

## FILE TRANSFER PROTOCOL (FTP)

### Status of this Memo

This memo is the official specification of the File Transfer Protocol (FTP). Distribution of this memo is unlimited.

The following new optional commands are included in this edition of the specification:

CDUP (Change to Parent Directory), SMNT (Structure Mount), STOU (Store Unique), RMD (Remove Directory), MKD (Make Directory), PWD (Print Directory), and SYST (System).

Note that this specification is compatible with the previous edition.

### 1. INTRODUCTION

The objectives of FTP are 1) to promote sharing of files (computer programs and/or data), 2) to encourage indirect or implicit (via programs) use of remote computers, 3) to shield a user from variations in file storage systems among hosts, and 4) to transfer data reliably and efficiently. FTP, though usable directly by a user at a terminal, is designed mainly for use by programs.

The attempt in this specification is to satisfy the diverse needs of users of maxi-hosts, mini-hosts, personal workstations, and TACs, with a simple, and easily implemented protocol design.

This paper assumes knowledge of the Transmission Control Protocol (TCP) [2] and the Telnet Protocol [3]. These documents are contained in the ARPA-Internet protocol handbook [1].

### 2. OVERVIEW

In this section, the history, the terminology, and the FTP model are discussed. The terms defined in this section are only those that have special significance in FTP. Some of the terminology is very specific to the FTP model; some readers may wish to turn to the section on the FTP model while reviewing the terminology.

## 2.1. HISTORY

FTP has had a long evolution over the years. [Appendix III](#) is a chronological compilation of Request for Comments documents relating to FTP. These include the first proposed file transfer mechanisms in 1971 that were developed for implementation on hosts at M.I.T. ([RFC 114](#)), plus comments and discussion in [RFC 141](#).

[RFC 172](#) provided a user-level oriented protocol for file transfer between host computers (including terminal IMPs). A revision of this as [RFC 265](#), restated FTP for additional review, while [RFC 281](#) suggested further changes. The use of a "Set Data Type" transaction was proposed in [RFC 294](#) in January 1982.

[RFC 354](#) obsoleted RFCs 264 and 265. The File Transfer Protocol was now defined as a protocol for file transfer between HOSTs on the ARPANET, with the primary function of FTP defined as transferring files efficiently and reliably among hosts and allowing the convenient use of remote file storage capabilities. [RFC 385](#) further commented on errors, emphasis points, and additions to the protocol, while [RFC 414](#) provided a status report on the working server and user FTPs. [RFC 430](#), issued in 1973, (among other RFCs too numerous to mention) presented further comments on FTP. Finally, an "official" FTP document was published as [RFC 454](#).

By July 1973, considerable changes from the last versions of FTP were made, but the general structure remained the same. [RFC 542](#) was published as a new "official" specification to reflect these changes. However, many implementations based on the older specification were not updated.

In 1974, RFCs 607 and 614 continued comments on FTP. [RFC 624](#) proposed further design changes and minor modifications. In 1975, [RFC 686](#) entitled, "Leaving Well Enough Alone", discussed the differences between all of the early and later versions of FTP. [RFC 691](#) presented a minor revision of [RFC 686](#), regarding the subject of print files.

Motivated by the transition from the NCP to the TCP as the underlying protocol, a phoenix was born out of all of the above efforts in [RFC 765](#) as the specification of FTP for use on TCP.

This current edition of the FTP specification is intended to correct some minor documentation errors, to improve the explanation of some protocol features, and to add some new optional commands.

In particular, the following new optional commands are included in this edition of the specification:

CDUP - Change to Parent Directory

SMNT - Structure Mount

STOU - Store Unique

RMD - Remove Directory

MKD - Make Directory

PWD - Print Directory

SYST - System

This specification is compatible with the previous edition. A program implemented in conformance to the previous specification should automatically be in conformance to this specification.

## 2.2. TERMINOLOGY

### ASCII

The ASCII character set is as defined in the ARPA-Internet Protocol Handbook. In FTP, ASCII characters are defined to be the lower half of an eight-bit code set (i.e., the most significant bit is zero).

### access controls

Access controls define users' access privileges to the use of a system, and to the files in that system. Access controls are necessary to prevent unauthorized or accidental use of files. It is the prerogative of a server-FTP process to invoke access controls.

### byte size

There are two byte sizes of interest in FTP: the logical byte size of the file, and the transfer byte size used for the transmission of the data. The transfer byte size is always 8 bits. The transfer byte size is not necessarily the byte size in which data is to be stored in a system, nor the logical byte size for interpretation of the structure of the data.

control connection

The communication path between the USER-PI and SERVER-PI for the exchange of commands and replies. This connection follows the Telnet Protocol.

data connection

A full duplex connection over which data is transferred, in a specified mode and type. The data transferred may be a part of a file, an entire file or a number of files. The path may be between a server-DTP and a user-DTP, or between two server-DTPs.

data port

The passive data transfer process "listens" on the data port for a connection from the active transfer process in order to open the data connection.

DTP

The data transfer process establishes and manages the data connection. The DTP can be passive or active.

End-of-Line

The end-of-line sequence defines the separation of printing lines. The sequence is Carriage Return, followed by Line Feed.

EOF

The end-of-file condition that defines the end of a file being transferred.

EOR

The end-of-record condition that defines the end of a record being transferred.

error recovery

A procedure that allows a user to recover from certain errors such as failure of either host system or transfer process. In FTP, error recovery may involve restarting a file transfer at a given checkpoint.

FTP commands

A set of commands that comprise the control information flowing from the user-FTP to the server-FTP process.

file

An ordered set of computer data (including programs), of arbitrary length, uniquely identified by a pathname.

mode

The mode in which data is to be transferred via the data connection. The mode defines the data format during transfer including EOR and EOF. The transfer modes defined in FTP are described in the Section on Transmission Modes.

NVT

The Network Virtual Terminal as defined in the Telnet Protocol.

NVFS

The Network Virtual File System. A concept which defines a standard network file system with standard commands and pathname conventions.

page

A file may be structured as a set of independent parts called pages. FTP supports the transmission of discontinuous files as independent indexed pages.

pathname

Pathname is defined to be the character string which must be input to a file system by a user in order to identify a file. Pathname normally contains device and/or directory names, and file name specification. FTP does not yet specify a standard pathname convention. Each user must follow the file naming conventions of the file systems involved in the transfer.

PI

The protocol interpreter. The user and server sides of the protocol have distinct roles implemented in a user-PI and a server-PI.

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