1.7 REIN Command

There are no additional requirements to the REIN command as specified in RFC 959, Section 4.1.1.

2.2.4.1.8 QUIT Command

There are no additional requirements to the QUIT command as specified in RFC 959, Section 4.1.1.

2.2.4.2 Transfer Parameter Commands

2.2.4.2.1 PORT Command

There are no additional requirements to the PORT command as specified in RFC 959, Section 4.1.2.

2.2.4.2.2 PASV Command

There are no additional requirements to the PASV command as specified in RFC 959, Section 4.1.2 and RFC 1123, Section 4.1.2.6.

2.2.4.2.3 TYPE Command

There are no additional requirements to the TYPE command as specified in RFC 959, Section 4.1.2.

2.2.4.2.4 STRU Command

There are no additional requirements to the STRU command as specified in RFC 959, Section 4.1.2.

2.2.4.2.5 MODE Command

There are no additional requirements to the MODE command as specified in RFC 959, Section 4.1.2.

2.2.4.3 Service Commands

RFC 1123, Section 4.1.3.1, references several experimental service commands that were never adopted as standard. Support for these objects in that RFC is listed as "should". However, these commands have not been standardized and support for the experimental XMKD, XRMD, and XPWD service commands is optional. Support of the equivalent, standardized MKD, RMD, and PWD service commands is required.

2.2.4.3.1 RETR Command

There are no additional requirements to the RETR command as specified in RFC 959, Section 4.1.3.

2.2.4.3.2 STOR Command

There are no additional requirements to the STOR command as specified in RFC 959, Section 4.1.3.

2.2.4.3.3 STOU Command

There are no additional requirements to the STOU command as specified in RFC 959, Section 4.1.3 and RFC 1123, Section 4.1.2.9.

2.2.4.3.4 APPE Command

There are no additional requirements to the APPE command as specified in RFC 959, Section 4.1.3.

2.2.4.3.5 ALLO Command

There are no additional requirements to the ALLO command as specified in RFC 959, Section 4.1.3.

2.2.4.3.6 REST Command

There are no additional requirements to the REST command as specified in RFC 959, Section 4.1.3.

2.2.4.3.7 RNFR Command

There are no additional requirements to the RNFR command as specified in RFC 959, Section 4.1.3.

2.2.4.3.8 RNTO Command

There are no additional requirements to the RNTO command as specified in RFC 959, Section 4.1.3.

2.2.4.3.9 ABOR Command

There are no additional requirements to the ABOR command as specified in RFC 959, Section 4.1.3.

2.2.4.3.10 DELE Command

There are no additional requirements to the DELE command as specified in RFC 959, Section 4.1.3.

2.2.4.3.11 RMD Command

There are no additional requirements to the RMD command as specified in RFC 959, Section 4.1.3.

2.2.4.3.12 MKD Command

There are no additional requirements to the MKD command as specified in RFC 959, Section 4.1.3.

2.2.4.3.13 PWD Command

There are no additional requirements to the PWD command as specified in RFC 959, Section 4.1.3.

2.2.4.3.14 LIST Command

There are no additional requirements to the LIST command as specified in RFC 959, Section 4.1.3 and RFC 1123, Section 4.1.2.7.

2.2.4.3.15 NLST Command

There are no additional requirements to the NLST command as specified in RFC 959, Section 4.1.3 and RFC 1123, Section 4.1.2.7.

2.2.4.3.16 SITE Command

There are no additional requirements to the SITE command as specified in RFC 959, Section 4.1.3 and RFC 1123, Section 4.1.2.8.

2.2.4.3.17 SYST Command

There are no additional requirements to the SYST command as specified in RFC 959, Section 4.1.3.

2.2.4.3.18 STAT Command

There are no additional requirements to the STAT command as specified in RFC 959, Section 4.1.3.

2.2.4.3.19 2.2.4.3.19 HELP Command

There are no additional requirements to the HELP command as specified in RFC 959, Section 4.1.3.

2.2.4.3.20 2.2.4.3.20 NOOP Command

There are no additional requirements to the NOOP command as specified in RFC 959, Section 4.1.3.

2.2.5 FTP Replies

There are no additional requirements to the FTP replies as specified in RFC 959, Section 4.2 and RFC 1123, Section 4.1.2.11.

2.2.6 Minimum Implementation

There are no additional requirements as specified in RFC 959, Section 5.1 and RFC 1123, Section 4.1.2.13.

2.2.7 User Interface

2.2.7.1 Pathname Specification

There are no additional requirements beyond those as specified in RFC 1123, Section 4.1.4.1. RFC 959 does not define a standard pathname or filename convention. The initiator of a transfer shall follow the filename and pathname conventions of the remote systems.

2.2.7.2 QUOTE Command

There are no additional requirements to the QUOTE command as specified in RFC 1123, Section 4.1.4.2.

2.2.7.3 Displaying Replies to User

There are no additional requirements as specified in RFC 1123, Section 4.1.4.3.

2.2.7.4 Maintaining Synchronization with server

There are no additional requirements as specified in RFC 1123, Section 4.1.4.4.

2.2.8 Idle Timeout

An idle timer shall be configurable as specified in RFC 1123, Section 4.1.3.2.

2.2.9 Interface Conformance

Implementations claiming conformance to this profile shall support the interfaces in the following two subclauses.

2.2.9.1 TCP Conformance

Support for the Transmission Control Protocol is required in order to operate in the transportation network and the Internet.

2.2.9.2 UDP Conformance

None.

2.2.10 Other Features

RFC 1123, Sections 4.1.2 and 4.1.3 references a number of features related to concurrency of data and control, restart, control and data ports, user, and server functions. There are no additional requirements beyond those as specified.

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Annex A FTP APPLICATION PROFILE REQUIREMENTS LIST

(Normative)

A.1 INTRODUCTION

This annex provides the Profile Requirements List (PRL) for implementations of the FTP - Application Profile. A Profile Implementation Conformance Specification (PICS) for an implementation is generated by an implementer or supplier by indicating the appropriate level of support provided by an implementation.

To claim conformance with this profile, an implementation shall satisfy the mandatory conformance requirements of this profile.

An implementation's completed PRL is called the PICS. The PICS states which capabilities and options of the protocol have been implemented. The following can use the PICS:

- a. The protocol implementer, as a checklist to reduce the risk of failure to conform to the standard through oversight.
- b. The supplier and user, as a detailed indication of the capabilities of the implementation.
- c. The user, as a basis for initially checking the possibility of interworking with another implementation (note that, while interworking can never be guaranteed, failure to do so can often be predicted from incompatible PICSs).
- d. A user, as the basis for selecting appropriate tests against which to assess the claim for conformance of the implementation.

A.1.1 Notation

The following notations and symbols are used to indicate status and conditional status in the PRL and PICS within all NTCIP standards. Not all of these notations and symbols may be used within this standard.

A.1.1.1 Status Symbols

The following symbols are used to indicate base standard and profile status:

m	mandatory
m.<n>	support of every item of the group labeled by the same numeral <n> required, but only one is active at time
o	optional
o.<n>	optional, but support of at least one of the group of options labeled by the same numeral <n> is required
c	conditional
n/a	not-applicable (i.e. logically impossible in the scope of the profile)
x	excluded or prohibited

The o.<n> notation is used to show a set of selectable options (i.e., one or more of the set must be implemented) with the same identifier <n>. Two character combinations are used for dynamic conformance requirements. In this case, the first character refers to the static (implementation) status, and the second refers to the dynamic (use); thus "mo" means "mandatory to be implemented, optional to be used." Base standard requirements are shown using the equivalent notations in upper case (e.g., M, O, X).

The classification of the requirements and options in Internet RFCs does not correspond to the convention described in above, and shall be mapped into the profile as follows:

RFC	Profile
MUST	Mandatory ¹
SHOULD	Mandatory ¹
MAY	Optional
SHOULD NOT	Prohibited
MUST NOT	Prohibited

A.1.1.2 Conditional Status Notation

The following predicate notations may be used:

<predicate>:	This notation introduces a single item that is conditional on the <predicate>.
<predicate>::	This notation introduces a table or a group of tables, all of which are conditional on the <predicate>.

The <predicate>: notation means that the status following it applies only when the PRL or PICS states that the feature or features identified by the predicate are supported. In the simplest case, <predicate> is the identifying tag of a single PICS item. The <predicate>:: notation may precede a table or group of tables in a clause or subclause. When the group predicate is true then the associated clause shall be completed. The symbol <predicate> also may be a Boolean expression composed of several indices. "AND", "OR", and "NOT" shall be used to indicate the Boolean logical operations.

A.1.1.3 Support Column Symbols

This profile is in the form of a PICS and, therefore, includes a support column. An implementer claims support of an item by circling the appropriate answer (Yes, No, or N/A) in the support column:

Yes	Supported by the implementation.
No	Not supported by the implementation.
N/A	Not applicable

A.1.1.4 Footnotes

Footnotes to the proforma are indicated by superscript numerals. The footnote appears on the page of the first occurrence of the numeral. Subsequent occurrences of a numeral refer to the footnote of the first occurrence.

¹ In the course of adapting communications industry standards to the transportation industry, there may be exceptions where specific mandatory requirements are not applicable to the new environment. Where these exceptions are made, a justification shall be provided.

A.1.1.5 Instructions for Completing the PRL

A Profile implementer shows the extent of compliance to a Profile by completing the PRL. The implementer indicates whether mandatory requirements are complied with, and whether optional functions are supported. The resulting completed PRL is called a PICS. Where this profile refines the features of the base standards, the requirements expressed in this PRL shall be applied (as indicated in PRL items with no "Profile Support" column) to constrain the allowable responses in the base standard PICS proforma. When this profile makes additional requirements, the "Support" column for such PRLs shall be completed. In this column, each response shall be selected either from the indicated set of responses, or it shall comprise one or more parameter values as requested. If a conditional requirement is inapplicable, use the Not Applicable (NA) choice. If a mandatory requirement is not satisfied, exception information must be supplied by entering a reference Xi, where i is a unique identifier, to an accompanying rationale for the noncompliance. When the profile requirement is expressed as a two-character combination (as defined in A.1.1 above), the response shall address each element of the requirement; e.g., for the requirement "mo," the possible compliant responses are "yy" or "yn."

A.2 STANDARDS REFERENCED

This profile specifies the provision of the File Transfer Protocol (FTP) as specified in IAB STD 9 (RFC 959: October 1985, File Transfer Protocol) and IAB STD 3 (RFC 1123: October 1989, Requirements for Internet Hosts – Application and Support).

A.3 PICS REQUIREMENTS LIST

A.3.1 General Information

A.3.1.1 Implementation Identification

Ref	Question	Response
1	Supplier	
2	Contact point for queries about the profile	
3	Implementation Name(s) and Version(s)	
4	Date of statement	
5	Other Information: Machine Name, Operating Systems, System Name	
6	Amendments or revisions to the base standards or profiles that are applicable.	

A.3.1.2 Global Statement of Conformance

Are all mandatory requirements met for:

Ref	Question	Response
1	IAB STD 9 (RFC 959) FTP?	
2	IAB STD 3 (RFC 1123) Internet Hosts?	

A.4 BASIC REQUIREMENTS

The following table lists the basic requirements for File Transfer Protocol– Application Profile implementation, and asks if the listed protocols or standards have been implemented:

Index	Protocol/Element	Clause of Profile	Profile Status	Support
ftp	IAB STD 33, RFC 959, implemented?	2.2	m	Yes
host-com	IAB STD 3, RFC 1122, Section 4.2, implemented?	2.2	m	Yes
host-app	IAB STD 3, RFC 1123, Section 4 implemented?	2.2	m	Yes
Client	Is implementation capable of acting as an FTP Client?	2.2	o.1	Yes No
Server	Is implementation capable of acting as an FTP Server?	2.2	o.1	Yes No

A.4.1 Data Types

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
1.1	ASCII – Non-Print (AN)	RFC 1123, Section 4.1.2.13	M	2.2.1	m	Yes
1.2	ASCII – Telnet (AT) -- if same as AN	RFC 1123, Section 4.1.2.2	M		m	Yes
1.2.1	ASCII – Telnet (AT) -- if different from AN	RFC 1123, Section 4.1.2.2	O		o	Yes No
1.3	ASCII – Carriage Control (AC)	RFC 959, Section 3.1.1.5.2	O		o	Yes No
1.4	EBCDIC – (any form)	RFC 959, Section 3.1.1.2	O		o	Yes No
1.4.1	EBCDIC – Non-print (EN)	RFC 959, Section 3.1.1.5.1	1.4:M		1.4:m	Yes No
1.4.2	EBCDIC – Telnet (ET)	RFC 959, Section 3.1.1.5.2	O		o	Yes No

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
1.4.3	EBCDIC – Carriage Control (EC)	RFC 959, Section 3.1.1.5.2	O		o	Yes No
1.5	IMAGE	RFC 1123, Section 4.1.2.1	M		m	Yes
1.6	LOCAL - 8 Bit Length	RFC 1123, Section 4.1.2.1	M		m	Yes
1.7	LOCAL - Variable Bit Length	RFC 1123, Section 4.1.2.1	O		o	Yes No

A.4.2 Data Structure

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
2.1	File	RFC 1123, Section 4.1.2.13	M	2.2.2	m	Yes
2.2	Implementation of record-structured file system	RFC 1123, Section 4.1.2.13	O		o	Yes No
2.2.1	Support of record-structured file system	RFC 1123, Section 4.1.2.13	2:M		2:m	Yes No
2.3	Page	RFC 1123, Section 4.1.2.3	X		x	No

A.4.3 Transmission Modes

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
Strm	Stream	RFC 1123, Section 4.1.2.13	M	2.2.3	m	Yes
Blk	Block	RFC 959, Section 3.4.2	O		o	Yes No
Comp	Compressed	RFC 959, Section 3.4.3	O		o	Yes No

A.4.4 FTP Commands

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
4.1	ACCESS CONTROL COMMANDS					
4.1.1	USER NAME (USER)	RFC 1123, Section 4.1.2.13	M	2.2.4.1	m	Yes

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
4.1.2	PASSWORD (PASS)	RFC 1123, Section 4.1.2.13	M	2.2.4.2	m	Yes
4.1.3	ACCOUNT (ACCT)	RFC 1123, Section 4.1.2.13	Client:M Server:O	2.2.4.3	Client:m Server:o	Yes Yes No
4.1.4	CHANGE WORKING DIRECTORY (CWD)	RFC 1123, Section 4.1.2.13	M	2.2.4.4	m	Yes
4.1.5	CHANGE TO PARENT DIRECTORY (CDUP)	RFC 1123, Section 4.1.2.13	M	2.2.4.5	m	Yes
4.1.6	STRUCTURE MOUNT (SMNT)	RFC 959, Section 5.3.1	Client:O Server:O	2.2.4.6	Client:o Server:o	Yes No Yes No
4.1.7	REINITIALIZE (REIN)	RFC 959, Section 5.3.1	Client:O Server:O	2.2.4.7	Client:o Server:o	Yes No Yes No
4.1.8	LOGOUT (QUIT)	RFC 1123, Section 4.1.2.13	M	2.2.4.8	m	Yes
4.2	TRANSFER PARAMETER COMMANDS					
4.2.1	DATA PORT()	RFC 1123, Section 4.1.2.13	M	2.2.4.2.1	m	Yes
4.2.2	PASSIVE (PASV)	RFC 1123, Section 4.1.2.6	Client:M Server:O	2.2.4.2.2	Client:m Server:o	Yes Yes No
4.2.3	REPRESENTATION TYPE (TYPE)	RFC 1123, Section 4.1.2.13	M	2.2.4.2.3	m	Yes
4.2.4	FILE STRUCTURE (STRU)	RFC 1123, Section 4.1.2.13	M	2.2.4.2.4	m	Yes
4.2.5	TRANSFER MODE (MODE)	RFC 1123, Section 4.1.2.13	M	2.2.4.2.5	m	Yes
4.3	SERVICE COMMANDS					
4.3.1	RETRIEVE (RETR)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.1	m	Yes
4.3.2	STORE (STOR)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.2	m	Yes
4.3.3	STORE UNIQUE (STOU)	RFC 959, Section 4.3.1 and RFC 1123, Section 4.1.2.9	O	2.2.4.3.3	o	Yes No
4.3.4	APPEND (with create) (APPE)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.4	m	Yes
4.3.5	ALLOCATE (ALLO)	RFC 959, Section 5.3.1	O	2.2.4.3.5	o	Yes No
4.3.6	RESTART (REST)	RFC 959, Section 5.3.1	O	2.2.4.3.6	o	Yes No
4.3.7	RENAME FROM (RNFR)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.7	m	Yes
4.3.8	RENAME TO (RNTO)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.8	m	Yes

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
4.3.9	ABORT (ABOR)	RFC 959, Section 5.3.1	Client:O Server:M	2.2.4.3.9	Client:o Server:m	Yes No Yes
4.3.10	DELETE (DELE)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.10	m	Yes
4.3.11	REMOVE DIRECTORY (RMD)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.11	m	Yes
4.3.12	MAKE DIRECTORY (MKD)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.12	m	Yes
4.3.13	PRINT WORKING DIRECTORY (PWD)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.13	m	Yes
4.3.14	LIST (LIST)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.14	m	Yes
4.3.15	NAME LIST (NLST)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.15	m	Yes
4.3.16	SITE PARAMETERS (SITE)	RFC 1123, Section 4.1.2.8	O	2.2.4.3.16	o	Yes No
4.3.17	SYSTEM (SYST)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.17	m	Yes
4.3.18	STATUS (STAT)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.18	m	Yes
4.3.19	HELP (HELP)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.19	m	Yes
4.3.20	NOOP (NOOP)	RFC 1123, Section 4.1.2.13	M	2.2.4.3.20	m	Yes

A.4.5 "Experimental" Directory Commands

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
5.1	XMKD	RFC 1123, Section 4.1.3.1	M	2.2.4.3	o	Yes No
5.2	XRMD	RFC 1123, Section 4.1.3.1	M	2.2.4.3	o	Yes No
5.3	XPWD	RFC 1123, Section 4.1.3.1	M	2.2.4.3	o	Yes No
5.4	XCUP	RFC 1123, Section 4.1.3.1	M	2.2.4.1	o	Yes No
5.5	XCWD	RFC 1123, Section 4.1.3.1	M	2.2.4.1	o	Yes No

A.4.6 Other Features

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
6.1	Concurrency of data and control	RFC 1123, Section 4.1.3.3	Client:O Server:M	2.2.10	Client:o Server:m	Yes No Yes
6.2	FTP Restart Mechanism	RFC 1123, Section 4.1.3.4	Blk OR Comp:M		Blk OR Comp:m	Yes No
6.3	Sender assume 110 replies are synchronous	RFC 1123, Section 4.1.3.4	X		x	No
6.4	Default data port same IP address as control connection	RFC 1123, Section 4.1.2.12	M		m	Yes
6.5	Use TCP READ boundaries on control connection	RFC 1123, Section 4.1.2.10	X		x	No
6.6	Server-FTP handle Telnet options	RFC 1123 , Section 4.1.2.12	Client:N/A Server:M		Client:N/A Server:m	Yes No
6.7	Server-FTP send only correct reply format	RFC 1123, Section 4.1.2.11	Client:N/A Server:M		Client:N/A Server:m	Yes No
6.8	Server-FTP use defined reply code if possible	RFC 1123, Section 4.1.2.11	Client:N/A Server:M		Client:N/A Server:m	Yes No
6.9	User-FTP send PORT command for stream mode	RFC 1123, Section 4.1.2.5	M		m	Yes
6.10	User-FTP send Telnet commands except SYNCH and IP	RFC 1123, Section 4.1.2.12	X		x	No
6.11	User-FTP negotiate Telnet options	RFC 1123, Section 4.1.2.12	X		x	No
6.12	User-FTP use only high digit of reply	RFC 1123, Section 4.1.2.11	M		m	Yes
6.13	User-FTP handle multi-line reply lines	RFC 1123, Section 4.1.2.11	M		m	Yes
6.14	User-FTP handle 421 reply specially	RFC 1123, Section 4.1.2.11	X		x	No

A.4.7 Idle Timeout

Index	Protocol Feature	Base Standard		Profile		Support
		Reference	Status	Clause	Status	
7.1	Configurable idle timeout	RFC 1123, Section 4.1.3.2	Client:O Server:M	2.2.8	Client:o Server:m	Yes No Yes

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