

# Client/Server Telnet

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This chapter describes the Cisco IOS for S/390 Telnet facilities. It provides the information necessary to develop a working knowledge of the Cisco IOS for S/390 implementation of Client Telnet and Server Telnet. This chapter contains these sections:

- **Introducing Client/Server Telnet**  
Provides a brief overview of the services Client Telnet provides.
- **Client Telnet**  
Describes how to use the Client Telnet facilities to access Cisco IOS for S/390 locally.
- **Server Telnet**  
Describes how to use the Server Telnet facilities to access Cisco IOS for S/390 remotely.
- **Telnet Escape Sequences**  
Describes the escape sequences Cisco IOS for S/390 uses to implement the Telnet protocol.

## Introducing Client/Server Telnet

Cisco IOS for S/390 provides Client Telnet facilities that let TSO and VTAM users access your network through the Telnet protocol. Cisco IOS for S/390 also provides Server Telnet facilities that let remote network users access host application programs. These facilities are shown in Table 6-1.

**Table 6-1 Telnet Facilities**

User-level Protocol	Service	Notes
Server Telnet	Lets network users access TSO and other VTAM applications.	Application must support 3278 or 3767 through VTAM.
	Provides Cisco IOS for S/390 help, news, status display, etc.	Implemented within Cisco IOS for S/390.
Client Telnet	Lets MVS users access network hosts.	Supports access from 3278s and 3767s via VTAM and from TSO via the <b>TELNET</b> command.

## Client Telnet

The Client Telnet facilities provide local access to your network via Cisco IOS for S/390. You can access Cisco IOS for S/390 locally in either of these ways:

- Indirectly, using the Client Telnet (or FTP) command processors under TSO

The TSO Telnet processor supports line-by-line and full-screen terminals, but both are mapped into line-by-line Network Virtual Terminal (NVT) operation of the remote host. A difficulty with this program is that TSO supports only half-duplex locked-keyboard operation, which makes access to character-by-character hosts awkward. You can receive pending screen data only by using Enter.

The TSO Telnet program is written in PL/I and you must have the PL/I Transient (runtime) Library (an IBM program product). Some useful features of this program are saving typescripts and multiplexing several sessions at once.

- Directly, using VTAM-supported 3767 or 3278 terminals

Although the Cisco IOS for S/390 3278 terminal manager does not have all the features of the TSO Telnet program, it can access the 3278 with a true full-duplex unlocked-keyboard protocol.

The 3278 can either be mapped into line-by-line operation as an NVT or can be operated in transparent 3278 full-screen mode to access a remote IBM MVS or VM server.

## The TSO Client Telnet Command

The TSO Client Telnet command, **TELNET**, provides a TSO Client Telnet interface to the network. The **TELNET** command supports only line-by-line or NVT operation of remote hosts. However, it has functions, such as multiple concurrent sessions, that the direct VTAM Client Telnet lacks.

Client Telnet operates the local terminal in either line or screen mode, depending on whether it is accessed from a terminal of the IBM 3270 family or from an ASCII terminal. Choice of mode is automatic and usually transparent. However, you can override the automatic choice if you need to operate in line mode on a terminal. This may prove useful if you use facilities such as the Session Manager in TSO/E.

Since IBM systems normally do not support character-by-character interactions, Client Telnet does not operate in character-oriented mode, and it can be inconvenient to communicate with processes on remote hosts that do operate in such a mode. Because there may be such hosts on a network, Client Telnet implements devices and techniques to ease the incompatibility.

The TSO Telnet program screen mode can present one or more multiplexed line-oriented terminal sessions; however, full-screen interaction with a processing program is not possible with this version of the program.

In screen mode, Client Telnet does all its own screen management. Client Telnet is not compatible with operation under the IBM ISPF program product. It can be invoked under ISPF, as can most TSO command processor programs, but Client Telnet is not aware of the ISPF environment, so it does not support such ISPF features as split-screen operation. In anticipation of future enhancements, this version of Client Telnet reserves certain screen fields and function keys for ISPF compatibility.

Some options of the TSO Telnet program (the **PRINT** and **TEST** commands) require allocation of a SYSPRINT file, but this is not absolutely necessary in normal operation (that is, when you are not using **PRINT** or **TEST**).

Allocating a SYSPRINT file to the terminal in screen mode causes constant switching between screen and line modes. To avoid this, allocate the SYSPRINT file to a SYSOUT file instead of to the terminal.

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## The TELNET Command

Invoke the TSO Telnet program with the TSO **TELNET** command in one of these forms:

**TELNET**

**TELNET** / *argument argument...*

No arguments are required and none are useful to most Client Telnet users. Any that are specified must be preceded by slash (/) to accommodate the conventions of the PL/I runtime support package.

The two classes of **TELNET** command options, general and debugging, are described in the following sections.

## General Command Options

These are the general Telnet command options:

- TTY

The TTY option specifies that your terminal is capable of generating carriage returns. Since virtual 3767 line terminals such as those supported by the Virtual Line Terminal (VLT) facility do not generate carriage return (CR) or new line (NL) characters at the end of lines, Client Telnet automatically appends an NL to every line of user input that is received. The TTY option disables this by specifying to Client Telnet that your terminal appends either a CR or an NL at the end of every line of input. This option is useful in supporting real local ASCII terminals that connect to TSO through TCAM, NTO, or NPSI.

- LINE

The LINE option causes the TSO Telnet program to drive the terminal in line mode even if the terminal is a CRT.

- SYS

The SYS option, in the form **SYS=x**, where *x* is an arbitrary character, causes Client Telnet to open its VLT connection to a network name of **ACCESx** instead of the usual **ACCES**. This allows communication through a test version of Cisco IOS for S/390.

- APPLID

The APPLID option, in the form **APPLID=aaaaaaaa**, where *aaaaaaaa* specifies to the TSO Telnet program the default VTAM application ID of the local Cisco IOS for S/390. This command causes Client Telnet to open its VLT connection to a network name of *aaaaaaaa* instead of the usual **ACCES**. If supplied, this parameter need not point exclusively to the local Cisco IOS for S/390; it can refer to any VTAM application. For example, TSO is the necessary APPLID to connect to TSO.

### Debug Options

The debugging options, TEST and U, are described here:

- TEST

The TEST option causes the program to operate in test mode, where status information is written to the SYSPRINT file. This information is essentially unformatted and is not useful to the casual Telnet user.

- U

The U option, specified as *U=userid*, modifies the output of TEST mode. It arranges to send the output via **TPUT** to the specified TSO user ID instead of to SYSPRINT.

### TSO Client Telnet Operation

Once the program has been activated, you can enter Telnet commands or data to be transmitted on the session. In session data, the logical not character (¬) is reserved as an escape character. To transmit the ¬ character, you must type it twice (¬¬). Refer to Telnet Escape Sequences for details on using the Telnet escape character.

### Line Mode Operation

TSO Telnet operates in line mode if TSO believes your terminal is line-oriented or if you have used the LINE argument when invoking the program. In most cases, Client Telnet commands operate essentially the same in either line or screen mode.

The techniques used to send data lines in line mode are described here:

- The keyboard operates in unlocked mode; you can type at any time. However, the underlying TSO system is operating in half-duplex, line-by-line mode, so sometimes your typing might be interrupted. If Client Telnet interrupts your typing with output, you must retype the portion that was not successfully read. It is not always possible to tell which characters were read and which were not, so it is best to abort the input line and start over. Since you usually know when output is expected and when it is not, this should not be a problem.
- In line mode, the data you type is sent to the currently active session unless the first character is a greater than ( > ) symbol (in which case it is sent to the TSO Telnet program rather than to the currently active session) or there is no session active. In either case, the data is taken to be a Telnet command.
- When you terminate an input line (including a null line) with a carriage return, the data is sent with a new line character appended.
- When you terminate an input line with CONTROL-D, the data is sent without a new line character. This facilitates communication with remote systems that operate in character mode.
- CONTROL-C and ESCAPE can be used as data characters and are transmitted properly. Most other control characters are filtered from the input by TSO. CONTROL-C is usually interpreted by a remote IBM process as an attention.
- The ATTN key is reserved for use by the local process. It stops output flow long enough to enter an input line.

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## Screen Mode Operation

TSO Telnet operates in screen mode if your terminal is believed by TSO to be a display terminal of the 3270 family and if you have not used the `LINE` argument when invoking the program. The rules of screen mode interaction seem complex, but screen mode is very useful.

In screen mode, the screen is divided into the following areas:

- The TSO Telnet banner and version number  
This field is also used to present short error or exception messages.
- The primary input area  
This 149-character field (`CMD`) is where you type most session input and Telnet commands, so TSO Telnet keeps moving the cursor to the beginning of this field.
- The command input area  
This field is provided for future ISPF compatibility and is not needed for normal TSO Telnet operation.
- The current VTAM application identification default  
This field points to the local Cisco IOS for S/390 application. Every Telnet **CONNECT** command initiates a VTAM connection to the Cisco IOS for S/390 currently identified by the `APPLID` default. Multiple VTAM sessions to different VTAM applications are possible by changing the `APPLID` default dynamically. This is described in VTAM Client Telnet.
- The current session identification  
When a session has been established, this identifies the session number and the host to which it is connected.
- A list of other session numbers  
Each session number is a single symbol, hence the limit of ten concurrent sessions. If a session is defined but not currently selected, its symbol **I** appears in this list. If the session has output waiting, its symbol **O** appears in the list. Undefined sessions are shown as a period (.).
- A separator row of dash characters (-)  
This row conceals a set of indicators that are replaced as various operating modes are activated. These are the operating modes:
  - `AUTO` for automatic page turning
  - `NOECHO` for non-display of output
  - `READ` during read processing
  - `WRITE` during write processing
  - `SLEEP` when the keyboard is disabled
  - `TEST` during test debugging
  - `HIDE` when the input line is turned into a non-display line
- 17 rows of output area  
Both input and output data are echoed to the output area. This data is not scrolled; the current output line is indicated by a row of equal characters (=). The line of equal characters rolls around the screen, erasing old output and overlaying it with new. When the indicator wraps from the bottom of the output area to the top, press `Enter` to prevent overwriting data that has not been read (in other words, “turn the page”).

- 2 rows of Program Function key (PF) definitions, associating certain commands with function keys

These associations are fixed and cannot be overridden. The key assignments are chosen to be compatible with the default assignments used by the ISPF program product, and, in this version, some function keys are reserved for ISPF functions that have not yet been implemented (SPLIT and SWAP). Like ISPF, Client Telnet follows the convention that there are no functions available through function keys that are not also available through commands.

In screen mode, you normally type into the input area; however, you can modify lines in the output area and cause them to be reread as input. Read Retransmitting Data.

### The NULL Transaction

In most cases, Client Telnet commands operate the same in either line or screen mode. However, the techniques used to send data lines and to differentiate them from command lines are different. Because IBM terminals operating under TSO are half-duplex, it is not possible to operate in screen mode with an unlocked keyboard.

For a NULL transaction in screen mode, press Enter with no screen fields modified or with all modified fields blank for a no-operation. This does not send data; it merely returns control of the terminal to the TSO Telnet program and allows the program to switch into output mode.

The most obvious effect of this is that an empty line can be sent *only* by using a Telnet command (XWNL) or a function key (PF10, which sends a NULL transaction and a new line (NL)).

A more important effect is that communication in screen mode frequently requires constantly using Enter to keep output flowing. Client Telnet tends to hold control of the terminal until there is an indication that no more output is immediately available. You can control how long the program waits for this indication, but the defaults are satisfactory for most conditions. While the null transaction is used frequently in screen mode, the real work of a Telnet session is done with the other kinds of transactions. The most common occur when non-blank data is typed into the input field and/or when the keyboard is locked through a key other than Enter.

### Sending Data

There are several ways to send data to the current session. The usual method is to type a complete input line into the input area and press Enter, which stands for the **SEND** command. The data is sent, including explicit leading and trailing blanks, and a new line character is sent after them.

Another method is to type the **SEND** command (or one of the other similar commands) into the input area, followed by the data to be sent, and then press PF5 instead of Enter. PF5 stands for the **EXEC** command, which causes Client Telnet to parse its input into a command and an operand string, and then to execute the command. The operand string begins with the character after the single blank that terminates the command.

A third method is to type the data into the input field and press a function key that has been assigned the value of a command. This is equivalent to using an explicit command and PF5 (**EXEC**).

With any of these methods, you can enter a command name in the command field on the screen. That command takes precedence over the command implied by the key you press. Normally, you do not need to use this method of input, but the rules of interaction with ISPF make it necessary.

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## Command Entry Rules

Many Client Telnet commands perform functions other than sending data. In all cases, the same rules apply.

- If you clear the screen and enter the command at the top left of the screen, the key you use has no effect. The command is parsed for a command verb and operands. (This is compatible with a panic exit, such as **CLEAR** followed by **END**.)
- If you modified the CMD field, its contents are the command verb. Otherwise, the verb is implied by the key you pressed.
- Operands for the command are in the CMD field.
- Any command of the class that transmits data is not active if there is no current session. Such a command is treated as an implied **EXEC**. This means that if there is a current session, strings entered with Enter are data to be transmitted. If there is no current session, strings entered with Enter are commands.
- The > convention sends Telnet commands as if PF5 were pressed. When used in line mode it does not apply to keyboard input in screen mode. (Read the description of the **READ** command in Commands for Controlling Input and Output for a situation in which it does apply.)

## Retransmitting Data

You can edit and retransmit lines from the output area of the screen. However, each line of the output area is a screen field and the folding of received data to accommodate the 79-character usable screen width might split a logical line into two separate fields. To make the feature easier to use, PF4 has been assigned the **CURSOR** command. The **CURSOR** command moves the physical cursor to the beginning of the last line echoed into the output area.

These are the rules of transmission from the output area:

- For every user interaction, there is an implicit command that is determined either by the contents of the CMD field or by the function key pressed. (The PA and Enter keys are included for this purpose.)
- For every such interaction, there is an ordered set of modified data fields, potentially including the input area and each line of the output area. The ordering is from the top of the screen down.
- The implied command is applied once with the operand field composed of the concatenation of all the modified data fields. New line characters are not automatically inserted when two lines are concatenated. Use the - (dash) command to insert them.

## Function Keys

A fixed mapping of commands onto function keys is used in this version of Client Telnet. The commands that can be executed by pressing function keys are listed in Table 6-2:

**Table 6-2 Client Telnet Function Keys**

Function Key	Associated Command	Function Key	Associated Command
PF1	HELP	PF7	XESC
PF2	No action	PF8	XCTL
PF3 *	END/BYE	PF9	HIDE
PF4	CURSOR	PF10	XWNL
PF5	EXEC	PF11	XNNL
PF6 *	BRK/KO	PF12	RETURN
Enter	SEND	PA1 *	ATTN/IP
		PA2	RESHOW

**Note** Those commands annotated with an asterisk can be entered when the screen shows the message **HIT ENTER TO TURN PAGE**.

## TSO Client Telnet Commands

This section outlines commands for sending data, for session control, for controlling input and output, and miscellaneous commands.

Some commands can be entered by hitting a programmed function key. Where a function key can be used in place of typing the command, the key name is shown to the right of the command name.

### Commands for Sending Data

These are the commands for sending data:

- **SEND** or **ENTER**

The **SEND** command sends its operand followed by a new line. If the operand is null, **SEND** has no effect (no-op).

- **XWNL** or **PF10**

The **XWNL** transmit with null line command sends its operand followed by a new line. A null operand results in only a new line.

- **XNNL** or **PF11**

The **XNNL** transmit with no null line command sends only its operand. If the operand is null, **XNNL** is a no-op.

- **XCTL** or **PF8**

The **XCTL** transmit control command sends its operand after transforming only the last character into control case (CONTROL-x). If the operand is null, **XCTL** is a no-op.

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- **XESC or PF7**

The **XESC** transmit escape command sends its operand followed by an escape. If only an escape is sent, a null operand results.

- **KO or PF6**

The **KO** kill output command transmits an abort-output signal followed by an interrupt-process signal. Any operand is ignored.

- **HEX**

The **HEX** command interprets its operand as hexadecimal field characters, so the operand must consist of an even number of hexadecimal digits with no blanks or delimiters. The operand is converted to binary bytes and transmitted. The TSO Telnet program operates in EBCDIC mode and translates your string from EBCDIC to ASCII before placing it on the network.

- **IP or PA1**

The **IP** command transmits an interrupt-process signal. Any operand is ignored.

The PA1 function key is also used for **ATTN** command.

- **BRK or PF6**

The **BRK** command transmits a break signal. Any operand is ignored.

## Commands for Session Control

These commands are sent to Client Telnet to add sessions, switch between sessions, and change the status of a session:

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**Note** Any matching function keys are in parentheses to the right of the command.

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- **APPLID** *string*

Changes the current APPLID default used by TSO Telnet to connect to the local Cisco IOS for S/390. The new APPLID is given by *string*. Thus, connections to multiple copies of Cisco IOS for S/390 or to other VTAM applications are possible.

- **END | BYE (PF3)**

Terminates the current TSO Telnet activity. Normally, this is a session or a HELP screen. However, if no sessions are defined and **HELP** is not in effect, TSO Telnet is terminated. This command is refused if you issue it when there are sessions defined but no session is current.

- **RETURN (PF12)**

Ends all TSO Telnet activity. It is equivalent to multiple **END** commands.

## Commands for Controlling Input and Output

These commands manipulate the TSO Telnet session that is currently running:

- **TTO** *number*

This command is effective only in screen mode. It specifies the number of milliseconds that TSO Telnet is to wait for more output before unlocking a locked keyboard. Large values cause sluggish operation, and small values require excessive use of **ENTER**. The default value of 500 is a reasonable compromise in most cases.

- **READ** *dsname* | **OFF**

The **READ** command opens the file *dsname* and reads its records as Telnet input lines. Each line is processed as though entered from the keyboard with the **ENTER** or carriage return in line mode. This means that if you are operating in screen mode, lines beginning with the greater than (>) character are processed as though entered with PF5, that is, as Telnet commands.

Use this feature carefully, because it can cause confusing results if errors occur.

The *dsname* is specified in the usual TSO syntax, either quoted or unquoted. It can name any file that can be read sequentially with the PL/I **READ** statement, including a PDS member. Blanks and sequence numbers are treated as data by the TSO Telnet **READ** command, so an unsequenced variable-length file is the preferred input form. TSO Telnet continues to accept input from the screen during the **READ** operation. Lines read from the screen are executed at whatever point in the file they fall. The most useful application of this feature is the ability to enter the **READ OFF** command to abort reading. Otherwise, reading proceeds to end-of-file and stops. Obviously, you cannot read a file named **OFF** unless you use its quoted name. When a **READ** operation is in effect in screen mode, a **READ** indicator is visible on the separator line.

- **RTO** *seconds*

The Read Timeout command specifies the number of milliseconds that TSO Telnet is to wait between input records during a **READ** operation. Normally, a **READ** operation is limited by the rate at which the data can be transmitted or by the need to turn the page as the read data is echoed; however, this command is provided for cases where those limitations do not apply. The default value is 500 milliseconds.

- **WAIT** *milliseconds*

This command causes TSO Telnet to pause just once for the number of milliseconds specified. You can interleave your **READ** data with **WAIT** commands at points where you know an operation takes a lot of time. For instance, it is wise to include **WAIT** commands behind **CONNECT** commands and **LOGON** sequences.

- **WRITE** *dsname* **OFF**

Use the **WRITE OFF** command to terminate writing. You cannot write to a file named **OFF** unless you use its quoted name. When a **WRITE** operation is in effect in screen mode, a **WRITE** indicator is visible on the separator line.

**WRITE OFF** opens the file *dsname* and echoes Telnet input and output records into it. This produces a typescript of all interactions with all sessions that TSO Telnet is managing. The named file must already exist. Its DCB characteristics are changed to VB, 260, 4000.

- **PRINT**

This command is effective only in screen mode. It writes a snapshot of only the current screen to the **SYSPRINT** file. It is different from **WRITE**, which writes continuously into a data set of your choice.

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- **ECHO ON | OFF**

This command controls echoing of output to the terminal and, in screen mode, echoing of input to the output area. When **ECHO OFF** has been specified, no output is written to the terminal, and a **NOECHO** indicator is visible on the separator line. This mode is usually used in conjunction with **WRITE**.

- **SAMPLE**

This command is used in **ECHO OFF** mode. It causes a small amount of output data to be echoed. In screen mode, one page is echoed, while in line mode the sample is determined by the size of the data records being received from the network and is usually only a partial line.

**SAMPLE** lets you monitor a session that is writing its output only to a file. However, your **SAMPLE** commands appear in the output file.

- **AUTO ON | OFF**

This command controls automatic page turning in screen mode. When **AUTO ON** (or just **AUTO**) has been specified, pages are turned without your intervention and an **AUTO** indicator is visible on the separator line. This mode, used with **SLEEP** mode, removes the terminal entirely from your control. Avoid using this combination.

- **SLEEP**

This command disables keyboard input (so you do not need to keep pressing **ENTER** to maintain output flow) and places a **SLEEP** indicator on the separator line. The only way to exit **SLEEP** mode is to press **ATTN** (**PA1** in screen mode). This mode can be used with **AUTO** mode to remove the terminal entirely from the user's control. Use caution with this option.

- **ATTN (PA1)**

This command is always invoked through **ATTN**. In screen mode, attention is signaled through **PA1** and is used only to break **SLEEP** mode. In line mode, attention interrupts TSO Telnet operation and requests a new input line. This input is then processed like any other.

The **PA1** function key is also used for the **IP** command.

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**Note** The attention key on a 3278 is the **PA1** key, not the **ATTN** key.

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- **NOTE**

This command introduces a limited comment. No data is transmitted, but when you are in screen mode, data is echoed to the output area.

- **HIDE (PF9)**

This command causes the next input on the terminal not to display. It implements password protection. When in screen mode, **HIDE** causes **HIDE** to appear on the separator line and turns the primary input area into a nondisplay field. It is a toggle switch, so if it is on, you can enter it again to turn it off. Any operand associated with **HIDE** is ignored.

### Miscellaneous Commands

These are some miscellaneous commands that can be useful:

- **EXEC (PF5)**

This command is always invoked through PF5, although it works as a command. It executes its argument as a Telnet command.

- **HELP (PF1)**

This command presents brief tutorial information. In line mode, it lists common commands briefly. In screen mode, it displays a sequence of HELP screens. You can step through the screens with ENTER or return to Client Telnet with PF3.

- **RESHOW (PA2)**

This command is meaningful in screen mode only and is invoked through PA2. It restores the screen to its previous condition.

- **CURSOR (PF4)**

This command is effective in screen mode only. It moves the cursor to the beginning of the last line written to the output area.

- **CLEAR**

This command is effective in screen mode only. It clears the screen for the current session and resets the current output line to the top of the output area, which can be useful in keeping things together on one display screen.

- **TEST ON | OFF**

This command controls the output of debugging information. When **TEST ON** (or just **TEST**) is specified, diagnostic data are written to the SYSPRINT file and a **TEST** indicator displays on the separator line.

- **LOG *userid***

This command modifies the action of **TEST**. *userid* is the target of **TPUT** macro instructions to write the **TEST** output data. The same data is not written to SYSPRINT. This command lets you receive test output in real time, but on another terminal. **LOG** without an operand stops this special behavior.

- **TSO | DO**

This command executes its argument as a TSO command and pre-empts Client Telnet temporarily. When the command processor returns, if screen mode is in effect, Client Telnet refreshes its screen.

### VTAM Client Telnet

Cisco IOS for S/390 is a VTAM primary application and can support 3278 or 3767 terminals with Client Telnet access to your network.

### Invoking VTAM Client Telnet

The VTAM Client Telnet command, **VTELNET**, operates in either NVT (line-by-line) mode or in transparent full-screen 3278 mode, depending on the Telnet negotiations initiated by the remote Server Telnet. The choice of mode is automatic and does not normally concern you except for the usage of special function keys (**PF $n$** ). See NVT Operation from 3278 Terminals for more information on programmable function key assignments.

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Invoke **VTELNET** with one of these commands:

**ACCES** *host\_name*

or

**LOGON APPLID(ACCES) to DATA**(*host\_name*)

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**Note** *host\_name* is a required operand.

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The command is entered on the system login invitation screen in place of the **LOGON** command used to start a TSO session. Here **ACCES** is the VTAM application name for Cisco IOS for S/390 and the permissible host name is defined in Using Host Name Strings in Introduction to Cisco IOS for S/390. For example, if you enter **ACCES SRI-NIC** and the message **SRI-NIC PARAMETER UNRECOGNIZED** displays, it means that the **LOGTAB=INTTAB** parameter has not been set correctly during the Cisco IOS for S/390 installation. Report this problem to your Cisco IOS for S/390 site administrator.

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**Note** The exact VTAM logon command might be different at your installation. If in doubt, contact your Cisco IOS for S/390 site administrator.

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## VTAM Client Telnet Operation

When you enter the VTAM **LOGON** command, VTAM connects the terminal to Cisco IOS for S/390. Cisco IOS for S/390 then checks the host name, displays appropriate error messages, and disconnects the terminal. If the host name is correct, Cisco IOS for S/390 prompts you for a user ID and password, checking that you are allowed access to the network. If you supply the correct user ID and password, the Telnet connection to the remote server is established and the server's banner message displays.

## NVT Operation from 3278 Terminals

While the remote host is operating in normal Telnet ASCII or NVT mode, VTAM Telnet maps line-by-line data onto the local 3278 screen much like TCAS does for TSO.

Each line segment is placed on a blank screen sequentially at the cursor. The control characters BS, CR, and LF affect the cursor in the applicable fashion. Characters typed on the keyboard display and transmit with the carriage return/line feed symbol (CRLF) appended when you press ENTER. The necessary 3278 orders are added to the screen data and deleted from the keyboard data.

The terminal operates in full-duplex local echo mode when controlled by VTAM Telnet. You need not press ENTER or any other key to poll for output. Any data received is immediately displayed. If you attempt to type while data is being sent to the screen, the typed data is lost. This is not normally a problem because usually you must wait for a prompt before beginning to type.

The screen can be erased at any time by pressing CLEAR. This homes the cursor so data display starts at the top of the screen. When the screen is filled, three asterisks (\*\*\*) display on the last line. Read the screen and press ENTER or CLEAR to erase the screen and continue the display of data.

The program function keys map into the functions shown in Table 6-3:

Table 6-3 VTAM Client Telnet Function Keys

Function Key	Associated Command	Action
PF1/PF13	HELP	Displays PF key usage.
PF2/PF14	n/a	No action.
PF3/PF15	END	Disconnects the terminal from Cisco IOS for S/390.
PF4/PF16	<AYT>	Sends the Telnet <b>Are You There</b> message. Any operand is ignored.
PF5/PF17	<AO>	Sends the Telnet <b>Abort Output</b> message. Any operand is ignored.
PF6/PF18	<BRK>	Sends the Telnet <b>Break</b> message.
PF8/PF20	XCTL	Sends typed data, with the last character as <b>CNTL-x</b> .
PF9/PF21	HIDE	Non-display of next input line.
PF10/PF22	XWNL	Sends typed data with <b>CRLF</b> .
PF11/PF23	XNNL	Sends typed data without <b>CRLF</b> .
PF12/PF24	END	Disconnects the terminal from Cisco IOS for S/390.
PA1	IP	Sends the Telnet <b>Interrupt Process</b> message.
PA2	KO	Sends both <b>IP</b> then <b>AO</b> .

Only Enter and PF10/PF22 append CRLF to the data sent. PF7/PF19 appends the ESC character and PF8/PF20 takes the last character typed and converts it to a control character before sending. Enter and PF10/PF22 are similar, but Enter causes the cursor to move to the next line while PF10/PF22 sends a blank line without moving to the next line. Use Enter.

On SNA 3278 terminals, attention maps into the PA1 key for compatibility.

### Full-Screen Operation from 3278 Terminals

If the remote server host is an IBM system (either MVS or VM) and the local user has a 3278-type terminal, **VTELNET** negotiates transparent full-screen mode with the server host.

In full-screen mode, all keys are transmitted and no local action is performed. If you must abruptly disconnect from Cisco IOS for S/390 while in full-screen mode, use the 3278 system request key (SYS REQ).

## Client Telnet for ASCII Terminals

Cisco IOS for S/390 can support Client Telnet access from ASCII terminals and other non-3270 terminals that support remote echo mode. You can run Client Telnet from qualifying clients as if they were full-screen 3270 facilities. Among the supported terminal types are:

- DEC VT52
- DEC VT100
- DEC VT220
- DEC VT320
- IBM316x
- TeleVideo 905
- Zentec 8031

- 
- AT&T 610
  - Hewlett-Packard terminals that have TCP/IP capability

The above list is not all-inclusive. Other kinds of terminals can also process Client Telnet commands. You can display an online listing of terminals supported at your site. See *Invoking Client Telnet from an ASCII Terminal* for details.

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**Note** Certain configuration steps are required to set up Client Telnet access for ASCII and other non-TN3270 terminals, including the installation of Simware Sim3278 TCP/IP software on the target host(s). For details, refer to the *Cisco IOS for S/390 Customization Guide*.

---

## Invoking Client Telnet from an ASCII Terminal

Follow these steps to invoke Client Telnet from an ASCII terminal or other non-3270 terminal:

- 1 At the system prompt, enter the **TELNET** command followed by the host name, and press ENTER. For example:

```
TELNET my_host
```

- 2 At the prompt, enter the command to call the service you want to access. The availability of commands and services is determined by site system managers. Consult your system manager to obtain the command(s) that are valid at your site. For example:

```
TSO
```

- 3 You are prompted to either enter the terminal type or log off.

If you are not sure whether your terminal is supported, type a question mark (?) at the prompt to see a list of supported terminals for your site. For example:

Otherwise, enter the terminal type and press ENTER.

```
VT220
```

- 4 The software validates the terminal access and connects you to the target service.

You can use normal commands and operations to invoke features offered by that service, and to logoff the service.

## Server Telnet

The Server Telnet facilities provide remote access to host application programs through the Telnet protocol. The Server Telnet facility accesses a server subsystem that drives a supported terminal type via ACF/VTAM. This includes TSO, CICS, and other popular subsystems.

The supported (virtual) terminal types are:

- IBM 3767 typewriter terminals (SNA LU1 virtual terminals)
- Locally connected non-SNA IBM 3278 terminals (SNA LU0 virtual terminals)

Either of these can be driven from an NVT to provide line-at-a-time operation for the remote user. The virtual 3278 can also be used in transparent full-screen mode. When you are a remote user from a remote IBM MVS or VM system and open a TCP connection to the well known Telnet server port (23), you are connected to a Telnet server process (ULPP) in Cisco IOS for S/390. If you proceed to logon to TSO, for example, the Telnet server ULPP invokes the Virtual Terminal Facility (VTF), which uses ACF/VTAM to make a cross-address-space connection to the virtual terminal handler for TSO. The ULPP makes all necessary conversions of code and protocols.

Remote users on non-IBM hosts who want to connect to applications in full-screen mode must have 3270 client emulation software on their host.

Server Telnet also supports the use of Session Level USSTAB (Unformatted System Services Tables) and the associated msg10 screens, as described later in this chapter.

## Server Telnet Commands

The Telnet server also implements these pre-logout services within Cisco IOS for S/390:

- **HELP**  
Displays available commands.
- **HELP command**  
Displays help information for that command.
- **NEWS**  
Displays the news data set.
- **BYE, CLOSE, END, QUIT, or LOGOFF**  
Causes Server Telnet to close the connection.
- **NETSTAT**  
Provides status information regarding Cisco IOS for S/390. For system programmers, an alternate entry called **SYSSTAT** is provided that enables the Cisco IOS for S/390 control functions in **NETSTAT**. The Telnet server requires a local **LOGON** before allowing access to **SYSSTAT**. The subcommands of **NETSTAT** are documented in the *Cisco IOS for S/390 Customization Guide*.
- **SIGNON or LOGIN**  
Prompts for user ID and password.
- **SIGNOFF or LOGOUT**  
Logs out the user.
- **ACTEST**  
This is the Cisco IOS for S/390 interactive debugging tool. It requires a local **LOGON** from the Server Telnet and is restricted to system programmers. The subcommands of **ACTEST** are documented in the *Cisco IOS for S/390 Customization Guide*.

### Full-Screen-Only TSO Service Port

At present, the Client Telnet implementation within VM/370 TCP/IP is unable to negotiate full-screen 3278 operation with an MVS service (like TSO) that can support it. The restriction applies only when VM contacts Cisco IOS for S/390 on Server Telnet port 23.

To circumvent this problem, Cisco IOS for S/390 has a special port on which users can directly access MVS/TSO with full-screen operation. The port number is 1023 and connects only to TSO (although other ports could easily be added in APPCFGxx for other services).

When Cisco IOS for S/390 is contacted on port 1023, full-screen negotiation takes place immediately. If it fails, service reverts to NVT.

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## Autologon to Specific VTAM Applications

Many sites with session manager software prefer their users to be automatically connected to the session manager. This requires minor changes to the configuration file. Read the *Cisco IOS for S/390 Customization Guide* for details.

## USS Table Support for Server Telnet

Server Telnet supports the use of Session Level USSTAB (Unformatted System Services Tables) and their associated msg10 screens. The feature enables you to customize screen access information for VTAM applications that are opened through Cisco IOS for S/390.

For more information about USS table support, read the *Cisco IOS for S/390 Customization Guide*.

## Telnet Escape Sequences

Cisco IOS for S/390 implements the Telnet protocol using the logical not character (¬) as an escape character. This character must be doubled (¬¬) to be transmitted correctly.

An escape sequence is a single Telnet escape character ¬, followed by a predefined character sequence. The entire sequence represents a single character, usually nongraphic or one that is not available on all IBM keyboards.

## Valid Escape Sequences

The sequences described in Table 6-4 are valid:

**Table 6-4 Valid Escape Sequences**

Sequence	Description
¬_x	x is any EBCDIC character. This represents the ASCII CONTROL-SHIFT of x. More precisely, it represents the low-order 5 bits of the ASCII equivalent to x.
¬=x	
or	
¬@X	x is any EBCDIC alphabetic. This represents the inverse alphabetic shift of x.
¬<	An ASCII left bracket.
¬>	An ASCII right bracket.
¬(	An ASCII left brace.
¬)	An ASCII right brace.
¬"	An ASCII caret.
¬'	An ASCII accent.
¬x	x is a valid control mnemonic string, in all one case. It can be one of the standard ASCII control mnemonics (LF, CR, FF, BEL, CAN, DEL, ETX, etc.) or one of these Telnet control mnemonics: AO      DM      EC      IP      SB AYT     SO      EL      IAC     WLL BRK     DNT     GA      NOP     WNT

