MultiNet 5.6 User's Guide

November 2020

This document describes how to use the MultiNet user commands. Included are easy to follow instructions for beginning users and command pages for advanced users.

Operating System/Version: OpenVMS VAX V5.5-2 or later

OpenVMS Alpha V6.2 or later

OpenVMS Itanium V8.2 or later

Software Version: MultiNet 5.6

Process Software
Framingham, Massachusetts
USA

Preface

This document contains information you might find helpful when using MultiNet for OpenVMS.

- Chapter 1, *Exploring Your Network Environment*, understanding your network environment.
- Chapter 2, *Sending and Receiving Electronic Mail*, sending and receiving e-mail.
- Chapter 3, *Using Kerberos Authentication*, acquiring and releasing Kerberos authentication tickets for use with the RCP, RLOGIN, RSHELL, and TELNET commands.
- Chapter 4, *Accessing Remote Systems with the RSHELL, RLOGIN, and TELNET Utilities*, logging into a remote system.
- Chapter 5, *Remote File Access with the RCP, FTP, and TFTP Utilities*, transferring files to or from a remote system.
- Chapter 6, *Using DECwindows with MultiNe*t, using DECwindows with MultiNet.
- Chapter 7, *Accessing Remote Systems with the Secure Shell (SSH) Utilities*.
- Chapter 8, *Secure File Transfer*.

Obtaining Online Help

Extensive information about MultiNet is provided in the MultiNet help library. For more information, use the following command:

```
$ HELP MULTINET
```

MultiNet Frequently Asked Questions List

You can obtain an updated list of frequently asked questions (FAQs) and answers about MultiNet products from the Process Software web site at www.process.com.

Accessing the MultiNet Public Mailing List

Process Software maintains two public mailing lists for MultiNet customers:

- Info-MultiNet@process.com
- MultiNet-Announce@process.com

The Info-MultiNet@process.com mailing list is a forum for discussion among MultiNet system managers and programmers. Questions and problems regarding MultiNet can be posted for a response by any of the subscribers. To subscribe to Info-MultiNet, send a mail message with the word `SUBSCRIBE` in the body to Info-MultiNet-request@process.com.

The MultiNet-Announce@process.com mailing list is a one-way communication (from Process Software to you) used for the posting of announcements relating to MultiNet (patch releases, product releases, etc.). To subscribe to MultiNet-Announce, send a mail message with the word `SUBSCRIBE` in the body to MultiNet-Announce-request@process.com.

Process Software World Wide Web Server

Electronic support is provided through the Process Software World Wide Web server, which you can access with any World Wide Web browser; the URL is www.process.com (select Support).

Conventions Used

Examples in this guide use the following conventions:

Convention	Meaning
host	Any computer system on the network. The local host is your computer. A remote host is any other computer.

`monospaced type`	System output or user input. User input is in **`reversed bold`** `type`. Example: `Is this configuration correct?` **`YES`** Monospaced type also indicates user input where the case of the entry should be preserved.
italic type	Variable value in commands and examples. For example, *username* indicates that you must substitute your actual username. Italic text also identifies documentation references.
[*directory*]	Directory name in an OpenVMS file specification. Include the brackets in the specification.
[*optional-text*]	(Italicized text and square brackets) Enclosed information is optional. Do not include the brackets when entering the information. Example: `START/IP` *`line address`* [*`info`*] This command indicates that the *`info`* parameter is optional.
{value | value}	Denotes that you should use only one of the given values. Do not include the braces or vertical bars when entering the value.
Note	Information that follows is particularly noteworthy.
Caution	Information that follows is critical in preventing a system interruption or security breach.
`key`	Press the specified key on your keyboard.
`Ctrl+key`	Press the control key and the other specified key simultaneously.
`Return`	Press the Return or Enter key on your keyboard.

1. Exploring Your Network Environment

This chapter helps you start exploring your network environment.

Specifying Remote Hosts

Most MultiNet applications allow you to specify a remote host by either name or Internet address. To access a host by name, the remote host must either be listed in the local system's host database or registered with a DNS (Domain Name System) server accessible from the local system. If you have difficulty accessing a remote host by its host name, contact your system manager or network administrator.

Displaying Names of Other Users

You can display a list of users on your system or on a remote system with the `RUSERS` command. For example:

```
$ MULTINET RUSERS
SURETE          RICK PATRICK
MIFIVE          MATT
KGB             KEN GIGI JOEL
SCIENCE         RICK
WHO             PATRICK ROB
DESIGN          BRUCE
CHAZ            GEORGE RICK
```

The `RUSERS` utility uses the `RUSERS` Remote Procedure Call (RPC) service to display information about users logged into the local system or a remote system. It can display information about a particular system, or, if supported by the network hardware, use broadcasts to display information about all remote systems on directly connected networks. `RUSERS` uses UDP/IP (User Datagram Protocol/Internet Protocol) as the transport mechanism for the RPC services it calls. When using `RUSERS`, the command can appear to hang, but is in fact waiting for a timeout period to ensure that the last packet is received.

> **Note:** If the system you are querying does not support the RUSERS RPC service, you will not receive any response (the RPC call times out silently).

Displaying Host Information

Use the WHOIS command to display information about a user, host, or domain accessed from the Internet's repository of information. The WHOIS command sends your request across the Internet to the NIC (at the RS.INTERNIC.NET host) and displays the information returned.

For example:

```
$ WHOIS ULANOV
Ulanov, V.I.         ulanov@example.COM
ABC, Incorporated
100 Nevsky Street
Anytown, CA 95060
(408) 555-1212
Record last updated on 31-March-03.
The InterNIC Registration Services Host contains only Internet information
(Networks, ASN's, Domains, and POC's).
$
```

Because RS.INTERNIC.NET is heavily used, you may receive a message stating that "the network is busy, try later." As an alternative, you can ask your system manager about possibly selecting another WHOIS server.

Displaying User Information

You can display information about a domain, host, IP address, or single user. The FINGER utility accesses information on your local system or on a remote system.

You can display information about your host, as shown in the following example:

```
$ MULTINET FINGER/NOCLUSTER
Monday, March 15, 2020 7:59PM-EST   Up 1 10:33:01
nn+0 Jobs on CHUCKO  Load ave  0.02 0.01 0.02

User     Personal Name     Job     Subsys   Terminal  Console Location
BROWN    John Brown        40A0022C MM         6.FTA13
                           40A0022D EMACS   1:20.FTA14
```

```
                          40A0022E *DCL*    22.FTA15
                          40A0025F *DCL*  3:46.FTA23
                          40A00260 *DCL*  3:33.FTA24
                          40A00261 FINGER     .FTA25
SYSTEM  System Manager    23000120 *DCL*   BIRD$RTA1  KARLA::PIPER
                          23000121 *DCL*   BIRD$RTA2  KARLA::PIPER
```

If you want to display `FINGER` information about every node in a VMScluster, omit the `/NOCLUSTER` qualifier. To display information about another host, add its name to the end of the command:

```
$ MULTINET FINGER
Monday, March 15, 2020 7:59PM-EST   Up 1 10:33:01
nn+0 Jobs on CHUCKO  Load ave  0.02 0.01 0.02

User    Personal Name     Job      Subsys    Terminal  Console Location
BROWN   John Brown        40A0022C MM         6.FTA13
                          40A0022D EMACS   1:20.FTA14
                          40A0022E *DCL*     22.FTA15
                          40A0025F *DCL*   3:46.FTA23
                          40A00260 *DCL*   3:33.FTA24
                          40A00261 FINGER      .FTA25
SYSTEM   System Manager   23000120 *DCL*    BIRD$RTA1  KARLA::PIPER
                          23000121 *DCL*    BIRD$RTA2  KARLA::PIPER
RICH     I. M. Rich       23200227 *DCL*   CODEZ$NTY1  Rich.EXAMPLE.COM
POOR     U. R. Poor       2280027B *DCL*       4$FTA4
JONES    Mary  Jones      21C00C04 EMACS   SYS1$NTY5   BigBird.EXAMPLE.COM
```

You can only display information about another system if a `FINGER` server is running there and if the system permits it (some do not). The information you receive can vary depending on the `FINGER` server in use.

To display information about users at a specific IP address, use this command format:

```
$ MULTINET FINGER @192.168.11.1
Monday, March 15, 2020 7:59PM-EST   Up 1 10:33:01
nn+0 Jobs on CHUCKO  Load ave  0.02 0.01 0.02
User    Personal Name        Job   Subsys       Terminal  Console Location
BROWN   John Brown           40A0022C MM            6.FTA13
                             40A0022D EMACS       1:20.FTA14
                             40A0022E *DCL*         22.FTA15
                             40A0025F *DCL*       3:46.FTA23
                             40A00260 *DCL*       3:33.FTA24
                             40A00261 FINGER          .FTA25
SYSTEM   System Manager      23000120 *DCL*       BIRD$RTA1  KARLA::PIPER
                             23000121 *DCL*       BIRD$RTA2  KARLA::PIPER
```

The load average information displayed at the beginning of the FINGER output is the average number of processes waiting for the CPU for the last one, two, and five minutes. For more information, ask your system manager.

To display information about a single user, use this command format:

```
$ MULTINET FINGER BROWN
BROWN    John                 40A0022C MM            11.FTA13
                              40A0022D EMACS           .FTA14
                              40A0022E *DCL*         27.FTA15
                              40A0025F FINGER          .FTA23
                              40A00260 *DCL*       3:39.FTA24
                              40A00261 *DCL*          2.FTA25
Mail from firefly@example.edu (Rufus T. Firefly) at Mon 15-Mar-2019 7:53 PM-
EST  Last read on Mon 15-Mar-2004 7:59 PM-EST
Plan:  At the beach today.  The higher, the fewer!
-- Alexander in the colony of free spirits (ST-TNG)
```

If you want specific information to be available when someone seeks information about you with FINGER, create a PLAN.TXT text file in your login directory. If you want to have a plan file on a UNIX system, create a .plan file in your login directory.

The information in this file is available even when you are not logged in. When you create this file, ensure the file has world read access (W:R) and your login directory has world execute permissions (W:E). You can insert any text (except control characters which are filtered out), and the file can be any length you want.

- If you FINGER a single user on a VMS system running MultiNet, the utility looks for a file named PLAN.TXT in that user's login directory. If that file does not exist, it looks for a file named .PLAN.
- If you FINGER a single user on a UNIX system, FINGER looks for a file named .plan.

Interacting with another User

You can communicate with another user over the network using the TALK utility. TALK is similar to the OpenVMS PHONE utility except TALK can work with some non-OpenVMS operating systems.

TALK divides the screen into two sections; it displays text you enter in one section, and text entered by the other user in the other. You can then converse with each other until one of you presses Ctrl/C to end the session.

Use the following keystrokes during a TALK session:

Press…	To...	Press...	To...
Delete	Delete the last character typed	**Ctrl+L**	Redraw the screen
Ctrl+C	Exit and return to DCL command mode	**Ctrl+W**	Delete the last word typed

Restrictions for Using TALK

Some restrictions apply when using TALK:

- You and the person with whom you wish to TALK need to be on systems with the same byte-ordering scheme (either "Big Endian" or "Little Endian").

  For example, if the other person is using a Sun workstation or a terminal connected to one, they cannot use the TALK command. Sun users need to use the NTALK command. NTALK is provided on the MultiNet software distribution CD-ROM in the [CONTRIBUTED-SOFTWARE.APPLICATIONS.NTALK] directory, or elsewhere as public domain software. Your system manager can provide more information.

- Both of your terminals must be able to accept broadcasts. Use these commands to enable broadcasts but suppress mail broadcasts:

  ```
  $ SET TERMINAL /BROADCAST
  $ SET BROADCAST=NOMAIL
  ```

- Your terminal type must be listed in the OpenVMS TERMTABLE.TXT database. As shipped with OpenVMS, this database includes all DEC/HP VT-series terminals. If you have a non-DEC/non-HP terminal, check with your system manager.
- The other person's system must be known to your system. TALK must be able to translate the remote system's IP address into its name. Your system must be using the Domain Name System (DNS) or have the remote system recorded in its host tables.

When a user uses TALK to call you, a message of the following form appears on your terminal:

```
Message from TALK-DAEMON@EXAMPLE.COM at 1:53PM-EDT
Connection request by username
[Respond with: TALK username@hostname]
Type a TALK command to start the conversation:
$ TALK username@hostname
```

Once communication is established, you and the other user can type simultaneously, with your output appearing in separate windows.

If you try to TALK with a user who has disabled reception of broadcast messages, this message appears:

```
[Your party is refusing messages]
```

The TALK Server uses the PHONE operator class.

> **Note:** To prevent users from attempting to TALK with you, use the SET BROADCAST=NOPHONE command.

Sending Reminders to Yourself

You can send reminders with the REMIND utility, as shown in the following example:

```
$ REMIND
REMIND Version V5.6(nn), 15-MAR-2020
There are no reminders in your remind file.
REMIND>CREATE
Time of first reminder? 22:45
Expiration count? 1
How should I send it? SEND
Addresses? ME
Subject? Testing
Text (end with ^Z)
This is a test.
^Z
REMIND>exit
   [Entering your changes...]
```

When REMIND starts, it checks to see if any reminders are pending. It then displays the REMIND> prompt. Use the CREATE command to start a new reminder. The time of the reminder can be in 12-hour or 24-hour time and can also be a special name. The expiration count is the number of times you want the message sent. You can specify that the message be sent by mail, broadcast to the terminal (SEND), or both. You can enter details in much the same way as a mail message with the address of the recipient, the subject, and the text. When you press **Ctrl+Z**, the message is queued.

If you request reminders by mail, the information you specify is used to construct an electronic mail message. If you request reminders by broadcast to the terminal, REMIND sends a message like the following:

```
[REMIND(10:50PM): subject Message text]
```

For help, enter a question mark (`?`) at any prompt. For example, at the `Time of first reminder?` prompt, the following help appears:

```
Time of first reminder? ?
date and time or one of the following:
FRIDAY MONDAY SATURDAY SUNDAY THURSDAY TODAY TOMORROW TUESDAY WEDNESDAY

or one of the following:
APRIL-FOOLS           BASTILLE-DAY              BEETHOVENS-BIRTHDAY
BLBOS-BIRTHDAY        CHRISTMAS                 COLUMBUS-DAY
FLAG-DAY              FRODO'S-BIRTHDAY          GONDORIAN-NEW-YEAR
GROUND-HOG-DAY        GUY-FAWKES-DAY            HALLOWEEN
INDEPENDENCE-DAY      LEAP-DAY                  LINCOLNS-BIRTHDAY
```

2. Sending and Receiving Electronic Mail

This chapter describes how to use OpenVMS `MAIL` and ALL-IN-1 Mail with MultiNet.

Using OpenVMS Mail across the Network

MultiNet enhances OpenVMS Mail so you can send and receive mail across the network.

Specifying Addresses

When you use OpenVMS Mail to send mail to a host outside your VMScluster, the message is sent via SMTP (Simple Mail Transfer Protocol). For this reason, you must specify the address so that SMTP accepts the mail correctly. The format for the address is:

```
To: SMTP%"recipient@destination"
```

The string SMTP and the destination system name are not case-sensitive; that is, you can type them in either uppercase or lowercase letters. The destination recipient specification may be case-sensitive, however, depending on the destination system's software. On some UNIX systems, `ROOT` and `root` specify two different user names (and hence different electronic mail addresses).

If the address contains an apostrophe, enter the address with either `\'` or `\s` as shown in the following example formats:

```
To:  SMTP%"Thomas.O\'Malley@example.net"
To:  SMTP%"Thomas.O\sMalley@example.net"
```

for the address <Thomas.O'Malley@example.net>.

If the address is on a local DECnet network, use this format:

```
To: SMTP%nodename::username
```

If the address is on a remote DECnet network, you may use this format:

```
To: SMTP%"'nodename::username'@destination"
```

> **Note:** MultiNet assumes that an address containing a double colon (`::`) is a DECnet address. If an address contains a double colon and is not a DECnet address, SMTP does not handle it correctly.

If you know the recipient's IP address, but not the host name (or if the host name is not registered in the Domain Name System), specify the recipient address as follows:

```
To: smtp%"recipient@[aa.bb.cc.dd]"
```

aa.bb.cc.dd is the destination system's IP address in dotted-decimal form. You must specify the IP address in square brackets.

The OpenVMS Mail utility also allows you to specify an addressee on the command line:

```
$ MAIL filename addressee
```

To use this form of the command with MultiNet, you must enclose the address in quotes (and you must double all existing quotes), as follows:

```
$ MAIL filename smtp%"recipient@destination"
```

The following example shows the user sending mail using the OpenVMS `MAIL` utility to a user named John Smith with a user name of "johns" on system SALES.EXAMPLE.COM.

```
$ MAIL
MAIL>SEND
To:      SMTP%"johns@sales.example.com"
Subj:    This is a test message.
Enter your message below. Press Ctrl/Z when complete, or
Ctrl/C to quit:
Hi John, this is a test of the MultiNet extension to the VMS MAIL utility.
Ctrl+Z
MAIL>EXIT
$
```

You receive network mail as you would all other mail in the VMS MAIL utility. The following example shows the user "WHORFIN" reading an SMTP mail message sent by the user "johns."

```
$
New mail on node KAOS from SMTP%"johns@sales.example.com" "John Smith"
$ MAIL
You have 1 new message.
MAIL>READ/NEW
```

```
#1          03-15-2020 10:05:40.79
From:   SMTP%"johns@sales.example.com"      "John Smith"
To:     WHORFIN
CC:
Subj:   Re: This is a test message.
Date: Mon, 15 Mar 2020 10:04:50 EST
From: johns@sales.example.com (John Smith)
Message-Id: <891120100450.77@SALES.EXAMPLE.COM>
Subject: Re: This is a test message.
To: whorfin@example.com
X-Vmsmail-To: SMTP%"whorfin@example.com"
Glad to see your test worked.
This is my response.
MAIL>EXIT
```

Specifying a Host Alias

MultiNet allows a system to have multiple names-or host aliases-with respect to electronic mail delivery. You can specify the host alias you want to use by defining the `MULTINET_SMTP_FROM_HOST` logical name. The alias you choose must be one of the SMTP host name aliases registered on the system (see the translation of the logical name `MULTINET_SMTP_HOST_NAME` and the contents of the file `MULTINET_HOST_ALIAS_FILE`). If the alias you use is unknown, the setting of `MULTINET_SMTP_FROM_HOST` is ignored.

The host alias feature allows users from different administrative units within an organization to have their return address reflect the name of their unit, even though mail for all units is handled by one system.

> **Note:** You can control the envelope by using the `MULTINET_SMTP_ENVELOPE_FROM_HOST` logical. In MultiNet v4.4 or higher this can be configured via `MULTINET CONFIGURE/MAIL`.

Specifying Individual Aliases

MultiNet supports both system-wide and per-user mail aliases. Using these aliases, you can refer to electronic mail addresses with names that are meaningful to you. Per-user mail aliases are kept in the file `SMTP_ALIASES.` in your login directory.

The format for alias entries is:

```
alias:      real_address[,...];
```

alias is an alphanumeric string and *real_address* is an electronic mail address. You can specify multiple addresses by separating them with commas (,). The alias definition may span multiple lines, if needed, and must always be terminated with a semicolon (;).

For example, a local user may have a user name of JB134A, but you want to send mail to him as john. Add the following line to your SMTP_ALIASES. file:

```
john:       jb134A;
```

Aliases are repeatedly translated until no more translations are found. You can circumvent the repeated translations by including a leading underscore (_) in the *real_address*. For example, this definition causes mail to be forwarded and delivered locally:

```
fnord:      fnord@somewhere.example.edu, _fnord:
```

Using Mail Under ALL-IN-1

This section explains how to use the mail subsystem under ALL-IN-1 to send mail to and receive mail from users on remote systems.

To send mail to a user on a remote system, specify an ALL-IN-1 e-mail address in the format:

recipient@*destination*@SMTP

@SMTP indicates to the ALL-IN-1 mail subsystem that the message should be given to the SMTP/MR gateway facility for eventual handling by the MultiNet SMTP mail system.

> **Note:** The string SMTP and the destination system name are not case-sensitive; that is, you can type them in either uppercase or lowercase letters. However, the destination recipient specification may be case-sensitive, depending on the destination system's software. On some UNIX systems, ROOT and root specify two different user names (and hence different electronic mail addresses).

You receive network mail as you would all other mail in the ALL-IN-1 mail subsystem. Contact your system manager for the correct syntax for remote users; frequently, the proper syntax is:

yourname@A1.*yourdomain*

3. Using Kerberos Authentication

This chapter explains how to use the Kerberos authentication system.

Understanding Kerberos

Kerberos provides a secure way of proving a user's identity across an unsecure network. It does this without transmitting passwords where an intruder could see them. MultiNet has several enhanced or *Kerberized* commands including `RCP`, `RLOGIN`, `RSHELL`, and `TELNET`.

The process of proving one's identity is called *authentication*. Deciding whether or not to allow access to a resource is called *authorization*. Kerberos is an authentication system. Because authentication is a prerequisite to authorization, an application can make an authorization decision (for example, deciding to permit you to log in) based on your identity as authenticated by Kerberos.

Kerberos maintains a list of users and their encrypted passwords. Before you can use Kerberized commands, your system manager must have added your name to this list. You can only use Kerberized commands if you have a ticket for the command you wish to use. Analogous to the tickets you purchase when you go to a movie, Kerberos tickets permit you to invoke Kerberized utilities while you are logged in.

To use Kerberos, you must first:

- Acquire an initial ticket when you log in. This initial ticket, known as a *ticket-getting ticket* (or TGT), enables you to automatically get other tickets you will need to access application servers. You may also need to acquire another TGT when a previous one expires.
- Delete tickets before you log out. *It is very important to remember to delete your tickets any time you leave your terminal!* If another user "borrows" your tickets, you can be locked out of the network or impersonated by the intruder.
- Always run Kerberized utilities with the `/AUTH` qualifier. (The full form of the qualifier is `/AUTHENTICATION=KERBEROS`)
- Change your Kerberos password at least once a month.

> **Note:** The instructions in this chapter apply to Kerberos V4. MultiNet has added Kerberos V5 functionality to the `TELNET` and `SSH` applications only. Kerberos V5 database and ticket management functionality can be obtained with the HP Kerberos for OpenVMS product.

Kerberos security helps protect you and other users from data theft and other possible security breaches. You are the ultimate security element in making sure your files are safe; it is up to you to choose a password that is not easily guessed, and delete your tickets before you log out.

Making Sure Kerberos is Available

Before continuing with this chapter, make sure Kerberos is available on your system by asking your system manager these questions:

1. Is Kerberos enabled?
2. Has a Kerberos principal been created for me?
3. Do I need to get and delete Kerberos tickets?

- If the answer to all three questions is yes, read this chapter.
- If Kerberos is not enabled, skip to the next chapter.
- If no Kerberos principal exists, your system manager must add one for you before you can use Kerberos.
- If you answered no only to question 3, and yes to questions 1 and 2, you only need to read the section on changing your Kerberos password for information on changing your Kerberos password. All other commands are handled automatically on your system.

Acquiring and Deleting Tickets

To acquire your initial ticket-getting ticket, enter this command from the DCL command line:

```
$ MULTINET KERBEROS INIT
This node is: holmes.example.com
```

```
Kerberos Initialization for "john"
Password: password
```

If you need to be authenticated as another user, use the /USERNAME qualifier. Use the /REALM qualifier to be authenticated in another realm. (A *realm* is an administrative name for a site, system, or other organizational entity.)

You can delete tickets with this command:

```
$ MULTINET KERBEROS DESTROY
```

Obtaining Tickets Under Another User Name

You can use the MULTINET KERBEROS INIT command with the /USERNAME qualifier to obtain tickets under another user name. For example, if you gained access to the system through a GUEST login, but you want to continue access to the network as yourself, you could use the /USERNAME qualifier with the MULTINET KERBEROS INIT command to specify your own user name. When you issue this form of the command, you are prompted for the other user's Kerberos password.

To access a remote system as another user, use both the /AUTH and /USERNAME qualifiers with the RCP, RLOGIN, RSHELL, and TELNET commands.

Using Kerberos with the RCP, RLOGIN, RSHELL, and TELNET Commands

The RCP, RLOGIN, RSHELL, and TELNET commands all support the /AUTHENTICATION=KERBEROS qualifier (specify this qualifier first before any other qualifiers). You can shorten this qualifier to /AUTH. For example:

```
$ RLOGIN/AUTH EXAMPLE.COM
```

You can use the /USERNAME qualifier with the /AUTH qualifier to specify the user name you want to use to log into the remote system.

Checking Ticket Status

You can check the status of your tickets with the MULTINET KERBEROS LIST utility. For example, to test the status from the command line, enter:

```
$ MULTINET KERBEROS LIST
Principal:    john@EXAMPLE.COM
Issued           Expires           Principal
June 13 16:16:47 June 14 00:16:47  krbgt.TROIKA.FOO@TROIKA.FOO
$
```

The utility also provides the /CHECK_TGT qualifier so you can test whether your ticket-getting ticket has already expired. If the ticket has expired, run MULTINET KERBEROS INIT again. The following command procedure tests your ticket status:

```
$! Test ticket status
$!
$ MULTINET KERBEROS LIST /CHECK_TGT
$ IF $STATUS THEN WRITE SYS$OUTPUT "Okay"
```

If the tickets are valid, $STATUS is true. If the tickets have expired, $STATUS is false.

Changing Your Kerberos Password

You can change your Kerberos password with this command:

```
$ MULTINET KERBEROS PASSWORD
Old password for holmes: ********
New password for holmes: ********
Verifying, re-enter New password for holmes: ********
$
```

Use these guidelines for selecting a Kerberos user password:

- Kerberos passwords are case-sensitive so if you press the SHIFT key when you create the password, you must always press the key at the same point when entering the password.
- Kerberos passwords can be up to 64 characters long.
- Spaces and control characters are not permitted. In addition, you cannot use the DELETE key to correct a misspelling when entering a password.
- Select a password that is not a name, proper noun, and preferably not a common word. Intersperse letters and numbers in the string.

4. Accessing Remote Systems with the RSHELL, RLOGIN, and TELNET Utilities

This chapter describes how to execute commands on remote systems using the RSHELL utility, and how to log into remote systems using the RLOGIN and TELNET utilities.

Executing Commands on a Remote System Using RSHELL

The RSHELL utility lets you execute commands on remote hosts. RSHELL connects to the specified host and creates an RSHELL server process to execute the commands you enter. If the remote command requires input, data is read from SYS$INPUT and sent over the network to the remote process. Output from the remote command is copied back over the network and displayed on SYS$OUTPUT.

Using RSHELL

Before you can execute a remote command successfully, the remote system must determine that you are allowed to do so. The RSHELL server checks the R services equivalence files to determine whether or not you are authorized to execute commands remotely. RSHELL uses the same authentication scheme as other R services. See the *R Services Authentication* and the *Host Equivalences* sections.*Error! Reference source not found.*The following example shows how to use RSHELL to get a directory listing on the UNIX system UNIX.EXAMPLE.COM from a local OpenVMS system:

```
$ RSHELL UNIX.EXAMPLE.COM ls -l
```

This command assumes that the remote user name is the same as the local user name. To specify a different remote user name, use the /USERNAME qualifier as shown in the following command:

```
$ RSHELL /USERNAME=zeno UNIX.EXAMPLE.COM ls -l
```

If R services equivalence files are not set up, you can still use the RSHELL command by specifying the /PASSWORD qualifier. When a password is specified, rather than connecting to the RSHELL server, the RSHELL client connects to the REXEC server on the remote system. REXEC is identical in function to RSHELL, except that it uses a user name and password to perform authentication rather than equivalence files. The command format for specifying a password is as follows:

```
$ RSHELL /USERNAME=zeno /PASSWORD=race UNIX.EXAMPLE.COM ls -l
```

> **Note:** If you specify /PASSWORD without a value, you are prompted for the password.

You can modify where the remote command standard input is read and where standard output and standard errors are written. Normally, RSHELL uses SYS$INPUT, SYS$OUTPUT, and SYS$ERROR for input, output, and error. You can redirect the input, output, or error streams using the /INPUT, /OUTPUT, or /ERROR qualifiers, respectively.

If you want to execute a command with RSHELL, but do not want your terminal to be tied up during the remote command execution, include the qualifier /INPUT=NLA0: on the RSHELL command to specify a null device. The remote command will see an end-of-file if it attempts to read from standard input.

> **Note:** OpenVMS 7.3-1 introduced a new SYSMAN parameter, DELPRC_EXIT. When left at the default value of 5 after an RSHELL command is executed, the message "%SYSTEM-F-EXITFORCED, forced exit of image or process by SYS$DELPRC" is displayed. This does not interfere with the execution of the command on the remote system. Using SYSMAN to set this dynamic parameter to 0 (zero) will stop the display of the SYSTEM-F-EXITFORCED message.

Interrupting and Terminating RSHELL

Normally, RSHELL terminates when the remote command terminates. However, if you press **Ctrl+C** while RSHELL is running, the interrupt is sent to the remote process. If the remote command is being executed on a UNIX system, the **Ctrl+C** is perceived as an interrupt signal.

Logging Into a Remote System with RLOGIN

The RLOGIN command lets you interactively log into a remote system from your local system. RLOGIN is similar to TELNET, except that support for RLOGIN is not as widespread, and the authentication method relies on equivalence files that identify trusted hosts rather than passwords.

Using RLOGIN

If your user name is the same on the local and remote systems, or the R services equivalence files are set up appropriately, you can use the following command format to log in:

```
$ RLOGIN hostname
```

To use a different remote user name, use the following command format:

```
$ RLOGIN hostname /USERNAME=remote_user
```

Once an RLOGIN session has been established, the following character sequences typed at the beginning of a line have the effect described:

~.	A tilde followed by a period disconnects the session and exits RLOGIN.
~Ctrl+Z	A tilde followed by **Ctrl+Z** creates and connects you to a subprocess on the local system. When you log out of the subprocess, you return to your RLOGIN session.
~~	Two consecutive tildes transmit a single tilde to the remote system.

Terminating an RLOGIN Session

You terminate your session with the remote host by logging out as you normally would.

R Services Authentication

The R services RLOGIN, RSHELL, RCP, and RMT use *trusted users* and *trusted hosts* listed in two files on the destination system for access control: `MULTINET:HOSTS.EQUIV` and `SYS$LOGIN:.RHOSTS`.

Host Equivalences

The `MULTINET:HOSTS.EQUIV` file (`/etc/hosts.equiv` on UNIX systems) provides a list of hosts to receive access on a system-wide basis. All users on the specified hosts can access the target system without specifying a user name or password. Each entry in this file consists of a host name.

> **Note:** You cannot use the `MULTINET:HOSTS.EQUIV` file to allow access to an individual user; user names specified in this file are ignored.

The following example shows a sample `HOSTS.EQUIV` file.

```
localhost
sales.example.com
example.com
bubba.example.com
```

If the `HOSTS.EQUIV` file shown in the previous example exists on the system such as the example SALES.EXAMPLE.COM, the following statements are true:

- Users on SALES.EXAMPLE.COM will have `RLOGIN`, `RCP`, and `RSHELL` access to their own accounts on the system. (Allowed by the first two entries.)
- EXAMPLE.COM and BUBBA.EXAMPLE.COM are identified (in the last two entries) as trusted hosts, allowing any user on either of these systems to have `RLOGIN`, `RCP`, and `RSHELL`

access to their own user name on SALES.EXAMPLE.COM without specifying the user name or a password.

User Equivalences

The `SYS$LOGIN:.RHOSTS` file (`~/.rhosts` on UNIX systems) allows remote users access to your user name. The format of an entry in this file consists of a host name and an optional user name:

```
hostname        [username]
```

Each entry specifies that `username` on system `hostname` can access your user name on the target without specifying a password (you may omit `username` if your user names are identical on the two systems).

The following example contains an example `.RHOSTS` file.

```
example.com         system
unix.example.com    root
```

If the `.RHOSTS` file shown in the previous example belongs to the user JDOE on SALES.EXAMPLE.COM, the following statements are true:

- The first entry grants access to user name JDOE on SALES.EXAMPLE.COM from user SYSTEM on host EXAMPLE.COM.
- The second entry grants access to user name JDOE from user ROOT on host UNIX.EXAMPLE.COM.

Hence, either of these two remote users can use RLOGIN, RCP, or RSHELL to access JDOE’s account on SALES.EXAMPLE.COM without specifying a password.

Cautions Concerning Use of Equivalences

The following cautions apply when using R services equivalence files:

- When specifying a user in any authentication file (particularly on UNIX systems), make sure to specify the user name in the correct case. `ROOT` and `root` are treated as different user names on case-sensitive systems.
- The host initiating the RLOGIN, RCP, or RSHELL request must be listed in the destination host's host name database by DNS, or its name must be resolvable by DNS (if domain name service is enabled). If the destination host cannot determine the initiating host's name from the IP address in the connection request, it rejects the request.

- The resolved host name must be an exact match. For example, if the IP address resolves to FNORD.FOO.COM, it is not correct to put only FNORD in the `HOST.EQUIV` or `.RHOSTS` file. In addition to being fully qualified, entries must be of the same case.
- The MultiNet RLOGIN, RCP, and RSHELL servers cache the contents of the `.RHOSTS` and `HOSTS.EQUIV` files in memory for ten minutes to improve performance. This means changes to the `.RHOSTS` and `HOSTS.EQUIV` file may not be noticed by the network immediately. Your system manager can use the following command to flush the cache before the timeout period:

```
$ MULTINET NETCONTROL RLOGIN FLUSH
```

- Access control requirements differ between RLOGIN and other R services. RLOGIN requires both NETWORK *and* LOCAL access, while RSHELL, RMT, and RCP only require NETWORK access.

Logging into a Remote System with TELNET

The MultiNet `TELNET` utility uses the standard Internet TELNET protocol to establish a virtual terminal connection between the interactive session on your OpenVMS system and a remote host. You can connect to any remote host on the network that supports the TELNET protocol, and perform any operation as if you were using a terminal physically connected to the remote host.

Refer to the *Accessing IBM Hosts with the TELNET Command* section for information on using the TELNET TN3270 and TN5250 features for accessing IBM hosts.

Starting a TELNET Connection

You can start TELNET and establish a connection to a remote host in either of two ways:

- From the DCL prompt
- Interactively from within the TELNET utility

The following example shows how to run TELNET and connect to a host in a single step.

```
$ telnet remote_host
Trying... Connected to remote_host, a host_type running os_type
```

In the next example, you invoke the TELNET utility. Once TELNET starts, you specify the remote host to which you want to connect.

```
$ telnet
SIMPLE.EXAMPLE.COM MultiNet TELNET-32 5.5(103)
TELNET>connect remote_host
Trying... Connected to remote_host, a host_type running os_type
```

In either case, TELNET informs you of the CPU type and operating system software on the remote host (if that information is available from DNS or the host table).

Once you have logged in, proceed as though you were connected to the remote host via a locally attached terminal. Use the command syntax conventions native to the remote host.

Using TELNET Commands

You can only execute TELNET commands in command mode; that is, when you see the TELNET> prompt (before a connection is established) or the host> prompt (after a connection has been established).

You can force TELNET into command mode by entering the current escape character followed by an X. The default ESCAPE character is **Ctrl+^** (control-caret).

The following example shows how to force TELNET into command mode:

```
$ Ctrl+^ X
host>
```

Use the STATUS command to determine the state of all parameters associated with the TELNET session. The following example shows typical STATUS command output.

```
$ Ctrl+^ X
EXAMPLE.COM>status
This is BUBBA.EXAMPLE.COM, VAX/VMS Version V7.3
Connected to host IRIS.EXAMPLE.COM, a VAXSTATION-4000-60 running VMS via
TCP.
Remote host is echoing
Host is not sending binary
Client is not sending binary
NO Abort Output character set
NO Interrupt Process character set
NO Are-You-There character set
NO Erase Character character set
NO Erase Line character set
Normal End Of Line mapping
```

```
Local Flow control
No log file
Remote host status reply:
IRIS::_VTA23: 11:24:21  (DCL) CPU=00.00.10.92 PF=322 IO=78 MEM=218
```

In general, when you type the TELNET ESCAPE character **Ctrl+^**, the next character you type is interpreted as follows:

?	Prints help information on TELNET escape commands.
A	Sends an "Attention" request to the remote host.
B	Sends a "Break" request to the remote host.
C	Closes the connection to the remote host.
O	Sends an "Abort Output" request to the remote host.
P	Spawns a new process (or attaches to a parent process, if there is one).
Q	Quits TELNET.
S	Prints the status of the TELNET connection.
T	Sends an "Are-You-There" request to the remote host.
X	Enters extended TELNET command mode.

To send the ESCAPE character itself to the remote host, type the ESCAPE character twice.

To change the ESCAPE character, use the DCL qualifier /ESCAPE_CHARACTER. For example, to change from the default ESCAPE character **Ctrl+^** to **Ctrl+A**, type:

```
TELNET>set escape "^A"
```

or:

```
$ TELNET /ESCAPE_CHARACTER="^A" example.com
```

You can determine all the available TELNET commands at any time by typing a question mark (?) at the TELNET> prompt.

Using TELNET Control Sequences

You can establish mappings between control characters and certain TELNET control sequences. This can often significantly improve terminal response. These mappings can also be used to provide a certain amount of system independence in the command interface across different systems. Consult the TELNET RFCs (854, 855, 856, 857, 1041, 1073, 1079, 1080, and 1091) for additional information on TELNET control sequences (also known as IACs).

Normally, in a TELNET session, all characters typed at the terminal are inserted in the TELNET stream sequentially and interpreted sequentially at the remote system. Hence, even control characters that you want interpreted immediately (like **Ctrl+C** or **Ctrl+O** on an OpenVMS system) are interpreted on the remote system only after all characters that precede them in the command stream.

TELNET control sequences, however, can cause the remote system to perform their function before processing characters already in the input stream.

To specify control characters that map to these commands, specify them from the DCL command line:

```
$ TELNET /ABORT_OUTPUT="^O" example.com
```

or, using the `SET` command from within `TELNET`; for example:

```
TELNET>set abort-output "^O"
```

The below table **Error! Reference source not found.**summarizes the possible TELNET control sequences:

Sequence Name	Action	Equivalent OpenVMS Function
`ABORT-OUTPUT`	Cancels any output in progress and sends an Abort Output command to the TELNET server. Additionally, if the `AUTO-FLUSH` feature is enabled, a Timing Mark command is sent to the TELNET server; the TELNET client begins discarding any buffered output until a Timing Mark command is received in the response.	`Ctrl+O`
`ARE-YOU-THERE`	Sends an Are You There command to the TELNET server.	`Ctrl+T`
`BREAK-CHARACTER`	Sends a Break command to the TELNET server.	`BREAK`

ERASE-CHARACTER	Sends an Erase Character command to the TELNET server.	<x
ERASE-LINE	Sends an Erase Line command to the TELNET server.	Ctrl+U
INTERRUPT-PROCESS	Sends an Interrupt Process command to the TELNET server.	Ctrl+C

You can also specify control characters from the DCL command line; for example:

```
$ telnet/abort_output=^O example.com
```

Running Applications over TELNET Connections

A TELNET connection normally exists between a remote pseudo-terminal (for example, NTYx:) and the TELNET user program. Characters received from the user's terminal are sent through the network to the remote pseudo-terminal and vice versa. Using the DCL qualifier /CREATE_NTY or the TELNET CREATE-NTY command, you can also connect the local end of the connection to a pseudo-terminal. Once the local end is connected to a pseudo-terminal, you can run other applications (such as KERMIT) over the TELNET connection.

The CREATE-NTY command first attempts to negotiate BINARY mode. BINARY mode ensures the connection is as transparent as possible. Then, a new NTY*x* terminal is created and the connection attached to it. Finally, the NTY*x* terminal is allocated to your current process and TELNET exits.

The following example shows how to use the DCL /CREATE_NTY qualifier.

```
$ TELNET/CREATE_NTY bubba
Trying... Connected to BUBBA, a VAX running VMS.
Welcome to BUBBA
Username: JOE
Password:
Welcome to VAX/VMS version V7.1 on node BUBBA
Last interactive login on Tuesday, 16-MAR-2020 13:34
Last non-interactive login on Wednesday, 17-MAR-2020 13:32
[ Process _VTA13: on BUBBA::VTA13: ]
$ Ctrl+^ X
BUBBA>create-nty
TELNET session now connected to _NTY3:
%DCL-I-ALLOC, _NTY3: allocated
$ kermit
VMS Kermit-32 version 3.3.111
Default terminal for transfers is: _TWA2:
```

```
Kermit-32>set line nty3:
Kermit-32>connect
[Connecting to _NTY3:.  Type ^]C to return to VAX/VMS Kermit-32]
$
```

The following example shows how to use TELNET CREATE-NTY.

```
$ TELNET BUBBA
Trying... Connected to BUBBA, a VAX running VMS.
Welcome to BUBBA
Username: JOE
Password:
Welcome to VAX/VMS version V7.3 on node BUBBA
Last interactive login on Tuesday, 16-MAR-2020 13:34
Last non-interactive login on Wednesday, 16-MAR-2020 13:32
[ Process _VTA13: on BUBBA::VTA13: ]
$ Ctrl+^ X
BUBBA>CREATE-NTY
TELNET session now connected to _NTY3:
%DCL-I-ALLOC, _NTY3: allocated
$ kermit
VMS Kermit-32 version 3.3.111
Default terminal for transfers is: _TWA2:
Kermit-32>set line nty3:
Kermit-32>connect
[Connecting to _NTY3:.  Type ^]C to return to VAX/VMS Kermit-32]
$
```

Accessing IBM Hosts with the TELNET Command

TELNET provides two IBM terminal emulations for accessing IBM hosts. The /TN3270 and /TN5250 qualifiers provide IBM 3270 and IBM 5250 terminal emulations, respectively. Using TELNET TN3270 and TN5250, you can:

- Log into IBM hosts
- Display and define your own keyboard map
- Capture screen output
- Print screen capture output

Both TN3270 and TN5250 modes use the OpenVMS screen management (SMG) runtime routines to create a full-screen IBM 3270 or 5250 mode display on your terminal. These TELNET modes give the appearance of being logged into the remote host from an IBM terminal.

Starting TELNET with an IBM Terminal Emulator

To start TELNET in TN3270 mode, enter the following command:

```
$ MULTINET TELNET /TN3270
```

To force TN3270 emulation, enter:

```
$ MULTINET TELNET /TN3270=FORCE
```

This qualifier is useful when communicating with a system that supports 3270 mode, but cannot negotiate it automatically, such as IBM mainframes running ACCESS/VMS. To start `TELNET` in TN5250 mode, enter:

```
$ MULTINET TELNET /TN5250
```

To force TN5250 emulation, enter:

```
$ MULTINET TELNET /TN5250=FORCE
```

Stopping an IBM Emulator Session

Exit a TN3270 or TN5250 session by pressing **`Ctrl+C`**.

IBM 3278 Models

In TN3270 mode, TELNET emulates an IBM 3278 terminal. The model number depends on the terminal "window" size (page width and length). The terminal (or window on a workstation) on which TN3270 mode `TELNET` is running must have at least 80 columns and 24 rows. The below table describes the actual emulation used, based on the terminal/window size.

Minimum Size (Rows x Columns)	Emulated Terminal
24 x 80	3278 model 2
32 x 80	3278 model 3
43 x 80	3278 model 4

27 x 132	3278 model 5

TN5250 TELNET mode emulates a TN5251-11 terminal with 24 rows and 80 columns and has only one screen mode.

Mapping Your Keyboard

TN3270 and TN5250 modes use the OpenVMS SMG runtime routines and the files `MULTINET:MAP3270.DAT` and `MULTINET:MAP5250.DAT`, respectively, to perform terminal emulation on the local system. These files contain the terminal key sequence to IBM terminal key mappings for a wide variety of terminals. Only those terminals with entries in both `MAP3270.DAT` or MAP5250.DAT and the OpenVMS SMG terminal definition library (`SYS$SYSTEM:TERMTABLE.TXT`) can use the IBM terminal modes.

Displaying the Current Keyboard Mapping

Press the **HELP** key to display the current key mappings from the current key mapping data file (such as `MAP3270.DAT`). The help screen reformats and improves readability of the information in the mapping file.

The following is an example help screen for `MAP3270.DAT`:

```
TN3270 Key Definitions (Press Help to dismiss)
PFK1   = "KP1" or "ESC 1"           PFK22  = "PF2 KP2" or "^F 2 2"
PFK2   = "KP2" or "ESC 2"           PFK23  = "PF2 KP3" or "^F 2 3"
PFK3   = "KP3" or "ESC 3"           PFK24  = "PF2 KP4" or "^F 2 4"
PFK4   = "KP4" or "ESC 4"           PA1    = "ESC PF1" or "^P 1"
PFK5   = "KP5" or "ESC 5"           PA2    = "ESC PF2" or "^P 2"
PFK6   = "KP6" or "ESC 6"           LEFT   = "^H" or "LEFT"
PFK7   = "KP7" or "ESC 7"           RIGHT  = "^L" or "RIGHT"
PFK8   = "KP8" or "ESC 8"           UP     = "^K" or "UP"
PFK9   = "KP9" or "ESC 9"           DOWN   = "^J" or "DOWN"
PFK10  = "PF1 KP0" or "ESC 0"       CLEAR  = "^Z" or "KP_ENTER"
PFK11  = "PF1 KP1" or "ESC -"       ENTER  = "^M"
PFK12  = "PF1 KP2" or "ESC ="       ESCAPE = "^C"
PFK13  = "PF1 KP3" or "^F 1 3"      CAPTURE= "^T" or "DO"
PFK14  = "PF1 KP4" or "^F 1 4"      TAB    = "^I"
PFK15  = "PF1 KP5" or "^F 1 5"      BTAB   = "^B"
PFK16  = "PF1 KP6" or "^F 1 6"      INSRT  = "" or "ESC SPACE"
```

```
PFK17  = "PF1 KP7" or "^F 1 7"      DELETE = "^D"
PFK18  = "PF1 KP8" or "^F 1 8"      ERASE  =
PFK19  = "PF1 KP9" or "^F 1 9"      EEOF   = "^E"
PFK20  = "PF2 KP0" or "^F 2 0"      EINP   = "^W"
PFK21  = "PF2 KP1" or "^F 2 1"      HOME   = "KP_PERIOD"
```

The 3270.DAT file viewed without the `HELP` formatting is as follows:

```
vt100|vt200|vt220|vt240|vt200-80|vt300|vt400|vt100nam|pt100| {
enter   = '^m';
clear   = '^z'     | '\EOM'  | '\3M';
help    = '\E[28~' | '\EH'   | '\C28~';
capture = '^t'     | '\E[29~'| '\C29~';
nl      = '^?';
tab     = '^i';
btab    = '^b';
left    = '^h'     | '\E[D'  | '\EOD' | '\3D' | '\CD';
right   = '^l'     | '\E[C'  | '\EOC' | '\3C' | '\CC';
up      = '^k'     | '\E[A'  | '\EOA' | '\3A' | '\CA'
down    = '^j'     | '\E[B'  | '\EOB' | '\3B' | '\CB';
home    = '\EOn'   | '\3n';
fm      = '^y';
delete  = '^d';
eeof    = '^e';
einp    = '^w';
insrt   = '^ '     | '\E ';

# pf keys
pfk1  = '\EOq'     | '\E1'  | '\3q';
pfk2  = '\EOr'     | '\E2'  | '\3r';
pfk3  = '\EOs'     | '\E3'  | '\3s';
pfk4  = '\EOt'     | '\E4'  | '\3t';
pfk5  = '\EOu'     | '\E5'  | '\3u';
pfk6  = '\EOv'     | '\E6'  | '\3v';
pfk7  = '\EOw'     | '\E7'  | '\3w';
pfk8  = '\EOx'     | '\E8'  | '\3x';
pfk9  = '\EOy'     | '\E9'  | '\3y';
pfk10 = '\EOP\EOp' | '\E0'  | '\3P\3p';
pfk11 = '\EOP\EOq' | '\E-'  | '\3P\3q';
pfk12 = '\EOP\EOr' | '\E='  | '\3P\3r';
pfk13 = '\EOP\EOs' | '^f13' | '\3P\3s';
pfk14 = '\EOP\EOt' | '^f14' | '\3P\3t';
pfk15 = '\EOP\EOu' | '^f15' | '\3P\3u';
pfk16 = '\EOP\EOv' | '^f16' | '\3P\3v';
pfk17 = '\EOP\EOw' | '^f17' | '\3P\3w';
pfk18 = '\EOP\EOx' | '^f18' | '\3P\3x';
pfk19 = '\EOP\EOy' | '^f19' | '\3P\3y';
pfk20 = '\EOQ\EOp' | '^f20' | '\3Q\3p';
pfk21 = '\EOQ\EOq' | '^f21' | '\3Q\3q';
pfk22 = '\EOQ\EOr' | '^f22' | '\3Q\3r';
pfk23 = '\EOQ\EOs' | '^f23' | '\3Q\3s';
pfk24 = '\EOQ\EOt' | '^f24' | '\3Q\3t';
```

```
# program attention keys
pa1 = '\E\EOP' | '^p1' | '\E\3P';
pa2 = '\E\EOQ' | '^p2' | '\E\3Q';

# local control keys

escape = '^c' | '^^'; # escape to telnet command mode
master_reset = '^g';

# local editing keys
settab = '\E;';
deltab = '\E\'';
clrtab = '\E:';
setmrg = '\E,';
sethom = '\E.';
coltab = '\E\E[B' | '\E\EOB' | '\E\3B' | '\E\CB';
colbak = '\E\E[A' | '\E\EOA' | '\E\3A' | '\E\CA';
indent = '\E\E[C' | '\E\EOC' | '\E\3C' | '\E\CC';
undent = '\E\E[D' | '\E\EOD' | '\E\3D' | '\E\CD';
}    # end of vt100, etc.
```

On terminals without a `HELP` key, edit the `MAP3270.DAT` or `MAP5250.DAT` file and assign a value to the "help" function. For example, to assign the help function to either **`Ctrl+X h`** or **`ESC h`**, add this line to the file:

```
help = '^XH' | '\EH';
```

For VT-class terminals without a **`HELP`** key, TELNET supports **`ESC h`** by default. On these terminals, you do not need to modify the `MAP`*`xxxx`*`.DAT` files.

Keyboard Mapping File Format

The keyboard mapping files contain mappings between characters entered from your keyboard, and 3270 or 5250 keycodes. The first line specifies all of the terminal types supported. For example, these mappings specify VT100-VT400 terminals:

```
vt100 | vt200 |  vt200-80| vt220 | vt240| vt300 | vt400
```

Subsequent lines specify the IBM keycode followed by an equal sign (=) and the keystrokes (in single quotes) you press to send the keycode. Each key definition ends with a semicolon (`;`). Some reserved characters are:

- Caret (`^`) begins a `Ctrl` character sequence.
- Backslash and the letter "`E`" (`\E`) represents an ESCAPE character.

- Caret-question mark (`^?`) represents rub out.

For example, this key sequence:

```
delete = '^d';
```

sends the IBM DELETE code when you press **Ctrl+D**.

Functions

The following is a list of the TN3270 and TN5250 functions that can be used in the `MAP3270.DAT` and `MAP5250.DAT` files.

```
aplend      cursel     escape     left2        right   up
aploff      delete     ferase     lprt         right2  vertical_bar
aplon       deltab     fieldend   master_reset sethom  werase
attn        disc       flinp      monocase     setmrg  wordbacktab
btab        down       fm         nl           ettab   wordend
capture     dp         help       pa1-pa3      space   wordtab
centsign    dvcnl      home       pcoff        synch
clear       eeof       indent     pcon         tab
clrtab      einp       init       pfk1-pfk36   test
colbak      enter      insrt      reset        treq
coltab      erase      left       reshow       undent
```

Specifying Multiple Keystrokes

You can assign multiple keystrokes to a single code by separating each set of keystrokes with a vertical bar (`|`) operator. The following example sends the delete keycode to the host when you press either **Ctrl+D** or **Ctrl+?**.

```
delete = '^d' | '^?';
```

TN3270 Function Key Mapping

The below table lists the mappings between 3270 function keys and the keys on VT100, VT200, VT300, and VT400 series terminals.

IBM Function	**VT Terminal Key Sequences**
Enter	`Ctrl+M` *or* `RETURN`
Clear	`Ctrl+Z` *or* `ENTER`
Input Editing Functions	
New line	`DELETE`
Tab	`TAB` *or* `Ctrl+1`
Backtab	`Ctrl+B`
Left	`Ctrl+H` *or* `LEFT ARROW`
Right	`Ctrl+L` *or* `RIGHT ARROW`
Up	`Ctrl+K` *or* `UP ARROW`
Down	`Ctrl+J` *or* `DOWN ARROW`
Home	`Keypad`
Delete	`Ctrl+D`
Erase to EOF	`Ctrl+E`
Erase Input	`Ctrl+W`
Insert	`Ctrl+Space` *or* `ESC + Space`
Attention Keys	
PA1	`ESC + PF1` *or* `Ctrl+P + 1`

PA2	ESC + PF2 *or* Ctrl+P + 2
Local Control Keys	
TELNET Escape	Ctrl+C *or* Ctrl+[
Master Reset	Ctrl+G
Local Editing Keys	
Set Tab	ESC + ;
Delete Tab	ESC + \
Clear Tabs	ESC + :
Set Merge	ESC + ,
Set Home	ESC + .
Column Tab	ESC + DOWN ARROW
Column Back Tab	ESC + UP ARROW
Indent	ESC + RIGHT ARROW
Unindent	ESC + LEFT ARROW
Function Keys	
PF1	Keypad 1 *or* ESC + 1
PF2	Keypad 2 *or* ESC + 2
PF3	Keypad 3 *or* ESC + 3

PF4	Keypad 4 *or* ESC + 4
PF5	Keypad 5 *or* ESC + 5
PF6	Keypad 6 *or* ESC + 6
PF7	Keypad 7 *or* ESC + 7
PF8	Keypad 8 *or* ESC + 8
PF9	Keypad 9 *or* ESC + 9
PF10	PF1 + Keypad 0 *or* ESC + 0
PF11	PF1 + Keypad 1 *or* ESC + -
PF12	PF1 + Keypad 2 *or* ESC + =
PF13	PF1 + Keypad 3 *or* Ctrl+F + 1 + 3
PF14	PF1 + Keypad 4 *or* Ctrl+F + 1 + 4
PF15	PF1 + Keypad 5 *or* Ctrl+F + 1 + 5
PF16	PF1 + Keypad 6 *or* Ctrl+F + 1 + 6
PF17	PF1 + Keypad 7 *or* Ctrl+F + 1 + 7
PF18	PF1 + Keypad 8 *or* Ctrl+F + 1 + 8
PF19	PF1 + Keypad 9 *or* Ctrl+F + 1 + 9
PF20	PF2 + Keypad 0 *or* Ctrl+F + 2 + 0
PF21	PF2 + Keypad 1 *or* Ctrl+F + 2 + 1

> **Note:** Key sequences denoted by `Keypad x` indicate key *x* on the VT terminal keypad.

TN5250 Function Key Mapping

The below table lists the mappings between 5250 function keys and the keys on VT100, VT200, VT300, and VT400 series terminals.

IBM Function	**VT Terminal Key Sequences**
Enter	`Ctrl+M` *or* `RETURN`
Clear	`Ctrl+Z` *or* `ENTER`
Input Editing Functions	
New line	`Del`
Tab	`Tab` *or* `Ctrl+1`
Backtab	`Ctrl+B`
Left	`Ctrl+H` *or* `Left arrow`
Right	`Ctrl+L` *or* `Right arrow`
Up	`Ctrl+K` *or* `Up arrow`
Down	`Ctrl+J` *or* `Down arrow`
Home	`Keypad .`
Delete	`Ctrl+D`

Insert	`Ctrl+Space or ESC + Space`
Local Control Keys	
TELNET Escape	`Ctrl+C or Ctrl+[`
Master Reset	`Ctrl+G`
Function Keys	
CMD1	`Keypad 1 or ESC + 1`
CMD2	`Keypad 2 or ESC + 2`
CMD3	`Keypad 3 or ESC + 3`
CMD4	`Keypad 4 or ESC + 4`
CMD5	`Keypad 5 or ESC + 5`
CMD6	`Keypad 6 or ESC + 6`
CMD7	`Keypad 7 or ESC + 7`
CMD8	`Keypad 8 or ESC + 8`
CMD9	`Keypad 9 or ESC + 9`
CMD10	`PF1 + Keypad 0 or ESC + -`
CMD11	`PF1 + Keypad 1 or ESC + -`
CMD12	`PF1 + Keypad 2 or ESC + =`
CMD13	`PF1 + Keypad 3 or Ctrl+F + 1 + 3`
CMD14	`PF1 + Keypad 4 or Ctrl+F + 1 + 4`

CMD15	PF1 + Keypad 5 *or* Ctrl+F + 1 + 5
CMD16	PF1 + Keypad 6 *or* Ctrl+F + 1 + 6
CMD17	PF1 + Keypad 7 *or* Ctrl+F + 1 + 7
CMD18	PF1 + Keypad 8 *or* Ctrl+F + 1 + 8
CMD19	PF1 + Keypad 9 *or* Ctrl+F + 1 + 9
CMD20	PF2 + Keypad 0 *or* Ctrl+F + 2 + 0
CMD21	PF2 + Keypad 1 *or* Ctrl+F + 2 + 1

> **Note:** Key sequences denoted by `Keypad x` indicate key *x* on the VT terminal keypad.

Editing the Keyboard Mapping File

To customize a keyboard mapping file:

1. Copy the appropriate file (`MAP3270.DAT` or `MAP5250.DAT`) from the `MULTINET:` directory to your login directory; for example, `USERS:[IGUANA]MAP3270.DAT`.

2. Define the `MAP3270` or `MAP5250` logical name to point to that file instead of the version in the `MULTINET:` directory; for example:

```
$ DEFINE/JOB MAP3270 "@USERS:[IGUANA]MAP3270.DAT"
```

> **Note:** You must use the `@` (at-sign) at the start of the file name.

3. Edit the file with any text editor.

To test a particular entry for a terminal in the MAP3270 or MAP5250 file, define the KEYBD logical name for your entry; for example:

```
$ DEFINE KEYBD "my_new_vt420"
```

Capturing Screen Output and Printing Screen Captures

You can press the Do key at any time during a TN3270 or TN5250 session to store the contents of the current screen in a file in the current directory (the default directory when the TELNET session started). The output file is named TN3270.LIS or TN5250.LIS and captures only the current screen. Each time you press the Do key, a new version of this file is created.

For keyboards that do not have a Do key, assign a value to the capture function in the MAP*xxxx*.DAT file. For example, assign the capture function to accept **Ctrl+T** as follows:

```
capture = '^t'
```

On VT-style keyboards without a Do key, TELNET supports Ctrl+T by default. For these terminals, you don't need to modify the MAP*xxxx*.DAT files.

The MULTINET_TN3270_PRINTER logical name lets you direct TN3270 screen output to a print queue. To use this feature, enter:

```
$ DEFINE MULTINET_TN3270_PRINTER queue_name
```

The MULTINET_TN5250_PRINTER logical name lets you direct TN5250 screen output to a print queue. To use this feature, enter:

```
$ DEFINE MULTINET_TN5250_PRINTER queue_name
```

Using Transparent Mode

TN3270 supports a transparent mode similar to the transparent mode offered by the IBM 7171 ASCII device controller. This feature is enabled automatically by TELNET when transparent mode information is received from the IBM host. You can disable this feature before entering TN3270 with the following command:

```
$ DEFINE MULTINET_TN3270_TRANSPARENT_MODE DISABLED
```

Application Keypad Access for TN3270 and TN5250

You can enable or disable access to the application keypad in TN3270 mode with the `MULTINET_TN3270_ APPLICATION_KEYPAD` logical name. The default value is `ON`. Disable access by defining the logical name as follows:

```
$ DEFINE MULTINET_TN3270_APPLICATION_KEYPAD OFF
```

You can enable or disable access to the application keypad in TN5250 mode with the `MULTINET_TN5250_APPLICATION_KEYPAD` logical. The default value is `ON`. Disable access by defining the logical as follows:

```
$ DEFINE MULTINET_TN5250_APPLICATION_KEYPAD OFF
```

TN3270 Emulation

The Yale Improved Null (`/[NO]YALE`) qualifier is enabled by default. Yale Improved Null replaces NULL characters found in fields with spaces when the TN3270 client writes the fields back to the server. Use the `/NOYALE` qualifier to disable this feature.

```
$ TELNET /TN3270/NOYALE
```

To disable text colors, use this command:

```
$ TELNET /TN3270/NOCOLOR
```

> **Note:** You can use `/NOCOLOR` for TN3270 in DPC emulation mode and for TN5250.

TN3270 Translation Table Mapping

TN3270 uses the `MULTINET_TN3270_LANGUAGE` logical to specify the regional language for the international character set translation table. Translation tables are stored in the

TN3270.TRANSLATION file. When TELNET is invoked, the translation file is searched for in the SYS$LOGIN directory. If it is not found, the MULTINET: directory is searched.

An entry in the translation table begins with the name of the language starting in the first column in the line. Use this value to define the MULTINET_TN3270_LANGUAGE logical. For example, this command specifies a translation table for a UK English keyboard:

```
$ DEFINE MULTINET_TN3270_LANGUAGE "UK_ENGLISH_DEC_MULTI"
```

The remainder of an entry consists of lines preceded with whitespace (either tabs or spaces). Each line contains these three values:

1. An EBCDIC code to be sent to the IBM host
2. The ASCII code to be displayed for that EBCDIC value
3. The ASCII character sent from the keyboard that causes the EBCDIC value to be sent to the host

A pound sign (#) specifies a comment and can appear in any column on a line, including lines containing translation codes. When specified on a line containing a translation code, the comment character must be preceded by at least one whitespace character. An entry is terminated by the first line following the entry that contains a "printable" character in column one. Entry names must start in the first column, and must consist only of uppercase letters, numbers, and underscores. The maximum length of an entry name is 255 characters.

The file name of the translation table can be changed with the MULTINET_TN3270_TRANSLATION_TABLES logical. For example, to define a translation table named US_FOO.DAT, enter:

```
$ DEFINE MULTINET_TN3270_TRANSLATION_TABLES "US_FOO.DAT"
```

An error message is issued if either logical name, MULTINET_TN3270_LANGUAGE or MULTINET_TN3270_TRANSLATION_TABLES, points to a non-existent entry.

The following example contains a sample translation file. In this example, the first line of the UK_ENGLISH_DEC_MULTI entry indicates that for the EBCDIC character 0x5b, the ASCII character 0xa3 is displayed. When the ASCII character 0xa3 is received from the keyboard, the EBCDIC character 0x5b is sent to the host.

```
#
# UK EBCDIC mapped into The HP Multinational Character Set
# Use following command to specify this table:
# $ DEFINE MULTINET_TN3270_LANGUAGE "UK_ENGLISH_DEC_MULTI"
#
UK_ENGLISH_DEC_MULTI
0x5b 0xa3 0xa3 # British monetary pound sign
0x4a 0x24 0x24 # Dollar sign ($)
#
```

```
#
# Austrian German mapped into The HP Multinational Character
# Set.  Use following command to specify this table:
# $ DEFINE MULTINET_TN3270_LANGUAGE "AUSTRIAN_GERMAN_DEC_MULTI"
#
#
AUSTRIAN_GERMAN_DEC_MULTI
0x4a 0xc4 0xc4 # A with umlaut
0x5a 0xdc 0xdc # U with umlaut
0x6a 0xf6 0xf6 # o with umlaut
0x79 0x60 0x60 # Grave
0x5b 0x24 0x24 # Dollar sign
0x7b 0x23 0x23 # Hash sign
0x7c 0xa7 0xa7 # Section sign
0x5f 0x5e 0x5e # Carat sign
0xa1 0xdf 0xdf # Beta sign
0xc0 0xe4 0xe4 # a with umlaut
0xd0 0xfc 0xfc # u with umlaut
0xe0 0xd6 0xd6 # O with umlaut
0x4f 0x21 0x21 # Exclamation point
0x7f 0x22 0x22 # Double quote
```

Kerberos V5 Authentication and Encryption

When a Kerberos V5 ticket has been acquired (for example, from HP's Kerberos for OpenVMS product), a TELNET session can be started with both Kerberos V5 authentication and DES encryption. The following example shows how to specify authentication and DES encryption when logging into a remote host:

```
$ telnet /auth/enc remote_host
```

> **Note:** The `/encryption` option will function with Kerberos V5 authentication only.

Troubleshooting TELNET

This section describes common problems that can occur when using TELNET to connect to a remote host.

Connection Problems

If you cannot connect to the remote host, use `PING` as follows to discover any network problems. For information about starting `PING`, refer to the *MultiNet Administrator's Reference*.

1. Ping the loopback address of your workstation, 127.0.0.1 to verify that MultiNet is working properly and that it can send and receive messages.
2. Ping your workstation by its IP address to verify that it is recognized on the network.
3. Ping your workstation by its host name to verify that it is recognized on the network and that its host name is being resolved.
4. Ping the broadcast address on your network to verify that your network can broadcast messages.
5. Ping another host on the same network by IP address to verify that the workstation can communicate with other hosts on the network.
6. Ping another host on the same network by host name to verify that host names are being resolved.
7. Ping a host on a different network, first by IP address and then by host name, to verify the default route is correct and that host names are being resolved.

Problems Logging In

If you cannot log into the remote host:

1. Make sure you have a valid user name on the remote host.
2. Make sure you are entering the correct user name and password.

If you still have difficulties logging in, contact your network administrator.

5. Remote File Access with the RCP, FTP, and TFTP Utilities

This chapter describes how to copy files between your local system and a remote system using the RCP, FTP, and TFTP utilities.

The FTP commands for renaming files, deleting files, and creating and deleting directories are described in the FTP command reference in *Appendix B*.

Copying Files Using RCP

The MultiNet RCP utility uses the RCP (remote copy) protocol to transfer files between the local host and a remote host. The Kerberos version of RCP also provides authenticated access between the two systems.

When the index file creates new buckets (the space allocated to store units of data) beyond the previous End-Of-File mark, but the End-Of-File is not updated to reflect the new buckets, RCP transfers the allocated buckets to the End-Of-File. You can turn this feature off by defining the logical `MULTINET_RCP_INDEX_UPTO_EOF`.

Requirements for RCP

The requirements for using the RCP utility are:

- Both the local and remote host must support the RCP protocol.
- You must specify the names of files on the remote host using the file-naming conventions of the remote host.

- If the remote host is an OpenVMS system, you must ensure that neither the system-wide login command procedure nor your local `LOGIN.COM` file displays any text. See *Inhibiting Output from SYSLOGIN.COM and LOGIN.COM* for more information on inhibiting output from these command procedures.

The R services authentication database files on the server system must be configured to allow RCP access from the local system. See the *Using RCP* section for additional information on R services authentication.

Using RCP

You can use RCP interactively or via a command file in batch mode.

Before you can copy files using RCP, the remote system must determine that you are allowed to do so. Normally, the remote system's RCP server checks the R services host equivalence files to determine whether or not you are authorized to copy files to or from the remote system. RCP uses the same authentication scheme as RLOGIN and RSHELL.

However, if you are using RCP with Kerberos authentication, authentication is handled by acquiring “tickets" that permit access to cooperating systems. (See Chapter 4 for more information.)

The following is an example using RCP to copy the file `/etc/hosts` from the UNIX system UNIX.EXAMPLE.COM to the user's current default directory on the local OpenVMS system.

```
$ RCP UNIX.EXAMPLE.COM::"/etc/hosts" []
```

> **Note:** The double quotation marks around "`/etc/hosts`" are necessary to prevent the slashes in the path name from being interpreted by DCL.

This command assumes the remote user name is the same as the local user name. To specify a different remote user name, use the `/USERNAME` qualifier as shown in the following command:

```
$ RCP /USERNAME=JETSON UNIX.EXAMPLE.COM::.cshrc [.UNIX-FILES]
```

If the host equivalence files are not set up, you can still use the RCP command by specifying the `/PASSWORD` qualifier. In that case, REXEC authentication is used instead. The command format for specifying a password is as follows:

```
$ RCP /USERNAME=JETSON /PASSWORD=ASTRO -
_$ UNIX.EXAMPLE.COM::report.july [.REPORTS]
```

> **Note:** If you specify `/PASSWORD` without a value, you are prompted for the password with echoing disabled.

To copy files with RCP using Kerberos authentication, use the following format:

```
$ RCP /AUTHENTICATION=KERBEROS UNIX.EXAMPLE.COM::"etc/hosts" []
```

or

```
$ RCP /AUTHENTICATION UNIX.EXAMPLE.COM::"etc/hosts" []
```

Inhibiting Output from SYLOGIN.COM and LOGIN.COM

The RCP protocol requires that neither the system-wide login command procedure (`SYS$MANAGER:SYLOGIN.COM`) nor users' `LOGIN.COM` procedures display any output. The following example shows commands to add to your `LOGIN.COM` and the system-wide `SYLOGIN.COM` to prevent any output from being displayed when they are executed.

```
$ VERIFY = 'F$VERIFY(0)                ! Turn off verify without echoing
$ IF F$MODE() .EQS. "OTHER" THEN EXIT  ! If a DETACHED process (RSHELL)
.
.
.
$ IF VERIFY THEN SET VERIFY            ! If a batch job, may want to turn
                                       ! verify back on.
```

Accessing Files with FTP

The FTP utility uses the Internet standard File Transfer Protocol (FTP) to transfer files between the local host and a remote host. FTP also allows you to perform directory and file operations, such as changing the working directory, listing files, renaming directories and files, and deleting directories and files.

The FTP utility has a command-line interface. Each action, such as copying files, requires a specific command.

Requirements for Using FTP

Requirements for using the FTP utility include the following:

- Both the local and remote host must support the Internet standard File Transfer Protocol.
- The names of files on the remote host must be specified using the file-naming conventions of the remote host.

Invoking FTP and Logging In

You can use FTP interactively or in batch mode with a command file.

When you invoke FTP, an FTP server process is created on the remote host. You can perform a limited set of operations on the files and directories that you have permission to access. FTP authenticates you on the remote host by checking the user name and password you specify against those in the authorization database on the remote host. For simplicity in this discussion, this verification process is referred to as *logging in*; however, you do not actually log in interactively to the remote host.

To illustrate, assume you are a user on the local system and you want to log into the remote host RESEARCH.EXAMPLE.COM. You can log in as yourself (by entering your name) or you can log in as any other user on RESEARCH, for example, MARK or BUBBA, as long as the specified user name is valid on the remote host and you know Mark's or Bubba's password.

> **Note:** Even though logging into another user's account is mentioned in the previous section, sharing passwords with other users is strongly discouraged.

You can connect to RESEARCH either by specifying the host name at the DCL command prompt (see the example below), or by entering the CONNECT command at the FTP prompt (see the example below).

Specifying host name at DCL prompt:

```
$ FTP RESEARCH.EXAMPLE.COM
DEVELOPMENT.EXAMPLE.COM MultiNet FTP user process 5.6(nnn)
Connection opened (Assuming 8-bit connections)
<RESEARCH.EXAMPLE.COM MultiNet FTP Server Process 5.6(nnn) at
Tue 16-Mar-2020 7:42am-EST
RESEARCH.EXAMPLE.COM>LOGIN MARK
Password: ********
RESEARCH.EXAMPLE.COM>
```

Entering the CONNECT command at FTP prompt

```
$ FTP
DEVELOPMENT.EXAMPLE.COM MultiNet FTP user process 5.6(nnn)
FTP>CONNECT RESEARCH.EXAMPLE.COM
Connection opened (Assuming 8-bit connections)
<RESEARCH.EXAMPLE.COM MultiNet FTP Server Process 5.6(nnn) at
Tue 15-Mar-2020 7:42am-EST
RESEARCH.EXAMPLE.COM>LOGIN MARK
Password: ********
RESEARCH.EXAMPLE.COM>
```

> **Note:** The initial FTP prompt (before connection to the remote host) is FTP>. After a connection is established, the prompt changes to the name of the remote host and FTP enters command mode.

At this point, you can specify your user name and password on RESEARCH with the FTP LOGIN command. Alternately, you can enter a command such as LOGIN MARK to log in as Mark (assuming you know Mark's password). The system then displays the Password: prompt. After you enter the password (which is not echoed), the system returns to FTP command mode, displays the prompt, and awaits further input.

Each time you invoke FTP, it checks first for a file called FTP.INIT in your login directory (SYS$LOGIN) and executes any commands in that file before it prompts you for input. Any commands you want executed at the beginning of every FTP execution can be included in this file. See the *FTP Initialization File* section for a description of FTP commands commonly used in FTP.INIT files.

> **Note:** Because the FTP server process is started by running `SYS$SYSTEM:LOGINOUT.EXE`, both the system-wide login command procedure (`SYS$MANAGER:SYLOGIN.COM`) and the specific user's `LOGIN.COM` are executed. As a result, any customization such as specifying default file protection, or process/job logical name definitions, and so on, are invoked in these command procedures and are available under the FTP server process.

All standard OpenVMS security-checking mechanisms are used to validate the FTP server process creation. If either of these command procedures contain any commands that are specific to interactive jobs (`SET TERMINAL` commands, for example), the FTP server process may crash. The easiest way to avoid this problem, without altering the functionality of these command procedures, is to use the DCL lexical function `F$MODE` together with interactive specific commands. For example:

```
$ IF F$MODE() .EQS. "INTERACTIVE" THEN SET TERMINAL /INQUIRE
```

The *FTP Log Files* section provides more information to assist you in determining the cause of any problems with the FTP server.

Using FTP Commands

After you have logged into a remote host, as described in the *Invoking FTP and Logging In* section, you can use FTP commands for operations such as copying files between hosts, changing working directories, listing directories, removing files, and renaming files. All FTP commands are described in *Appendix B*.

The FTP user interface looks very similar to the TOPS-20 command interface. In particular:

- You can type an `ESC` (escape character) at any point to attempt to complete (fill in) the current command, parameter (including file names), or qualifier.
- You can type a question mark (`?`) at any time for help on what to enter next.
- A question mark entered at the current FTP prompt displays the currently available commands. The commands that are available depend on whether or not a connection to a remote server has been established. Some commands are always recognized; others are recognized only before or after a connection has been made.

Getting FTP Command Help

The HELP command displays a brief description of a specified FTP command, general help information, or a list of available HELP topics. The format of the HELP command is as follows:

```
FTP>HELP [command]
```

If you specify the command name, HELP displays information for the specified command. If you type a ? in place of a command, HELP displays general help information. If you request HELP without an argument, the HELP facility lists available help topics and instructions for obtaining additional information.

> **Note:** The available commands vary depending on whether you have an open connection to a remote host.

Using Basic FTP Commands

Some commands simply set or reset various FTP options. They can be explicitly set using the ON argument or reset using the OFF argument. The default, if no argument is typed, is TOGGLE. Hence, if an option is on, executing the command controlling the option sets it to off. Executing the command a second time resets it to on. For example, when you first invoke FTP, the VERBOSE option (which gives detailed messages) is off. The following command would toggle VERBOSE on:

```
FTP>VERBOSE
```

You can reset the VERBOSE option to off by executing the above command a second time, hence "toggling" the setting back and forth.

You can display the state of a MultiNet FTP Server at any given time using the STATUS command. The following example shows the information reported by the STATUS command. Note, however, that some FTP implementations do not support the STATUS command.

```
RESEARCH.EXAMPLE.COM>STATUS
<RESEARCH.EXAMPLE.COM MultiNet FTP Server Process 5.6 (nnn)
User MARK logged into directory USERS:[MARK]
<The current transfer parameters are:
<   MODE S
```

```
<   STRU O VMS
<   TYPE A N
<A connection is open to host DEVELOPMENT.EXAMPLE.COM
<The data connection is CLOSED.
```

Specifying TCP Window Size with FTP

The FTP server and client let you specify the TCP window sizes to use during an FTP transfer. The value to be used is determined as follows:

If...	Then use...
The logical name `MULTINET_FTP_WINDOW_SIZE` is defined	Its equivalence string as the value.
The `/WINDOW_SIZE` qualifier is specified with FTP `[/SERVER]`	The value specified with the qualifier.
A value is specified with `[SITE] WINDOW-SIZE size`	The value specified.

If none of these criteria exist, then use the default value 32768.

In all cases, the value must be between `NET_MIN_TCPWINDOW` and `NET_MAX_TCPWINDOW` (presently 512 and 1073741824, respectively). The size of the send and receive buffers is set to the specified value.

File Name Translations

When you issue an `FTP GET` command to a host running the UNIX operating system and you do not specify an output file name, the resulting VMS file name can contain unexpected characters. These characters occur because the UNIX operating system has case-sensitive characters and special symbols that require conversion before they can be used with VMS.

You can use the `/FDL` qualifier with the FTP client `GET` and `PUT` commands for compatibility with TCP/IP Services for OpenVMS (formerly UCX). When you create a file with the `PUT /FDL` qualifier, a file description language (FDL) file is created at the same time as the original file. The contents of the original file are transmitted in IMAGE (binary) mode.

The FDL file has the same name except that FDL is appended to the file name extension.

An example of the PUT command is:

```
host>PUT /FDL AFILE.TXT BFILE.TXT
<ASCII Store of USERS:[ME]BFILE.TXTFDL;1 started.
<Transfer completed.  888 (8) bytes transferred.
<IMAGE Store of USERS:[ME]BFILE.TXT;1 started.
<Transfer completed.  6 (8) bytes transferred.
```

This command copies AFILE.TXT to BFILE.TXT on the system to which you are connected, then creates another file, BFILE.TXTFDL.

The BFILE.TXTFDL file is in ASCII format and resembles:

```
IDENT   " 15-MAR-2020 17:13:24   VAX/VMS FDL$GENERATE Routine"
SYSTEM
            SOURCE               VAX/VMS
FILE        ALLOCATION           5
            BEST_TRY_CONTIGUOUS  no
            BUCKET_SIZE          0
            CONTIGUOUS           no
            DEFERRED_WRITE       no
            EXTENSION            0
            GLOBAL_BUFFER_COUNT  0
            MT_BLOCK_SIZE        512
            MT_PROTECTION        32
            MAX_RECORD_NUMBER    0
            MAXIMIZE_VERSION     no
            NAME                 "USERS:[ME]AFILE.TXT;1"
            ORGANIZATION         sequential
            OWNER                [STAFF,ME]
            PROTECTION           (system:RWED, owner:RWED,group:,world:)
            READ_CHECK           no
            SUPERSEDE            no
            WRITE_CHECK          no
RECORD      BLOCK_SPAN           yes
            CARRIAGE_CONTROL     carriage_return
            CONTROL_FIELD_SIZE   0
            FORMAT               variable
            SIZE                 0
```

The newly created BFILE.TXT file is in raw block format which is not easily readable. When you use the GET /FDL command to retrieve the file, the original format is restored using the attributes stored in the FDL file. If you do not use the /FDL qualifier with the GET command, the new raw block format is retained.

In all instances, the FDL file is retained and must be deleted independently.

Notes:

- The FTP server `/TYPE=EBCDIC` qualifier is no longer supported.
- If you invoke FTP from the DCL command line and a password string is case-sensitive, use the following format for the command:

```
$ FTP /USER=username /PASSWORD="""MiXedCAse"""
```

  If you do not use quotation marks, MultiNet converts the password to lowercase.

- If you replaced the `FTP_SERVER.COM` file, you must add `/ACCESS=NOSPAWN` on "captive" accounts such as the `ANONYMOUS` account so that users cannot spawn commands. Spawning commands from such accounts opens a potential security hole.
- When transferring files between OpenVMS systems, do not use the `BINARY` command except when the desired output requires fixed, 512-byte records; most importantly, do not use `BINARY` on Process Software ECO save sets that you acquired with FTP, if you are using FTP from a MultiNet system.

The following table shows how UNIX printable file name characters are translated into VMS file names:

VMS Character	Server Char.	Hex Value	VMS Character	Server Char.	Hex Value	VMS Character	Server Char.	Hex Value
$4A	^A	1	$5A	!	21	$7A	Space	20
$4B	^B	2	$5B	"	22	$7B	;	3B
$4C	^C	3	$5C	#	23	$7C	<	3C
$4D	^D	4	$5E	%	25	$7D	=	3D
$4E	^E	5	$5F	&	26	$7E	>	3E
$4F	^F	6	$5G	'	27	$7F	?	3F
$4G	^G	7	$5H	(	28			
$4H	^H	8	$5I	)	29	$8A	@	40
$4I	^I	9	$5J	*	2A	$8B	[	5B
$4J	^J	A	$5K	+	2B	$8C	\	5C

$4K	^K	B	$5L	,	2C	$8D	]	5D
$4L	^L	C	$5N	.	2E	$8E	^	5E
$4M	^M	D	$5O	/	2F			
$4N	^N	E	$5Z	:	3A	$9A	`	60
$4O	^O	F	$			$9B	{	7B
$4P	^P	10	$6A	^@	00	$9C	|	7C
$4Q	^Q	11	$6B	^[	1B	$9D	}	7D
$4R	^R	12	$6C	^\	1C	$9E	~	7E
$4S	^S	13	$6D	^]	1D	$9F	DEL	7F
$4T	^T	14	$6E	^^	1E			
$4U	^U	15	$6F	^-	1F			
$4V	^V	16						
$4W	^W	17						
$4X	^X	18						
$4Y	^Y	19						
$4Z	^Z	1A						

- International characters in the range of octal 200 to 377 are translated as a dollar sign ($) followed by the three-digit octal value for the character.
- Directory names copied to VMS are appended with the `.DIR` suffix.
- The dot (`.`) character is treated as a special case. The first occurrence in a file name is interpreted explicitly as a dot; the next occurrences are translated into the `$5N` character sequence shown in the previous table. In a directory name, all occurrences of the dot character are translated into the `$5N` character sequence.
- A dollar sign followed by a letter indicates that the case should be shifted from its current state.

An example of file name translation occurs when a UNIX file called `foo.bar#1.old` is copied to the VMS system. The resulting VMS file name is `FOO.BAR$5C1$5NOLD`. If the file was a directory, the translated name would be `FOO$5NBAR$5C1$5NOLD.DIR`. If the UNIX file name was `Foo.BAr#1.old`, the translated case-sensitive VMS file name would be `$F$OO.$BA$R$5C1$5NOLD`.

Listing the Contents of a File

You can use the `GET` command to list the contents of a file as follows:

```
$ GET filename TT:
```

This command displays a list of the files on your terminal, and works with all FTP servers.

Working with Directories

When you open a connection to a remote host and log in, your default directory is set to your login directory on the remote system. If you log in as another user, your default directory is set to that user's login directory. You can find out the path name of this directory with the command:

```
FTP>PWD
```

You can list the contents of your current working directory on the remote host with the command:

```
FTP>DIR
```

You can change the working directory on the remote host to *`remote_directory`* with the command:

```
FTP>CD remote_directory
```

To change the working directory on the local host to *`local_directory`*, use the command:

```
FTP>LCD local_directory
```

Commands for Copying Files

The `GET` and `PUT` commands are the two basic commands for copying files between your system and a remote host. The `GET` command copies a single file from the remote host to your system. The `PUT`

command copies a single file from your system to the remote host. These commands have the following format:

```
FTP>GET remote_file local_file
FTP>PUT local_file remote_file
```

Under OpenVMS, the GET and PUT commands create new files. For other operating systems, the file is only created if it does not exist; if the file exists, an error is displayed. The AGET and APUT commands can be used to append to an existing file. These two commands have the following format:

```
FTP>AGET remote_file local_file
FTP>APUT local_file remote_file
```

The GET and PUT commands copy single files. Their counterparts, MGET and MPUT, copy multiple files. The format of these commands is similar, but not identical, to that of GET and PUT:

```
FTP>MGET remote_file
FTP>MPUT local_file
```

In these two commands, you specify the file names with wildcard specifications. For MGET, use the file name wildcard syntax for the remote host. For MPUT, use the OpenVMS file name wildcard syntax. The files retain their original names when they are copied. An MGET to an empty directory returns a status code of 552 from the FTP server.

Parameters for Copying Files

Transfer parameters define how a file should be copied. The three transfer parameters and their values are described in the following list:

STRUCTURE

Defines the structure of files to be transferred; takes one of the following values:

FILE	An unstructured byte stream. This is the default when communicating with systems that do not understand the OpenVMS structure described below.
RECORD	A file that is partitioned into records.
VMS	An arbitrary OpenVMS file; allows for transparent transfer of any RMS file between cooperating systems.

Note: The "VMS" transfer structure is automatically negotiated between systems that support it. After connecting to a remote system, the MultiNet FTP utility sends the FTP command "STRU O VMS" to the FTP server. If the server responds positively, both sides use the "VMS" structure to ensure total transparency when transferring files (that is, all RMS record and file attributes are retained). If the server responds negatively, both sides default to the "FILE" transfer structure.

TYPE

Defines the contents of files to be transferred; takes one of the following values:

`ASCII`	A file consisting of ASCII characters (the default).
`BACKUP`	Like `IMAGE`, but causes the local file to be written with 2048-byte fixed length records; used for transferring OpenVMS BACKUP save sets.
`IMAGE`	A binary image.
`LOGICAL-BYTE`	Used for doing binary transfers with TOPS-20 systems.

MODE

Defines how the file should be transferred; takes one of the following values:

`COMPRESSED`	Run length-encoded compression.
`STREAM`	Normal data transfer (the default).
`DEFLATE`	Uses mode Z data compression for data transfers. Mode Z transfers are not compatible with TLS authentication, which includes data compression.

FTP commands copy files using the current transfer parameters. When you first start FTP, the default transfer parameters are `FILE` structure, `ASCII` type, and `STREAM` mode. `VMS` structure is used if the

FTP Server supports it. Use the following commands to change the transfer parameters from their defaults:

```
FTP>TYPE type_name
FTP>STRUCTURE struct_name
FTP>MODE mode_name
```

There are a number of command synonyms for the TYPE and STRUCTURE commands; see *Appendix B* for a complete list.

FTP Commands While a Transfer is in Progress

Control characters entered during an FTP file transfer have the following effects:

Press...	To
Ctrl+G	Send an abort command to the remote server, thus aborting a data transfer.
Ctrl+A	Display the state and progress of the file transfer.
Ctrl+P	Suspend the transfer and spawn a new DCL subprocess. The file transfer will continue upon return to the FTP program from the spawned DCL subprocess.

Aborting a file transfer does not work correctly with servers that do not support the ABOR (abort) command. If attempted, the connection to the server may be lost.

Issuing FTP Commands from the DCL Command Line

You usually run the FTP utility by typing the FTP command then issuing additional commands once the program starts. If you are only interested in transferring one file, or issuing a single FTP command, you can specify the command on the DCL command line. See MULTINET FTP in *Appendix A* for the complete DCL command syntax.

For example, if you wish to retrieve the file pub/hack.c via anonymous login to the host EXAMPLE.COM, you might issue the DCL command:

```
$ FTP /USER=ANONYMOUS /PASSWORD=GUEST EXAMPLE.COM GET pub/hack.c hack.c
```

To get a listing of the `pub` directory on this same system, you would use the command:

```
$ FTP /USER=ANONYMOUS /PASSWORD=GUEST EXAMPLE.COM DIR pub
```

If you want to retrieve all files in the `pub` directory and copy them to your current directory on your local system, you might use the command:

```
$ FTP /USER=ANONYMOUS /PASSWORD=GUEST EXAMPLE.COM MGET pub/*
```

FTP Command Scripts

FTP commands are usually entered directly from the keyboard. You can, however, execute a predefined sequence of FTP commands by redirecting standard input (`SYS$INPUT`) interactively, or from within a DCL command procedure.

The following example shows an interactive session that uses a predefined command script, in this case in the file `FTP.COM`, to control FTP:

```
$ FTP /TAKE=FTP.COM
```

The following example shows a sample `FTP.COM` file. The italicized comments are provided only to explain each line in the `FTP.COM` file; do not include them in the actual file!

```
SET EXAMPLE.COM /USER:BOOJUM /PASS:SNARK   Set user & password
CONNECT EXAMPLE.COM                        Open connection
GET FOO.BAR NEWFOO.BAR                     Execute an FTP command
EXIT                                       Conclude session
```

The following example shows a DCL command procedure that runs FTP to get the file `FOO.BAR` from the remote host `EXAMPLE.COM`.

```
$! FTP DCL command procedure
$ FTP
SET EXAMPLE.COM /USER:BOOJUM /PASS:SNARK
CONNECT EXAMPLE.COM
GET FOO.BAR NEWFOO.BAR
EXIT
$! continue with any other commands
```

Ending an FTP Session

Once you have finished with your FTP session, you can either break the connection with the remote system while still remaining in FTP command mode, or you can log out from the remote host, exit FTP, and return to DCL.

To close the current connection without terminating in FTP, enter the command:

```
FTP>BYE
FTP>
```

To close the connection and return to DCL, enter the command:

```
FTP>EXIT
$
```

Using FTP over TLS (FTPS)

The FTP client can use FTP over TLS as specified in RFC 4217. Use the `AUTHENTICATE` command before the `USER` command to start a session with a secure command stream. The `PROTECTION PRIVATE` command can then be used to set file transfers to be encrypted. The `CCC` command will return the command stream to clear text mode, which is often necessary when traversing a firewall. The FTP client can also be started with `/AUTHENTICATE=TLS` to automatically enter TLS authentication after connection to the remote system.

FTP Log Files

The MultiNet FTP Server keeps a log of all FTP transactions that occur between the client and server after login in the file `FTP_SERVER.LOG` in the login directory on the server system. The following sample log file contains the FTP transactions involved in a user logging in under the user name SMITH, issuing a `DIRECTORY` command, and then retrieving the file `FOO.BAR`.

> **Note:** If the MultiNet FTP server process does not start or mysteriously disappears, examine the beginning of the `FTP_SERVER.LOG` file for any error messages.

> Because the system-wide login command procedure (SYS$MANAGER:SYLOGIN.COM) and the user's LOGIN.COM are executed as part of the server process creation, any errors in these procedures can cause the server process to die suddenly. In most instances, however, the reason for the process terminating will appear at the beginning of the FTP_SERVER.LOG file.

```
------------------------------------------------------
FTP Login request received at Tue Mar 16 15:30:27 2020
         from remote IP address 127.0.0.1
------------------------------------------------------
>>> 230 User SMITH logged into U1:[SMITH] at Tue 16-Mar-20 15:30, job 3a.
<<< TYPE A
>>> 200 Type A ok.
<<< STRU F
>>> 200 Stru F ok.
<<< MODE S
>>> 200 Mode S ok.
<<< PORT 127,0,0,1,4,14
>>> 200 Port 4.14 at Host 127.0.0.1 accepted.
<<< LIST
>>> 150 List started.
>>> 226 Transfer completed.
<<< PORT 127,0,0,1,4,15
>>> 200 Port 4.15 at Host 127.0.0.1 accepted.
<<< RETR foo.bar
>>> 150 ASCII retrieve of USERS:[SMITH]FOO.BAR;1 started (210 bytes).
>>> 226 Transfer completed.  210 (8) bytes transferred.
<<< QUIT
>>> 221 QUIT command received. Goodbye.
SMITH job terminated at  16-MAR-2020 15:31:23.08
```

Anonymous FTP

Many system managers use anonymous FTP to allow network access to files of general interest on their system, without having to assign a user name to each user who wants access to the files. Anonymous FTP means that the ANONYMOUS login is created on a system to permit anyone access to that system. When using anonymous FTP, connect to the remote system as you would normally, but instead of specifying your user name, specify the user name anonymous and the password guest. In many implementations, you are restricted to read-only access of the files in a certain directory or a certain directory tree.

Note: While many systems allow you to use any password, some systems only allow anonymous FTP access with the password `guest`. Many systems prefer you to enter your e-mail address (*username@host*) instead of the `guest` password; either method works. Also, specify the `anonymous` user name in lowercase, as many systems (primarily those running UNIX) support case-sensitive user names. Hence, `anonymous` and `ANONYMOUS` are considered different user names, and only the former can be used for anonymous FTP access.

Transferring Files from Behind a Firewall

The MultiNet FTP Client `PASSIVE` command allows a range of control of the `PASV` directive for transferring files from FTP servers when your system is located behind a firewall gateway. The list of parameters and an explanation of how they work follows:

- an `ON` parameter (the default setting)
- an `OFF` parameter
- a `NEGOTIATED` parameter
- a `/PASV` DCL qualifier, allows you to specify the `PASSIVE` command setting as you start up the FTP Client (at the `FTP>` prompt, you may specify either `PASSIVE` or `PASV`; the two are interchangeable)

Note: If the change in the default setting causes you problems or changes the way things have worked for you in the past, you may control the default setting for your site by putting the appropriate `PASSIVE` command in the file `MULTINET:FTP.INIT`.

With `PASSIVE` mode `ON`, the Client sends the `PASV` directive to the server, instructing it to wait for the client to make the data connection. If the server does not understand the `PASV` command, the connection is aborted. The default for `PASSIVE` is `ON` to help facilitate transfers through a firewall. Under certain conditions, this default might cause problems. Use the MultiNet FTP client logical `MULTINET_FTP_NONPASV` to turn off the `PASSIVE` mode default or use the passive command on the command line. When you define this logical, passive mode is not used as the default.

With PASSIVE mode OFF, the FTP client expects the FTP server to establish the connection over which data is transferred. (Note that this may not work through firewalls as some FTP servers do not support the PASSIVE command.)

With PASSIVE mode NEGOTIATED, the FTP client sends the PASV command as with PASSIVE mode ON, but switches the mode to OFF if the FTP server generates an error in response.

The /NONPASV, /PASV, and /PASV=NEGOTIATE qualifiers allow you to specify each of the PASSIVE mode settings as you start up the FTP client.

When an IPv6 connection is in use the FTP client sends the EPSV command instead of the PASV command. All user commands and behavior described above remain the same.

FTP Initialization File

On startup, FTP executes commands in the FTP.INIT file in your login directory (if the file exists), to allow you to customize your FTP sessions. The below table lists commands you may find useful to have in your FTP.INIT file.

BELL ON	Rings the terminal bell when a file transfer operation is completed.
EXIT-ON-ERROR ON	Causes FTP to exit after any error occurs.
HASH ON	Prints a pound sign (#) for each data buffer transferred.
PROMPT-FOR-MISSING-ARGUMENTS OFF	Disables FTP prompting for missing command line arguments.
PROMPT-ON-CONNECT ON	Automatically prompts for user name and password when a connection to the remote system is established.
SET *host* /USERNAME:*username* [/PASSWORD:*password*]	Sets the default user name or default user name and password for the specified host. If you place SET commands containing passwords in your FTP.INIT file, *be careful to protect the file from access by others.*
STATISTICS ON	Upon completion of file transfers, displays transfer timing statistics.

VERBOSE ON	Displays all responses from the remote FTP server as they are received.

If you invoke FTP with the /NOINITIALIZATION qualifier, the FTP.INIT file is not processed.

The commands in the above table are more completely documented in *Appendix B.*

Troubleshooting FTP

As the first step in any FTP troubleshooting, check the FTP_SERVER_LOG file for error messages.

General Troubleshooting Tips

If the logged information does not help, check the following:

1. Make sure the FTP server is running on the remote system.
2. Ping the FTP server to make sure it is available through the network.
3. If the remote host is on the other side of a firewall, try passive mode.
4. Make sure you entered the correct user name and password for the remote system.

Transmitted Files Are Corrupt

If you can copy files, but the files are corrupted after transmission, verify that you are using the correct transfer mode - ASCII or binary. Use ASCII mode for text files and binary mode for executable files, compressed files, graphics files, and any other non-text files. Use Logical-Byte mode if the remote system does not use the standard 8-bit byte.

Copying Files Using TFTP

Like the FTP, TFTP copies files between your system and a remote host. Unlike FTP, you cannot perform operations other than copying files between your system and a remote one (you cannot list directories, delete files, and so on). Also, TFTP does not perform any authentication when transferring files, so a user name and password on the remote host are not required. In general, only files with world read (`W:R`) access in certain directories on the remote host are available for reading, and only certain directories are available for writing.

> **Note:** TFTP does not check the permissions of directories before attempting to access them. Because the TFTP protocol does not specify any user login or validation, the remote system will probably have some sort of file-access restrictions. The exact restrictions are site-specific and thus cannot be documented here.

The mail option of TFTP, as defined in RFC-783, is obsolete and not supported under the MultiNet TFTP server.

Requirements for TFTP

When you copy a file from a remote host, it must be world-readable (`W:R`). When copying a file to a remote host:

- A file of the same name must already exist on the remote host.
- The file must be world-writable (`W:W`).

If these two conditions are not met, TFTP will fail.

Using TFTP

To start TFTP, enter the following command:

```
$ tftp remote_host
tftp>
```

remote_host is the name of the remote system with which you want to transfer files.

To transfer a file from your system to a remote host, enter a TFTP command in the following format:

```
tftp>put local_file remote_file
```

local_file	Identifies the file you are transferring.
remote_file	Specifies the name you want the file to have on the remote system. If you specify a file name, it must be an absolute path name (device, directory, and file name). If you do not specify a file name, it defaults to the same name as *local_file*.

For example, suppose you want to transfer the file `user:[boojum]accts.log` from your system to the file `/x/boojum/accts.log` on the remote host sales.example.com. To do this, you would enter the following commands:

```
$ tftp sales.example.com
tftp>put user:[boojum]accts.log /x/boojum/accts.log
```

Both the directory `/x/boojum` and the file `accts.log` must already exist on the remote host, and `accts.log` must be world-writable.

To transfer a file to your system from a remote host, issue a TFTP command in the following format:

```
$ tftp sales.example.com
tftp>get remote_file local_file
```

local_file	Specifies the name you want the file to have on your system. If you do not specify a file name, it defaults to the same name as the *remote_file*.
remote_file	Identifies the file you want to transfer from the remote host. You must supply an absolute path name (device, directory, and file name).

For example, suppose you want to transfer the file `/x/boojum/accts.log` from the remote host sales.example.com to the file `user:[boojum]accts.log` on the your system. To do this, you would enter the following commands:

```
$ tftp sales.example.com
tftp>get /x/boojum/accts.log user:[boojum]accts.log
```

The file `/x/boojum/accts.log` must be world-readable.

6. Using DECwindows with MultiNet

OpenVMS supports running DECwindows applications over TCP/IP. This feature provides the ability to run X Windows applications not only between OpenVMS and ULTRIX systems, but also using non-Hewlett-Packard computer systems that support X Windows (for example, UNIX workstations, Apple Macintosh systems, PCs, and so on). For more information about running DECwindows applications over a network, see the *VMS DECwindows User's Guide.*

Running DECwindows Applications

To run a DECwindows application on an OpenVMS system over TCP/IP using MultiNet, you must first use the DCL command `SET DISPLAY` to indicate to DECwindows which system display it should use for the application's user interface.

> **Note:** If you are accessing a remote system using TELNET, RLOGIN, or RSHELL, `SET DISPLAY` is performed automatically.

Use the `/NODE` qualifier to specify the remote host name or IP address, and the `/TRANSPORT` qualifier to specify `TCPIP` transport. The following example shows how to run the application `SYS$SYSTEM:DECW$PUZZLE.EXE` on the local OpenVMS system, and direct the output to a Linux host named ZEPHYR.EXAMPLE.COM.

```
$ SET DISPLAY /CREATE /NODE=ZEPHYR.EXAMPLE.COM /TRANSPORT=TCPIP
$ RUN SYS$SYSTEM:DECW$PUZZLE
```

Authorizing Remote Systems

Before running a DECwindows application on a remote system and directing the user interface to an OpenVMS workstation running MultiNet, you must authorize the remote system to have access to the

local display. Under the DECwindows Session Manager Customize menu, select the Security option. When the Customize Security dialog box appears, specify TCPIP for the Transport, the Internet host name of the remote host for the Node, and a question mark (?) for the Username for each host you wish to grant access to the local display.

> **Note:** EACH user on a workstation who wishes to allow access to the local display from a remote system must specify the remote system under the Customize Security dialog box. A different list is maintained for each user.

7. Accessing Remote Systems with the Secure Shell (SSH) Utilities

The SSH implementation for MultiNet provides the client software for allowing secure interactive connections to other computers in the manner of rlogin/rshell/telnet.

SSH Protocol Support

The SSH client software supports both the SSH1 and SSH2 protocols. SSH1 and SSH2 are different, and incompatible protocols. The SSH1 implementation is based on the V1.5 protocol, and the SSH2 implementation is based on the V2 protocol. While SSH2 is generally regarded to be more secure than SSH1, both protocols are offered by MultiNet, and although they are incompatible, they may exist simultaneously on server systems, including MultiNet servers. The SSH client identifies the protocol(s) offered by any given server. If both SSH2 and SSH1 protocols are offered, the client will always use SSH2. Otherwise, the client will use the correct protocol based on the server's capability.

The cryptographic library used by MultiNet SSH2 (***this <u>does not</u> apply to SSH1 sessions***) is FIPS 140-2 level 2 compliant, as determined by the Computer Security Division of the National Institute of Science and Technology (NIST).

Secure Shell Client

```
$ SSH hostname[#port] [qualifiers] [command]
```

or

```
$ SSH "user@hostname[#port]" [qualifiers] [command]
```

SSH (Secure Shell) is a program for logging into and executing commands on a remote system. It replaces rlogin, rsh, and telnet, and provides secure encrypted communications between two untrusted

hosts over an insecure network. X11 connections and arbitrary TCP/IP ports can be forwarded over the secure channel. SSH connects and logs into the specified hostname.

Qualifier	**Description**
`/ALLOW_REMOTE_CONNECT`	Allow remote hosts to connect local port forwarding ports. The default is only localhost; may connect to locally binded ports.
`/CIPHER=(`*`cipher-1,...,cipher-n`*`)`	Select encryption algorithm(s).
`/COMPRESS`	Enable compression.
`/CONFIG_FILE=`*`file`*	Read an alternative client config file.
`/DEBUG=`*`level`*	Set debug level.
`/ESCAPE_CHARACTER=`*`char`*	Set escape character; "`none`" = disable (default: ~).
`/HELP`	Display help text.
`/IDENTITY_FILE=`*`file`*	Identity file for public key authentication.
`/IDKEY=(`*`key1,key2,...,keyn`*`)`	Specifies the key(s) to be used for public key authentication. If specified, the `IDENTIFICATION` file is ignored.
`/IPV4`	Use IPV4 protocol to connect.
`/IPV6`	Use IPV6 protocol to connect.
`/LOCAL_FORWARD=([protocol/]`*`listen-port:host:port,...`*`)`	Causes the given port on the local (client) host to be forwarded to the given host and port on the remote side. The system to which SSH connects acts as the intermediary between the two endpoint systems. Port forwardings can be specified in the configuration file. Only system can forward privileged ports. See the *Port Forwarding* section for more details.

/LOG_FILE=*logfilename*	Log all terminal activity to the specified log file. Defaults to SYS$DISK:[]SSH.LOG if logfilename is not specified.
/MAC=*(mac-1,...,mac-n)*	Select MAC algorithm(s).
/NO_AGENT_FORWARDING	Disable authentication agent forwarding.
/NO_X11_FORWARDING	Disable X11 connection forwarding.
/OPTION=*(option-1,...option-n)*	Gives options in the format used in the configuration file. This is useful for specifying options for which there is no separate command-line flag. The option has the same format as a line in the configuration file, and are processed prior to any keywords in the configuration file. For example: /OPTION=(CompressionLevel=6)
/PORT=*port*	Connect to this port on server system. Server must be listening on the same port.
/QUIET	Quiet Mode. Causes all warning and diagnostic messages to be suppressed. Only fatal errors display.
/REMOTE_FORWARD=([protocol/]*listen-port:host:port,...*)	Forward remote port to local address. These cause ssh to listen for connections on a port, and forward them to the other side by connecting to host port.
USE_NONPRIV_PORT	Use a non-privileged (>1023) source port.
USER=*user*	Log in to the server system using this user name.
VERBOSE	Display verbose debugging messages. Equal to /DEBUG=2.
/VERSION	Display version number of the client.

Initial Server System Authentication

When an initial connection is made from the client system to the server system, a preliminary authentication of the server is made by the client. To accomplish this, the server system sends its public key to the client system.

SSH maintains a directory containing the public keys for all hosts to which it has successfully connected. For each user, this is the `[.SSH2.HOSTKEYS]` directory off the individual `SYS$LOGIN` directory. In addition, a system-wide directory of known public keys exists in the system directory pointed to by the logical name `MULTINET_SSH2_HOSTKEY_DIR`, and this may be populated by the system manager. Both directories are searched as needed when establishing a connection between systems. Any new host public keys are added to the user's `HOSTKEYS` directory. If a host's identification changes, SSH warns about this and disables password authentication to prevent a trojan horse from getting the user's password. Another purpose of this mechanism is to prevent man-in-the-middle attacks that could be used to circumvent the encryption. The SSH configuration option `StrictHostKeyChecking` can be used to prevent logins to a system whose host key is not known or has changed.

Host-based Authentication

Host-based authentication relies on two things: the existence of the user's system and username in either `SSH_DIR:HOSTS.EQUIV` or in the individual user's `SYS$LOGIN:.RHOSTS` or `SYS$LOGIN:.SHOSTS` file; and the server system having prior knowledge of the client system's public host key.

For SSH2, when a user logs in:

1. The server checks the `SSH_DIR:HOSTS.EQUIV` file, and the user's `SYS$LOGIN:.RHOSTS` and `SYS$LOGIN:.SHOSTS` files for a match for both the system and username. Wildcards are not permitted.
2. The server checks to see if it knows of the client's public host key (`SSH2_DIR:HOSTKEY.PUB` on VMS client systems) in either the user's `SYS$LOGIN:[SSH2.KNOWNHOSTS]` directory or in the system-wide directory pointed to by the `MULTINET_SSH2_KNOWNHOSTS_DIR` logical name. The key file is named *`FQDN_algorithm`*`.PUB`. For example, if the client system is foo.example.com and its key uses the DSS algorithm, the file that would contain its key on the server would be `FOO_EXAMPLE_COM_SSH-DSS.PUB`. This key file must exist on the server system before attempting host-based authentication.

3. If the key file is found by the server, the client sends its digitally-signed public host key to the server. The server will check the signature for validity.

For SSH1:

This form of authentication alone is not allowed by the server because it is not secure. The second (and primary) authentication method is the `RHOSTS` or `HOSTS.EQUIV` method combined with RSA-based host authentication. It means that if the login would be permitted by `.RHOSTS`, `.SHOSTS`, `SSH_DIR:HOSTS.EQUIV`, or `SSH_DIR:SHOSTS.EQUIV` file, and if the client's host key can be verified (see `SYS$LOGIN:[.SSH]KNOWN_HOSTS` and `SSH_DIR:SSH_KNOWN_HOSTS`), only then is login permitted. This authentication method closes security holes due to IP spoofing, DNS spoofing, and routing spoofing.

> **Note:** To the administrator: `SSH_DIR:HOSTS.EQUIV`, `.RHOSTS`, and the rlogin/rshell protocol are inherently insecure and should be disabled if security is desired.

Public Key Authentication

The SSH client supports DSA-based authentication for SSH2 sessions, and RSA-based authentication for SSH1 sessions. The scheme is based on public-key cryptography. There are cryptosystems where encryption and decryption are done using separate keys, and it is not possible to derive the decryption key from the encryption key.

For SSH1:

SSH supports RSA-based authentication. The scheme is based on public-key cryptography. There are cryptosystems where encryption and decryption are done using separate keys, and it is not possible to derive the decryption key from the encryption key.

RSA is one such system. The idea is that each user creates a public/private key pair for authentication purposes. The server knows the public key (`SYS$LOGIN:[.SSH]AUTHORIZED_KEYS` lists the public keys permitted for log in), and only the user knows the private key.

When the user logs in:

1. The SSH client program tells the server the key pair it would like to use for authentication.
2. The server checks if this key pair is permitted.

3. If it is permitted, the server sends the SSH client program running on behalf of the user a challenge (a random number) encrypted by the user's public key. The challenge can only be decrypted using the proper private key.
4. The user's client then decrypts the challenge using the private key, proving that he/she knows the private key but without disclosing it to the server.
5. SSH implements the RSA authentication protocol automatically.

The key identity files are created with `SSHKEYGEN`. To create the RSA key pair files with MultiNet run `SSHKEYGEN` to create the RSA key pair: `IDENTITY` and `IDENTITY.PUB`. Both of these files are stored in the user's `SYS$LOGIN:[.SSH]` directory. `IDENTITY.;` is the private key; `IDENTITY.PUB` is the public key.

Once you have created your identity files:

1. Transfer the `IDENTITY.PUB` file to the remote machine.
2. Update the `AUTHORIZED_KEYS` file on the remote machine by appending the contents of the public key file to the `SYS$LOGIN:[.SSH]AUTHORIZED_KEYS` file on the remote host. The format of the `AUTHORIZED_KEYS` file requires that each entry consists of a single long line.

After this, the user can log in without giving the password. RSA authentication is much more secure than RHOSTS authentication. The most convenient way to use RSA authentication may be with an authentication agent. See *Public Key Authentication* for more information.

For SSH2, when the user logs in:

1. The client reads possible keys to be used for authentication from its `IDENTIFICATION` file. Note that this file does not contain the actual keys; rather, it contains the name of the key files.
2. The client sends to the server its list of keys.
3. The server compares each key that it received to see if it can match this key with one of those specified in the `AUTHORIZATION` file.
4. The server tells the client the key that was accepted. The client then signs the key with a digital signature that only the server with the proper key could verify, and sends the signature to the server.
5. The server verifies the signature.

Password Authentication

The password is sent to the remote host for checking. The password cannot be seen on the network because all communications are encrypted. When the server accepts the user's identity it either executes

the given command or logs into the system and gives the user a normal shell on the remote system. All communication with the remote command or shell will be encrypted automatically.

Using Public Key Authentication with SSH

When a parameter such as a username or hostname is quoted, it's always passed verbatim to the other side. When it's not quoted, it's lowercased. The username entered is used when constructing the digital signature for a key.

On the host side, the uppercase username will be used, and on the server side, the lowercased username (the default on the server since VMS isn't case-sensitive) will be used to generate the digital signature of the public key that's being used, as shown in the following examples:

```
$ MULTINET SSH2 "XXXXXXX@hostname" command
```

`XXXXXXX` is the username that was specified in all uppercase letters. Public key authentication fails.

```
$ MULTINET SSH2 "xxxxxxx@hostname" command
```

`xxxxxx` is the username that was specified in all lowercase letters. Public key authentication is successful.

Break-in and Intrusion Detection

Care must be exercised when configuring the client to minimize problems due to intrusion records created by OpenVMS security auditing. The SSH user should consult the system manager to determine the authentication methods offered by the SSH server. Examples of such authentication methods include `HostBased`, `PublicKey`, and `Password`. The client should be configured to not attempt any authentication method that is not offered by the server.

If a client attempts authentication methods not offered by the server, the OpenVMS security auditing system may log several intrusion records for each attempt to create a session to that server. The result being that the user could be locked out and prevented from accessing the server system without intervention from the server's system manager.

Session Termination

The user can disconnect with "~ .". All forwarded connections can be listed with "~#". All available escapes can be listed with "~?". A single tilde character can be sent as "~~" (or by following the tilde with a character other than those described above). The escape character must always follow a carriage return to be interpreted as special. The escape character "~" can be changed in configuration files or on the command line.

The session terminates when the command or shell on the remote system exits, or when the user logs out of an interactive session, and all X11 and TCP/IP connections have been closed. The exit status of the remote program is returned as the exit status of SSH.

X11 Forwarding

With X11 in use, the connection to the X11 display forwards to the remote side any X11 programs started from the interactive session (or command) through the encrypted channel. Also, the connection to the real X server is made from the local system. The user should not set `DECW$DISPLAY` manually. Forwarding of X11 connections can be configured on the command line or in configuration files.

The `DECW$DISPLAY` value set by SSH points to the server system with a display number greater than zero. This is normal and happens because SSH creates a proxy X server on the server system for forwarding the connections over the encrypted channel.

SSH sets up fake Xauthority data on the OpenVMS server, as OpenVMS does not support Xauthority currently. It generates a random authorization cookie, stores it in Xauthority on the server, and verifies that any forwarded connections carry this cookie and replace it by the real cookie when the connection is opened. The real authentication cookie is never sent to the server system (and no cookies are sent in plain text).

Configuring the SSH Client

The SSH client uses only SSH2 configuration keywords. There are no SSH1-specific configuration keywords for the SSH client.

The SSH client obtains configuration data from the following sources (in this order):

1. Command line options. See the table of SSH Client Command Options and Qualifiers for details.
2. User's configuration file (`SYS$LOGIN [.SSH2]SSH2_CONFIG`). See the table below for details.
3. System-wide configuration file (`SSH2_DIR:SSH2_CONFIG`). See the table below for details.

For each parameter, the first obtained value is used. The configuration files contain sections bracketed by `Host` specifications. That section applies only for hosts that match one of the patterns given in the specification. The matched host name is the one given on the command line. Since the first obtained value for each parameter is used, more host-specific declarations should be given near the beginning of the file, and general defaults at the end.

Keyword	**Value**	**Default**	**Description**
`AllowedAuthentications`	List	All methods except for host-based	Permitted techniques, listed in desired order of attempt. These can be the following: `keyboard-interactive`, `password`, `publickey`, `kerberos-1@ssh.com`, `kerberos-tgt-1@ssh.com`, `kerberos-2@ssh.com`, `kerberos-tgt-2@ssh.com`, and `hostbased`. Each specifies an authentication method. The authentication methods are tried in the order in which they are specified with this configuration parameter.
`AuthenticationSuccessMsg`	Y/N	Y	Print message on successful authentication
`AuthorizationFile`	Filename	Authorization	Authorization file for public key authentication. See below for more information on the contents of this file.
`BatchMode`	Y/N	N	Don't prompt for any input during session
`Ciphers`	Cipher list	None	Supported encryption ciphers

ClearAllForwardings	Y/N	N	Ignore any specified forwardings
ClientKeyList	Key list	None	This client configuration option can be used in a user's ssh2_config file to control the selection order of host keys from the remote host. This can help with changing over to a new type of key or help avoid a combination of key exchange and host key that might never work. The list of potential possibilities includes: ssh-dss, ssh-rsa, ecdsa-sha2-nistp521, ecdsa-sha2-nist384, ecdsa-sha2-nistp256, rsa2048-sha256.
Compression	Y/N	N	Enable data compression
DebugLogFile	Filename	None	Specify the file to hold debug information. If used with the QuietMode keyword turned on as well, only the first part of the log information will be written to SYS$ERROR, until the DebugLogFile keyword is parsed. If QuietMode is not used, all debug output will go to both SYS$ERROR and the log file.
DefaultDomain	Domain		Specify domain name
EscapeChar	Character	“~”	Set escape character (^=ctrl key)
ForwardAgent	Y/N	Y	Enable agent forwarding

`ForwardX11`	Y/N	Y	Enable X11 forwarding
`GatewayPorts`	Y/N	N	Allow connection to locally-forwarded ports
`Host`	Pattern		Begin the per-host configuration section for the specified host
`HostCA`	Certificate	None	Specifies the CA certificate (in binary or PEM (base64) format) to be used when authenticating remote hosts. The certificate received from the host must be issued by the specified CA and must contain a correct alternate name of type DNS (FQDN). If the remote host name is not fully qualified, the domain specified by configuration option `DefaultDomain` is not fully qualified, the domain specified by configuration option `DefaultDomain` is appended to it before comparing it to certificate alternate names. If no CA certificates are specified in the configuration file, the protocol tries to do key exchange with ordinary public keys. Otherwise, certificates are preferred. Multiple CAs are permitted.
`HostCANoCRLs`	Certificate	None	Similar to `HostCA`, but disables CRL checking for the given CA-certificate.
`IdentityFile`	Filename	Identificatio n	Name of identification file for public key authentication
`KeepAlive`	Y/N	Y	Send keep-alives

`LdapServers`	ServerURL	None	Specified as `ldap://server.domainname:389` CRLs are automatically retrieved from the CRL distribution point defined in the certificate to be checked if the point exists. Otherwise, the comma-separated server list given by option `LdapServers` is used. If intermediate CA certificates are needed in certificate validity checking, this option must be used or retrieving the certificates will fail.
`LocalForward`	Port, Socket		Local port forwarding
`Macs`	Algorithm	None	Select MAC (Message Authentication Code) algorithm
`NoDelay`	Y/N	N	Disable Nagle (TCP_NODELAY)
`NumberOfPasswordPrompts`	Number	3	Number of times the user is prompted for a password before the connection is dropped
`PasswordPrompt`	String	"%U's password:"	Password prompt. The following substitutions may be made within the prompt string: `%U` = insert user's username `%H` = insert user's system name

`Port`	Port	22	Server port number
`QuietMode`	Y/N	Y	Quiet mode - only fatal errors are displayed
`RandomSeedFile`	Filename	Random_seed	Random seed file
`RekeyIntervalSeconds`	Seconds	3600	Number of seconds between doing key exchanges during a session. 0 = disable
`RemoteForward`	Port, Socket		Remote port forwarding
`SendNOOPPackets`	Y/N		Send NOOP packets through the connection. Used typically to prevent a firewall from closing an interactive session
`StrictHostKeyChecking`	Y/N/Ask	Y	Behavior on host key mismatch
`TryEmptyPassword`	Y/N	N	Attempt an empty password first when doing password authentication. **Note:** Doing so may result in an extra intrusion being logged.
`User`	Username		Remote username
`VerboseMode`	Y/N	N	Verbose mode
`VerifyHostKeyDNS`	Y/N/ASK	N	Determines if the host key fingerprint must be matched in DNS.

The user may specify default configuration options, called “stanzas”, for different destination systems. The format of this within the configuration file is:

```
hostname:
  keyword        value
  keyword        value

hostname2:
   keyword       value
   keyword       value
```

For example:

```
petunia:
  port          17300
  user          dilbert
  host          petunia.example.com

rose:
  port          16003
  user          dogbert
  host          rose.example.com
  allowedauthentications password

*.example.edu:
  user           limabean
  keepalive      no
  ciphers        3des,twofish
```

In the preceding example:

- When a user types "`$ SSH PETUNIA`", the client will connect to port 17300 on petunia.example.com, and will use the default username of "dilbert".
- When a user types "`$ SSH ROSE`", the client will connect to port 16003 on host rose.example.com, and will use the default username of "dogbert", and only allow password authentication.
- When a user types "`$ SSH anything.EXAMPLE.EDU`", the client will use the default username of "limabean", will not send keepalives, and will only allow 3DES or TWOFISH encryption.

The user may override defaults specified in configurations. Options that are specified on the command line override any like options in the configuration file. For example, if the user wants to use a username of "catbert" when connecting to host rose instead of the default username of "dogbert", this would be specified as:

```
$ SSH /USER=CATBERT ROSE
```

Authorization File Options

The authorization file has the same general syntax as the configuration files. The following keywords may be used.

Key
This is followed by the filename of a public key in the `[.SSH2]` directory file that is used for identification when contacting the host. If there is more than one key, they are all acceptable for login.

Options
This keyword, if used, must follow the `Key` keyword above. The various options are specified as a comma-separated list. See below for documentation of the options.

Command
This keyword is deprecated (though it still works). Use `Options` instead.

Options that can be specified:

allow-from="*pattern*"
deny-from="*pattern*"
Specifies that in addition to public-key authentication, the canonical name of the remote host must match the pattern(s). These parameters follow the logic of `{Allow,Deny} Hosts` described in detail in `sshd2_config`. Specify one pattern per keyword, and multiple keywords can be used.

command="*command*"
This is used to specify a "forced command" that will be executed on the server side instead of anything else when the user is authenticated. This option might be useful for restricting certain public keys to perform just a specific operation. An example might be a key that permits remote backups but nothing else. Notice that the client may specify TCP/IP and/or X11 forwarding, unless they are explicitly prohibited.

idle-timeout=*time*

Sets idle timeout limit to time in seconds (`s` or nothing after number), in minutes (`m`), in hours (`h`), in days (`d`), or in weeks (`w`). If the connections have been idle (all channels) for that long a period of time, the connection is closed down.

no-port-forwarding
Forbids TCP/IP forwarding when this key is used for authentication. Any port forward requests by the client will return an error. This might be used, for example, in connection with the command option.

no-x11-forwarding
Forbids X11 forwarding when this key is used for authentication. An X11 forward request by the client will return an error.

SSH Client/Server Authentication Configuration Examples

Host-Based Authentication Example

The following is an example of how to set up the SSH client and SSH2 server for Host-based Authentication:

```
$!
$! First, generate the host key - ONLY if it doesn't exist!
$!
$ multinet sshkeygen /ssh2 /host
Generating 1024-bit dsa key pair
4 oOo.oOo.oOo

Key generated.
1024-bit dsa, myname@myclient.foo.com, Thu MAR 04 2004 13:43:54
Private key saved to multinet_ssh2_hostkey_dir:hostkey.
Public key saved to multinet_ssh2_hostkey_dir:hostkey.pub
```

```
$ directory multinet_ssh2_hostkey_dir:hostkey.*

Directory MULTINET_SPECIFIC_ROOT:[MULTINET.PSCSSH.SSH2.HOSTKEYS]

HOSTKEY.;1          HOSTKEY.PUB;1

Total of 2 files
$!
$! Copy the client system public key to the user directory on the server
$!
$! DECnet must be running before you execute the following commands:
$!
$ copy multinet_ssh2_hostkey_dir:hostkey.pub -
_$ myserv"myname myuser"::[.ssh2.knownhosts]myclient_foo_com_ssh-dss.pub
$!
$! Finally, log into the server system and ensure the
$! SSH_DIR:HOSTS.EQUIV file is correct
$!
$ SET HOST MYSERV

      Welcome to OpenVMS (TM) VAX Operating System, Version V7.3
Username: myname
Password: ********
      Welcome to OpenVMS VAX V7.3

    Last interactive login on Monday,  1-MAR-2020 17:07
    Last non-interactive login on Monday, 1-MAR-2020 08:30

MYSERV_$ type multinet:hosts.equiv
#
# HOSTS.EQUIV - names of hosts to have default "r" utility access to the
local # system.
#
#   This file should list the full domain-style names.
#
#   This list augments the users' SYS$LOGIN:.RHOSTS file for authentication.
#   Both the .RHOSTS and the HOSTS.EQUIV files are cached by multinet -
#   see the section entitled "RLOGIN and RSHELL Authentication Cache"
#   in the _Administrator's Guide_ for more information on controlling
#   the cache.
#
#   This file is ignored for the users SYSTEM and ROOT. SYSTEM and ROOT
#   must have a SYS$LOGIN:.RHOSTS file if you want to use RSHELL or RLOGIN
#   with them.
#
localhost
myclient.foo.com       myname
MYSERV_$
MYSERV_$ logout
  MYNAME      logged out at  1-MAR-2020 13:46:58.91
%REM-S-END, control returned to node MYCLIENT::
```

SSH2 Public Key Authentication Example

Public key authentication reduces the number of passwords that you need to remember, and can be used for non-interactive access to remote systems. You should choose a key type and length that meets or exceeds your security requirements and that is supported on the local and remote systems.

```
$ multinet sshkeygen/ssh2/keytype=rsa/bits=1024
Generating 1024-bit rsa key pair
   1 oO
Key generated.
1024-bit rsa, user1@localsys.example.com, Tue Sep 03 2019 11:15:38
Passphrase :
Again      :
Private key saved to USERDISK:[USER1.SSH2]id_rsa_1024_c
Public key saved to USERDISK:[USER1.SSH2]id_rsa_1024_c.pub
```

Note that if you intend to use public key authentication for batch access, you will have to use the SSH-Agent to load the keys so that the passphrase can be specified. You can supply a blank passphrase and not bother with the agent; If you do so there will be a warning message.

If the local system is something other than VMS with MultiNet, then create the key on that system, make sure that the public key is in the format specified by RFC 4716 (not all SSH implementations use this format), and put the public key on the remote VMS system.

Distribute the Public Key to the Remote (Server) System

This can be done in any manner that is convenient, as the public key does not need to be protected. A single public key can be used for multiple remote systems.

Set Up Profile

Local and remote configuration files tell the SSH client and server what files to use for the keys. Though it is possible to use a single `identification.` file for all keys on the local system, doing so will increase the number of keys that need to be tried, slowing down user authentication and possibly creating false intrusion reports.

Local System Profile

This is how to set up a profile on VMS with MultiNet, using a separate identification file for each system.

```
$ set default sys$login
$ set default [.ssh2]
$ set protection=(s:r,o:rwd) id_rsa_1024_c.
```

```
$ create remote_sys_id.idkey id_rsa_1024.c
$ append sys$input: ssh2_config.
remote_pubkey:
Host remote_system.example.com
identityFile remote_sys_id.
allowedAuthentications publickey
```

Remote System Profile

The following assumes a VMS system running MultiNet, and that the key has already been transferred to the user's `SYS$LOGIN:[.SSH2]` directory. Though this example keeps the name the same as what was generated, the name does not need to match and the key can be named such that you can easily see which client it is for.

```
$ set default sys$login
$ set default [.ssh2]
$ append sys$input: authorization.
key id_rsa_1024_c.pub
```

> **Note:** The public key assistant and subsystem can also be used to transfer public keys and maintain the authorization file with SSH implementations that support the public key subsystem. It will automatically update the authorization. file when the key is added to the remote key storage.

> **Note:** Other implementations of SSH may use a different format for storing the public key and listing it as an authorized key; consult the documentation on how to set up public key authentication. The MultiNet `SSHKEYGEN` utility can convert OpenSSH public keys with the `/OPENSSH_CONVERT=`*`input_file`* qualifier.

SSH1 Public Key Authentication Example

```
$ ! An example of the procedure of setting up SSH to enable
$ ! RSA-based authentication.
$ ! Using SSH client node to connect to an SSH server node.
$ !
$ ! On the client node
```

```
$ !
$ MULTINET SSHKEYGEN /SSH1
Initializing random number generator...
Generating p:  ..............................++ (distance 662)
Generating q:  ................++ (distance 370)
Computing the keys...
Testing the keys...
Key generation complete.
Enter file in which to save the key
(DISK$SYS_LOGIN:[MYNAME.ssh]identity.):
Enter passphrase:
Enter the same passphrase again:
Your identification has been saved in
DISK$SYS_LOGIN:[MYNAME.ssh]identity..
Your public key is:
1024 33 13428..........29361 MYNAME@long.example.com
Your public key has been saved in DISK$SYS_LOGIN:[MYNAME.ssh]identity.pub
$ !
$ ! A TCP/IP stack must be loaded on the remote system.
$ !
$  FTP DAISY /USER=MYNAME/PASSWORD=DEMONSOFSTUPIDITY -
_$ PUT DISK$SYS_LOGIN:[MYNAME.ssh]identity.PUB -
_$ DISK$SYS_LOGIN:[MYNAME.ssh]identity.PUB
long.example.com MultiNet FTP user process V5.6
Connection opened (Assuming 8-bit connections)
<daisy.example.com MultiNet FTP Server Process V5.5 at Thu 4-Mar-2020
3:20PM-EDT
[Attempting to log in as myname]
<User MYNAME logged into DISK$SYS_LOGIN:[MYNAME] at Thu 4-MAR-2020 3:21PM-
EDT, job 20e00297.
<VMS Store of DISK$SYS_LOGIN:[MYNAME.SSH]IDENTITY.PUB; started.
<Transfer completed.  395 (8) bytes transferred.
<QUIT command received. Goodbye.
$
$ TELNET DAISY
Trying... Connected to DAISY.EXAMPLE.COM.


        Authorized Users Only (TM) VAX Operating System, Version V7.1

Username: MYNAME
Password: ******
     Welcome to OpenVMS (TM) VAX Operating System, Version V7.1 on node
DAISY
    Last interactive login on Thursday,  4-MAR-2020 08:07
    Last non-interactive login on Thursday,  6-MAR-2020 15:21
         Logged into DAISY at  4-MAR-2020 15:22:43.68
$ !
$ ! For the first entry into the AUTHORIZED_KEYS file copy
$ ! (or rename) the file [.SSH]IDENTITY.PUB to [.SSH]AUTHORIZED_KEYS.
$ !
$ COPY [.SSH]IDENTITY.PUB [.SSH]AUTHORIZED_KEYS.
```

```
$
$ ! FOR SUBSEQUENT ENTRIES use the APPEND command
$ !
$ APPEND [.SSH]IDENTITY.PUB [.SSH]AUTHORIZED_KEYS.
$
$ ! A sanity check of the file protections shows
$ !
$ DIRECTORY/PROTECTION [.SSH]*.*

Directory DISK$SYS_LOGIN:[MYNAME.SSH]

AUTHORIZED_KEYS.;1   (RWE,RWED,RE,E)
IDENTITY.;1          (RWD,RWD,,)
IDENTITY.PUB;1       (RWE,RWED,RE,E)
KNOWN_HOSTS.;1       (RWD,RWD,,)
RANDOM_SEED.;1       (RWD,RWD,,)

Total of 5 files.
$ !
$ DIRECTORY/PROTECTION SSH.DIR

Directory DISK$SYS_LOGIN:[MYNAME]

SSH.DIR;1            (RWD,RWD,,)

Total of 1 file.
```

SSH2 User Authentication Using Certificates:

Client setup:

1. Copy the private key and certificate (`.crt`) into the user's `[.ssh2]` directory, and edit the `[.ssh2]` identification file, adding entry "`certkey private key name`".

```
$ dir [.ssh2]
Directory DKA0:[DILBERT.SSH2]

AUTHORIZATION.;13 IDENTIFICATION.;1 MYCERT.;1 MYCERT1.CRT.;2

Total of 4 files.

$ type [.ssh2]identification.
  certkey mycert1
$
```

Server setup:

1. Copy the CA certificate into your SSH2_DIR: directory.

2. Add the following entries in SSH2_DIR:SSHD2_CONFIG:

```
Pki SSH2_DIR:CAcertname
Mapfile SSH2_DIR:CAcertname.map
```

The Pki keyword begins an authority block for a given CA certificate. There might be more than one CA certificate along with its own mapping file.

The Mapfile keyword specifies the location of the certificate to username mapping file.

In addition, for testing, you might use PkiDisableCRLs yes to disable CRL checking for the given authorization block.

3. Create the mapping file SSH2_DIR:CAcertname.map

The mapping file consists of rows of the following format:

```
userid mappingrule mapdata
```

userid is the user ID that's allowed to login for the given cert (there might be multiple user IDs for a given certificate).

mappingrule is one of subject, email, serialandissuer or emailregex.

- subject means that the following *mapdata* is matched against the subject of the certificate:
- email is the e-mail alternative subject extension (with emailregex can be used regular expressions - e.g., %subst% emailregex ([a-z}|+)@foo\.com would be any trusted certificate having e-mail alternative name of *username*@foo.com to login with user ID username)
- serialAndissuer is the serial number and DN of the issuer separated by whitespace. DNs are used in reverse LDAP order (e.g., c=US,o=Foobar,cn=Dilbert Dogbert).

SSH2 Hostkey Authentication Using Certificates

Server setup:

1. Create a certificate for the server. Host certificate must contain FQDN as DNS alternative name.

2. Copy the private key and certificate into the MULTINET_SSH2_HOSTKEY_DIR directory.

3. Add the following entries into the ssh2_dir:sshd2_config file

```
HostKeyFile multinet_ssh_hostkey_dir:hostcert
HostCertificateFile multinet_ssh_hostkey_dir:hostcert.crt
```

Client setup:

1. Copy the CA certificate in `MULTINET_SSH2_HOSTKEY_DIR` directory.

2. Add the following entries into `ssh2_dir:ssh2_config`

```
HostCA multinet_ssh_hostkey_dir:CAcert.crt
DefaultDomain <domain of the FQDN of the client>
```

> **Note:** For testing purposes, you can use `HostCANoCRLs` instead of `HostCA` to disable CRL checking.

Host Key Verification Using DNS

MultiNet SSH can be configured to calculate the fingerprint of the host key it receives, then perform a lookup in DNS for that fingerprint. This can help prevent man-in-the-middle attacks. See RFC 4255 for more details. Refer to *Appendix B* of the *MultiNet Installation and Administrator's Guide* for information on configuring DNSSEC on MultiNet systems.

In order to do this, the following conditions must be met:

- DNSSEC must be enabled and configured for the DNS used by the client.
- A host key SSHFP record must be generated, signed by the zone key, and added to the DNSSEC configuration as a type SSHFP record for the server system. The MultiNet `SSH-KEYGEN2` utility can be used to display the host key SSHFP type record for DNS.
- The client configuration keyword `VerifyHostKeyDNS` must be set to `Y` or `ASK`
- The client configuration keyword `StrictHostKeyChecking` must be set to `Y` or `ASK`.

When the host key is received from the server, and after the client goes through its normal host key checking (e.g., does the client already know about this host key), it checks the status of the

`VerifyHostKeyDNS` keyword. If not set to "`N`", the client calculates the fingerprint of the host key, then performs a DNS lookup of the key,

If no records are found, the user may be given the option of proceeding (if `VerifyHostKeyDNS` is set to `ASK`). If the user responds `N`, then the session is terminated. Otherwise, the host key is accepted and the session continues.

If one or more records are found, the fingerprint and type of the host key received are compared against those found in DNS. If no matches are made, the user may be given the opportunity to ignore this state (see above).

If a match was made, the `RRSET_VALIDATED` flag returned by DNSSEC is examined to see if the signing of the records can be fully trusted. If this is true, the host key processing is complete. If this flag is false, the user may be given the opportunity to ignore this state (see above).

Port Forwarding

Port forwarding is a mechanism whereby programs that use known TCP/IP ports can have encrypted data forwarded over unsecure connections. This is also known as "tunneling".

If the user is using an authentication agent, the connection to the agent is forwarded automatically to the remote side unless disabled on the command line or in a configuration file. Forwarding of arbitrary TCP/IP connections over the secure channel can be specified either on the command line or in a configuration file.

> **Note:** Forwarded ports (tunnels) exist only as long as the SSH session that established them exists; if the SSH session goes away, so do the forwardings.

```
/LOCAL_FORWARD=(localport:remotehost:remoteport)
```

This causes *`localport`* on the system the client is running on to be forwarded to *`remotehost`*`:`*`remoteport`*. The system to which SSH2 connects acts as the intermediary between the two endpoint systems.

For example: Use port forwarding to allow a system (`midsys)` to encrypt and forward TELNET sessions between itself (`mysys`) that's outside a corporate firewall to a system (`remotesys`) that is inside a corporate firewall. Note that the use of port 2300 in the examples is arbitrary.

From the DCL prompt on `mysys`:

```
$ SSH midsys /local_forward=(2300:remotesys:23)
```

With the SSH session to `midsys` now active, type in another window on `mysys`:

```
$ telnet localhost /port=2300
```

> **Note:** The SSH session must remain active for port forwarding activity.

This causes a connection to `mysys:2300`. The SSH2 client has bound to this port, and will see the connection request. SSH sends an "open channel" request to `midsys`, telling it there's a connect request for port 23 on `remotesys`. `Midsys` will connect to `remotesys:23`, and send back the port information to `mysys`. `Mysys` completes the connection request, and the TELNET session between `mysys` and `remotesys` is now in place, using the tunnel just created through the firewall between `mysys` and `midsys`.

All traffic between `mysys` and `midsys` (through the firewall) is encrypted/decrypted by SSH on `mysys` and SSHD on `midsys`, and hence, is safe. TELNET does not know this, of course, and does not care.

Note that ports can also be forwarded from a localhost to the remote host that's running SSHD, as illustrated in this figure.

In this example, port 2300 on `mysys` is being forwarded to `remotesys:23`. To do this, use SSH on `mysys`:

```
$ SSH remotesys /local_forward=(2300:remotesys:23)
```

Then, also on `mysys`, type:

```
$ telnet localhost /port=2300
```

When SSH and SSHD start their dialog, SSHD on `remotesys` connects back to itself, port 23, and the TELNET session is established.

```
/REMOTE_FORWARD=(remoteport1:remotehost:remoteport2)
```

This causes `remoteport1` on the system to which SSH connects to be forwarded to `remotehost:remoteport2`. In this case, the system on which the client is running becomes the intermediary between the other two systems.

For example, a user wants to use `mysys` to create a tunnel between `sys1:4000` and `sys2:23`, so that TELNET sessions that originate on `sys1:4000` get tunneled to `sys2` through the firewall. On `mysys`:

```
$ SSH sys1 /remote_forward=(4000:sys2:23)
```

Now, on `sys1`, a user could establish a TELNET session to `sys1` by doing:

```
$ telnet localhost /port=4000
```

The mechanism used for making the TELNET connection (setting up the tunnel) is essentially the same as described in the `/LOCAL_FORWARD` example above, except that the roles of SSH and SSHD in the dialog are reversed.

Other Files

The files listed in the below table are used by SSH. Note that these files generally reside in the `[.SSH2]` subdirectory from the user's `SYS$LOGIN` directory. The `[.SSH2]` subdirectory is created automatically on your local system the first time SSH is executed, and on a remote OpenVMS system the first time an SSH connection is made to that system. File protection for `SYS$LOGIN:SSH2.DIR` should be (`S:RWD, O:RWD, G:, W:`).

File Name	Resides On	Description
`[.SSH2]SSH2_CONFIG.`	Client System	This is the individual configuration file. This file is used by the SSH2 client. It does not contain sensitive information. The recommended file protection is (`S:RWD,O:RWD,G:,W:`).
`[.SSH2]IDENTIFICATION`	Client System	Contains the information about private keys that can be used for public-key authentication, when logging in.

[.SSH2]ID_*alg_bits_seq*	Client System	Contains a private key for authentication. • alg is either RSA or DSA • bits is the length of the key • seq is an incrementing alphabetic value Thus, a key named ID_DSA_1024_A. indicates this is a private DSA key 1024 bits long, and it is the first time the key was generated using SSHKEYGEN. A user may have multiple private key files in a directory.
[.SSH2]ID_*alg_bits_seq*.PUB	Client System and Server System	Contains a public key for authentication. • alg is either RSA or DSA • bits is the length of the key • seq is an incrementing alphabetic value Thus, a key named ID_DSA_1024_B.PUB indicates this is a public DSA key 1024 bits long, and it is the second time the key was generated using SSHKEYGEN. A user may have multiple public key files in a directory.
[.SSH2.HOSTKEYS]xxx.PUB	Client System	Contains public host keys for all hosts the user has logged into. The files specifications have the format KEY_port_hostname.PUB • port is the port over which the connection was made • hostname is the hostname of the key's host. For example, if tulip.example.com was accessed via port 22, the keyfile would be "KEY_22_TULIP_EXAMPLE_ COM.PUB". If this file changes on the host (for example, the system manager regenerates the host key), SSH2 will note this and ask if you want the

		new key saved. This helps prevent man-in-the-middle attacks.
`[.SSH2]RANDOM_SEED.`	Client System	Seeds the random number generator. This file contains sensitive data and MUST have a protection of no more than (`S:RWD,O:RWD,G:,W:`), and it must be owned by the user. This file is created the first time the program is run and is updated automatically. The user should never need to read or modify this file. On OpenVMS systems, multiple versions of this file will be created; however, all older versions of the file may be safely purged. Use the DCL command: `SET FILE /VERSION_LIMIT=n RANDOM_SEED` to set a limit on the maximum number of versions of this file that may exist at any given time.
`MULTINET:.RHOSTS`	Server System	Is used in host-based authentication to list the host/user pairs that are permitted to log in. Each line of the file contains a host name (in the fully-qualified form returned by name servers), and then a user name on that host, separated by a space. This file must be owned by the user, and must not have write permissions for anyone else. The recommended permission is read/write for the user, and not accessible by others.
`MULTINET:.SHOSTS`	Server System	Is used the same way as `.RHOSTS`.
`MULTINET:HOSTS.EQUIV`	Server System	Is used during `.rhosts` authentication. It contains fully-qualified hosts names, one per line. If the client host is found in this file, login is permitted

		provided client and server user names are the same. Additionally, successful RSA host authentication is required. This file should only be writable by SYSTEM.
`MULTINET:SHOSTS.EQUIV`	Server System	Is processed exactly as `SSH_DIR:HOSTS.EQUIV`. This file may be useful to permit logins using SSH but not using rshell/rlogin.
`SSH2_DIR:SSH2_CONFIG`	Client System	This is a system-wide client configuration file. This file provides defaults for those values that are not specified in a user's configuration file, and for users who do not have a configuration file. This file must be world-readable.
`MULTINET_SSH2_KNOWNHOSTS_DIR`	Server System	Contains public host keys for all hosts the system has logged into. The files specifications have the format `KEY_port_hostname.PUB` • `port` is the port over which the connection was made • `hostname` is the hostname of the key's host. For example, if tulip.example.com was accessed via port 22, the keyfile would be "`KEY_22_TULIP_EXAMPLE_COM.PUB`". If this file changes on the host (for example, the system manager regenerates the host key), SSH will note this and ask if you want the new key saved. This helps prevent man-in-the-middle attacks.

SSHKEYGEN

Generates authentication key pairs. The format of the keys is incompatible between SSH1 and SSH2. Therefore, the correct format keys must be generated for each version of the protocol to be supported.

There is no way to recover a lost passphrase. If the passphrase is lost or forgotten, you need to generate a new key and copy the corresponding public key to other systems.

Each key may be protected via a passphrase, or it may be left empty. Good passphrases are 10-30 characters long and are not simple sentences or otherwise easily guessable. Note that the passphrase can be changed later, but a lost passphrase cannot be recovered, as a “one-way” encryption algorithm is used to encrypt the passphrase.

> **Note:** The Host Key has no password.

SSH1

```
MULTINET SSHKEYGEN /SSH1 [/BITS=n] [/IDENTITY_FILE=file]
                         [/PASSPHRASE=passphrase] [/COMMENT=comment]
MULTINET SSHKEYGEN /SSH1 /CHANGE_PASSPHRASE [/PASSPHRASE=old_passphrase]
                         [/NEW_PASSPHRASE=new_passphrase]
MULTINET SSHKEYGEN /SSH1 /CHANGE_COMMENT [/PASSPHRASE=passphrase]
                         [/COMMENT=comment]
MULTINET SSHKEYGEN /SSH1 /CHANGE_CIPHER [/IDENTITY_FILE=file]
                         [/PASSPHRASE=passphrase]
MULTINET SSHKEYGEN /SSH1 /HOST [/BITS=n][/COMMENT=comment]
```

Option	Description
/BITS=*nnn*	Specify key strength in bits (default = 1024).
/CHANGE_PASSPHRASE	Change the passphrase of private key file.

/CHANGE_COMMENT	Change the comment for a key.
/CHANGE_CIPHER	Change the cipher to current default (3DES).
/COMMENT="*comment*"	Provide the comment.
/HOST	Generate the host key.
/IDENTITY_FILE=*file*	Specify the name of the host key file.
/PASSPHRASE=*ppp*	Provide the current passphrase.
/NEW_PASSPHRASE=*ppp*	Provide new passphrase.
/VERSION	Print sshkeygen version number.

Option	**Description**
/BASE=*nnn*	Number base for displaying key info
/BITS=*nnn*	Specify key strength in bits (default = 1024).
/COMMENTS="*comment*"	Provide the comment.
/PKCS_CONVERT=*file*	Convert a PKCS 12 file to an SSH2 format certificate and private key.
/SSH1_CONVERT=*file*	Convert SSH1 identity to SSH2 format.
/X509_CONVERT=*file*	Convert private key from X.509 format to SSH2 format.
/DERIVE_KEY=*file*	Derive the private key given in `file` to public key.
/DNS_DIGEST	Calculate and display a DNSSEC SSHFP record of the local host key that can be added to a DNS configuration file.

/EDIT=*file*	Edit the comment/passphrase of the key.
/EXTRACT_CERTS=*file*	Extract certificates from a PKCS 7 file.
/FINGERPRINT=*file*	Dump the fingerprint of file.
/INFO=*file*	Load and display information for 'file'.
/HELP	Print help text.
/HOST	Generate the host key.
/KEYS=(key1,...,keyn)	Generate the specified key file(s).
/KEYTYPE=(*dsa* | *rsa*)	Choose the key type: dsa or rsa.
/OPENSSH_CONVERT=*file*	Convert the specified OpenSSH key to SSH2 format
/OUTPUT_FILE=*file*	Write the key to the specified output file
/PASSPHRASE=*ppp*	Provide the current passphrase.
/NOPASSPHRASE	Assume an empty passphrase.
/QUIET	Suppress the progress indicator.
/STIR=file	Stir data from file to random pool.
/VERSION	Print sshkeygen version number.
/[NO]WARN	Enable or disable warnings if the process of generating host keys using /HOST will cause existing host keys to be overwritten. If enabled, the user will be prompted to overwrite them. If disabled, no warnings or prompts are issued if the host keys exist. Default is /WARN.

SSH2

```
MULTINET SSHKEYGEN /SSH2[/BITS=n][/COMMENT=comment][/KEYTYPE=type]
                     [/KEYS=(key1...keyn)]
                     [/PASSPHRASE=ppp|/NOPASSPHRASE][/STIR=file][/QUIET]
MULTINET SSHKEYGEN /SSH2/HOST
                     [/BITS=n][/COMMENT=comment][/STIR=file][/QUIET]
MULTINET SSHKEYGEN /SSH2/DERIVE_KEY=file
MULTINET SSHKEYGEN /SSH2/EDIT=file
MULTINET SSHKEYGEN /SSH2/FINGERPRINT=file
MULTINET SSHKEYGEN /SSH2/INFO=file [/BASE=n]
MULTINET SSHKEYGEN /SSH2/SSH1_CONVERT=file
MULTINET SSHKEYGEN /SSH2/X509_CONVERT=file
MULTINET SSHKEYGEN /SSH2/PKCS_CONVERT=file
MULTINET SSHKEYGEN /SSH2/EXTRACT_CERTS=file
MULTINET SSHKEYGEN /SSH2/HELP
MULTINET SSHKEYGEN /SSH2/VERSION
MULTINET SSHKEYGEN /SSH2/NOWARN
MULTINET  SSHKEYGEN /SSH2/DNS_DIGEST
```

There is also a comment field in the public key file that is for the convenience to the user to help identify the key. The comment can tell what the key is for, or whatever is useful. The comment is initialized to `nnn-bit dsa, username@hostname, ddd mm-dd-yyyy hh:mm:ss` when the key is created unless the `/COMMENT` qualifier is used, and may be changed later using the `/EDIT` qualifier.

> **Note:** When the `/HOST` qualifier is used, the `/KEYS=(key1,...keyn)` qualifier is ignored.

> **Note:** The public key file must be world-readable.

SSHAGENT (authentication agent)

SSHAGENT is a program that holds authentication private keys. Both SSH1 and SSH2 keys are supported by SSHAGENT. SSHAGENT may be started in the beginning of a login session by including the commands to start it in, for example, LOGIN.COM. It may also be started interactively at any time during a login session.

To start SSHAGENT, one of the three methods may be used:

1. Start it in a separate window:

```
$ MULTINET SSHAGENT
```

2. Spawn it as a subprocess:

```
$ SPAWN/NOWAIT MULTINET SSHAGENT
```

3. Run it in a detached process:

```
$ RUN/DETACHED/OUTPUT=AGENT.OUT/INPUT=NLA0:/PROCESS_NAME="SSH AGENT"
    SSH_EXE:SSH-AGENT2
```

The agent is used for public key authentication when logging to other systems using SSH. A connection to the agent is available to all programs run by all instances of the user on a specific system. The name of the mailbox used for communicating with the agent is stored in the MULTINET_SSH_AGENT_username logical name. Note that while the agent mailbox is accessible only by the user that starts the agent, a user with sufficient VMS privileges could access the agent mailbox and steal or modify keys currently loaded into the agent (although, the keys as stored on disk cannot be modified simply by accessing the agent).

The agent does not have any private keys initially. Keys are added using SSHADD. When executed without arguments, SSHADD adds the user's identity files. If the identity has a passphrase, SSHADD asks for the passphrase. It then sends the identity to the agent. Several identities can be stored in the agent; the agent can use any of these identities automatically.

$ MULTINET SSHADD /LIST displays the identities currently held by the agent. The idea is that the agent is run on the user's workstation.

FILES

[.SSH]IDENTITY in SYS$LOGIN:	Contains the RSA authentication identity of the user. This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key. That passphrase is used to encrypt the private part of this

	file. This file is not used by SSHAGENT, but is added to the agent using SSHADD at login.

SSHADD

Adds identities for the authentication agent.

Format

MULTINET SSHADD [*OPTIONS*] [*FILE*[,*FILE*,*FILE*]]

Description

SSHADD adds identities to SSHAGENT, the authentication agent. When run without arguments, SSHADD adds the file [.SSH]IDENTITY. Alternative file names can be given on the command line. If any file requires a passphrase, SSHADD asks for the passphrase from the user.

The authentication agent must be running and must have been executed by the user for SSHADD to work.

FILE is an identity or certificate file. If no file is specified, the files in the users[.SSH2] directory are used.

Options

/HELP	Display help text.
/LIST	List all identities currently represented by the agent.
/LOCK	Lock the agent with a password.
/NOSSH1	Agent cannot use SSH1 keys.

/PURGE	Remove all identities from the agent.
/REMOVE	Remove the identity from the agent. In order to remove identities, you must either issue the command from the subdirectory that the identities are located in, or issue the command using the full path name of the identity (as is seen in an SSHADD /LIST command).
/TIMEOUT=*n*	Agent should delete this key after the timeout value (in minutes) expires.
/UNLOCK	Unlock the locked agent.
/URL	Give key to the agent as a URL.

Files

These files exist in SYS$LOGIN:

[.SSH]IDENTITY	Contains the RSA authentication identity of the user. This file should not be readable by anyone but the user. It is possible to specify a passphrase when generating the key. That passphrase is used to encrypt the private part of this file. This is the default file added by SSHADD when no other files have been specified. If SSHADD needs a passphrase, it reads the passphrase from the current terminal if it was run from a terminal. If SSHADD does not have a terminal associated with it but DECW$DISPLAY is set, it opens an X11 window to read the passphrase.
[.SSH]IDENTITY.PUB	Contains the public key for authentication. The contents of this file should be added to [.SSH]AUTHORIZED_KEYS on all systems where you want to log in using RSA authentication. There is no need to keep the contents of this file secret.

[.SSH]RANDOM_SEED	Seeds the random number generator. This file should not be readable by anyone but the user. This file is created the first time the program is run, and is updated every time SSHKEYGEN is run.

CERTTOOL

The CERTTOOL utility is used for different needs concerning X.509 certificates.

Format

```
multinet certtool [options] /pk10 /subject=<subject> /key_usage=<flags>
          /extended_key_usage=<flags>
multinet certview [options] /pk12 /input_files=<objects>
```

Options

/BITS=*n*	Key strength in bits (default 2048)
/DEBUG=*n*	Set debug level to n
/EXTENDED_KEY_USAGE =(flag1...flagn)	(PKCS#10 only) Extended key usage flags, as a comma-separated list. Valid values are: anyExtendedKeyUsage ServerAuth clientAuth codeSigning emailprotection

	No extended flags are set by default.
/HELP[=(PK10,PK12)]	Display help. More detailed help on manipulating PKCS#10 and PKCS#12 certs is available by adding the PK10 and PK12 qualifier, respectively, to the HELP switch.
/INPUT_FILES=(file1...filen)	(PKCS#12 only) List of files to include in the PFX package.
/KEY_TYPE=*type*	Create a new key of type DSA or RSA.
/KEY_USAGE=(flag1...flagn)	(PKCS#10 only) Key usage flags, as a comma-separated list. Valid values are: digitalSignature nonRepudiation keyEncipherment dataEncipherment keyAgreement keyCertSign CRLSign encipherOnly decipherOnly Default values are digitalSignature and keyEncipherment.
/OPTION=(*x*,*y*)	Set certificate option x to y. The options that can be set are dependent upon the type of certificate (PKCS#10 or PKCS#12) being affected. For PKCS#10: • DNS - set certificate DNS names • Email - set certificate email addresses

	For PKCS#12: • KeyPBE - set the PBE scheme for shrouding keys. "default" means pbeWithSHAAnd3-KeyTripleDES-CBC. • SafePBE - set the PBE scheme for protecting safes. "default" means pbeWithSHAAand40BitRC2-CBC.
/OUTPUT_FILE=*prefix*	Use prefix as the prefix for all output filenames. Private key filenames will be prefix.SSH2 and PKCS#10 files will be prefix.PKCS10.
/PRIVATE_KEY=*keyname*	Use keyname as the private key.
/SUBJECT="*subject*"	(PKCS#10 only) Use subject as the certificate subject.
/VERSION	Display the version of CERTTOOL.

Example:

```
$ MULTINET CERTTOOL /PK10 /SUBJECT=("cn=john doe,cn=lima,cn=beans"-
$_ /PRIVATE_KEY=DKA0:[JOHENDOE.SSH2]ID_DSA_1024_A
PKCS#10 creation succcesful.
Wrote certificate request to output.pkcs10.
```

CERTVIEW

CERTVIEW can be used to view certificates and check their validity. This tool can also be used to output the data in format that is suitable for insertion in the SSH2_DIR:SSHD2_CONFIG configuration file.

Format

```
multinet certview [options] certificate [, certificate, ..., certificate]
```

Options

/COMMENT	Prepend information lines with “#” (comment mark)
/DEBUG=*n*	Set debug level to *n*
/FORMAT_OUTPUT	Output data in a format suitable for insertion to *user-map*
/HELP	Display help
/QUIET	Don’t display certificate information
/VALIDATE=certificate	Validate using the CA certificate `certificate`
/VERBOSE	Increase verbosity (display extensions).
/VERSION	Display version information

Example

```
$ MULTINET CERTVIEW MYCERT_PKCS7.P7B-1_SSH2_CRT
Certificate MYCERT_PKCS7.P7B-1_SSH2_CRT
Certificate issuer ........... : MAILTO=foo@bar.com, C=US, ST=CO, L=Colorado
Springs, CN=FOOCA
Certificate serial number .... : 206680290271582356976177697926629044 21
Certificate subject .......... : MAILTO=foo@bar,com, C=US, ST=CO, L=Colorado
Springs, CN=FOOCA
```

CMPCLIENT

Allows users to enroll certificates. It will connect to a CA (certification authority) and use the CMPv2 protocol for enrolling a certificate. The user may supply an existing private key when creating the certification request or allow a new key to be generated.

Format

`multinet cmpclient [`*`options`*`]/ca_access_url="`*`url`*`" /subject="`*`subject`*`" cert-file [private-key]`

Parameters

`url`	Specifies the URL for the Certification Authority
`Subject`	Specifies the subject name for the certificate. For example, "c-ca,o=acme,ou=development,cn=Bob Jones"
`Cert file`	Specifies the file the certification is written to.
`Private key`	Specifies the private key to be written to.

Options

`/BASE=`*`name`*	Specify base prefix for the generated files.
`/BITS=`*`n`*	Specify the key length in bits.
`/CA__URL="`*`url`*`"`	Specify the URL of the Certification Authority.
`/DEBUG=`*`n`*	Set debug to level *n* (0-60).

/ENROLLMENT_PROTOCOL=*prot*	Use specified enrollment protocol (SCEP or CMP).
/EXTENSIONS	Enable extensions in the subject name.
/GENERATE_KEY	Generate a new private key.
/HELP	Print this help text.
/PROXY_URL="*url*"	Specify the URL of the HTTP proxy server URL to be used when connecting to the certification authority.
/REFNUM=refnum:key	Specify the CMP enrollment reference number and key.
/SOCKS_SERVER="*url*"	Specify the URL of the SOCKS server URL to be used when connecting to the certification authority.
/SUBJECT="*subject*"	Specifies the subject name for the certificate.
/TYPE=rsa|dsa	Specify the key type to generate (default: RSA)
/USAGE_BITS=*n*	Specify the key usage bits.
/VERSION	Print the version information for this program.

Examples:

1. Enroll a certificate and generate a DSA private key:

```
$ multinet cmpclient/type=dsa/generate_key/base=mykey/refnum=1234:abc -
_$ /ca_access_url="http://www.ca-auth.domain:8080/pkix/"-
_$ /subject="c=us,o=foobar,cn=Dilbert Dogbert" ca-certification.crt
```

This will generate a private key called `mykey.prv` and a certificate called `mykey-0.crt`.

2. Enroll a certificate using a supplied private key and provide an e-mail extension:

```
$ multinet cmpclient/base=mykey/refnum=12345:abcd -
_$ /ca_access_url="http://www.ca-auth.domain:8080/pkix/" -
_$ /subject="c=us,o=foobar,cn=Dilbert Dogbert:email=foo@bar.com" -
_$ ca-certification.crt my_private_key.prv
```

This will generate and enroll a certificate called `mykey-0.crt`.

> **Note:** SSH stores and uses software certificates in DER encoded binary format. You can use `sshkeygen` to import and convert PKCS#12 packages (`/pkcs_convert=file`) into private key/certificate pair, X.509 format private key into SSH private key (`/x509_convert=file`) or PKC#7 into certificate (`/extract_certs=file`).

Public Key Subsystem

The public-key subsystem and assistant that can be used to add, remove and list public keys stored on a remote server. The public key assistant and server are based upon a recent IETF draft, so other implementations of SSH may not yet offer this functionality.

The Public-key assistant can be started with:

```
$ MULTINET PUBLICKEY_ASSISTANT [qualifiers] [[user@]host[#port]]
```

Public Key Assistant Commands

`ADD key file name` - Transfers the key file name to the remote system. The file name specified is expected to be in the `SSH2_CONFIG` directory from the user's login directory. e.g., `ADD ID_DSA_1024_A.PUB` will transfer the public key in `ID_DSA_1024_A.PUB` to the remote system and updates the `AUTHORIZATION.` file on the remote system to include this key name.

`CLOSE` - Closes the connection to the remote system

`DEBUG {no | debug_level}` - Sets debug level (like in SFTP2)

`DELETE key finger-print` - Deletes the key that matches the fingerprint specified. It is necessary to do a `LIST` command before this to get a list of the finger prints (and for the program to build its internal database mapping fingerprints to keys).

`EXIT` - Exits the program.

HELP - Displays a summary of the commands available

LIST - Displays the fingerprint and attributes of keys stored on the remote system. The attributes that are listed will vary with key.

OPEN [user@]host[#port] - Opens a connection to a remote public key subsystem.

QUIT - Quits the program.

UPLOAD key file name - Transfers the key file name to the remote system. The file name specified is expected to be in the SSH2_CONFIG directory from the user's login directory. e.g., UPDATE ID_DSA_1024_A.PUB will transfer the public key in ID_DSA_1024_A.PUB to the remote system and updates the AUTHORIZATION. file on the remote system to include this key name.

VERSION [protocol version] - Displays or sets the protocol version to use. The protocol version can only be set before the OPEN command is used. The default version is 1.

Public Key Assistant Qualifiers

/BATCHFILE - Provides file with public key assistant commands to be executed. Starts SSH2 in batch mode. Authentication must not require user interaction.

/CIPHER - Selects encryption algorithm(s).

/COMPRESS - Enables SSH data compression.

/DEBUG - Sets debug level (0-99).

/HELP - Displays a summary of the qualifiers available.

/MAC - Selects MAC algorithm(s). /MAC=(mac-1,...,mac-n)

/PORT - Tells SFTP2 which port SSD2 listens to on the remote machine.

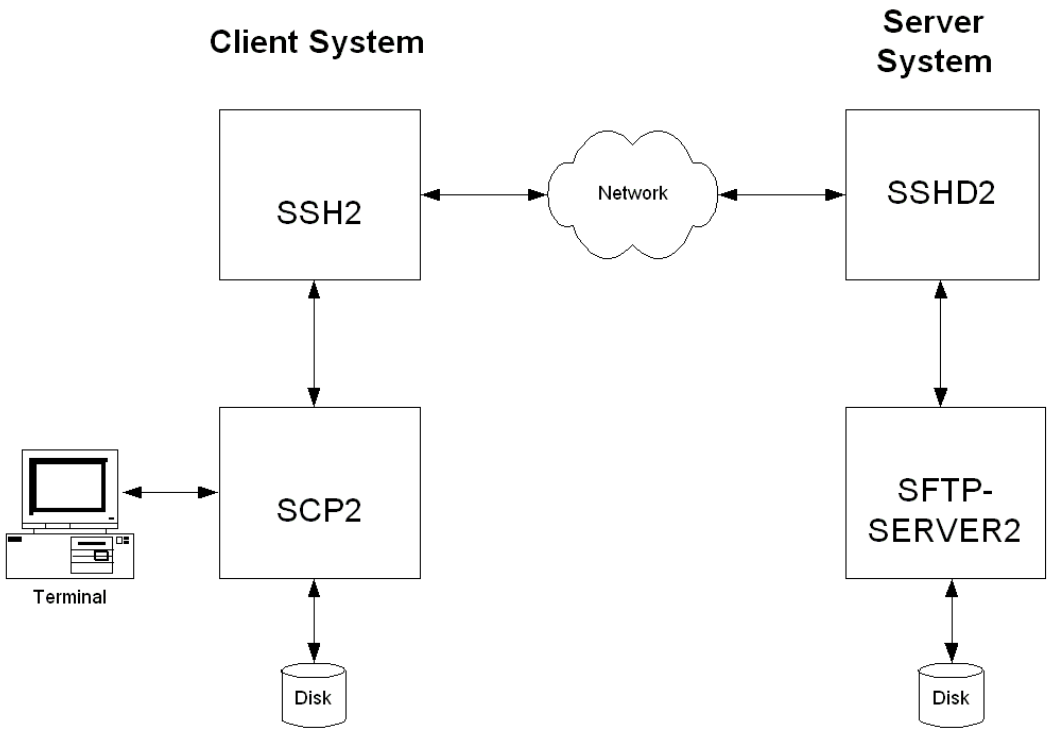
/VERBOSE - Enables verbose mode debugging messages. Equal to /DEBUG=2. You can disable verbose mode by using /DEBUG DISABLE.

/VERSION - Displays version number only.

8. Secure File Transfer

There are three methods to do secure file transfer: SCP2, SFTP2, and FTP over SSH2. SCP2 and SFTP2 communicate with SSH2 for authentication and data transport (which includes encryption) to remote systems and to activate the `SFTP-SERVER2` image. An SCP1 server is provided for compatibility with OpenSSH SCP.

The following diagram illustrates the relationship among the client and server portions of an SCP2 or SFTP2 file transfer:



SCP file transfers are different from FTP file transfers. With FTP a file can be transferred as `ASCII`, `BINARY`, `RECORD`, or in OpenVMS format (if MultiNet or TCPware is in use). In SCP the primary transfer format is `BINARY`. Also, the defined syntax for a file specification is UNIX syntax. Due to these restrictions, files that are transferred from dissimilar systems may or may not be useful. ASCII transfers are done by searching the transferred data for the specified newline sequence and making the specified substitution. Process Software has used methods available in the protocol to attempt to improve the chances that files will be useful upon transfer. The SSH File Transfer Protocol is an evolving specification, and some implementations may not support all options available in the protocol, or worse, not tolerate some optional parts of later versions of the protocol.

Process Software has used the defined extensions in the protocol to transfer information about the VMS file header characteristics such that when a file is transferred between two VMS systems running MultiNet 4.4 or higher, TCPware 5.6 or higher, and/or SSH for OpenVMS, the file header information will also be transferred and the file will have the same format on the destination system as it had on the source system. Also, when a text file is transferred to a non-VMS system, a method has been provided to convert those files that can be translated into a format that will be usable on the remote system. Files that are converted from non-VMS systems are stored as stream files on the VMS system, which provides compatibility for text files from those systems. Filenames are SRI-encoded when files are stored on ODS-2 disks.

SCP-SERVER1

The `SCP-SERVER1` program is used when a system with OpenSSH initiates an SCP command. OpenSSH uses RCP over SSH2 instead of the SFTP protocol. `SCP-SERVER1` will always convert VMS text files (if possible) when copying a file from VMS. Converted VMS text files may have some trailing nulls at the end of them, due to the RCP protocol not being able to tolerate a file that comes up short of the reported size. `SCP-SERVER1` (and `SFTP-SERVER2`) use sophisticated methods to estimate the amount of user data in the file to minimize this. On ODS-5 disks the estimation routine uses the file size hint if it is valid. On ODS-2 disks (and ODS-5 without a valid size hint), the size of the file and file characteristics are used to estimate the amount of user data. The method provides as accurate an estimate as possible without actually reading the file and never underestimates the amount of data in the file. Underestimating would cause significant problems as the programs use the size of the file to determine how much data to expect.

SCP2

Usage

`SCP2 [qualifiers] [[user@]host[#port]::]file [[user@]host[#port]::]file`

> **Note:** The source and destination file specification must be quoted if they contain a user specification or a non-VMS file specification.

Qualifiers

Qualifier	Description
`/ASCII[=newline convention]`	Newline convention is one of `dos`, `mac`, `unix`, `vms`, or `sftp`. The newline convention specified is the newline convention to use if a newline convention is not specified by the server. Allowed values: `dos` (\r\n), `mac` (\r) , `unix` (\n), `vms` (\n) , `sftp` (\r\n). Default = `unix`.
`/BATCH`	Starts SSH2 in batch mode. Authentication must be possible without user interaction.
`/BUFFER_SIZE=integer`	Number of bytes of data to transfer in a buffer. Default is 7500. Minimum value is 512.
`/CIPHER=(cipher-1,...,cipher-n)`	Selects an encryption algorithm(s).
`/COMPRESS`	Enables SSH data compression.
`/CONCURRENT_REQUEST=integer`	Number of concurrent read requests to post to the source file. Default is 4.

/DEBUG=*level*	Sets a debug level. (0-99)
/DIRECTORY	Forces the target to be a directory.
/HELP	Displays the help text.
/IDENTITY_FILE=*file*	Identifies the file for public key authentication.
/OVERWRITE	Overwrite existing file instead of deleting first.
/PORT=*number*	Tells SCP2 which port SSHD2 listens to on the remote machine.
/PRESERVE	Preserves file attributes and timestamps.
/NOPROGRESS	Does not show progress indicator.
/QUIET	Does not display any warning messages.
/RECORD	Open the source file in VMS record mode if possible. This is equivalent to record mode transfer in SFTP2. The file is transferred as a stream of records with no carriage control added between them.
/RECURSIVE	Processes the entire directory tree.
/REMOVE	Removes the source files after copying.
/TRANSLATE_VMS= *(ALL, NONE, VARIABLE, FIXED, VFC)*	Selects the VMS text files to be translated (default=ALL). Note that /ASCII performs a similar function and may be supported in other SCP products.
/VERBOSE	Displays verbose debugging messages. Equal to /debug=2.
/VERSION	Displays the version number only.

/VMS	Negotiates the ability to transfer VMS file information.

> **Note:** /ASCII, /VMS and /TRANSLATE_VMS are mutually exclusive.

File Specifications

The source and destination strings are changed to lowercase unless they are enclosed in quotes, in which case they are left the same. File specification must be in UNIX format for remote systems, unless the remote system is running TCPware 5.6, MultiNet v4.4 or higher, or SSH for OpenVMS, and /VMS or /TRANSLATE_VMS (source files only) are used. UNIX format file specifications need to be enclosed in quotes (") if they contain the / character to prevent the DCL parsing routines from interpreting the string as a qualifier.

Qualifiers

/ASCII[=*newline convention*]
Uses the newline convention specified if the server does not specify a newline convention. Available conventions are: dos (\r\n), mac (\r) , unix (\n), vms (\n) , sftp (\r\n). Default = unix.

/BATCH
Starts SSH2 in BATCH mode. When SSH2 is running in BATCH mode it does not prompt for a password, so user authentication must be performed without user interaction.

/BUFFER_SIZE=*integer*
Number of bytes of data to transfer in a buffer. Default is 7500.

/CIPHER=(*cipher,...,cipher-n*)
Lets you select which SSH2 cipher to use.

/COMPRESS
Enables SSH2 data compression. This can be beneficial for large file transfers over slow links. The compression level is set by the client configuration file for SSH2.

/CONCURRENT_REQUEST=*integer*
Number of concurrent read requests to post to the source file. Default is 4.

/DEBUG
Enables debugging messages for SCP2 and SSH2. Higher numbers get more messages. The legal values are between 0 (none) and 99. Debugging for `SFTP-SERVER2` is enabled via the `MULTINET_SSH_SFTP_SERVER_DEBUG` logical.

/DIRECTORY
Informs SCP2 that the target specification should be a directory that the source file(s) will be put in. This qualifier is necessary when using wildcards in the source file specification, or `/RECURSIVE`.

/HELP
Displays command qualifier list and parameter format.

/IDENTITY_FILE=*file*
Specifies the identity file that SSH2 should use for public-key authentication.

/PORT=*number*
Specifies the port that SSH2 uses on the remote system. Note that if both the source and destination files are remote, this value is applied to both. If SSH2 is available on different ports on the two systems, then the `/PORT` option must be used.

/PRESERVE
Sets the Protection, Owner (UIC), and Modification dates on the target file to match that of the source file. The adjustment of timestamps for time zones is dependent upon the logical `SYS$LOCALTIME` being set correctly. This is defined automatically on VMS V7 and can be defined similarly on earlier versions of VMS. `/PRESERVE` is not very useful when the target machine is a VMS system as VMS

does not provide runtime library calls for setting the file attributes (owner, protection) and timestamps. Note that the VMS modification date (not the creation date) is propagated to the remote system. When files are copied between two VMS systems and /VMS is used /PRESERVE is implied and the process of transferring VMS attributes preserves the information about the protection, dates, and file characteristics.

/NOPROGRESS
SCP2, by default, updates a progress line at regular intervals when it is run interactively to show how much of the file has been transferred. This qualifier disables the progress line.

/QUIET
Disables warning messages. Note that it does not disable warning messages from SFTP-SERVER2, which return on the error channel.

/RECORD
Open the source file in VMS record mode. This copies the source file to the destination as records converted to a stream of bytes without any carriage control between records. This is equivalent to RECORD mode transfer in SFTP.

/RECURSIVE
Copies all of the files in the specified directory tree. Note that the top level directory on the local system is not created on the remote system. Only the most recent version is copied unless in VMS mode and the MULTINET_SFTP_VMS_ALL_VERSIONS logical is defined to be TRUE.

/REMOVE
Deletes the source files after they have been copied to the remote system.

/TRANSLATE_VMS
Translates VMS text files in the copying process to byte streams separated by linefeeds because the defined data transfer format for SCP2 is a binary stream of bytes.

/TRANSLATE_VMS is only applicable to the source specification. If a remote source file is specified, then that system must be running MultiNet v4.4 or higher, TCPware 5.6, or SSH for OpenVMS. If /TRANSLATE_VMS is specified with no value, then VARIABLE, FIXED, and VFC (Variable, Fixed

Control) files are translated to stream linefeed files. If the value is NONE, no files are translated. VARIABLE, FIXED, and VFC can be combined in any manner. The SFTP-SERVER2 process uses the value of the logical MULTINET_SFTP_TRANSLATE_VMS_FILE_TYPES to determine which files should be translated automatically. This is a bit mask with bit 0 (1) = FIXED, bit 1 (2) = VARIABLE, and bit 2 (4) = VFC. These values can be combined into a number between 0 and 7 to control which files are translated.

> **Note:** Due to the structure of the programs, the SCP2 program uses this logical if the /TRANSLATE_VMS qualifier has not been specified.

/VERBOSE
Displays debugging messages that allow the user to see what command was used to start up SSH and other basic debugging information. Note that debugging information can interfere with the normal display of the progress line. Equivalent to /DEBUG=2.

/VERSION
Displays the version of the base SCP2 code.

/VMS
Transfers VMS file information similar to that transferred in OVMS mode in FTP such that VMS file structure can be preserved. All of the information transferred in FTP OVMS mode is transferred along with the file creation date and protection. Timestamps are not adjusted for time zone differences in VMS transfers. If the file is a contiguous file, and it is not possible to create the file contiguously, and the logical MULTINET_SFTP_FALLBACK_TO_CBT has the value of TRUE, YES, or 1, SFTP-SERVER2 attempts to create the file Contiguous, Best Try. VMS mode is only available with SCP2 provided in MultiNet v4.4 or higher, TCPware 5.6, and SSH for OpenVMS.

The logical name MULTINET_SCP2_VMS_MODE_BY_DEFAULT can be defined to TRUE, YES, or 1 to specify that /VMS should be the default unless /NOVMS or /TRANSLATE_VMS are specified. /VMS and /TRANSLATE_VMS cannot be used on the same command line. If /VMS is not specified, but the logical is set to enable it by default, a /TRANSLATE_VMS on the command line will take precedence.

Note that even though SCP2 & SFTP-SERVER2 pass the request for VMS file transfers or to translate a VMS file in a manner that is consistent with the protocol specification, other implementations may not

handle this information well. Since there is no error response present at that point in the protocol, the program hangs. To prevent it from hanging forever, the logical `MULTINET_SCP2_CONNECT_TIMEOUT` is checked to see how long SCP2 should wait for a response when establishing the connection. The format for this logical is a VMS delta time. The default value is 2 minutes. If SCP2 times out before a connection is established with `SFTP-SERVER2` and `/VMS` or `/TRANSLATE_VMS` were specified, a warning message is displayed and the initialization is tried again without the request for VMS information (or `/TRANSLATE_VMS`). This retry is also subject to the timeout, and if the timeout happens again, then SCP2 exits. This helps for implementations that ignore the initialization message when information they do not recognize is present; implementations that abort will cause SCP2 to exit immediately.

Logicals

For the following logicals, all that start `MULTINET_SFTP` apply to the SCP2 client, SFTP2 client and SFTP2 server.

`MULTINET_SFTP_FALLBACK_TO_CBT`
When defined to `TRUE`, `YES`, or `1` and a VMS file transfer is being performed, this logical creates a Contiguous file if that file has Contiguous characteristics. The file will be created as Contiguous Best Try if there is insufficient space to create it as Contiguous.

`MULTINET_SFTP_TRANSLATE_VMS_FILE_TYPES`
This is a bit mask that determines which VMS file types should be translated when not operating in VMS mode.

- Bit 0 (1) = `FIXED`
- Bit 1 (2) = `VARIABLE`
- Bit 2 (4) = `VFC`

The values are:

- 0 (zero) = `NONE`
- 7 = `ALL`

Note that this logical affects SCP2 as well as the server, as SCP2 has the server built into it for handling local file access. If this logical is not defined, the value 7 will be used.

MULTINET_SCP2_CONNECT_TIMEOUT
This logical defines a number specifying how long SCP2 should wait for a response to the INITIALIZE command from the server program. This is a VMS delta time number. The default is 2 minutes.

MULTINET_SCP2_VMS_MODE_BY_DEFAULT
When defined to TRUE, YES, or 1, this logical chooses the /VMS qualifier if /TRANSLATE_VMS or /NOVMS has not been specified.

MULTINET_SFTP_RETURN_ALQ
When defined to TRUE, YES, or 1 and files are being transferred in VMS mode, this logical includes the Allocation Quantity for the file in the file header information. This is disabled by default because copying a small file from a disk with a large cluster size to a disk with a small cluster size causes the file to be allocated with more space than necessary. You have the option of retaining the allocated size of a file if it was allocated the space for a reason. Some combinations of file characteristics require that the Allocation Quantity be included in the file attributes; this is handled by SCP2/SFTP-SERVER2.

MULTINET_SSH_SCP_SERVER_DEBUG
Enables debugging messages for the SCP-SERVER1 image that provides service to SCP commands that use the RCP over SSH2 protocol (OpenSSH). When this is defined, the file SCP-SERVER.LOG is created in the user's login directory. These files are not purged. Larger values yield more debugging information.

MULTINET_SSH_SFTP_SERVER_DEBUG
Enables debugging messages for the SFTP-SERVER2 image that provides service to SCP2 commands that use the SFTP protocol. When this is defined, the file SFTP-SERVER.LOG is created in the user's login directory. These files are not purged. Larger values yield more debugging information.

MULTINET_SFTP_MAXIMUM_PROTOCOL_VERSION
This logical can be used to limit the version of the SSH File Transfer Protocol that the SFTP client and Server use. This can sometimes provide a work-around for problems encountered with different implementations of the protocol. The default value is 4. Protocol versions 2 and 3 are also used by popular implementations.

MULTINET_SFTP_VMS_ALL_VERSIONS
This logical controls whether or not all versions of a file are returned. The values TRUE, YES or 1 will cause all versions to be returned, any other value is to only return the name of the file without a version. The default is to return only one filename without the version number.

MULTINET_SFTP_NEWLINE_STYLE
This logical controls the newline style that SFTP uses, which can be helpful in transferring text files. The values are: UNIX <lf>, VMS <lf>, MAC <cr>. If the logical is not defined, or defined to any other value, then <cr><lf> will be used for the text line separator as documented in the SSH File Transfer specification.

MULTINET_SFTP_CASE_INSENSITIVE
This logical causes SFTP to treat filenames in a case insensitive manner when it is defined to TRUE, YES, or 1.

MULTINET_SFTP_ODS2_SRI_ENCODING
This logical controls whether or not SRI encoding is used for filenames on VMS ODS-2 disks. If the logical is not defined, or is defined to TRUE, YES, or 1 then SRI encoding is used on ODS-2 disks for filenames that contain uppercase letters and special characters.

MULTINET_SFTP_FILE_ESTIMATE_THRESHOLD
This logical controls the minimum number of blocks that a text file must be for an estimated transfer size to be returned instead of an exact size. The default is to estimate the transfer size for all text files.

MULTINET_SFTP_DEFAULT_FILE_TYPE_REGULAR
If this logical is defined to TRUE, YES or 1, then the SFTP server will use a default file type of REGULAR instead of UNKNOWN for OPEN operations. This can correct problems with filenames without a . (dot) in them getting .dir added to them. The filename will appear with a . (dot) at the end of the name in directory listings.

MULTINET_SFTP_*username*_CONTROL
The logical MULTINET_SFTP_username_CONTROL can be defined /SYSTEM to any combination of NOLIST, NOREAD, NOWRITE, NODELETE, NORENAME, NOMKDIR, NORMDIR, to restrict

operations for the username in the logical. NOWRITE will disable PUT, DELETE, RENAME, MKDIR, RMDIR; NOREAD will disable GET and LIST.

MULTINET_SFTP_*username*_ROOT
The logical MULTINET_SFTP_username_ROOT can be defined /SYSTEM to restrict the user to the directory path specified. Subdirectories below the specified directory are allowed.

SSH_SFTP_LOG_SEVERITY
The logical SSH_SFTP_LOG_SEVERITY can be defined /SYSTEM to 20000 to log file transfers or 30000 to log all SFTP operations.

SSH2_SFTP_LOG_FACILITY
The logical SSH2_SFTP_LOG_FACILITY must also be defined /SYSTEM to specify the logging class that is used with OPCOM.

Values below 5 will use the network class; 5 will use OPER1, 6 will user OPER2, etc. The maximum value that can be specified is 12, which will use OPER8.

MULTINET_SFTP_SEND_VENDOR_ID
If this logical is defined to No, False or 0, then the SFTP2 client will not send the extended command containing the vendor-id upon completion of version negotiation with the server.

SFTP2

File Specifications

File specification must be in UNIX format for remote systems, unless `/VMS` transfers are being used.

Usage

`SFTP2 [`*`qualifiers`*`] [[`*`user`*`@]`*`host`*`[#`*`port`*`]]`

If the *`username`*`@` is included in the remote system specification, the specification must be enclosed in quotes.

Qualifiers

Qualifier	Description
`/BATCHFILE=<`*`file specification`*`>`	Provides file with SFTP commands to be executed. Starts SSH2 in batch mode. Authentication must not require user interaction.
`/BUFFER_SIZE=`*`integer`*	Number of bytes of data to transfer in a buffer. Default is 7500.
`/CIPHER=`*`(cipher-1,...,cipher-n)`*	Selects encryption algorithm(s).
`/COMPRESS`	Enables SSH data compression.
`/CONCURRENT_REQUEST=`*`integer`*	Number of concurrent read requests to post to the source file. Default is 4.
`/DEBUG=`*`level`*	Sets debug level (0-99).
`/HELP`	Displays help.

/MAC=*(mac-1,...,mac-n)*	Select MAC algorithm(s).
/NOPROGRESS	Do not show progress indicator.
/PORT	Tells SFTP2 which port the SSHD2 server is listening on.
/VERBOSE	Enables verbose mode debugging messages. Equal to /debug=2. You can disable verbose mode by using “debug disable.”
/VERSION	Displays version number only.
/[NO]VMS	Negotiates ability to transfer VMS file information. VMS transfer mode will be automatically negotiated if SFTP2 detects that the server is capable of doing VMS transfers unless /NOVMS is specified.

SFTP2 Commands

SFTP2 Command	Description
ASCII[{-*s* | <*remote*> [<*local*>]}]	With -s option, shows current newline convention. remote nl conv sets remote newline convention. local nl conv operates on local side, but is not as useful (the correct local newline convention is usually compiled in, so this is mainly for testing). You can set either of these to ask, which will cause sftp to prompt you for the newline convention when needed. With the exception of the -s option, this command sets transfer mode to ASCII. Available conventions are dos, unix, sftp, vms, or mac, using “\r\n”, “\n”, “\r\n”, “\n” and “\r” as newlines, respectively. Note that some implementations of SFTP may check to see if a file can be transferred in ASCII mode before

	doing so, and return errors for files that cannot be transferred. SSH for OpenVMS, MultiNet, and TCPware make this check.
AUTO	Sets the transfer mode (ASCII or BINARY) to depend upon the extension of the file specification.
BINARY	Sets the transfer mode to be binary. (This is the default.)
BUFFERSIZE *[number]*	Sets the size of the buffer used for file transfer. A larger buffer size helps speed large transfers. Displays the current buffer size when no parameter is specified.
CD <*directory specification*>	Changes current directory on remote system. VMS file specifications may be used when operating in VMS mode. A logical name must include the trailing colon so that it can be recognized as such. SFTP from other vendors cannot use VMS specifications due to the way that SFTP works.
CHMOD [-R] <mode> file [file...]	Change the protection on a file or directory to the specified octal mode. (Unix values). -R recurses over directories.
CLOSE	Closes connection to the remote server.
DEBUG {disable | no |<*debug level*>}	Sets the debug level for SFTP2. It does not change the current debug level for SSH2 for an existing connection, but will be used with SSH2 for a new connection. With disable or no, this disables all debugging current sessions for SFTP2.
DELETE <*file specification*>	Removes the specified file from the remote system.
DIRECTORY [<*file |directory specification*>]	Displays the contents of the current directory or specified directory in VMS format when the transfer mode is VMS. File names are displayed as they would be with a DIRECTORY command from DCL.

`EXIT`	Exits SFTP client.
`GET [--preserve-attributes | -p ] <file1> [ <file2>...]`	Retrieves the specified file(s) from the remote system and stores it in the current working directory on the local system. File names are case sensitive and in UNIX format. When operating in VMS mode, either UNIX or VMS-style file specifications can be used. Directories are recursively copied with their contents. Multiple files may be specified by separating the names with spaces. If `--preserve-attributes` or `-p` is specified, then SFTP attempts to preserve timestamps and access permissions. Note that a target filename cannot be provided.
`GETEXT`	Displays the list of file extensions to use ASCII transfers when in AUTO mode. The initial value is `txt,htm*,pl,php*`
`HELP`	Displays help on commands.
`LCD <directory specification>`	Changes the current directory on the local system. VMS file specifications may be used when in VMS mode.
`LCHMOD [-R] <mode> file [file...]`	Change the protection on a file or directory on the local connection to the specified octal mode. (Unix values). `-R` recurses over directories.
`LCLOSE`	Close the local connection.
`LDELETE <file>`	Removes the specified file from the local system. VMS file specifications may be used when in VMS mode.
`LDIRECTORY [<file |directory specification>]`	Displays the contents of the current directory for the local system in VMS format when the transfer mode is

	VMS. File names are displayed as they would be with a `DIRECTORY` command from DCL.
`LLS [<`*`file |directory specification`*`>]`	Displays the contents of the current directory or specified directory in UNIX format. Lists the names of files on the local server. For directories, contents are listed. See `LS` for options and more details.
`LLSROOTS`	Like `LSROOTS`, but for the "local" side.
`LMKDIR <`*`directory specification`*`>`	Creates the specified directory on the local system.
`LOCALOPEN {[`*`user@host[#port`*`] | -1}`	Tries to connect the local side to the host `hostname`. If successful, `LLS` and friends will show the contents of the filesystem on that host. With the `-l` option, connects to the local filesystem (which doesn't require a server). There is an implied `LOCALOPEN -l` when SFTP2 starts up. Note that an implicit `LOCALOPEN` is done when SFTP2 starts, so the only time that a user needs to do a `LOCALOPEN` is when neither directory tree is immediately accessible. `OPEN` is the command that is generally used to establish the connection with the remote system. `LOPEN` is a synonym for `LOCALOPEN`.
`LPWD`	Displays the current working directory on the local system.
`LREADLINK` *`path`*	Provided that `path` is a symbolic link, shows where the link is pointing to. This command is not supported for VMS.

LRENAME <*oldfile*> <*newfile*>	Renames a file on the local system.
LRM <*file specification*>	Removes the specified file from the local system. VMS file specifications may be used when in VMS mode.
LRMDIR <*directory specification*>	Deletes a directory on the local system.
LS [-R] [-l] [-S] [-r] [*file ...*]	Displays the contents of the current directory or specified directory in UNIX format. Lists the names of files on the remote server. For directories, contents are listed. When the -R is given, directory trees are listed recursively. (By default, subdirectories of the arguments are not visited.) When the -l option is given, permissions, owners, sizes, and modification times are also shown. When the -S options is specified sorting is based upon file size instead of alphabetically. The -r option reverses the sort order. When no arguments are given, it assumes that the contents of "." (current working directory) are being listed. Currently, the options -R and -l are mutually incompatible. LS will fill a screen with output, then wait for the user to decide if they want more or have seen enough.
LSROOTS	Displays the virtual roots of the server. (This is VanDyke Software's V Shell extension. Without this you can't know the filesystem structure of a V Shell server). This is also a VMS extension to display the roots (devices) on the VMS system. Though the commands are the same, the information provided is not compatible with what is displayed by VanDyke Software's Secure FX.
LSYMLINK *targetpath linkpath*	Like SYMLINK, but for the "local" side.
MGET [--preserve-attributes | -p] <*file1*> [<*file2*>...]	Retrieves multiple files from the remote system and stores them in the current working directory on the local system.

	If `--preserve-attributes` or `-p` is specified, then SFTP attempts to preserve timestamps and access permissions.
`MKDIR <directory specification>`	Creates the specified directory on the remote system.
`MPUT [--preserve-attributes | -p] <file1> [<file2>...]`	Stores multiple files in the current working directory on the remote system. File names are case-sensitive and in UNIX format. When operating in VMS mode, either UNIX or VMS-style file specifications can be used. Directories are recursively copied with their contents. Multiple files may be specified by separating the names with spaces. If `--preserve-attributes` or `-p` is specified, then SFTP attempts to preserve timestamps and access permissions.
`OPEN {-1| [user@]host[#port]}`	Tries to connect to the host `hostname`. Or with the `-l` option, connects the remote side to the local filesystem (which doesn't require a server).
`PUT [--preserve-attributes | -p] <file1> [<file2>...]`	Stores the specified file in the current working directory on the remote system. File names are case-sensitive and in UNIX format. When operating in VMS mode, either UNIX or VMS-style file specifications can be used. Directories are recursively copied with their contents. Multiple files may be specified by separating the names with spaces. If `--preserve-attributes` or `-p` is specified, then SFTP attempts to preserve timestamps and access permissions. Note that a target filename cannot be provided.

PWD	Displays the current working directory on the remote system. Displayed in VMS format when in VMS mode; otherwise displayed in UNIX format.
QUIT	Exits SFTP client.
READLINK *targetpath linkpath*	Provided that path is a symbolic link, shows where the link is pointing to. Not valid for VMS systems as VMS does not have symbolic links.
RECORD	Enters record transfer mode if the server supports Process Software's record open. The direction in which record transfer mode is possible will be displayed in response to this command. In record transfer mode the source file is opened as binary records and the destination file is opened as binary. This produces the same effect as MultiNet's FTP server BINARY transfer when a BLOCK_SIZE has not been specified, and can be used to transfer a file that contains VMS records to a system that can only handle "flat" files.
RENAME *oldfile newfile*	Renames file on the remote system.
RM <*file specification*>	Removes the specified file from the remote system.
RMDIR <*directory specification*>	Deletes a directory on the remote system.
SETEXT <*ext1*>[<*ext2*>...]	Sets the list of file extensions to use ASCII transfers when in AUTO mode. Individual file extensions must be separated by spaces.
STATUS	Shows the transfer mode, remote server name, and remote server version. The current newline sequence is displayed if operating in ASCII or AUTO mode.
SYMLINK <*targetpath*> <*linkpath*>	Creates symbolic link linkpath, which will point to targetpath. Not valid for VMS systems as VMS does not have symbolic links.

VERBOSE	Enables verbose mode (identical to /DEBUG=2 command-line option). You may later disable verbose mode by DEBUG DISABLE.
VMS	Sets the transfer mode to include VMS file information.

Logicals

The following logicals are specific to SFTP2.

MULTINET_SFTP_VMS_MODE_BY_DEFAULT
When defined to TRUE, YES, or 1, this logical chooses the /VMS qualifier if /NOVMS has not been specified.

Configuration File Parameters

The system wide configuration file (SSH2_DIR:SSH2_CONFIG.) or the user's configuration file (SYS$LOGIN:[.SSH2]SSH2_CONFIG.) can be used to specify the following parameters. The user's configuration file takes precedence over the system configuration file.

SFTP/SCP2 User Configuration Parameters:

FilecopyMaxBuffers	This is equivalent to the /CONCURRENT_REQUEST qualifier on the SFTP2 or SCP2 command line. The command line qualifier will supersede any value in the configuration file.
FilecopyMaxBuffersize	This is equivalent to the SFTP2 BUFFERSIZE command or the SCP2 /BUFFER_SIZE qualifier. The command or qualifier takes precedence.

The system server configuration file (SSH2_DIR:SSHD2_CONFIG.) can include parameters to control which users can perform remove SSH commands (including SSH terminal sessions) as well as SFTP2 access.

SSH2 Terminal Restriction Parameters

Terminal.AllowUsers	Allow users in the specified list to create SSH2 terminals and do interactive commands
Terminal.DenyUsers	Prevent users in the specified list from creating SSH2 terminals and performing interactive commands. The users can still use the SFTP2, SCP1 and Public Key servers.
Terminal.AllowGroups	Allow groups in the specified list to create SSH2 terminals and do interactive commands
Terminal.DenyGroups	Prevent groups in the specified list from creating SSH2 terminals and performing interactive commands. The groups can still use the SFTP2, SCP1 and Public Key servers.

FTP over SSH

SSH2 can be used to set up port forwarding that can be used for FTP. This allows users to use the richness of the FTP command set to access files on a remote system and have their control and data information encrypted. The command format to set up the SSH port forwarding is:

```
$ ssh remote_host/local_forward=("ftp/port:localhost:21")
```

The usual SSH authentication mechanisms come into play, so there may be a request for a password and a terminal session is established to the remote host. As long as this terminal session is alive, other users on the local system can use FTP to access the remote system over an encrypted channel. The location of the quotes is important, as it is necessary to prevent DCL from interpreting the / in the local forwarding information as the start of a new qualifier, and SSH2 does not know or expect to find the ( ) around the forwarding information. Note that the "localhost" inside of the forwarding string is important, as it will make the connection to FTP on the remote system come from localhost, which will then allow FTP to open the data port.

When a user desires to use an encrypted FTP connection, the following sequence of commands would be issued:

```
PORT port
OPEN LOCALHOST
```

Normal FTP authentication takes place and multiple FTP sessions may use a single forwarded port. The FTP protocol filter in SSH2 scans the FTP command stream for the FTP `PORT` and `PASV` commands and their replies, and makes substitutions in these commands and replies to use a secure data stream through the SSH2 session that has been set up. This command will establish an encrypted FTP session with the remote host that the SSH connection is sent to.

To allow a single system to act as a gateway between two networks, add `/ALLOW_REMOTE_CONNECT` to the SSH command that initiates the connection.

Appendix A. DCL User Commands

This appendix lists the commands you can invoke from the DCL command line.

Command Summary

Error! Reference source not found. lists the MultiNet user DCL commands:

Utility	Description
`MULTINET DECODE`	Decodes a file encoded by the MultiNet SMTP mail handler.
`MULTINET FINGER`	Displays information about users currently logged into local or remote systems.
`MULTINET FTP`	Uses the standard Internet FTP protocol to transfer files between TCP/IP hosts, and allows you to manipulate them.
`MULTINET KERBEROS DESTROY`	Deletes Kerberos authentication tickets you previously acquired.
`MULTINET KERBEROS INIT`	Acquires the initial ticket that allows client programs to obtain tickets to access network services.
`MULTINET KERBEROS LIST`	Displays your ticket status.
`MULTINET KERBEROS PASSWORD`	Changes your Kerberos password.
`MULTINET LPRM`	Cancels print jobs, specified by job number, from the SYS$PRINT queue.
`MULTINET RCP`	Transfers file between TCP/IP hosts.

MULTINET REMIND	Creates reminders to be sent at specified intervals by either mail or broadcast to the recipient's terminal.
MULTINET RLOGIN	Connects your terminal to another system on the network.
MULTINET RSHELL	Runs commands on a remote system and displays the command output on your terminal.
MULTINET RUSERS	Displays information about users logged into local or remote systems.
MULTINET SEND	Sends a brief message to another user's terminal.
Error! Reference source not found.MULTINET TELNET	Logs into a remote host from the local host.
MULTINET TFTP	Transfers files between TCP/IP hosts.
MULTINET TALK	Initiates an interactive conversation with another user on the local host or on any remote host that supports the TALK protocol.
MULTINET WHOIS	Displays information about users registered with the Internet Network Information Center (InterNIC).

MULTINET DECODE

Decodes a file encoded by the MultiNet SMTP mail handler.

FORMAT

```
MULTINET DECODE input_file output_file
```

PARAMETERS

input_file

Specifies the name of a file containing the encoded file, including the RFC822 headers at the top of the message. The message must include MIME-Version, Content-Type, and Content-Transfer-Encoding headers in order to be decoded. Only the APPLICATION/RMS content-type and base64 content-transfer-encoding are supported.

output_file

The name for the resulting decoded file.

EXAMPLE

Binary files can be sent via SMTP using the undocumented `/FOREIGN` qualifier of the OpenVMS Mail SEND command. The following example shows how to send such a file and use `DECODE` to translate the corresponding mail message:

1. First, send an executable file using OpenVMS Mail:

```
$ MAIL
MAIL>SEND /FOREIGN /NOEDIT BINARY.EXE
To: SMTP%"JDOE@XAMPLE.COM"
Subj: BINARY.EXE
```

2. When the file arrives, store the ASCII-encoded mail as a text file:

```
$ MAIL
MAIL>EXTRACT/NOHEADER BINARY.TXT
```

3. Finally, decode the `BINARY.TXT` file into an executable file:

```
$ MULTINET DECODE BINARY.TXT BINARY.EXE
```

MULTINET FINGER

Displays information about users currently logged into local or remote systems.

FORMAT

`MULTINET FINGER [user_name] [@host_name]`

PARAMETERS

user_name

Specifies the user name about which to obtain detailed information. If not specified, brief information is displayed about users currently logged in.

host_name

The name (or network address) of the host to which a connection should be made. If you do not specify a host name, information about the local host is displayed. The host name can be specified as an IP address; for example:

```
$ MULTINET FINGER @127.0.0.1
```

QUALIFIERS

/NOCLUSTER

Restricts output to that of a single system instead of its VMScluster.

/CLUSTER

Displays all cluster users.

RESTRICTIONS

To display information about users logged into a remote system, that system must have a FINGER server enabled.

EXAMPLE

```
$ MULTINET FINGER
Friday, April 9,2020 12:39AM-PDT Up 0 02:10:27 4+0 Load ave 0.24 0.25 0.19
User    Personal Name    Job   Subsys  TTY   Console Location
SYSTEM  System Manager   37    *DCL*   TTA3  Macintosh SE
SMITH   L. Stuart Smith  32    FINGER  FTA1  Console
                         33    *DCL*   FTA2  Console
                         35    *DCL*   FTA3  Console
```

MULTINET FTP

Uses the standard Internet FTP protocol to transfer files between TCP/IP hosts, and allows you to manipulate them.

FORMAT

`MULTINET FTP [host] [command]`

PARAMETERS

host

Specifies the name of a remote host to which you want to connect. You can also specify the host name as an IP address. If you enter the name of a remote host on the DCL command line, FTP immediately attempts to connect to the FTP server on that host. If you do not specify a remote host, FTP enters its TOPS-20 style command interpreter and prompts for FTP commands.

command

Specifies an FTP command to execute. If you do not specify a command, FTP starts interactive mode and prompts for commands.

> **Note:** You must specify all FTP DCL qualifiers on the command line before any *command*.

If *command* causes an FTP error to occur, the error condition is reported back to DCL in the `$STATUS` symbol. To determine if an FTP error occurred, examine the hexadecimal value of `$STATUS`. If the lower byte is the value `%X2C`, the FTP error code can be determined by dropping the high order four bits of the 32-bit condition code and examining the next twelve. For example, if you specify the incorrect remote password, the FTP error status code returned by the server will be the decimal value `530`. As the FTP image exits, the error status (and hence the `$STATUS` symbol) is set to the value `%X1212002C` (decimal `530` is the same as hexadecimal `%X212`).

QUALIFIERS

/ACCOUNT=*account_name*

Specifies your account name. In addition to a user name and password for validation, some systems require an account string. MultiNet preserves the case of characters placed within quotation marks. Characters not placed within quotation marks are converted to lowercase. Be aware that some systems might not recognize these lowercase characters and deny access.

/BINARY

Equivalent to `/TYPE=IMAGE`, this qualifier allows you to transfer binary files. You can override the `/BINARY` qualifier with the `TYPE` command in interactive mode.

/IMAGE

Equivalent to `/TYPE=IMAGE`, this qualifier allows you to transfer binary files. You can override the `/IMAGE` qualifier with the `TYPE` command in interactive mode.

/INITIALIZATION
/NOINITIALIZATION

Tells FTP to read commands from your `SYS$LOGIN:FTP.INIT` file when invoked (on by default). Use the `/NOINITIALIZATION` qualifier to disable this behavior.

```
        { STREAM }
/MODE=  { COMPRESS }
        { user-defined-mode }
```

Specifies the file transfer mode. You can change the `MODE` by using the `MODE` command in interactive mode, and default to `STREAM`. A user-defined mode can be created as an executable file.

/PASSWORD=*password*

Specifies the password to use on the remote host, which must be specified in conjunction with the `/USERNAME` qualifier. If not specified, FTP prompts for the password. MultiNet preserves the case of characters placed within quotation marks. Characters not placed within quotation marks are converted to lowercase. Be aware that some systems might not recognize these lowercase characters and deny access.

/PORT=*port*

Specifies an alternate TCP port number to use when connecting to the FTP control port on the remote host. You should only use this qualifier when communicating with an FTP server that uses a non-standard control port number.

```
            { CONNECT, }
/PROMPT[=( { NOMISSING_ARGUMENTS } )]
```

Modifies the operation of FTP. If /PROMPT=CONNECT is used following a successful connection FTP prompts for a user name and password to send to the remote system. The same result can be achieved by adding the line PROMPT-ON-CONNECT ON to your SYS$LOGIN:FTP.INIT file.

If you use /PROMPT=NOMISSING_ARGUMENTS, FTP does not prompt you for missing command line arguments. The same behavior can be accomplished by adding the line PROMPT-FOR-MISSING-ARGUMENTS OFF to your SYS$LOGIN:FTP.INIT file.

For compatibility with previous releases of MultiNet, using the /PROMPT qualifier alone implies /PROMPT=CONNECT.

/STATISTICS

Sets the FTP STATISTICS flag so FTP displays transfer timing statistics upon completion of file transfers.

```
            { FILE }
/STRUCTURE={ RECORD }
            { VMS }
```

Specifies the STRUCTURE of the file transfers. You can change the STRUCTURE by using the STRUCTURE command in interactive mode. The default is FILE, or VMS when communicating between systems running MultiNet. The /STRUCTURE qualifier disables automatic negotiation of VMS structure.

/TAKE_FILE=*file*

Causes FTP to execute commands from the specified file before entering command mode. This qualifier is functionally equivalent to re-directing SYS$INPUT:.

```
       { ASCII }
       { IMAGE }
```

/TYPE={ BACKUP }
{ LOGICAL_BYTE }
Specifies the file transfer TYPE. You can change the TYPE by using the TYPE command (which defaults to ASCII) in interactive mode.

/USERNAME=*username*
Specifies the user name to use on the remote host. MultiNet preserves the case of characters placed within quotation marks. Characters not placed within quotation marks are converted to lowercase. Be aware that some systems might not recognize these lowercase characters and deny access.

/VERBOSE
Sets the FTP VERBOSE flag. Causes FTP to display all responses from the remote FTP server as they are received.

/VMS_STRUCTURE_NEGOTIATION
/NOVMS_STRUCTURE_NEGOTIATION
Causes the FTP client to send a STRU O VMS FTP command to the server FTP to negotiate transparent transfer of files with arbitrary RMS attributes. If the server responds with an error, the default transfer structure of FILE is assumed. The negotiation takes place after a connection has been successfully opened.

You can use the /NOVMS_STRUCTURE_NEGOTIATION qualifier to disable this feature if automatic negotiation causes unforeseen problems with another vendor's server.

EXAMPLES

This example shows how to establish a connection to the host EXAMPLE.COM with prompting for a remote user name and password, and printing statistics for the duration of the session (or until the user turns it off).

```
$ MULTINET FTP EXAMPLE.COM /PROMPT=CONNECT /STATISTICS
```

This example shows how to establish a connection to the host DS.INTERNIC.NET, log in with the user name ANONYMOUS and password GUEST, and fetch the file RFC:RFC959.TXT (the FTP Request for Comments), placing it in the file RFC959.TXT in your default directory.

```
$ MULTINET FTP /USER=ANONYMOUS /PASSWORD=GUEST DS.INTERNIC.NET -
_$ GET RFC:RFC959.TXT RFC959.TXT
```

MULTINET KERBEROS DESTROY

Deletes Kerberos authentication tickets you previously acquired.

FORMAT

```
MULTINET KERBEROS DESTROY
```

QUALIFIERS

/NOQUIET
Sound the terminal bell when tickets cannot be destroyed.

/NOSTATUS
Don’t display a message when the tickets are destroyed.

EXAMPLE

This example shows how to destroy your tickets.

```
$ MULTINET KERBEROS DESTROY
Tickets destroyed.
$
```

MULTINET KERBEROS INIT

Acquires the initial ticket that allows client programs to obtain tickets to access network services.

FORMAT

`MULTINET KERBEROS INIT`

QUALIFIERS

/INSTANCE="*name*"
Specifies the instance to use in obtaining the initial ticket (by default, an empty string).

/LIFETIME=*minutes*
Specifies how long the ticket can be used. The specified value is in minutes and can range from 5 to 1275 (21 hours, 15 minutes). Typically, the default is set to 480 (8 hours). You can change the default by using the `MULTINET KERBEROS DATABASE EDIT` utility to edit the `DEFAULT` principal name.

/REALM=*realm*
Specifies the Kerberos realm to use. The default is the local realm name specified in the `MULTINET:KERBEROS.CONFIGURATION` file.

> **Note:** The realm name is case-sensitive.

/USERNAME=*login_name*
Specifies an alternate `login_name`.

/VERBOSE
Provide extra information in displayed messages.

EXAMPLE

```
$ KERBEROS INIT /REALM=EXAMPLE.COM
$
```

MULTINET KERBEROS LIST

Displays your ticket status.

FORMAT

```
MULTINET KERBEROS LIST
```

QUALIFIERS

/BRIEF
/NOBRIEF (default)
Lists only the acquired tickets without issuance dates, expiration dates, principal name, or the ticket file name.

/CHECK_TGT
/NOCHECK_TGT
Determines if the tickets are still valid and returns an exit status of either success or failure. (TGT stands for ticket-getting ticket.) The default is to indicate ticket status with a message on the screen.

/SRVTAB
Lists the contents of the `MULTINET:KERBEROS.SRVTAB` file which indicates what services are available. This can provide an administrator with useful information about what services are configured in the Kerberos database.

EXAMPLE

This example shows how to list the ticket status.

```
$ MULTINET KERBEROS LIST
Principal: john@EXAMPLE.COM
Issued            Expires           Principal
June 12 16:16:47   June 13 02:16:47

$ MULTINET KERBEROS LIST /SRVTAB
Server key file:  multinet:kerberos.srvtab
Service     Instance     Realm          Key Version
-------------------------------------------------
```

```
changepw     iris          EXAMPLE.COM    1
rcmd         iris          EXAMPLE.COM    1
$
```

Indicates that CHANGEPW service is configured, as is the RCMD service used by RCP, RLOGIN, and RSHELL.

MULTINET KERBEROS PASSWORD

Changes your Kerberos password.

FORMAT

`MULTINET KERBEROS PASSWORD`

QUALIFIERS

/INSTANCE="*name*"
Specifies the instance to change (by default, an empty string).

/REALM=*realm*
Specifies the Kerberos realm to use. The default is the local realm name specified in the `MULTINET:KERBEROS.CONFIGURATION` file.

> **Note:** The realm name is case-sensitive.

/USERNAME=*login_name*
Specifies an alternate *login_name*.

EXAMPLE

```
$ MULTINET KERBEROS PASSWORD
```

MULTINET LPRM

Cancels print jobs, specified by job number, from the SYS$PRINT queue. When you issue this command without arguments, the currently active job is cancelled.

FORMAT

MULTINET LPRM *job-ID*(*s*)[,*username*(*s*)]

PARAMETERS

***job-ID*(*s*)[,*username*(*s*)]**

Specifies a comma-separated list of job ID numbers and/or user names. You can only specify job ID numbers of jobs you submitted that originated on your system (unless you are authorized to use /SUPERUSER). Enter a user name to indicate that you want all jobs submitted by the specified user to be removed. If you do not specify /SUPERUSER, you can only specify your user name.

QUALIFIERS

/ALL

Cancels all jobs on the specified printer.

/NODE=*remote_print_queue*

Specifies the name of a print queue on a remote system.

/QUEUE=*queue*

Specifies an alternate print queue.

/SUPERUSER

Indicates you have SYSTEM privilege and can delete all jobs in the specified queue.

/USER=*user_name*

Specifies the user name of the print job to be deleted. To use this qualifier, you must have SYSPRV or OPER privilege.

EXAMPLE

This example invokes LPRM to remove print jobs in the HP_LPD print queue. Job ID numbers 9, 42, and 66 are removed if you submitted them and they originated on your system. In addition, if you are named Lang, all your print jobs are removed from the system. If you are not named Lang, or you did not submit any of the other jobs, the requests are ignored unless you use the /SUPERUSER qualifier.

```
$ MULTINET LPRM /QUEUE=HP_LPD 9,42,66,LANG
```

MULTINET RCP

Transfers file between TCP/IP hosts. Uses the UNIX "rcp" (remote copy) to copy files between TCP/IP hosts. If the remote host you specify in the input or output file specification is an OpenVMS system running MultiNet, the MultiNet RCP utility automatically negotiates transparent transfer of any OpenVMS file, retaining all RMS attributes.

FORMAT

`MULTINET RCP` *`input_file_spec output_file_spec`*

PARAMETERS

`input_file_spec`

Specifies the name of one or more files to be copied. This parameter may be either a local OpenVMS file specification or a remote file specification of the form:

```
hostname::input_file_spec
```

If *`input_file_spec`* is not a full directory and file specification, it is interpreted relative to your login directory on `hostname`. If the directory/file specification on the remote host contains special characters (including mixed-case directory and file names), you should enclose it within double quotation marks.

`input_file_spec` can be a directory specification if used with the `/RECURSIVE` qualifier. See the `/RECURSIVE` qualifier for more details.

You may use wildcards in either the local or remote file specification. For remote file specifications, however, you must use the wildcard characters normally used on the remote system.

`output_file_spec`

Specifies the name(s) of the output file(s) into which the input file(s) are to be copied. This parameter may be either a local OpenVMS file specification or a remote file specification of the form:

```
hostname::output_file_spec
```

If *`output_file_spec`* is not a full directory and file specification, it is interpreted relative to your login directory on `hostname`. If the directory and file specification on the remote host contains special characters (including mixed-case directory and file names), you should enclose it within double quotation marks.

You may use wildcards in either the local or remote file specification. For remote file specifications, however, you must use the wildcard characters normally used on the remote system.

QUALIFIERS

/AUTHENTICATION=KERBEROS

If you specify /AUTHENTICATION=KERBEROS, command authentication is performed using Kerberos; you will not be prompted for authentication information. (KERBEROS is currently the only value supported by this qualifier.)

/EXACT

Disables the automatic conversion of file names to lowercase. When DCL passes command line parameters and qualifiers to RCP, it converts them to uppercase unless you explicitly enclose them within double quotation marks. Because lowercase file names are preferred by UNIX, and since OpenVMS file names are case-insensitive, RCP converts file names to lowercase. You can use mixed case file names if you enclose them in double quotation marks, and specify them with the /EXACT qualifier.

/LOG=log_spec

Specifies if RCP should display the file specifications and transfer information of each file copied. *log_spec* can take the values SIZE or TIME (or both if enclosed in parentheses and separated by commas). If you specify only /LOG, /LOG=SIZE is assumed.

When you use the /LOG qualifier, RCP displays the following information for each file copied:

- The names of the input and output files
- The number of blocks copied if you specify /LOG=SIZE
- The data transfer rate (in bytes or kilobytes per second) if you specified /LOG=TIME
- Both the number or blocks and the data transfer rate if you specified /LOG=(SIZE,TIME)

/PASSWORD=password

Specifies the password to use on the remote host which you must specify with the /USERNAME qualifier. If you specify /PASSWORD without a value, RCP prompts for the password (terminal echoing is disabled).

/RECURSIVE
Specifies that the directory subtree rooted at the directory named by *input_file_spec* should be copied recursively, that is, the directory and all files and directories below it. If you specify the local file specification with an ellipsis ([...]), the /RECURSIVE qualifier is assumed.

/TRUNCATE_USERNAME
Causes RCP to truncate your OpenVMS user name to be no longer than eight characters. Some RSHELL server implementations, notably UNIX, assume that the remote user name is no longer than eight characters and dies with the error "remuser too long" if it is longer. You can use this qualifier to communicate with those systems.

/USERNAME=*username*
Specifies the user name to use on the remote host.

/VMS[={TCPWARE | MULTINET}] (default)
/NOVMS
If /VMS is omitted, RCP by default attempts a MultiNet style VMS mode transfer. This retains VMS file attributes across copies. Use /VMS=TCPWARE to do a transfer involving a TCPware machine. /NOVMS disables maintaining VMS file attributes during a third-party copy.

RESTRICTIONS

The MultiNet RCP utility does not support third-party copies, so either the input or output file specification may contain remote host information, but not both.

You may use wildcards in either the local or remote file specification. For remote file specifications, however, you must use the wildcard characters normally used on the remote system.

You must specify at least one field in the local file specification. If you do not specify the device or directory, your current default device and directory are used. For a local output specification, RCP fills in any other missing fields (file name, file type, version) with the corresponding field of the input file specification.

RCP fails if a login command procedure displays information. Ensure your OpenVMS login command procedure contains the following lines at the start of the file:

```
$ VERIFY := 'F$VERIFY(0)'
$ IF F$MODE() .EQS. "OTHER" THEN EXIT
```

You should also add this line to the end of your login command procedure:

```
$ IF VERIFY THEN SET VERIFY
```

For UNIX login scripts (such as `.profile`), ensure the file does not display any information.

EXAMPLES

This command copies the file `JETSON.LOG` from your login directory on the host `SPROCKETS.COM` to your default directory (`USERS:[SPACELY]`) on the local host.

```
$ RCP SPROCKETS.COM::JETSON.LOG    [] /LOG
%RCP-I-COPIED, SPROCKETS.COM::JETSON.LOG;8
   copied to USERS:[SPACELY]JETSON.LOG;1 (1 block)
```

This command copies the file `LOGIN.COM` in your default directory on the local system to the login directory of the user `GIGI` on the host BIGBOOTE.EXAMPLE.COM.

```
$ RCP /USER=GIG2 /PASS=RABBIT LOGIN.COM BIGBOOTE.EXAMPLE.COM::
```

In this example, you copy all files in the `tmp` subdirectory of your login directory on the host UNIX.SPROCKETS.COM into your default directory on the local system.

> **Note:** The double quotation marks enclosing `"tmp/*"` are required to prevent DCL from interpreting the slashes.

```
$ RCP /LOG  U3IX.SPROCKETS.COM::"tmp/*" []
 %RCP-I-COPIED UNIX.SPROCKETS.COM::tmp/work.order
     copied to USERS:[SPROCKETS]WORK.ORDER;1 (9 blocks)
 %RCP-I-COPIED UNIX.SPROCKETS.COM::tmp/judy.note
     copied to USERS:[SPROCKETS]JUDY.NOTE;1 (4 blocks)
%RCP-I-NEWFILES, 2 files created
```

This command copies all directories and files under the `/src` directory tree on UNIX.SPROCKETS.COM. The command creates a comparable directory structure on the local host starting at the current default directory (`USERS:[JETSON]`), and places the files into this tree. As in the previous example, the double quotation marks enclosing `"tmp/*"` are required to prevent DCL from interpreting the slashes.

```
$ RCP /RECURSIVE /LOG UNIX.SPROCKETS.COM::"/src" [...]
%RCP-I-CREATED, created directory USERS:[JETSON.SRC]
%RCP-I-COPIED, UNIX.SPROCKETS.COM::/src/hack.c
     copied to USERS:[JETSON.SRC]HACK.C;1 (20 blocks)
%RCP-I-COPIED UNIX.SPROCKETS.COM::/src/hack.h
     copied to USERS:[JETSON.SRC]HACK.H;1 (2 blocks)
 %RCP-I-COPIED created directory USERS:[JETSON.SRC.DATA]
 %RCP-I-COPIED, UNIX.SPROCKETS.COM::/src/data/test
     copied to USERS:[JETSON.SRC.DATA]TEST.;1 (100 blocks)
 %RCP-I-NEWFILES, 3 files created
```

MULTINET REMIND

Creates reminders to be sent at specified intervals by either mail or broadcast to the recipient's terminal.

FORMAT

```
MULTINET REMIND
```

PARAMETERS

After invoking the utility, you are prompted to enter a command. Enter `HELP` to list information about the utility, or enter one of these commands:

Command	Use to...
`CREATE`	Create new reminders
`DELETE` *nn*	Delete a reminder
`EXIT`	Exit `REMIND`
`LIST`	List reminder headers
`MODIFY` *nn*	Change an existing reminder
`TYPE` *nn*	Display an existing reminder

nn is the reminder number you must supply.

EXAMPLE

In the following example, a question mark is first entered to list possible commands. At each step, a question mark is entered to investigate the possibilities. A reminder is then created and sent.

```
$ REMIND
REMIND>?
CREATE  DELETE  EXIT    HELP    LIST    MODIFY  TYPE
```

```
REMIND>CREATE
Time of first reminder? ?
date and time
or one of the following:
FRIDAY     MONDAY     SATURDAY   SUNDAY     THURSDAY
TODAY      TOMORROW   TUESDAY    WEDNESDAY
or one of the following:
APRIL-FOOLS          BASTILLE-DAY          BEETHOVENS-BIRTHDAY
BILBOS-BIRTHDAY      CHRISTMAS             COLUMBUS-DAY
FLAG-DAY             FRODOS-BIRTHDAY       GONDORIAN-NEW-YEAR
GROUND-HOG-DAY       GUY-FAWKES-DAY        HALLOWEEN
INDEPENDENCE-DAY     LEAP-DAY              LINCOLNS-BIRTHDAY
MAY-DAY              MEMORIAL-DAY          NEW-YEARS
SAINT-PATRICKS-DAY   SHERLOCK-RV-BIRTHDAY  VALENTINES-DAY
Time of first reminder? GROUND-HOG-DAY
Expiration count? ? Number of times to repeat message
decimal number
Expiration count? 1
How should I send it? ? one of the following:
BOTH  MAIL  SEND
How should I send it? MAIL
Addresses? HOLMES@EXAMPLE.COM
Subject? Happy Ground Hog Day!!!
Text (end with ^Z)
If you see your shadow, consider moving to Santa Cruz.
-Watson
^Z
REMIND> EXIT
$
```

MULTINET RLOGIN

Connects your terminal to another system on the network. RLOGIN is similar to TELNET, except support for the protocol is not as wide-spread and the protocol automatically authenticates the user instead of requesting a user name and password. Local flow control (instead of remote) is also negotiated dynamically. RLOGIN permits the use of X applications without issuing a `SET DISPLAY` command.

FORMAT

`MULTINET RLOGIN` *`host_name`*

PARAMETERS

`host_name`
Specifies the remote host to which to connect.

QUALIFIERS

`/AUTHENTICATION=KERBEROS`
If you specify `/AUTHENTICATION=KERBEROS`, command authentication is performed using Kerberos; you will not be prompted for authentication information. (`KERBEROS` is currently the only value supported by this qualifier.)

`/BUFFER_SIZE=`*`number`*
Changes the maximum size of write operations to the terminal. A large write size is more efficient, but a smaller size makes RLOGIN more responsive to output flushing (**Ctrl+O**). The default buffer size is 1024 bytes; the value for number can range from 20 bytes to 1024 bytes. Number is reset to 20 bytes if you specify a value below 20; a value for number above 1024 bytes is reset to 1024.

`/DEBUG`
Displays any out-of-band control information that arrives during the session.

`/EIGHT_BIT`

Forces RLOGIN to set the OpenVMS terminal to 8-bit mode for the duration of the session. The default behavior is to use the current setting of the OpenVMS terminal parameter `EIGHT_BIT`.

/PORT=*number*
Specifies a non-standard TCP port number to which to connect (the default port is 513).

/TRUNCATE_USERNAME
Truncates your VMS user name to a maximum of eight characters. Some RLOGIN server implementations, notably UNIX, assume the remote user name is no longer than eight characters and fail with the error "`remuser too long`" if it is longer. You can use this qualifier when communicating with such hosts.

/USERNAME=*username*
Specifies an alternative remote user name. By default, the requested remote user name is the same as your local user name.

EXAMPLE

This example shows an OpenVMS user using RLOGIN to connect to a UNIX system.

```
$ RLOGIN UNIX.EXAMPLE.COM
Last login:   Thu Dec 7 22:43:48 from VMS.EXAMPLE.COM
Sun UNIX  4.3 Release 3.5 (UNIX) #1: Fri Apr 9 17:07:00 PDT 2020
%
```

MULTINET RSHELL

Runs commands on a remote system and displays the command output on your terminal.

FORMAT

`MULTINET RSHELL` *`host_name command_line`*

PARAMETERS

`host_name`

Specifies the remote host on which to execute the command. You can also specify the host name as an IP address.

`command_line`

Specifies the command line to execute on the remote system. By default, the command line is converted to lowercase. If uppercase characters are required, specify them by enclosing the entire line in double quotations (`"command_line"`).

You can specify multiple commands to the OpenVMS RSHELL server by separating them with a backslash-semicolon (`\;`). Ensure the multiple command string does not exceed the DCL limit of 256 bytes for reading command lines.

QUALIFIERS

`/ERROR=`*`filename`*

Specifies the error file name (by default, error output goes to `SYS$ERROR`).

`/INPUT=`*`filename`*

Specifies the input file name (by default, `SYS$INPUT`). To spawn an RSHELL that does not require input, specify `/INPUT=NL:` to prevent RSHELL from reading data from your terminal.

`/OUTPUT=`*`filename`*

Specifies the output file name (by default, `SYS$OUTPUT`).

/PASSWORD[=*password*]
Indicates that the REXEC protocol should be used with the specified password instead of the RSHELL protocol. The two protocols are identical except REXEC requires a password, and RSHELL validates on the basis of trusted user names and systems. If you specify `/PASSWORD` with no password, a password prompt appears with echoing disabled.

/PORT=*number*
Specifies a non-standard TCP port number to which to connect (by default, port 514 unless you specify `/PASSWORD`; in that case, port 512 is used).

/TRUNCATE_USERNAME
Truncates your VMS user name to no longer than eight characters. Some RSHELL server implementations, notably UNIX, assume the remote user name is no longer than eight characters and exit with the error "`remuser too long`" if it is longer. You can use this qualifier to communicate with those systems.

/USERNAME=*username*
Specifies an alternative remote user name. By default, the remote user name is the same as your local user name.

DESCRIPTION

The MultiNet RSHELL utility uses the rsh (remote shell) protocol to log on, execute a command, and log out. Normally, it authenticates your use of the remote host with its database of trusted hosts and trusted users. However, if you use the `/PASSWORD` qualifier, the RSHELL utility uses the password you specify and the rexec (remote execution) protocol to authenticate your use of the remote host.

RESTRICTIONS

- RSHELL cannot be used to run interactive programs such as editors; use RLOGIN for these applications instead.
- RSHELL permits the use of X Windows applications without the need to issue a `SET DISPLAY` command.

EXAMPLE

```
$ rshell unix   ls -l
total 216
-rwxr-xr-x 1   smith   212992 Sep 25 07:37 foo
-rw-r--r-- 1   smith      111 Nov 19 22:51 foo.c
$
```

MULTINET RUSERS

Displays information about users logged into local or remote systems. RUSERS can display information about a particular system or, if supported by the network hardware, use broadcasts to display information about all remote systems on directly connected networks. RUSERS uses UDP/IP as its communication protocol.

FORMAT

`MULTINET RUSERS` *`[host-name]`*

PARAMETERS

`[`*`host-name`*`]`
Specifies the name (or network address) of the host from which the remote user information is to be gathered. If you specify the host specified as an asterisk (*), a broadcast RPC gathers information from all directly-connected hosts. If you do not specify a host, a default of * is used.

QUALIFIERS

`/ALL`
Displays all remote hosts, even those on which there are no users logged in.

`/NOALL`
Displays only hosts on which there are users logged in (the default).

`/FULL`
Displays remote users in a longer format, including time of login, idle time, terminal line name, and remote host.

`/NOFULL`
Displays remote users as a summary line, showing only the system name and user names for that system (the default).

MULTINET SEND

Sends a brief message to another user's terminal.

FORMAT

`MULTINET SEND address [message]`

PARAMETERS

address

Specifies the user name or remote address in the form *user@hostname*.

> **Note:** Many SMTP implementations do not support the `SEND` facility that this command uses to send messages.

message

Specifies optional text of the message. If omitted, you are prompted for the message text.

QUALIFIERS

/AND_MAIL

Specifies the message should be both mailed to the user and displayed on the user's terminal.

/OR_MAIL

Specifies the message should be mailed to the user if it cannot be displayed on the user's terminal.

MULTINET TALK

Initiates an interactive conversation with another user on the local host or on any remote host that supports the TALK protocol. Start a conversation by specifying another user's name and host name, if necessary; for example, BILL@FNORD.EXAMPLE.COM. End TALKing by pressing **Ctrl+C**. TALK uses the VMS Screen Management (SMG) runtime routines to create a multiwindow display on your terminal through which the conversation takes place. TALK fails if you specify only the person's login name.

FORMAT

MULTINET TALK *user_name*[@*host_name*]

PARAMETERS

user_name
Specifies the remote user name to talk with.

host_name
Specifies the name (or network address) of the host to which a connection should be made. If you do not specify a host name, the local host name is used.

RESTRICTIONS

The restrictions for using TALK include:

You and the person with whom you want to talk need to be on systems with the same byte-ordering scheme (either "Big Endian" or "Little Endian"). While this is not easy to determine, the easiest rule is that if the other person is using a Sun workstation or a terminal connected to one, TALK does not work at their end. Sun users must use the NTALK command. NTALK is provided on the MultiNet software distribution CD-ROM in the [CONTRIBUTED-SOFTWARE.APPLICATIONS.NTALK] directory, and elsewhere as public domain software.

The [CONTRIBUTED-SOFTWARE.APPLICATIONS.NTALK] directory contains documentation describing how to access the file. NTALK is distributed as a UNIX tar file. Use these steps to make it available for use:

1. Copy the NTALK tar archive to a UNIX system.
2. Use tar to retrieve the archived files.
3. Use make to compile the files into binary source. (The make file assumes you have the UNIX cc compiler.)
   - Both of your terminals must accept broadcasts. Use these commands to enable broadcasts and to suppress mail broadcasts:

     ```
     $ SET TERMINAL /BROADCAST
     $ SET BROADCAST=NOMAIL
     ```

   - The terminal type must be listed in the OpenVMS TERMTABLE.TXT database. As shipped with OpenVMS, this database supports all DEC/HP VT-series terminals. If you have a non-DEC/HP terminal, check with your system manager.
   - The other person's system must be known to your system. TALK must be able to translate the remote system's IP address into its name. Therefore, your system must be using the Domain Name System (DNS), or have the remote system listed in its host tables.

USAGE NOTES

Use the following keystrokes during a TALK session:

Press...	To...	Press...	To...
Ctrl+W	Delete the last word typed (left of the cursor)	**Ctrl+L**	Redraw the screen
Delete	Delete the last character typed	**Ctrl+C**	Exit to DCL

When someone calls you using TALK, a message similar to the following appears on your terminal:

```
Message from TALK-DAEMON@EXAMPLE.COM at 1:53PM-PDT
Connection request by username
[Respond with: TALK username@host]
```

Use this TALK command to answer the remote user's TALK request:

```
$ TALK username@host
```

Once communication is established, you and the other user can type simultaneously, and your output appears in separate windows.

If the user being called has disabled reception of broadcast messages, this message appears:

```
[Your party is refusing messages]
```

EXAMPLE

```
$ TALK HOLMES@EXAMPLE.COM
```

MULTINET TELNET

Logs into a remote host from the local host. TELNET uses the standard Internet TELNET protocol to establish a virtual terminal connection between a terminal connected to your VMS system and a remote host.

FORMAT

`MULTINET TELNET` *`[host]`*

PARAMETERS

host

Specifies the name or numeric network address of the remote host to which you wish to connect. If you don't specify a host name, TELNET enters a TOPS-20 style interactive mode. If you specify the name of a remote host on the DCL command line, TELNET immediately attempts to connect to the remote host. If you don't specify a remote host, TELNET enters its TOPS-20 style command interpreter and prompts you for TELNET commands.

QUALIFIERS

/ABORT_OUTPUT_CHARACTER=*character*

Sets the `TELNET ABORT-OUTPUT` character which, when typed during a TELNET session, sends a `TELNET ABORT OUTPUT` sequence to the remote host. Specify control characters with a caret (`^`) followed by a letter. By default, there is no `ABORT OUTPUT` character; specifying this qualifier without a value sets the character to `^O` (a caret followed by uppercase O, to represent **Ctrl+O**).

/ARE_YOU_THERE_CHARACTER=*character*

Sets the `TELNET ARE-YOU-THERE` character which, when typed during a TELNET session, sends a `TELNET ARE YOU THERE` sequence to the remote host. By default, there is no `ARE-YOU-THERE` character; specifying that qualifier without a value sets the character to `^T` (a caret followed by uppercase T, to represent **Ctrl+T**).

/AUTHENTICATION=KERBEROS

Uses the Kerberos authentication system.

/AUTOFLUSH
Activates the AUTOFLUSH feature. When used with the /ABORT_OUTPUT_CHARACTER, /BREAK_CHARACTER, and /INTERRUPT_PROCESS_CHARACTER qualifiers, the /AUTOFLUSH qualifier causes TELNET to flush any data which may be in the network buffers when the ABORT-OUTPUT, INTERRUPT_PROCESS, or BREAK character is used. Data is flushed by sending a TIMING-MARK command to the TELNET server and discarding all data until one is received in response.

/BREAK_CHARACTER=*character*
Sets the TELNET BREAK character which, when typed during a TELNET session, sends a TELNET BREAK sequence to the remote host. By default there is no BREAK character; specifying this qualifier without a value sets the character to ^C (a caret followed by uppercase C, to represent **Ctrl+C**).

/BUFFER_SIZE=*number*
Changes the maximum size of terminal write operations to the specified number of bytes. A large write size is more efficient, but a smaller size makes TELNET more responsive.

The default buffer size is 512 bytes. The value for number can range from 20 to 1024 bytes. If you specify a value below 20, the buffer size is reset to 20. If you specify a value above 1024, it is reset to 1024.

/CREATE_NTY[=(*options*)]
Performs the same function as the CREATE-NTY command (available in command mode once a connection has been made). When specified without options, /CREATE_NTY causes TELNET to make a temporary connection to the specified host, attach this connection to an NTY device, and exit immediately. You can then run another application, such as KERMIT or SET HOST/DTE through this pseudo-terminal device. The TELNET_NTY logical name is defined to be the NTY device created. Use it as you would any other terminal device. When you are finished with the terminal, use the DEALLOCATE command to dismantle the connection and associated NTY device control blocks. Alternatively, the connection will be dismantled when you log out.

```
$ TELNET /CREATE_NTY[=([PERMANENT] -
       [,NAME=logical_name] -
       [,TABLE=logical_name_table] -
       [,MODE={EXECUTIVE|SUPERVISOR}] -
       [/PORT=target-TCP-port] -
host
```

The *options* contain a comma-separated list beginning with:

PERMANENT	Specifies that the NTY device will persist after you close the TELNET connection. To delete the permanent NTY device, use the MULTINET TELNET /DELETE_NTY=logical_name command.
and continuing with any of the following:	
NAME=logical_name	Specifies the NTY device's logical name. The default logical name is TELNET_NTY.
TABLE=logical_name_table	Specifies the logical name table to which the new NTY device name is added. The default logical name table is LNM$PROCESS_PROCESS.
MODE=access_mode	Specifies the logical name's access mode. access_mode is either SUPERVISOR (the default) or EXECUTIVE.

Privileged users can use /CREATE_NTY options to establish permanent NTY devices. In this case, the NTY device is created but no connection is made to the specified host until the first I/O operation.

Use this qualifier only with permanent NTY devices.

/DELETE_NTY=*logical_name*
Deletes a permanent NTY device named by logical_name. Create permanent NTY devices with the MULTINET TELNET /CREATE_NTY command.

/DEBUG
Sets the TELNET debug flag. When you specify /DEBUG, TELNET prints all option negotiations made with the remote host.

/ERASE_CHARACTER_CHARACTER=*character*

Sets the TELNET ERASE-CHARACTER character which, when typed during a TELNET session, sends a TELNET ERASE CHARACTER sequence to the remote host. By default, there is no ERASE-CHARACTER character. Specifying this character without a value sets this character to `^?` (a caret followed by a question mark, to represent `Delete`).

/ERASE_LINE_CHARACTER=*character*
Sets the TELNET ERASE-LINE character which, when typed during a TELNET session, sends a TELNET ERASE LINE sequence to the remote host. By default, there is no ERASE LINE character; specifying this qualifier without a value sets the character to `^U` (a caret followed by uppercase U, representing **Ctrl+U**).

/ESCAPE_CHARACTER=*character*
Sets the TELNET ESCAPE character. When you type the TELNET ESCAPE character during a TELNET session, communication with the remote host temporarily stops, and TELNET interprets the next character you type as a TELNET command. The ESCAPE character defaults to `^^` (two consecutive carets, representing **Ctrl+^**).

After you type the TELNET ESCAPE character, the next character you type is interpreted according to the following list:

Character	Action
`?`	Displays information about TELNET escape commands.
`A`	Sends an `INTERRUPT PROCESS` command to the remote host.
`B`	Sends a `BREAK` command to the remote host.
`C`	Closes the connection to the remote host.
`O`	Sends an `ABORT OUTPUT` command to the remote host.
`P`	Spawns a new DCL process (or attaches to a parent process).
`S`	Displays the status of the TELNET connection.

T	Sends an ARE YOU THERE (AYT) command. On a MultiNet server, this command is mapped to **Ctrl+T**.
Q	Quits TELNET.
X	Enters extended TELNET command mode.

Type the ESCAPE character twice to send it to the remote host.

/INTERRUPT_PROCESS_CHARACTER=*character*
Sets the TELNET INTERRUPT-PROCESS character which, when typed during a TELNET session, sends an INTERRUPT PROCESS sequence to the remote host. By default, there is no INTERRUPT PROCESS character; specifying this qualifier without a value sets the character to ^C (a caret followed by uppercase C, representing **Ctrl+C**).

/LOCAL_FLOW_CONTROL
/NOLOCAL_FLOW_CONTROL
Specifies that **Ctrl+Q** and **Ctrl+S** should be treated by the local terminal driver as XON and XOFF, instead of being passed down the network connection for processing by the remote terminal driver. Use of this qualifier makes XOFF more responsive, which helps prevent data loss; however, the remote system will never see any **Ctrl+S** character.

The default flow control setting depends on the setting of the VMS terminal characteristic TT$_TTSYNC (set by the DCL command SET TERMINAL /TTSYNC or by many full-screen editors). Specify /LOCAL_FLOW_CONTROL to force TELNET into local flow control mode. Specify /NOLOCAL_FLOW_CONTROL to force TELNET into remote flow control mode.

/LOG_FILE=[*file-spec*]
Specifies a file in which to log a transcript of the TELNET session. Everything received by the local system from the remote system is recorded in this file. If you specify the /LOG_FILE qualifier without a value, the default file specification TELNET.LOG is used. The log file is created in the directory from which TELNET is run. /LOG_FILE is not supported in 3270 or 5250 mode.

/PORT=*port-spec*

Specifies the port to which a connection is to be made. If you do not specify this qualifier, the standard TELNET port for the specified protocol is used. For the TCP/IP protocol, use a port number or a port defined in `MULTINET:HOSTS.` service file.

When connecting via TCP/IP to a port other than the default TELNET port (23), full VMS command line editing is available on command input.

/PRINT_ESCAPE_CHARACTER
Displays the ESCAPE character used to access TELNET command mode. If you use this qualifier, the escape character is displayed when a connection occurs:

```
Escape character is '^^'
```

You can also use the logical name `MULTINET_TELNET_PRINT_ESCAPE_CHARACTER` to set this feature. If this logical is defined, a message will be output.

/PROTOCOL=protocol-spec
Specifies the protocol to be used in making the connection to the remote system. The protocol specification can be either `TCP` or `IP` (`TCP` is the default).

/TCP
Used as an abbreviation for `/PROTOCOL=TCP`.

/TERMINAL_TYPE
Specifies the terminal type to be negotiated with the remote TELNET server. This qualifier has the same function as the `TERMINAL-TYPE` command.

/TN3270=AUTOMATIC (default)
FORCE
/NOTN3270
Allows the negotiation of IBM 3270 terminal emulation mode. `AUTOMATIC` (the default) causes TELNET to automatically negotiate IBM 3270 emulation mode with the remote host. TELNET enters 3270 mode only if the remote host supports it.

Use FORCE to force TELNET into IBM 3270 emulation mode when communicating with a system that supports 3270 mode, but cannot negotiate it automatically. (IBM mainframes running ACCESS/MVS have this restriction.) Use /NOTN3270 to disable IBM 3270 emulation mode entirely.

/TN5250=AUTOMATIC (default)
FORCE
/NOTN5250
Allows the negotiation of IBM 5250 terminal emulation mode. Use AUTOMATIC (the default) to cause TELNET to automatically negotiate IBM 5250 emulation mode with the remote host. TELNET enters 5250 mode only if the remote host supports it. FORCE is used to force TELNET into IBM 5250 emulation mode when communicating with a system that supports 5250 mode, but cannot negotiate it automatically. IBM MVS does not support 5250. Use /NOTN5250 to disable IBM 5250 emulation mode entirely.

/UNIX
Uses the 4.3BSD UNIX end-of-line specification, <CR><NL>, instead of the standard end-of-line specification, <CR><LF>. This qualifier is useful when using TELNET to connect to 4.3BSD UNIX systems.

/VERSION
Displays version information about the TELNET utility. If you use this qualifier, all other parameters and qualifiers are ignored and a TELNET session is not started.

> **Note:** To specify a control character for the value of character in any of the preceding qualifiers, type it as a ^ (caret) followed by the appropriate character, all enclosed within double quotes.

EXAMPLES

This command creates a permanent NTY device pointing at port 9100 on WHORFIN.EXAMPLE.COM, and creates the logical name WHORFINDEVICE (in the system logical name table in executive mode) that translates to the NTY device name.

```
$ MULTINET TELNET EXAMPLE.COM
```

```
$ MULTINET TELNET SALES.EXAMPLE.COM /LOG_FILE=SALES.LOG
$ MULTINET TELNET LOCALHOST /PORT=SMTP
$ MULTINET TELNET /ABORT_OUTPUT_CHARACTER="^A"
$ MULTINET TELNET /PORT=9100 /CREATE_nty=PERMANENT, -
_$  NAME=WHORFINDEVICE, TABLE=SYSTEM, MODE=EXECUTIVE -
_$  WHORFIN.EXAMPLE.COM
```

MULTINET TFTP

Transfers files between TCP/IP hosts. The TFTP utility uses the Internet standard Trivial File Transfer Protocol to transfer files between Internet hosts. TFTP uses the User Datagram Protocol (UDP), and performs no user authentication.

FORMAT

`TFTP [host [port]]`

PARAMETERS

host

Specifies the name or numeric address of the remote host to which you want to connect.

port

Specifies the UDP port number on the server to which you want to connect. If you do not specify the port number, the standard TFTP UDP server port number (69) is used.

EXAMPLE

This example shows how to use TFTP to connect to the host EXAMPLE.COM.

```
$ TFTP EXAMPLE.COM
tftp>
```

MULTINET WHOIS

Displays information about users registered with the Internet Network Information Center (InterNIC). The default WHOIS server is RS.INTERNIC.NET.

FORMAT

`MULTINET WHOIS *name*`

PARAMETERS

name
Specifies the name or *handle* of the registered user about whom you want to retrieve information.

For more information and help from the InterNic type `WHOIS HELP` from the DCL prompt.

QUALIFIERS

/HOST=*hostname*
Specifies the remote host to which to connect. The default is RS.INTERNIC.NET, but can be changed by a system manager. The connection is done to the NICNAME port.

/OUTPUT=*filespec*
Specifies an output file in which to store WHOIS output.

/PORT=*port number*
Specifies the number of a non-standard port.

EXAMPLE

This example shows how to display information about the user "Smith" from the InterNIC database.

```
$ WHOIS SMITH
    SMITH, J.R.   smith@abc.com
    ABC, Incorporated
    101 Elm Street
```

```
    Surf City, CA 95060
    (408) 555-1212
    Record last updated on 1-Jun-00.
The InterNIC Registration Services Host ONLY contains Internet Information
Networks, ASN's, Domains, and POC's).
```

Appendix B. FTP Command Reference

The MultiNet FTP utility uses the Internet-standard FTP (File Transfer Protocol) to transfer files between the local host and a remote host. This appendix lists the commands you can use during an FTP session.

Command Summary

The below table lists the MultiNet FTP commands:

Command	Description
`ACCOUNT`	Sends an account name to the remote FTP server.
`AGET`	Appends a remote file to a file on the local host.
`APPEND GET`	Appends `remote_file` from the remote host to `local_file` on the local host.
`APPEND PUT`	Appends `local_file` on the local host to `remote_file` on the remote host.
`APPEND RECEIVE`	Appends `remote_file` from the remote host to `local_file` on the local host.
`APPEND SEND`	Appends `local_file` on the local host to `remote_file` on the remote host.
`APUT`	Appends `local_file` on the local host to `remote_file` on the remote host.

ASCII	Sets the transfer type to ASCII for transferring text files.
ATTACH	Detaches the terminal from the calling process and reattaches it to another process.
AUTHENTICATE	Requests the FTP server to enter into TLS authentication mode as defined in RFC 4217. This can be done after connecting to the remote server and before sending the USER command.
BELL	Turns on, off, or toggles the sounding of a bell when a file transfer completes.
BINARY	Sets the transfer type for transferring binary files.
BLOCK	Reads files of TYPE I, STRUCTURE FILE using block I/O.
BYE	Closes the current FTP connection, but remains in the FTP command interpreter.
BYTE	Sets the transfer byte size to size.
CCC	Changes an encrypted command connection back to clear text. This command is provided so that an encrypted command connection can be put in clear text mode allowing firewalls and NAT devices to recognize and process PORT/PASV commands and their responses. The file transfer protection level should be established before setting the command channel to clear text mode.
CD	Changes the current working directory on the remote host to dir.
CDUP	Changes the current working directory on the remote host by moving up one level in the directory system.
CLOSE	Closes the current FTP connection, but remains in the FTP command interpreter.
CONFIRM	Turns on, off, or toggles (the default) interactive confirmation of each command in a MULTIPLE command.

CONNECT	Establishes a connection to the FTP server on host.
CPATH	Changes the current working directory on the remote host to dir.
CREATE-DIRECTORY	Creates the directory dir on the remote host.
CWD	Changes the current working directory on the remote host to dir.
DEFLATE	Specifies the amount of compression for MODE DEFLATE data compression.
DELETE	Deletes a file on the remote host.
DIRECTORY	Obtains an annotated listing of the files on the remote host.
DISCONNECT	Closes the current FTP connection without waiting for a confirming response from the remote host, but remains in the FTP command interpreter.
EXIT	Closes the current FTP connection and exits FTP.
EXIT-ON-ERROR	Turns on, off, or toggles (the default) whether or not FTP automatically exits when an error occurs.
GET	Copies remote_file from the remote host to local_file on the local host.
HASH	Turns on, off, or toggles (the default) the display of hash marks (#) for each data buffer transferred.
HELP	Displays FTP help information.
LCD	Changes the current working directory on the local host to dir.
LDIR	Displays the contents of your local working directory. LDIR is the same as LOCAL-DIRECTORY.
LIST	Displays automatic login information for host.

LOCAL-CD	Changes the current working directory on the local host to dir.
LOCAL-DIRECTORY	Displays the contents of your local working directory.
LOCAL-PWD	Displays the current working directory on the local host.
LOGIN	Identifies you to a remote FTP server.
LPWD	Displays the current working directory on the local host.
LS	Displays a names-only listing of files on the remote host.
MDELETE	Deletes multiple files on the remote host.
MGET	Copies multiple files from the remote host to the local host.
MKDIR	Creates the directory dir on the remote host.
MPUT	Copies multiple files from the local host to the remote host.
MULTIPLE DELETE	Deletes multiple files on the remote host.
MULTIPLE GET	Copies multiple files from the remote host to the local host.
MULTIPLE PUT	Copies multiple files from the local host to the remote host. MULTIPLE PUT is a synonym for MULTIPLE SEND. See MULTIPLE SEND for more information.
MULTIPLE RECEIVE	Copies multiple files from the remote host to the local host.
MULTIPLE SEND	Copies multiple files from the local host to the remote host.
OPEN	Establishes a connection to a host system.
PASSIVE	Enables or disables "passive" mode for file transfers with FTP servers on the opposite side of "firewall" gateways.

PASSWORD	Sends a password to the remote FTP server explicitly, which normally happens automatically during login.
PORT	Specifies a TCP port number to use for the FTP control connection.
PROMPT-FOR-MISSING-ARGUMENTS	Turns on, off, or toggles (the default) whether or not FTP prompts for missing command arguments automatically.
PROMPT-ON-CONNECT	Turns on, off, or toggles (the default) whether or not FTP prompts for a user name and password after making a connection automatically.
PROTECTION	Sets the protection level for data transfers as specified in RFC 4217. Use CLEAR to transfer files over a clear text connection. This is the default after specifying the username and password to an authenticated connection. Use PRIVATE to transfer files over an encrypted connection with data integrity checking.
PUSH	Starts and attaches a DCL subprocess.
PUT	Copies local_file on the local host to remote_file on the remote host.
PWD	Displays the current working directory on the remote host.
QUIT	Closes the current FTP connection and exits FTP.
QUOTE	Sends a string to the FTP server verbatim.
RECEIVE	Copies remote-file from the remote host to local-file on the local host.
RECORD-SIZE	Sets or displays the record size for IMAGE mode transfers.
REMOTE-HELP	Displays information about commands available on the FTP server.
REMOVE-DIRECTORY	Deletes a directory on the remote host. REMOVE-DIRECTORY is the same as RMDIR.

RENAME	Renames files on the remote host.
RETAIN	Turns on, off, or toggles (the default) the retention of OpenVMS version numbers in file transfers.
RM	Deletes a file on the remote host.
RMDIR	Deletes a directory on the remote host.
SEND	Copies `local_file` on the local host to `remote_file` on the remote host.
SET	Sets automatic login information for host.
SHOW-DIRECTORY	Displays the current working directory on the remote host. `SHOW DIRECTORY` is the same as `PWD`.
SITE	Specifies commands that are interpreted by the MultiNet FTP server for use on the server host.
SPAWN	Executes a single DCL command, or if entered without options, starts a subprocess with the same effect as `PUSH`.
STATISTICS	Turns on, off, or toggles (the default) `STATISTICS` mode.
STATUS	Displays the status of the FTP server.
STREAM	Turns on, off, or toggles (the default) the creation of binary output files as Stream_LF files.
STRUCTURE	Sets the transfer structure to `structure`.
TAKE	Interprets FTP commands in a file.
TENEX	Changes the byte size for transferring binary files to or from a TOPS-20 system.

TYPE	Sets the transfer type to `type`.
USER	Identifies you to the remote FTP server.
VERBOSE	Turns on, off, or toggles (the default) VERBOSE mode.
VERSION	Prints information about the FTP program version.

ACCOUNT

Sends an account name to the remote FTP server. Use this command when connecting to hosts that require account specifications in addition to a user name.

FORMAT

`ACCOUNT *account*`

PARAMETERS

account
Specifies the name of the account to be sent to the remote FTP server.

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

```
EXAMPLE.COM> account sales
<Account “sales" accepted
EXAMPLE.COM>
```

AGET

Appends a remote file to a file on the local host. `AGET` is a synonym for `APPEND GET`.

FORMAT

`AGET` *`remote_file`* [*`local_file`*]

APPEND GET

Appends *remote_file* from the remote host to *local_file* on the local host. APPEND uses the current settings for type, mode, and structure during file transfers. APPEND GET is the same as AGET and APPEND RECEIVE.

FORMAT

APPEND GET *remote-file* [*local-file*]

PARAMETERS

remote_file
Specifies the name of the file on the remote host from which to copy.

local_file
Specifies the name of a file on the local host to which the file is to be appended.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the GET command.
- You cannot use the APPEND GET command in STRUCTURE VMS mode. If you try to do this, FTP toggles temporarily into STRUCTURE FILE mode for the transfer.

EXAMPLE

This example shows how to append a remote file to a file on the local host.

```
EXAMPLE.COM> append get login.com
To local file: RETURN
<ASCII retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
<Transfer completed.  2498 (8) bytes transferred.
EXAMPLE.COM>
```

APPEND PUT

Appends *local_file* on the local host to *remote_file* on the remote host. APPEND PUT is a synonym for APPEND SEND.

FORMAT

APPEND PUT *local_file remote_file*

APPEND RECEIVE

Appends *remote_file* from the remote host to *local_file* on the local host. APPEND RECEIVE is a synonym for APPEND GET.

FORMAT

APPEND RECEIVE *remote_file* [*local_file*]

APPEND SEND

Appends *local_file* on the local host to *remote_file* on the remote host. APPEND SEND uses the current settings for type, mode, and structure during file transfers. APPEND SEND is the same as APUT and APPEND PUT.

FORMAT

APPEND SEND *local_file remote_file*

PARAMETERS

local_file
Specifies the name of the file on the local host to be copied.

remote_file
Specifies the destination file name on the remote host.

Restrictions

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the APPEND SEND command.
- The MultiNet FTP Server cannot APPEND to a file in STRUCTURE VMS mode.

EXAMPLE

This example shows how to append the LOGIN.COM file to the remote file FOO.COM.

```
EXAMPLE.COM>append send login.com foo.com
<ASCII Store of ST_ROOT:[TMP]FOO.COM;12 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

APUT

Appends *local_file* on the local host to *remote_file* on the remote host. APUT is a synonym for APPEND PUT and APPEND SEND.

FORMAT

APUT *local_file remote_file*

ASCII

Sets the transfer type to ASCII for transferring text files. `ASCII` is a synonym for `TYPE`.

FORMAT

```
ASCII
```

ATTACH

Detaches the terminal from the calling process and reattaches it to another process. Use the `SPAWN SHOW PROCESS /SUBPROCESSES` command to list the names of subprocesses. Use the `DCL LOGOUT` command to return to the original process. If the `MULTINET_DISABLE_SPAWN` logical is enabled, `ATTACH` does not work.

FORMAT

`ATTACH` *process-name*

PARAMETERS

process_name

Specifies the name of a process to which you want your terminal attached. (Not all subprocesses can be attached; some testing may be required.)

BELL

Turns on, off, or toggles the sounding of a bell when a file transfer completes.

FORMAT

`BELL` *mode*

PARAMETERS

mode
Specifies a value of `ON`, `OFF`, or `TOGGLE`.

EXAMPLE

This example shows how to toggle the bell feature.

```
FTP>bell
[Bell will now ring when operations complete]
FTP>
```

BINARY

Sets the transfer type for transferring binary files. `BINARY` is a synonym for `TYPE`.

FORMAT

```
BINARY
```

BLOCK

Reads files of TYPE I, STRUCTURE FILE using block I/O.

FORMAT

```
BLOCK
```

Restrictions

Use this command only when connected to a remote host.

BYE

Closes the current FTP connection, but remains in the FTP command interpreter.

FORMAT

```
BYE
```

Restrictions

Use this command only when connected to a remote host.

EXAMPLE

This example shows how to disconnect an FTP connection.

```
EXAMPLE.COM>bye
<QUIT command received. Goodbye.
FTP>
```

BYTE

Sets the transfer byte size to size.

FORMAT

BYTE *size*

PARAMETERS

size

Specifies the size to which to set the transfer byte size. The only permitted value is 8 bits.

EXAMPLE

This example shows how to set the transfer byte size to 8 bits.

```
EXAMPLE.COM>byte
Type: Logical-Byte (Byte Size 8), Structure: VMS, Mode: Stream
EXAMPLE.COM>
```

CD

Changes the current working directory on the remote host to *dir*. CD is the same as CPATH and CWD.

FORMAT

CD *dir*

PARAMETERS

dir
Specifies the name of the directory to use as the current working directory.

Restrictions

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the CD command.

EXAMPLE

This example shows how to change the default directory on the remote host to USERS:[ANONYMOUS].

```
EXAMPLE.COM>cd [anonymous]
<Connected to USERS:[ANONYMOUS].
EXAMPLE.COM>
```

CDUP

Changes the current working directory on the remote host by moving up one level in the directory system.

FORMAT

```
CDUP
```

Restrictions

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the `CDUP` command.

EXAMPLE

This example shows how to move up one directory on the remote host.

```
EXAMPLE.COM>cdup
<Connected to USERS:[000000].
EXAMPLE.COM>
```

CLOSE

Closes the current FTP connection, but remains in the FTP command interpreter. `CLOSE` is a synonym for `BYE`.

FORMAT

```
CLOSE
```

CONFIRM

Turns on, off, or toggles (the default) interactive confirmation of each command in a MULTIPLE command.

FORMAT

CONFIRM *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to enable CONFIRM mode and use it with MGET to prompt for each file name.

```
EXAMPLE.COM>confirm
[You will be asked to confirm each transaction in a multiple transaction]
EXAMPLE.COM>mget *.com
<List started.
<Transfer completed.
GET copy.com? [YES] n
GET login.com? [YES] y
<VMS retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

CONNECT

Establishes a connection to the FTP server on *host*. CONNECT is the same as OPEN.

FORMAT

CONNECT *host*

PARAMETERS

host

Specifies the name of the host to which to establish a connection. *host* is specified as either a symbolic host name or as a dotted Internet address.

RESTRICTIONS

Do not use this command when connected to a remote host.

EXAMPLE

This example shows how to connect to the EXAMPLE.COM host.

```
FTP>connect example.com
Connection opened (Assuming 8-bit connections)
<EXAMPLE.COM MultiNet FTP Server Process
<5.5 (nnn) at Fri 9-Apr-2019 7:42am-PST
EXAMPLE.COM>
```

CPATH

Changes the current working directory on the remote host to `dir`. `CPATH` is a synonym for `CD`.

FORMAT

`CPATH` *`dir`*

CREATE-DIRECTORY

Creates the directory *dir* on the remote host. CREATE DIRECTORY is the same as MKDIR.

FORMAT

CREATE-DIRECTORY *dir*

PARAMETERS

dir
Specifies the name of the directory to create.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the CREATE-DIRECTORY command.

EXAMPLE

This example shows how to create the subdirectory test.

```
EXAMPLE.COM>create-dir test
<"USERS:[HOLMES.TEST]" Directory created
EXAMPLE.COM>
```

CWD

Changes the current working directory on the remote host to *dir*. CWD is a synonym for CD.

FORMAT

CWD *dir*

DEFLATE

Specifies how much mode Z compression to use for data transfers.

FORMAT

`DEFLATE LEVEL n`

PARAMETERS

n

Specifies the level of compression. The default level is -1, which is a balances compute intensity and data compression. 0 is no compression, 1 is best speed, 9 is best compression.

RESTRICTIONS

- Use this command after logging in

EXAMPLE

This example shows how to set the deflation (compression).

```
EXAMPLE.COM>deflate level 1
<MODE Z LEVEL set to 1.
EXAMPLE.COM>
```

DELETE

Deletes a file on the remote host. DELETE is the same as RM.

FORMAT

DELETE *file*

PARAMETERS

file
Specifies the name of the file to delete.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the DELETE command.

EXAMPLE

This example shows how to delete the file FOO.BAR from the remote host.

```
EXAMPLE.COM>del foo.bar
<File deleted ok, file USERS:[HOLMES]FOO.BAR;1.
EXAMPLE.COM>
```

DIRECTORY

Obtains an annotated listing of the files on the remote host.

FORMAT

DIRECTORY [*file_spec*] [*output_file*]

PARAMETERS

file_spec

Specifies the file specification to use in the directory lookup on the remote host. If you do not specify *file_spec*, the current working directory on the remote host is used. Any wildcards you specify are interpreted in the context of the remote host operating system.

output_file

Specifies the name of the file to which to write the directory listing. If you do not specify *output_file*, the list is directed to SYS$OUTPUT:.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the DIRECTORY command.

EXAMPLE

This example shows how to retrieve list of files that match the wildcard *.COM.

```
EXAMPLE.COM>dir *.com
<List started.
USERS: [HOLMES]
COPY.COM;4    2     1-APR-2019 08:49 [HOLMES] (RWD,RWD,R,R)
LOGIN.COM;1   5     1-APR-2019 01:25 [HOLMES] (RWD,RWD,R,R)
Total of 7 blocks in 2 files.
<Transfer completed.
EXAMPLE.COM>
```

DISCONNECT

Closes the current FTP connection without waiting for a confirming response from the remote host, but remains in the FTP command interpreter.

FORMAT

```
DISCONNECT
```

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

```
EXAMPLE.COM>disc
FTP>
```

EXIT

Closes the current FTP connection and exits FTP. `QUIT` is the same as `EXIT`.

FORMAT

```
EXIT
```

EXAMPLE

```
EXAMPLE.COM>exit
<QUIT command received. Goodbye.
$
```

EXIT-ON-ERROR

Turns on, off, or toggles (the default) whether or not FTP exits automatically when an error occurs.

If EXIT-ON-ERROR is enabled, FTP exits automatically if an error occurs. After exiting, the DCL symbol $STATUS contains the status code of the last error to occur. If the last error was reported by the FTP server, it contains the value %X1000002C + (%X10000 * ftp_error_code).

FORMAT

EXIT-ON-ERROR *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to use EXIT-ON-ERROR to exit automatically when an error occurs. Here the error was not an FTP error.

```
FTP>exit-on-error
[Will exit when an error occurs]
FTP>connect 10.1.1.4
10.1.1.4: %MULTINET-F-ETIMEDOUT, Connection timed out
$ sho symbol $status
$STATUS == "%X100081E4"
```

This example shows how EXIT-ON-ERROR exits when an error occurs automatically. Here the FTP server responded as follows to the command user unknown password:

```
FTP>exit-on-error
[Will exit when an error occurs]
FTP>connect somehost
Connection opened (Assuming 8-bit connections)
<Somehost MultiNet FTP Server Process V5.6(15) at Thu 4-Mar-19 2:37PM-EDT
SOMEHOST>user unknown password
<%SYSTEM-F-INVLOGIN, login information invalid at remote node
$ show symbol $status
$STATUS == "%X1212002C"
```

```
$ write sys$output ($status-%X1000002C)/%X10000
530
530 %SYSTEM-F-INVLOGIN, login information invalid at remote node
```

FACT

Sets or displays the file facts that will be set to match the facts of the source file after transfer. The only fact currently supported is the file modification time.

FORMAT

```
FACT [MFMT]
```

PARAMETERS

MFMT
File modification time will be set after transferring files provided the FTP server supports the necessary commands.

EXAMPLE

```
FTP>FACT MFMT
FTP>PUT FILE.EXE
```

GET

Copies *remote_file* from the remote host to *local_file* on the local host. The current settings for type, mode, and structure are used during file transfers. GET is the same as RECEIVE.

FORMAT

GET *remote-file* [*local-file*]

PARAMETERS

remote-file
Specifies the name of the file on the remote host.

local-file
Specifies the name of the file on the local host.

QUALIFIERS

/FDL
Obtains a file previously saved with the PUT /FDL command. When you create a file with the PUT /FDL qualifier, a file description language (FDL) file is created at the same time as the original file. The output file is converted to raw block format. When you retrieve a file with GET /FDL, the original format is restored using the attributes stored in the FDL file. If you don't use the /FDL qualifier with the GET command, the new raw block format is retained. In any case, the FDL file is retained and must be deleted independently. The /FDL qualifier provides compatibility with HP TCP/IP Services for OpenVMS (formerly UCX). The FDL file has the same name except the string FDL is appended to the end.

/RESTART
For STREAM mode transfers restart the transfer where it was interrupted. The client verifies that the server supports the RFC 3659 SIZE and REST commands, and ignores the qualifier if it does not.

This does NOT work for VMS mode transfers (`STRU VMS`), and if the remote system is a VMS system it is recommended that a `STRU FILE` be done before the transfer command and to include `/NOVMS` on the command line when starting FTP.

`GET/RESTART` is not supported in ASCII mode to systems that support VMS mode transfers due to problems with properly concatenating a possibly broken line of text. It is recommended that the file be ZIPped and then transfer the .zip file in binary mode.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the `GET` command.

EXAMPLE

This example shows how to transfer a file to the local host.

```
EXAMPLE.COM>get login.com
To local file: RETURN
<VMS retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

HASH

Turns on, off, or toggles (the default) the display of hash marks (#) for each data buffer transferred.

FORMAT

HASH *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to display hash marks during a GET file transfer.

```
EXAMPLE.COM>hash
[Hash marks will be printed during transfers]
EXAMPLE.COM>get login.com login.com
<VMS retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
###
Transfer completed. 2498 (8) bytes transferred.
```

HELP

Displays FTP help information. Type **HELP ?** to see a list of HELP topics. Type **HELP** without an argument to display general help information.

FORMAT

`HELP [command]`

PARAMETERS

command
Specifies the name of the command about which you want help.

EXAMPLE

```
FTP>help
The HELP command prints on-line help for the FTP user program. The argument
to HELP selects the particular FTP command about which help is desired. In
addition to the FTP commands, several control characters can be typed while
file transfers are in progress:

 Control-A shows the progress of a data transfer.
 Control-G aborts the file transfer and returns to FTP command level.
 Control-P spawns a new command interpreter.
FTP>
```

LCD

Changes the current working directory on the local host to dir. `LCD` is a synonym for `LOCAL-CD`.

FORMAT

`LCD` *dir*

LDIR

Displays the contents of your local working directory. `LDIR` is the same as `LOCAL-DIRECTORY`.

FORMAT

`LDIR`

EXAMPLE

```
FTP>ldir *.com
USERS:[EXAMPLE.DOC.V32]
DOC.COM;2     1   1-APR-2019 01:36 FLOWERS_FILES (RWED,RWED,,)
LOGIN.COM;3   5   1-APR-2010 19:07 FLOWERS_FILES (RWED,RWED,,)
LOGIN.COM;2   5   1-APR-2019 19:04 FLOWERS_FILES (RWED,RWED,,)
LOGIN.COM;1   5   1-APR-2019 18:49 FLOWERS_FILES (RWED,RWED,,)
Total of 16 blocks in 4 files.
FTP>
```

LIST

Displays automatic login information for *host*. See the SET command for information about setting automatic login information for a host.

FORMAT

LIST [*host*]

PARAMETERS

host

Specifies the host whose automatic login information you are trying to display. If you do not specify host, LIST displays automatic login information for all hosts for which login information has been set.

RESTRICTIONS

Do not use this command when connected to a remote host.

EXAMPLE

This example shows how to set and list information for the DS.INTERNIC.NET host.

```
FTP>set ds.internic.net  /user=anonymous /pass=guest
FTP>list
DS.INTERNIC.NET
    User: anonymous
    Password: guest
FTP>
```

LOCAL-CD

Changes the current working directory on the local host to *dir*. LOCAL-CD is the same as LCD.

FORMAT

LOCAL-CD *dir*

PARAMETERS

dir

Specifies the name of the directory to which to change the current working directory.

EXAMPLE

```
FTP>lcd [-]
Connected to USERS:[EXAMPLE.DOC].
FTP>
```

LOCAL-DIRECTORY

Displays the contents of your local working directory. `LOCAL-DIRECTORY` is a synonym for `LDIR`.

FORMAT

```
LOCAL-DIRECTORY
```

LOCAL-PWD

Displays the current working directory on the local host. `LOCAL-PWD` is a synonym for `LPWD`.

FORMAT

`LOCAL-PWD`

LOGIN

Identifies you to a remote FTP server. LOGIN is the same as USER.

FORMAT

LOGIN *user* [*password*]

PARAMETERS

user

Specifies your user name on the remote server.

password

Specifies your password on the remote server. If you do not specify *password* and the remote site requires one, you are prompted for it. In either case, the password is not echoed.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts do not allow you to use LOGIN once you have already logged in.

EXAMPLE

This example shows how to connect to a remote host and log in.

```
$ ftp example.com
Connection opened (Assuming 8-bit connections)
<EXAMPLE.COM MultiNet FTP Server Process 5.6(nn) at Fri 9-Apr-2019 7:42 am
EDT
EXAMPLE.COM>login HOLMES password
<User HOLMES logged into U1:[HOLMES] at Fri 9-Apr-2019, 19:13, job 433.
EXAMPLE.COM>
```

LPWD

Displays the current working directory on the local host. `LPWD` is the same as `LOCAL-PWD`.

FORMAT

`LPWD`

EXAMPLE

```
FTP>lpwd
Connected to USERS:[EXAMPLE.DOC].
FTP>
```

LS

Displays a names-only listing of files on the remote host. You can use wildcard specifications.

FORMAT

LS [*file_spec*] [*output_file*]

PARAMETERS

file_spec

Specifies the file specification to use in the directory lookup on the remote host. If you do not specify *file_spec*, the current working directory on the remote host is used. Any wildcards used are interpreted in the context of the remote host operating system.

output_file

Specifies the name of the file to which to write the directory listing. If *output_file* is not specified, the list is directed to SYS$OUTPUT:.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the LS command.

EXAMPLE

This example shows how to retrieve the directory listing of the files matching the wildcard character *.

```
EXAMPLE.COM>ls *.
<List started.
$mailinterface.
mymail.
todo.
<Transfer completed.
EXAMPLE.COM>
```

MDELETE

Deletes multiple files on the remote host. `MDELETE` is a synonym for `MULTIPLE DELETE`.

FORMAT

`MDELETE` *files*

MGET

Copies multiple files from the remote host to the local host. `MGET` is a synonym for `MULTIPLE GET`.

FORMAT

`MGET` *files*

MKDIR

Creates the directory *dir* on the remote host. MKDIR is a synonym for CREATE-DIRECTORY.

FORMAT

MKDIR *dir*

MODE

Sets the transfer mode to COMPRESSED, DEFLATE (MODE Z compression), or STREAM (the default).

FORMAT

MODE *mode*

PARAMETERS

mode
Specifies one of three values: COMPRESSED, DEFLATE, or STREAM (the default).

RESTRICTIONS

- The MODE command can only be used when connected to a remote host.
- Not all modes are supported by all remote hosts.

EXAMPLE

This example shows how to enable COMPRESSED mode.

```
EXAMPLE.COM>mode c
Type: Ascii (Non-Print), Structure: VMS, Mode: Compression
EXAMPLE.COM>
```

MPUT

Copies multiple files from the local host to the remote host. `MPUT` is a synonym for `MULTIPLE-SEND`.

FORMAT

`MPUT` *files*

MULTIPLE DELETE

Deletes multiple files on the remote host. If you have turned on CONFIRM, (to confirm multiple transactions interactively), you are asked to confirm the deletion of each file. MULTIPLE DELETE is the same as MDELETE.

FORMAT

MULTIPLE DELETE *files*

PARAMETERS

files

Specifies which files to delete. Wildcard characters in files are expanded on the remote host.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the MULTIPLE DELETE command.

EXAMPLE

This example shows how to delete all files matching the remote wildcard * character.

```
EXAMPLE.COM>multiple delete *.com;*
< List started
<Transfer completed.
<File deleted ok, file USERS:[EXAMPLE.DOC.V32]LOGIN.COM;3.
<File deleted ok, file USERS:[EXAMPLE.DOC.V32]LOGIN.COM;2.
<File deleted ok, file USERS:[EXAMPLE.DOC.V32]LOGIN.COM;1.
```

MULTIPLE GET

Copies multiple files from the remote host to the local host. If you have turned on `CONFIRM` (to confirm multiple transactions interactively), you are asked to confirm the transfer of each file. `MULTIPLE GET` is the same as `MGET` and `MULTIPLE RECEIVE`.

FORMAT

`MULTIPLE GET` ***files***

PARAMETERS

files

Specifies the names of the files to be copied. Wildcard characters are expanded on the remote host.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the `MULTIPLE GET` command.

EXAMPLE

This example shows how to transfer all files matching the * wildcard character.

```
EXAMPLE.COM>multiple get *.com
<List started.
<Transfer completed.
<VMS retrieve of USERS:[HOLMES]COPY.COM;4 started.
<Transfer completed. 732 (8) bytes transferred.
<VMS retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
<Transfer completed. 2498 (8) bytes transferred.
```

MULTIPLE PUT

Copies multiple files from the local host to the remote host. `MULTIPLE PUT` is a synonym for `MULTIPLE SEND`.

FORMAT

`MULTIPLE PUT` *files*

MULTIPLE RECEIVE

Copies multiple files from the remote host to the local host. `MULTIPLE RECEIVE` is a synonym for `MULTIPLE GET`.

FORMAT

`MULTIPLE RECEIVE` *files*

MULTIPLE SEND

Copies multiple files from the local host to the remote host. If you have turned on `CONFIRM` (to confirm multiple transactions interactively), you are asked to confirm the transfer of each file. `MULTIPLE SEND` is the same as `MULTIPLE PUT` and `MPUT`.

FORMAT

`MULTIPLE SEND` *`files`*

PARAMETERS

`files`

Specifies which files to copy. Wildcard characters in *`files`* are expanded on the local host.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the `MULTIPLE SEND` command.

EXAMPLE

This example shows how to transfer the files which match the `*.COM` wildcard.

```
EXAMPLE.COM>multiple send *.com
<VMS Store of ST_ROOT:[TMP]COPY.COM;4 started.
<Transfer completed. 732 (8) bytes transferred.
<VMS Store of ST_ROOT:[TMP]FIX.COM;3 started.
<Transfer completed. 496 (8) bytes transferred.
<VMS Store of ST_ROOT:[TMP]FOO.COM;11 started.
<Transfer completed. 436 (8) bytes transferred.
<VMS Store of ST_ROOT:[TMP]LOGIN.COM;4 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

OPEN

Establishes a connection to a host system. `OPEN` is a synonym for `CONNECT`.

FORMAT

`OPEN` *`host`*

PASSIVE

Enables or disables passive mode for file transfers with FTP servers on the opposite side of firewall gateways.

FORMAT

`PASSIVE [state]`

PARAMETERS

state
Specifies a value of `ON`, `OFF`, or `TOGGLE`.

DESCRIPTION

Typically, when an FTP client requests data from an FTP server, the server attempts to establish a connection with the client over which it transfers the data. If a firewall gateway separates the FTP client and server, the gateway may prohibit incoming connections. The solution is to enable passive mode transfers, in which the FTP server asks the FTP client to initiate the connection.

> **Note:** Not all FTP servers support passive mode transfers.

The `PASSIVE` command lets you enable or disable passive mode explicitly. When you do not specify a state, the current state is toggled.

EXAMPLE

This example uses `PASSIVE` to allow the server to transfer a directory listing across a connection established by the FTP client rather than the server.

```
HQ.EXAMPLE.COM>passive on
[Passive mode is ON for transfers]
```

```
HQ.EXAMPLE.COM>dir
<List started.
FTP_ANON:[000000]
UNZIP.EXE;3      155   27-MAR-2004 10:29 [WEBMASTER] R,RWED,RWED,R)
UNZIP_ALPHA.EXE;1 163  27-MAR-2004 10:29 [WEBMASTER] (R,RWED,RWED,R)
VMSIO.H;12         7   27-MAR-2004 10:29 [WEBMASTER] (R,RWED,RWED,R)
WHATS_NEW.TXT;1    1    5-MAR-2004 16:31 [WEBMASTER] (R,RWED,RWED,R)
<Transfer completed.
HQ.EXAMPLE.COM>
```

PASSWORD

Sends a password to the remote FTP server explicitly, which happens automatically during login.

FORMAT

`PASSWORD` *`password`*

PARAMETERS

`password`
Specifies the password to send to the remote server. The password is not echoed when typed.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that the password be sent as part of the login procedure only.

EXAMPLE

This example shows how to send a password to the remote host.

```
EXAMPLE.COM>pass airplane
<Password accepted, thank you.
EXAMPLE.COM>
```

PORT

Specifies a TCP port number to use for the FTP control connection. Use this command only when connecting to an FTP server that provides a nonstandard FTP control connection port number.

FORMAT

PORT *port*

PARAMETERS

port
Specifies the port to use when establishing the FTP control connection with the remote server system.

EXAMPLE

This example shows how to explicitly specify a port number for the FTP control connection with the remote host.

```
EXAMPLE.COM>port 1099
EXAMPLE.COM>
```

PROMPT-FOR-MISSING-ARGUMENTS

Turns on, off, or toggles (the default) whether or not FTP prompts for missing command arguments automatically.

FORMAT

`PROMPT-FOR-MISSING-ARGUMENTS` *mode*

PARAMETERS

mode
Specifies a value of `ON`, `OFF`, or `TOGGLE`.

EXAMPLE

This example shows how to use the `PROMPT-FOR-MISSING-ARGUMENTS` command.

```
FTP>prompt-for-missing-arguments
[Will NOT prompt for missing arguments];
SALES.EXAMPLE.COM>get
?Missing remote filename
SALES.EXAMPLE.COM>
```

PROMPT-ON-CONNECT

Turns on, off, or toggles (the default) whether or not FTP prompts for a user name and password automatically after making a connection.

FORMAT

PROMPT-ON-CONNECT *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to use PROMPT-ON-CONNECT to automatically prompt for a user name and password when a connection is made.

```
FTP>prompt-on-connect
[Will automatically prompt for username and password]
FTP>connect ftp.example.com
Connection opened (Assuming 8-bit connections)
<FTP.EXAMPLE.COM MultiNet FTP Server Process 5.6(nn) at Fri 9-Apr-2019
7:42am PST
Username: HOLMES
Password: ******
<User HOLMES logged into USERS:[HOLMES] at Fri 9-Apr-2019 14:42, job
2060011f.
FTP.EXAMPLE.COM>
```

PUSH

Starts and attaches a DCL subprocess. If a parent process exists, attach to it. To return from DCL, use the ATTACH or the LOGOUT command. To switch back from a DCL subprocess, use the ATTACH command. If the MULTINET_DISABLE_SPAWN logical is set, PUSH does not work.

FORMAT

PUSH

PUT

Copies *local_file* on the local host to *remote_file* on the remote host. The current settings for type, mode, and structure are used during file transfers. PUT is the same as SEND.

FORMAT

PUT *local_file remote_file*

PARAMETERS

local_file
Specifies the name of the file on the local host.

remote_file
Specifies the name of the file on the remote host.

QUALIFIERS

/FDL
Puts a file in FDL format. When you create a file with the PUT /FDL qualifier, a file description language (FDL) file is created at the same time as the original file. The output file is converted to raw block format. When you retrieve a file with GET /FDL, the original format is restored using the attributes stored in the FDL file. If you do not use the /FDL qualifier with the GET command, the new raw block format is retained. In any case, the FDL file is retained and must be deleted independently. The /FDL qualifier provides compatibility with HP TCP/IP Services. The FDL file has the same name except the string FDL is appended to the end of the file name.

/RESTART
For STREAM mode transfers restart the transfer where it was interrupted. The client verifies that the server supports the RFC 3659 SIZE and REST commands, and ignores the qualifier if it does not.

This does NOT work for VMS mode transfers (STRU VMS), and if the remote system is a VMS system it is recommended that a STRU FILE be done before the transfer command and to include /NOVMS on the command line when starting FTP.

GET/RESTART is not supported in ASCII mode to systems that support VMS mode transfers due to problems with properly concatenating a possibly broken line of text. It is recommended that the file be ZIPped and then transfer the .zip file in binary mode.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the PUT command.

EXAMPLES

This example copies the file LOGIN.COM to the remote file FOO.COM.

```
EXAMPLE.COM>put login.com foo.com
<VMS Store of ST_ROOT:[TMP]FOO.COM;12 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

This example copies AFILE.TXT to BFILE.TXT and creates the additional BFILE.TXTFDL file. The BFILE.TXTFDL file is in ASCII format and is an appropriate FDL description of AFILE.TXT.

```
EXAMPLE.COM>PUT /FDL AFILE.TXT BFILE.TXT
<ASCII Store of USERS:[HOLMES]BFILE.TXTFDL;1 started.
<Transfer completed. 888 (8) bytes transferred.
<IMAGE Store of USERS:[HOLMES]BFILE.TXT;1 started.
<Transfer completed. 6 (8) bytes transferred.
EXAMPLE.COM>
```

PWD

Displays the current working directory on the remote host. `PWD` is a synonym for `SHOW_DIRECTORY`.

FORMAT

```
PWD
```

QUIT

Closes the current FTP connection and exits FTP. `QUIT` is a synonym for `EXIT`.

FORMAT

```
QUIT
```

QUOTE

Sends a string to the FTP server verbatim. You can use `QUOTE` to access non-standard commands on the FTP server.

FORMAT

`QUOTE` *`string`*

PARAMETERS

`string`
Specifies a string to send to the server.

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

This example shows how to send a `NOOP` command to the remote host.

```
EXAMPLE.COM>quote noop
<NOOP command successful.
EXAMPLE.COM>
```

RECEIVE

Copies *remote-file* from the remote host to *local-file* on the local host. The current settings for type, mode, and structure are used during file transfers. RECEIVE is a synonym for GET.

FORMAT

RECEIVE *remote-file* [*local-file*]

PARAMETERS

remote-file

Specifies the name of the file on the remote host.

local-file

Specifies the name of the file on the local host.

QUALIFIERS

/FDL

Gets a file previously saved with the PUT /FDL command. When you create a file with the PUT /FDL qualifier, a file description language (FDL) file is created at the same time as the original file. The output file is converted to raw block format. When you retrieve a file with RECEIVE /FDL, the original format is restored using the attributes stored in the FDL file. If you do not use the /FDL qualifier with the RECEIVE command, the new raw block format is retained. In any case, the FDL file is retained and must be deleted independently. The /FDL qualifier provides compatibility with HP TCP/IP Services. The FDL file has the same name except the string FDL is appended to the end of the file name.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the GET command.

EXAMPLE

This example shows how to transfer a file to the local host.

```
EXAMPLE.COM>receive login.com
To local file: RETURN
<VMS retrieve of USERS:[HOLMES]LOGIN.COM;1 started.
<Transfer completed. 2498 (8) bytes transferred.
EXAMPLE.COM>
```

RECORD-SIZE

Sets or displays the record size for IMAGE mode transfers.

FORMAT

RECORD-SIZE *[size]*

PARAMETERS

size

Specifies the record size for IMAGE mode transfers. Values range from 1 to 32767. When omitted, the current setting is displayed. The default record size is 512 bytes.

EXAMPLE

```
$ ftp ftp.example.com
FTP.EXAMPLE.COM MultiNet FTP user process 5.6(nnn)
Connection opened (Assuming 8-bit connections)
<FTP.EXAMPLE.COM MultiNet FTP Server Process 5.6(nnn) at Fri 9-Apr-2019
7:42am-PST
FTP>record 1024
FTP>record
Record size for IMAGE files: 1024
FTP>
```

REMOTE-HELP

Displays information about commands available on the FTP server.

FORMAT

```
REMOTE-HELP
```

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

This example shows how to retrieve help from a remote host.

```
UNIX.EXAMPLE.COM>remote-help
<The following commands are recognized (* =>'s unimplemented).
< USER    PORT   STOR    MSAM*   RNTO    NLST    MKD    CDUP
< PASS    PASV   APPE    MRSQ*   ABOR    SITE    XMKD   XCUP
< ACCT*   TYPE   MLFL*   MRCP*   DELE    SYST    RMD    STOU
< SMNT*   STRU   MAIL*   ALLO    CWD     STAT    XRMD   SIZE
< REIN*   MODE   MSND*   REST    XCWD    HELP    PWD    MDTM
< QUIT    RETR   MSOM*   RNFR    LIST    NOOP    XPWD
<Direct comments to ftp-bugs@ucbarpa.Berkeley.EDU.
UNIX.EXAMPLE.COM>
```

REMOVE-DIRECTORY

Deletes a directory on the remote host. `REMOVE-DIRECTORY` is the same as `RMDIR`.

FORMAT

`REMOVE-DIRECTORY` *dir*

PARAMETERS

dir

Specifies the name of the directory to be removed.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you be logged in before using the `REMOVE-DIRECTORY` command.

EXAMPLE

This example shows how to delete the `test` subdirectory from the remote host.

```
EXAMPLE.COM>remove-directory test
<"USERS:[HOLMES.TEST]" Directory deleted
EXAMPLE.COM>
```

RENAME

Renames files on the remote host.

FORMAT

RENAME *file1 file2*

PARAMETERS

file1

Specifies the name of the file to be renamed.

file2

Specifies the new name of file1.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the RENAME command.

EXAMPLE

This example shows how to rename COPY.COM to NEWCOPY.COM on the remote host.

```
EXAMPLE.COM>rename copy.com newcopy.com
<Old FILE renamed to USERS:[HOLMES]NEWCOPY.COM;1.
EXAMPLE.COM>
```

RETAIN

Turns on, off, or toggles (the default) the retention of OpenVMS version numbers in file transfers. By default, version numbers are stripped from OpenVMS file names before they are sent over the network.

FORMAT

`RETAIN` *`mode`*

PARAMETERS

mode
Specifies a value of `ON`, `OFF`, or `TOGGLE`.

EXAMPLE

This example shows how to enable retention of OpenVMS version numbers.

```
FTP>retain
[Transferred files will retain their version numbers]
FTP>
```

RM

Deletes a file on the remote host. `RM` is a synonym for `DELETE`.

FORMAT

`RM` *`file`*

RMDIR

Deletes a directory on the remote host. `RMDIR` is a synonym for `REMOVE-DIRECTORY`.

FORMAT

`RMDIR` *`dir`*

SEND

Copies *local_file* on the local host to *remote_file* on the remote host. The current settings for type, mode, and structure are used during file transfers. SEND is the same as PUT.

FORMAT

SEND *local_file remote_file*

PARAMETERS

local_file
Specifies the name of the file on the local host to be copied.

remote_file
Specifies the destination file name on the remote host.

QUALIFIERS

/FDL
Sends a file in FDL format. When you create a file with the SEND /FDL qualifier, a file description language (FDL) file is created at the same time as the original file. The output file is converted to raw block format. When you retrieve a file with GET /FDL, the original format is restored using the attributes stored in the FDL file. If you do not use the /FDL qualifier with the GET command, the new raw block format is retained. In any case, the FDL file is retained and must be deleted independently. The /FDL qualifier provides compatibility with HP TCP/IP Services. The FDL file has the same name except the string FDL is appended to the end of the file name.

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the SEND command.

EXAMPLE

This example shows how to transfer the file `LOGIN.COM` to the remote file `FOO.COM`.

```
EXAMPLE.COM>send login.com foo.com
<VMS Store of ST_ROOT:[TMP]FOO.COM;12 started.
<Transfer completed.  2498 (8) bytes transferred.
```

SET

Sets automatic login information for host.

FORMAT

`SET host`

PARAMETERS

host

Specifies the host for which you want to set automatic login information.

QUALIFIERS

/USER:*username*

Specifies the user name sent when a connection is made to *host*.

/PASSWORD:*password*

Specifies the password sent when a connection is made to *host*.

/ACCOUNT:*account*

Specifies the account is sent when a connection is made to *host*.

DESCRIPTION

When a connection to `host` is made, FTP uses the information set to automatically log in. This command is usually used in the `FTP.INIT` file to specify a list of hosts and their login information. If `FTP.INIT` contains passwords in clear text, it is imperative that you protect the file from access by other users. If you specify `/USER` but not `/PASSWORD`, an automatic login is attempted and, if necessary, a password prompt displayed.

RESTRICTIONS

Do not use this command when connected to a remote host.

USAGE NOTE

If you do not specify any qualifiers, any automatic login information is cleared.

EXAMPLE

This example sets the user name and password for the host DS.INTERNIC.NET.

```
FTP>SET HOST ds.internic.net  /user:anonymous /pass:guest
```

SHOW-DIRECTORY

Displays the current working directory on the remote host. `SHOW DIRECTORY` is the same as `PWD`.

FORMAT

`SHOW-DIRECTORY`

RESTRICTIONS

- Use this command only when connected to a remote host.
- Most remote hosts require that you log in before using the `SHOW-DIRECTORY` command.

EXAMPLE

This example shows how to retrieve the remote default directory.

```
EXAMPLE.COM>show
<ST_ROOT: [TMP] is current directory.
EXAMPLE.COM>
```

SITE

Specifies commands that are interpreted by the MultiNet FTP server for use on the server host.

FORMAT

`SITE` *`command`*

PARAMETERS

command

Selects a command from the following:

`RMS RECSIZE` *`n`*	Indicates a non-default record size for files transferred in IMAGE mode to the FTP server. Record size values can range from 1 to 32767; the default is 512 bytes.
`SPAWN`	Allows users to execute commands on the server host. The command must not require a terminal device, and must exit on completion. You cannot use this command during an anonymous FTP session.

SPAWN

Executes a single DCL command, or if entered without options, starts a subprocess with the same effect as PUSH. To return from DCL, use the LOGOUT command. If the MULTINET_DISABLE_SPAWN logical is set, SPAWN does not work.

FORMAT

SPAWN [*command*]

PARAMETERS

command
Specifies a command to execute. If you omit command, a DCL command line subprocess is created.

QUALIFIERS

/INPUT=*file-spec*
Specifies an input file to the command you enter with SPAWN.

/LOGICAL_NAMES
/NOLOGICAL_NAMES
Specifies that logical names and logical name tables are not copied to the subprocess.

/SYMBOLS
/NOSYMBOLS
Specifies that global and local names are not passed to the subprocess.

/WAIT
/NOWAIT
Returns control without waiting for the command to complete. Do not use this qualifier with commands that have prompts or screen displays.

/OUTPUT=file-spec

Specifies a file that retains the output of the command invoked with SPAWN. This qualifier only works when a single command is entered without creating a DCL subprocess. In addition, this qualifier is positional; you must enter it immediately after SPAWN or other qualifiers.

STATISTICS

Turns on, off, or toggles (the default) STATISTICS mode. In STATISTICS mode, FTP displays, upon completion of file transfers, timing statistics about the transfer.

If the logical MULTINET_FTP_STATISTICS_IN_HHMMSS is defined with either 1, T, or Y, then the elapsed time displays in HH:MM:SS format if statistics are requested using the STATISTICS mode.

FORMAT

STATISTICS *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to enable STATISTICS mode.

```
FTP>statistics
[Transfer statistics printing is ON]
FTP>
```

STATUS

Displays the status of the FTP server.

FORMAT

`STATUS [`*`data`*`]`

PARAMETERS

`data`

Sends this command data to the FTP server; data depends on the implementation of the FTP server. This parameter is optional.

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

```
EXAMPLE.COM>status
<EXAMPLE.COM MultiNet FTP Server Process 5.6(nnn)
<User HOLMES is logged into directory ST_ROOT:[TMP]
<The current transfer parameters are:
<    MODE S
<    Stru O VMS
<    TYPE A N
<A connection is open to host EXAMPLE.COM
<The data connection is CLOSED.
EXAMPLE.COM>
```

STREAM

Turns on, off, or toggles (the default) the creation of binary output files as Stream_LF files.

FORMAT

`STREAM` *mode*

PARAMETERS

mode

Specifies `ON`, `OFF`, or `TOGGLE`.

EXAMPLE

```
EXAMPLE.COM>stream
[ IMAGE files will be written as Stream_LF format]
EXAMPLE.COM>
```

STRUCTURE

Sets the transfer structure to *structure*.

FORMAT

`STRUCTURE` *structure*

PARAMETERS

structure

Specifies a value of `FILE`, `RECORD`, or `VMS`.

- Use `FILE` (the default) when connecting to systems that do not support VMS structure negotiation.
- Use `RECORD` to transfer files when you want to preserve the record boundaries.
- Use `VMS` to transfer files with arbitrary RMS attributes transparently. Transparent transfer is negotiated automatically between systems that support it. RMS semantics are passed along with the data.

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

```
EXAMPLE.COM>stru r
Type:Ascii (Non-Print), Structure: Record, Mode: Stream
EXAMPLE.COM>
```

TAKE

Interprets FTP commands in a file. When the end of the file is encountered, the FTP command interpreter returns to its previous input source. You can nest TAKE commands up to ten levels deep.

FORMAT

TAKE *file*

PARAMETERS

file

Specifies the name of the file that contains commands to be interpreted.

EXAMPLE

This example shows how to take commands from the file FTP.COMMANDS.

```
FTP>take ftp.commands
```

TENEX

Changes the byte size for transferring binary files to or from a TOPS-20 system.

FORMAT

```
TENEX
```

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

This example shows how to set the transfer type to TENEX.

```
EXAMPLE.COM>tenex
Type: Logical-Byte (Byte Size 8), Structure: File, Mode: Stream
EXAMPLE.COM>
```

TYPE

Sets the transfer type to *type*.

FORMAT

`TYPE` *type*

PARAMETERS

type

Specifies a value of `ASCII`, `BACKUP`, `BINARY`, `IMAGE`, or `LOGICAL-BYTE`.

- Use `TYPE ASCII` (the default) for transferring text files.
- Use `TYPE BACKUP` to set the transfer type to `IMAGE` and write the local file with 2048-byte fixed length records. Use this command to transfer VMS BACKUP save sets.
- Use `TYPE BINARY` to transfer binary files (same as `TYPE IMAGE`).
- Use `TYPE IMAGE` to transfer binary files (for example, `.EXE`).
- Use `TYPE LOGICAL-BYTE` to transfer binary files to or from a TOPS-20 machine.

RESTRICTIONS

Use this command only when connected to a remote host.

EXAMPLE

This example shows how to set the type to transfer an image file.

```
EXAMPLE.COM>type i
Type: Image, Structure: File, Mode: Stream
EXAMPLE.COM>
```

USER

Identifies you to the remote FTP server. `USER` is a synonym for `5`.

FORMAT

`USER` *`user`* [*`password`*]

VERBOSE

Turns on, off, or toggles (the default) VERBOSE mode. VERBOSE mode causes FTP to display all responses from the remote FTP server as they are received.

FORMAT

VERBOSE *mode*

PARAMETERS

mode
Specifies a value of ON, OFF, or TOGGLE.

EXAMPLE

This example shows how to enable VERBOSE mode.

```
FTP>verbose
[Verbose reply printing is ON]
FTP>
```

VERSION

Prints information about the FTP program version.

FORMAT

```
VERSION
```

EXAMPLE

This example shows how to print the FTP program version number.

```
EXAMPLE.COM>version
EXAMPLE.COM MultiNet FTP user process 5.6(nnn)
EXAMPLE.COM>
```

WINDOW-SIZE

Displays or sets the TCP window size to be used on data transfers.

FORMAT

`WINDOW-SIZE` *`[size]`*

PARAMETER

`size`
Integer value to use for TCP window size.

EXAMPLE

This example shows how to display the current TCP window size.

```
EXAMPLE.COM>window-size
TCP window size: 32768
EXAMPLE.COM>
```

Appendix C. TELNET Command Reference

The MultiNet TELNET utility uses the Internet-standard TELNET protocol to establish a virtual terminal connection between your terminal and a remote host. This appendix lists the commands you can use during a TELNET session.

Command Summary

The below table lists the TELNET commands:

Command:	**Description:**
`ABORT`	Sends an `ABORT OUTPUT` sequence to the remote host.
`ATTACH`	Detaches the terminal from the calling process and reattaches it to another process.
`ATT`	Sends an `INTERRUPT PROCESS` sequence to the remote host.
`AYT`	Sends an `ARE YOU THERE` sequence to the remote host.
`BINARY`	Attempts to negotiate binary (8-bit) mode with the remote system.
`BREAK`	Sends a `BREAK` sequence to the remote host.
`BYE`	Closes any open TELNET connection and exits to DCL.
`CLOSE`	Closes the TELNET connection.
`CONNECT`	Establishes a TELNET connection to a host.

CREATE-NTY	Connects the local end of a TELNET connection to an NTY pseudo-terminal device.
DEBUG	Displays TELNET option negotiations.
ECHO	Turns on or off remote host character echoing.
EXIT	Closes any open TELNET connection and exits to DCL. EXIT is the same as BYE and QUIT.
HELP	Displays help information for the specified TELNET command.
LOG_FILE	Enables or disables logging of the TELNET session.
PUSH	Starts and attaches a DCL subprocess.
QUIT	Closes any open TELNET connection and exits to DCL. QUIT is the same as EXIT.
SET ABORT-OUTPUT-CHARACTER	Sets the character that TELNET maps to the ABORT OUTPUT sequence.
SET ARE-YOU-THERE-CHARACTER	Sets the character that TELNET maps to the ARE YOU THERE sequence.
SET AUTO-FLUSH	Turns auto-flushing on or off.
SET BREAK-CHARACTER	Sets the character that TELNET maps to the BREAK sequence.
SET DEBUG	Enables or disables the display of TELNET option negotiations.
SET ERASE-CHARACTER-CHARACTER	Sets the character that TELNET maps to the ERASE CHARACTER sequence.

SET ERASE-LINE-CHARACTER	Sets the character that TELNET maps to the ERASE LINE sequence.
SET ESCAPE-CHARACTER	Sets the character that switches TELNET to command mode.
SET EXTENDED	Causes TELNET to go into extended command mode automatically whenever you type the TELNET ESCAPE character, Ctrl+^ by default.
SET INTERRUPT-PROCESS-CHARACTER	Sets the character that TELNET maps to the INTERRUPT PROCESS sequence.
SET LOCAL-FLOW-CONTROL	Specifies whether or not Ctrl+S and Ctrl+Q should be treated by the local terminal driver as XON and XOFF.
SET LOG-FILE	Enables or disables logging of the TELNET session.
SET REMOTE-USERNAME	Specifies the user name to which you want to log in using Kerberos.
SET UNIX-LINE-TERMINATOR	Causes TELNET to use the 4.3BSD UNIX end-of-line specification, Ctrl+NULL.
SPAWN	Executes a single DCL command, or if entered without options, starts a subprocess with the same effect as PUSH.
STATUS	Displays the status of the current TELNET connection and parameters.
TERMINAL-TYPE	Specifies a terminal type for the TELNET session.
VERSION	Displays the TELNET version number.

ABORT

Sends an ABORT OUTPUT sequence to the remote host. If the remote host is running MultiNet, the TELNET ABORT OUTPUT sequence is treated as a Ctrl+O.

FORMAT

ABORT

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

This example sends the ABORT OUTPUT sequence to the remote system.

```
TELNET>abort
```

ATTACH

Detaches the terminal from the calling process and reattaches it to another process. Use the `SPAWN SHOW PROCESS /SUBPROCESSES` command to list the names of subprocesses. Use the DCL `LOGOUT` command to return to the original process. If the `MULTINET_DISABLE_SPAWN` logical is enabled, `ATTACH` does not work.

FORMAT

`ATTACH` *process-name*

PARAMETERS

process-name

Specifies the name of a process to which you want your terminal attached. (Not all subprocesses can be attached; some testing may be required.)

ATTN

Sends an `INTERRUPT PROCESS` sequence to the remote host. If the remote host is also running MultiNet, the TELNET `INTERRUPT PROCESS` sequence is treated as a `Ctrl+C`.

FORMAT

`ATTN`

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

This example sends the `INTERRUPT PROCESS` sequence to the remote system.

```
TELNET>attn
```

AYT

Sends an `ARE YOU THERE` sequence to the remote host. If the remote host is also running MultiNet, the `ARE YOU THERE` sequence is treated as a `Ctrl+T`.

> **Note:** `AYT` does not work if the terminal is not enabled for broadcasts. Invoke the DCL command `SET TERMINAL /BROADCAST` before using `AYT` if broadcasts have been disabled.

FORMAT

`AYT`

EXAMPLE

This example shows how to ensure the host is still active.

```
TELNET>ayt
EXAMPLE::_VTA81: 01:37:57 (DCL) CPU=00:00:01.83 PF=2298 IO=530 MEM=345
```

BINARY

Attempts to negotiate binary (8-bit) mode with the remote system.

FORMAT

```
BINARY
```

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

```
TELNET>binary
```

BREAK

Sends a `BREAK` sequence to the remote host. If the remote host is running MultiNet, the `BREAK` sequence is treated as a `Ctrl+C`.

FORMAT

```
BREAK
```

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

```
TELNET>break
```

BYE

Closes any open TELNET connection and exits to DCL. `BYE` is the same as `EXIT`.

FORMAT

`BYE`

EXAMPLE

```
TELNET>bye
$
```

CLOSE

Closes the TELNET connection.

FORMAT

```
CLOSE
```

USAGE NOTES

If you specified the remote host in the DCL TELNET command, exit to DCL. If you connected to the remote host in TELNET command mode, return to general command mode.

On most remote hosts, closing the connection is seen as a modem-style terminal hang-up. If the remote host is also running MultiNet and OpenVMS virtual terminals are enabled, the remote login session becomes detached.

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

```
TELNET>close
```

CONNECT

Establishes a TELNET connection to a host. TELNET connections may be established using INTERNET protocols; the default is INTERNET.

FORMAT

CONNECT [*protocol*] *host* [*port*]

PARAMETERS

protocol

Specifies the protocol to use to establish the connection. The protocol is INTERNET (the default).

host

Specifies the host to which to establish the connection. With the INTERNET protocol, the host can be a name or a numeric IP address.

port

Specifies the remote port number or name to use for the connection. With the INTERNET protocol, the default is the TELNET port.

RESTRICTIONS

Do not use this command in extended mode.

EXAMPLE

This example shows how to connect to a remote system.

```
TELNET>connect internet unix
Trying... Connected to UNIX.EXAMPLE.COM
login:
```

CREATE-NTY

Connects the local end of a TELNET connection to an NTY pseudo-terminal device. This device can be used by other applications such as KERMIT. This command includes the remote host and port number in the `SHOW TERMINAL` "remote port information" field.

FORMAT

`CREATE-NTY`

EXAMPLE

```
TELNET>create-nty
TELNET session now connected to _NTY3:
%DCL-I-ALLOC, _NTY3: allocated
$
```

DEBUG

Displays TELNET option negotiations.

FORMAT

`DEBUG [mode]`

PARAMETERS

mode

Specifies whether debugging is enabled (default) or disabled (OFF). Debug mode causes TELNET to display option negotiations between the local host and the foreign host.

EXAMPLE

This example shows how to enable DEBUG mode.

```
TELNET>debug on
```

ECHO

Turns on or off remote host character echoing.

FORMAT

`ECHO` *mode*

PARAMETERS

mode

Specifies whether the server handles character echoing. If you specify `OFF`, TELNET performs local character echoing. If you specify `ON`, the remote system performs the echoing.

RESTRICTIONS

Use this command only in extended mode.

EXAMPLE

```
TELNET>echo off
```

EXIT

Closes any open TELNET connection and exits to DCL. `EXIT` is the same as `BYE` and `QUIT`.

FORMAT

`EXIT`

EXAMPLE

This example shows how to exit TELNET.

```
TELNET>exit
$
```

HELP

Displays help information for the specified TELNET command. Type **HELP ?** to see a list of HELP topics, or type **HELP** with no argument to see general information regarding TELNET.

FORMAT

HELP [*command*]

PARAMETERS

command
Specifies information about this command.

EXAMPLE

```
TELNET>help
HELP
Displays help information for the specified TELNET command.
Type HELP ? to see a list of HELP topics, or type HELP with no
argument to see general information regarding TELNET.
Format
HELP [command]
Additional information available:
ATTACH   BYE    CONNECT    DEBUG    EXIT    HELP    LOG-FILE
PUSH     QUIT   SET        SPAWN    STATUS  TERMINAL-TYPE
VERSION
Topic?
```

LOG-FILE

Enables or disables logging of the TELNET session. If you specify a *log_file*, everything received by the local system from the remote system is copied into this file.

FORMAT

LOG-FILE *log_file*

PARAMETERS

log_file

Specifies a file to which to write a log of the TELNET session. If you do not specify a file, logging is enabled to the file TELNET.LOG. If you specify the file name NONE, logging is disabled.

RESTRICTIONS

LOG-FILE is not supported in 3270 or 5250 modes.

EXAMPLE

This example shows how to enable TELNET output to be logged to the file ST_TMP:DEBUG.LOG.

```
TELNET>log-file st_tmp:debug.log
[Log file open (ST_TMP:<TMP>DEBUG.LOG.1)]
TELNET>
```

PUSH

Starts and attaches a DCL subprocess. If a parent process exists, attach to it. To return from DCL, use the ATTACH or the LOGOUT command. To switch back from a DCL subprocess, use the ATTACH command. If the MULTINET_DISABLE_SPAWN logical is set, PUSH does not work.

FORMAT

PUSH

QUIT

Closes any open TELNET connection and exits to DCL. `QUIT` is the same as `EXIT`.

FORMAT

`QUIT`

EXAMPLE

This example shows how to exit TELNET.

```
TELNET>quit
$
```

SET ABORT-OUTPUT-CHARACTER

Sets the character that TELNET maps to the ABORT OUTPUT sequence. The value set by this command is not the character passed to the remote host. The remote host receives an ABORT OUTPUT sequence; SET ABORT-OUTPUT-CHARACTER defines the key you press to tell TELNET to send an ABORT OUTPUT sequence. This character can also be set by invoking TELNET with the /ABORT_OUTPUT_CHARACTER qualifier.

FORMAT

SET ABORT-OUTPUT-CHARACTER *character*

PARAMETERS

character

Specifies which character sends the ABORT OUTPUT sequence to the TELNET server. If you type the command without specifying *character*, it defaults to Ctrl+O.

EXAMPLE

This example sets the ABORT OUTPUT character to Ctrl+A.

```
TELNET>set abort "^A"
[Abort Output character set to ^A]
TELNET>
```

SET ARE-YOU-THERE-CHARACTER

Sets the character that TELNET maps to the ARE YOU THERE sequence. The value set by this command is not the character passed to the remote host. The remote host receives an ARE YOU THERE sequence; SET ARE-YOU-THERE-CHARACTER defines the key you press to tell TELNET to send an ARE YOU THERE sequence. This character can also be set by invoking TELNET with the /ARE_YOU_THERE_CHARACTER qualifier. The ARE YOU THERE sequence can be sent by pressing the ARE YOU THERE character or by issuing the TELNET AYT command.

> **Note:** The ARE YOU THERE sequence only displays an information line from the host if broadcasts are enabled for the terminal.

FORMAT

SET ARE-YOU-THERE-CHARACTER *character*

PARAMETERS

character

Specifies which character sends the ARE YOU THERE sequence to the TELNET server. If you type the command without specifying character, it defaults to Ctrl+T.

EXAMPLE

This example sets the ARE YOU THERE character to Ctrl+T.

```
TELNET>set are-you-there "^T"
[Are-You-There character set to ^T]
TELNET>
```

SET AUTO-FLUSH

Turns auto-flushing on or off. You can also set this mode by invoking TELNET with the /AUTOFLUSH qualifier.

When you define an ABORT-OUTPUT character, enabling AUTO-FLUSH (SET AUTO-FLUSH ON) causes TELNET to flush any data which may be in the network buffers when the ABORT-OUTPUT character is typed. The TELNET client does this by sending a TIMING-MARK command to the TELNET server and discarding all data until one is received in response.

FORMAT

SET AUTO-FLUSH *mode*

PARAMETERS

mode

Turns auto-flush ON or OFF. If you do not specify *mode*, it defaults to ON.

EXAMPLE

This example sets the Auto Flush option on.

```
TELNET>set auto-flush on
TELNET>
```

SET BREAK-CHARACTER

Sets the character that TELNET maps to the BREAK sequence. The value set by this command is not the character passed to the remote host. The remote host receives a BREAK sequence; `SET BREAK-CHARACTER` defines the key you press to tell TELNET to send a BREAK sequence. You can also set this character by invoking TELNET with the `/BREAK_CHARACTER` qualifier.

FORMAT

`SET BREAK-CHARACTER` *character*

PARAMETERS

character

Specifies which character sends the BREAK sequence to the TELNET server. If you type the command without specifying *character*, it defaults to `Ctrl+A`.

EXAMPLE

This example sets the BREAK character to `Ctrl+A`.

```
TELNET>set break "^A"
[Break character set to ^A]
TELNET>
```

SET DEBUG

Enables or disables the display of TELNET option negotiations. You can also set this mode by invoking TELNET with the /DEBUG qualifier.

FORMAT

SET DEBUG [*mode*]

PARAMETERS

mode

Turns debugging ON or OFF. If *mode* is not specified, the default is ON.

EXAMPLE

This example enables DEBUG mode.

```
TELNET>set debug on
```

SET ERASE-CHARACTER-CHARACTER

Sets the character that TELNET maps to the ERASE CHARACTER sequence. The value set by this command is not the character passed to the remote host. `SET ERASE-CHARACTER-CHARACTER` defines the key you press to tell TELNET to send an ERASE CHARACTER sequence. This character can also be set by invoking TELNET with the `/ERASE_CHARACTER_CHARACTER` qualifier.

FORMAT

`SET ERASE-CHARACTER-CHARACTER` *`character`*

PARAMETERS

`character`

Specifies which character sends the ERASE CHARACTER sequence to the TELNET server. If you type this command without specifying *`character`*, it defaults to `DEL`.

EXAMPLE

This example sets the ERASE CHARACTER to `Ctrl+A`.

```
TELNET>set erase "^A"
[Erase character set to "^A"]
TELNET>
```

SET ERASE-LINE-CHARACTER

Sets the character that TELNET maps to the ERASE LINE sequence. The value set by this command is not the character passed to the remote host; `SET ERASE-LINE-CHARACTER` defines the key you press to tell TELNET to send an ERASE LINE sequence. This character can also be set by invoking TELNET with the `/ERASE_LINE_CHARACTER` qualifier.

FORMAT

`SET ERASE-LINE-CHARACTER` *character*

PARAMETERS

character
Specifies which character sends the ERASE LINE sequence to the TELNET server. If you type the command without specifying character, it defaults to `Ctrl+U`.

EXAMPLE

This example sets the ERASE LINE character to `Ctrl+U`.

```
TELNET>set erase-line "^U"
[Escape Line character set to ^U
TELNET>
```

SET ESCAPE-CHARACTER

Sets the character that switches TELNET to command mode. This character can also be set by invoking TELNET with the `/ESCAPE_CHARACTER` qualifier.

FORMAT

`SET ESCAPE-CHARACTER` *character*

PARAMETERS

character

Specifies which character is used as the TELNET ESCAPE character. If you type the command without specifying character, it defaults to `Ctrl+^`.

EXAMPLE

This example sets the ESCAPE character to `Ctrl+^`.

```
TELNET>set escape "^\"
[Escape character set to ^\]
TELNET>
```

SET EXTENDED

Causes TELNET to go into extended command mode automatically whenever you type the TELNET ESCAPE character, `Ctrl+^` by default.

FORMAT

`SET EXTENDED` *mode*

PARAMETERS

mode

Turns extended mode `ON` or `OFF`. If you do not specify *mode*, it defaults to `ON`.

EXAMPLE

This example enables the extended option.

```
TELNET>set extended on
TELNET>
```

SET INTERRUPT-PROCESS-CHARACTER

Sets the character that TELNET maps to the INTERRUPT PROCESS sequence. The value set by this command is not the character passed to the remote host. The remote host receives an INTERRUPT PROCESS sequence; `SET INTERRUPT-PROCESS-CHARACTER` defines the key you press to tell TELNET to send an INTERRUPT PROCESS sequence. You can also set this character by invoking TELNET with the `/INTERRUPT_PROCESS_CHARACTER` qualifier.

FORMAT

`SET INTERRUPT-PROCESS-CHARACTER` ***character***

PARAMETERS

character

Specifies which character sends the INTERRUPT PROCESS sequence to the TELNET server. If you type the command without specifying character, it defaults to `Ctrl+C`.

EXAMPLE

This example sets the INTERRUPT PROCESS character to `Ctrl+C`.

```
TELNET>set interrupt-process "^C"
[Interrupt Process character set to ^C]
TELNET>
```

SET LOCAL-FLOW-CONTROL

Specifies whether or not Ctrl+S and Ctrl+Q should be treated by the local terminal driver as XON and XOFF. You can also set this mode by invoking TELNET with the /LOCAL_FLOW_CONTROL qualifier.

Use of this qualifier causes a more responsive XOFF, which helps prevent data loss, but the remote system is unable to see any Ctrl+S characters.

The default under the MultiNet TELNET utility is to use the current setting of the VMS terminal characteristic TT$_TTSYNC (set by the DCL command SET TERMINAL/TTSYNC), unless the remote host supports the TOGGLE-FLOW-CONTROL TELNET option. In that case, the LOCAL-FLOW-CONTROL option is set automatically by the TELNET server.

FORMAT

SET LOCAL-FLOW-CONTROL *mode*

PARAMETERS

mode

Turns local flow control ON or OFF. If mode is not specified, it defaults to ON.

EXAMPLE

This example enables local processing of Ctrl+S and Ctrl+Q.

```
TELNET>set local-flow on
TELNET>
```

SET LOG-FILE

Enables or disables logging of the TELNET session. You can also set a log file by invoking TELNET with the /LOG_FILE qualifier.

FORMAT

SET LOG-FILE *log_file*

PARAMETERS

log_file

Specifies a file to which to write the log of the TELNET session. If you specify *log_file*, everything received by the local system from the remote system is copied into this file. If you do not specify a file, logging is enabled to the file TELNET.LOG. If you specify the file name NONE, logging is disabled.

RESTRICTIONS

log_file is not supported in 3270 and 5250 modes.

SET REMOTE-USERNAME

Specifies the user name to which you want to log in using Kerberos. If you are not logging in with the `/AUTH` qualifier, TELNET prompts you to supply a user name.

FORMAT

`SET REMOTE-USERNAME` *`username`*

PARAMETERS

`username`
Specifies the user name to which you want to log in using Kerberos.

SET UNIX-LINE-TERMINATOR

Causes TELNET to use the 4.3BSD UNIX end-of-line specification, `Ctrl+NULL`. You can also set this mode by invoking TELNET with the `/UNIX` qualifier. This command is useful when using TELNET to connect to 4.3BSD UNIX systems whose TELNET server does not conform to the TELNET specification.

FORMAT

`SET UNIX-LINE-TERMINATOR` *mode*

PARAMETERS

mode

If `mode` is `ON`, TELNET uses the 4.3BSD UNIX end-of-line specification, `Ctrl+NULL`. If `mode` is `OFF` (the default), TELNET uses the standard end-of-line specification, `Ctrl+LF`.

EXAMPLE

This example enables use of a 4.3BSD UNIX-style line terminator.

```
TELNET>set unix-line-terminator on
TELNET>
```

SPAWN

Executes a single DCL command, or if entered without options, starts a subprocess with the same effect as PUSH. To return from DCL, use the LOGOUT command. If the MULTINET_DISABLE_SPAWN logical is set, SPAWN does not work.

FORMAT

SPAWN [*command*]

PARAMETERS

command
Specifies a command to execute. If you omit command, a DCL command line subprocess is created.

QUALIFIERS

/INPUT=*file-spec*
Specifies an input file to the command you enter with SPAWN.

/LOGICAL_NAMES
/NOLOGICAL_NAMES
Specifies that logical names and logical name tables are not copied to the subprocess.

/SYMBOLS
/NOSYMBOLS
Specifies that global and local names are not passed to the subprocess.

/WAIT
/NOWAIT
Returns control without waiting for the command to complete. Do not use this qualifier with commands that have prompts or screen displays.

/OUTPUT=*file-spec*

Specifies a file that retains the output of the command invoked with `SPAWN`. This qualifier only works when a single command is entered without creating a DCL subprocess. In addition, this qualifier is positional; you must enter it immediately after `SPAWN` or other qualifiers.

STATUS

Displays the status of the current TELNET connection and parameters.

FORMAT

```
STATUS
```

EXAMPLE

```
TELNET>status
This is BIGBOOTE.EXAMPLE.COM, VMS Version V8.4
Connected to host CONE.EXAMPLE.COM, a VAXSTATION-4000-90 running VMS via
TCP.
Remote host is echoing
Host is not sending binary
Client is not sending binary
NO Abort Output character
NO Interrupt Process character
NO Are-You-There character
NO Break Character character
NO Erase Character character
NO Erase Line character
Escape Character character is '^^'
Normal End Of Line mapping
Local Flow control
No log file
Terminal type is vt100
Remote host status reply:
BIGBOOTE::_VTA12: 16:40:02   (DCL)   CPU=00:00:03.21 PF=686 IO=196 MEM=514
```

TERMINAL-TYPE

Specifies a terminal type for the TELNET session.

FORMAT

`TERMINAL-TYPE` *type*

PARAMETERS

type

Refer to RFC-1340 for a list of possible terminal types. RFCs are provided on the MultiNet CD-ROM. MultiNet TELNET permits you to specify any terminal type, even if the terminal type is not listed in the RFC. The `TERMINAL-TYPE` command has the same effect as invoking TELNET with the `/TERMINAL_TYPE` qualifier.

EXAMPLE

```
TELNET>terminal-type dec-vt220
```

VERSION

Displays the TELNET version number.

FORMAT

```
VERSION
```

EXAMPLE

```
TELNET>version
This is MultiNet K5-TELNET V5.6(13)
TELNET>
```

Appendix D. TFTP Command Reference

The MultiNet TFTP utility uses the Internet-standard Trivial File Transfer Protocol (TFTP) to transfer files between the local host and a remote host. This appendix describes the commands you can use during a TFTP session.

Command Summary

The below table lists the TFTP commands:

Command	Description
`CONNECT`	Specifies the name or address of the TFTP server.
`GET`	Transfers *`remote_file`* on the remote host to *`local_file`* on the local host.
Error! Reference source not found.	Copies *`local_file`* on the local host to *`remote_file`* on the remote host.
Error! Reference source not found.	Terminates TFTP and returns to DCL.
Error! Reference source not found.	Specifies the amount of time TFTP waits for a response to arrive before retransmitting a request. The default value for the retransmission timer is five seconds.
Error! Reference source not found.	Displays the current TFTP status.
Error! Reference source not found.	Sets the amount of time TFTP waits for a response from the server before aborting a transfer.

Error! Reference source not found.	Toggles TFTP packet tracing.

CONNECT

Specifies the name or address of the TFTP server. This value overrides the command line host specification. You may use either a symbolic host name or an Internet address.

This command does not cause any network action, but sets the destination address for the TFTP UDP packets. If the host cannot be reached, an error is not displayed until a `GET` or `PUT` command is attempted.

FORMAT

`connect` *`host`*

PARAMETERS

`host`
Specifies a remote host.

EXAMPLE

This example connects to the host EXAMPLE.COM.

```
tftp>connect example.com
```

GET

Transfers *remote_file* on the remote host to *local_file* on the local host.

You must specify an absolute path name (device, directory, and file name) for *remote_file*, and typically the server requires the file to be world-readable. If you do not specify *local_file*, the default is the same name and directory as *remote_file*.

FORMAT

`get remote_file [local_file]`

PARAMETERS

remote_file
Specifies the name of the input file on the remote host.

local_file
Specifies the name of the output file on the local host.

EXAMPLE

This example retrieves the file `USERS:[SMITH]LOGIN.COM` and stores it in the file `LOGIN.COM`.

```
tftp>get users:[smith]login.com login.com
Received 2361 bytes in 1 seconds.
tftp>
```

PUT

Copies *local_file* on the local host to *remote_file* on the remote host.

You must use absolute pathnames on *remote_file*, and typically the server requires the file to already exist and be world-writable (W:W). If you do not specify *remote_file*, it defaults to the same name and directory as *local_file*.

FORMAT

put *local_file* [*remote_file*]

PARAMETERS

local_file
Specifies the name of the input file on the local host.

remote_file
Specifies the name of the output file on the remote host.

EXAMPLE

This example transfers SYS$LOGIN:LOGIN.COM to the remote file specification /tmp/foo.

```
tftp>put sys$login:login.com /tmp/foo
Sent 2361 bytes in 1 second.
tftp>
```

QUIT

Terminates TFTP and returns to DCL.

FORMAT

```
quit
```

EXAMPLE

```
tftp>quit
$
```

REXMT

Specifies the amount of time TFTP waits for a response to arrive before retransmitting a request. The default value for the retransmission timer is five seconds.

FORMAT

`rexmt` *`seconds`*

PARAMETERS

`seconds`
Sets the TFTP retransmission timer to the specified number of seconds.

EXAMPLE

This example sets the TFTP retransmission timer to 10 seconds.

```
tftp>rexmt 10
```

STATUS

Displays the current TFTP status.

FORMAT

```
STATUS
```

EXAMPLE

This example shows how to display TFTP status after a connection has been made to EXAMPLE.COM. All values shown are the defaults.

```
tftp>status
Connected to EXAMPLE.COM.
Mode: octet Tracing:  off
Rexmt-interval:  5 seconds, Max-timeout: 25 seconds
tftp>
```

TIMEOUT

Sets the amount of time TFTP waits for a response from the server before aborting a transfer.

The `REXMT` command controls how often the request is retransmitted. The default value for the maximum timeout is 25 seconds.

FORMAT

`timeout` *`seconds`*

PARAMETERS

`seconds`
Specifies the number of seconds for the maximum timeout allowed per TFTP packet.

EXAMPLE

This example shows how to set the maximum timeout to 50 seconds.

```
tftp> timeout 50
tftp>
```

TRACE

Toggles TFTP packet tracing.

FORMAT

```
trace
```

EXAMPLES

This example shows how to enable TFTP packet tracing. Issue the command a second time to disable packet tracing.

```
tftp>trace
Packet tracing on.
tftp>
```

This example shows a transfer with packet tracing enabled.

```
get use2s:[smith]login.com .com
sent LOCALHOST.69   RRQ <file=users:[smith]login.com, mode=octet>
received LOCALHOST.69       DATA <block=1, 512 bytes>
sent LOCALHOST.69   ACK <block=1>
received LOCALHOST.69       DATA <block=2, 512 bytes>
sent LOCALHOST.69   ACK <block=2>
received LOCALHOST.69       DATA <block=3, 512 bytes>
sent LOCALHOST.69   ACK <block=3>
received LOCALHOST.69       DATA <block=4, 512 bytes>
sent LOCALHOST.69   ACK <block=4>
received LOCALHOST.69       DATA <block=5, 313 bytes>
Received 2361 bytes in 2 seconds.
tftp>
```