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#### FILE TRANSFER PROTOCOL

#### 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, and TIPs, with a simple, and easily implemented protocol design.

This paper assumes knowledge of the following protocols described in the ARPA Internet Protocol Handbook.

The Transmission Control Protocol

The TELNET Protocol

#### DISCUSSION

In this section, 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.

#### TERMINOLOGY

#### ASCII

DOCKET

The ASCII character set 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.

#### data connection

A simplex 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.

#### EOF

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

#### EOR

DOCKET

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.

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#### 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. FTP only partially implements the NVFS concept at this time.

#### 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.

#### record

DOCKET

A sequential file may be structured as a number of contiguous parts called records. Record structures are supported by FTP but a file need not have record structure.

#### reply

A reply is an acknowledgment (positive or negative) sent from server to user via the TELNET connections in response to FTP commands. The general form of a reply is a completion code (including error codes) followed by a text string. The codes are for use by programs and the text is usually intended for human users.

#### server-DTP

The data transfer process, in its normal "active" state, establishes the data connection with the "listening" data port, sets up parameters for transfer and storage, and transfers data on command from its PI. The DTP can be placed in a "passive" state to listen for, rather than initiate a, connection on the data port.

#### server-FTP process

A process or set of processes which perform the function of file transfer in cooperation with a user-FTP process and, possibly, another server. The functions consist of a protocol interpreter (PI) and a data transfer process (DTP).

#### server-PI

The protocol interpreter "listens" on Port L for a connection from a user-PI and establishes a TELNET communication connection. It receives standard FTP commands from the user-PI, sends replies, and governs the server-DTP.

#### TELNET connections

The full-duplex communication path between a user-PI and a server-PI, operating according to the TELNET Protocol.

#### type

DOCKET

The data representation type used for data transfer and storage. Type implies certain transformations between the time of data storage and data transfer. The representation types defined in FTP are described in the Section on Establishing Data Connections.

#### user

A human being or a process on behalf of a human being wishing to obtain file transfer service. The human user may interact directly with a server-FTP process, but use of a user-FTP process is preferred since the protocol design is weighted towards automata.

#### user-DTP

The data transfer process "listens" on the data port for a connection from a server-FTP process. If two servers are transferring data between them, the user-DTP is inactive.

#### user-FTP process

A set of functions including a protocol interpreter, a data transfer process and a user interface which together perform the function of file transfer in cooperation with one or more server-FTP processes. The user interface allows a local language to be used in the command-reply dialogue with the user.

#### user-PI

The protocol interpreter initiates the TELNET connection from its port U to the server-FTP process, initiates FTP commands, and governs the user-DTP if that process is part of the file transfer.

## DOCKET A L A R M



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