Telnet Test Port for TTCN-3 Toolset with TITAN, User Guide

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About This Document

How to Read This Document

This is the User Guide for the Telnet test port. The Telnet test port is developed for the TTCN-3 Toolset with TITAN. This document should be read together with Function Specification [4].

Presumed Knowledge

The knowledge of the TITAN TTCN-3 Test Executor [2] and the TTCN-3 language [1] is essential.

System Requirements

In order to operate the Telnet test port the following system requirements must be satisfied:

- TITAN TTCN-3 Test Executor version R8A (1.8.pl0) or higher installed. For installation guide see [3]. NOTE: This version of the test port is not compatible with TITAN releases earlier than R8A.
- Any operating system supported by TITAN, while only tested on Solaris.

Fundamental Concepts

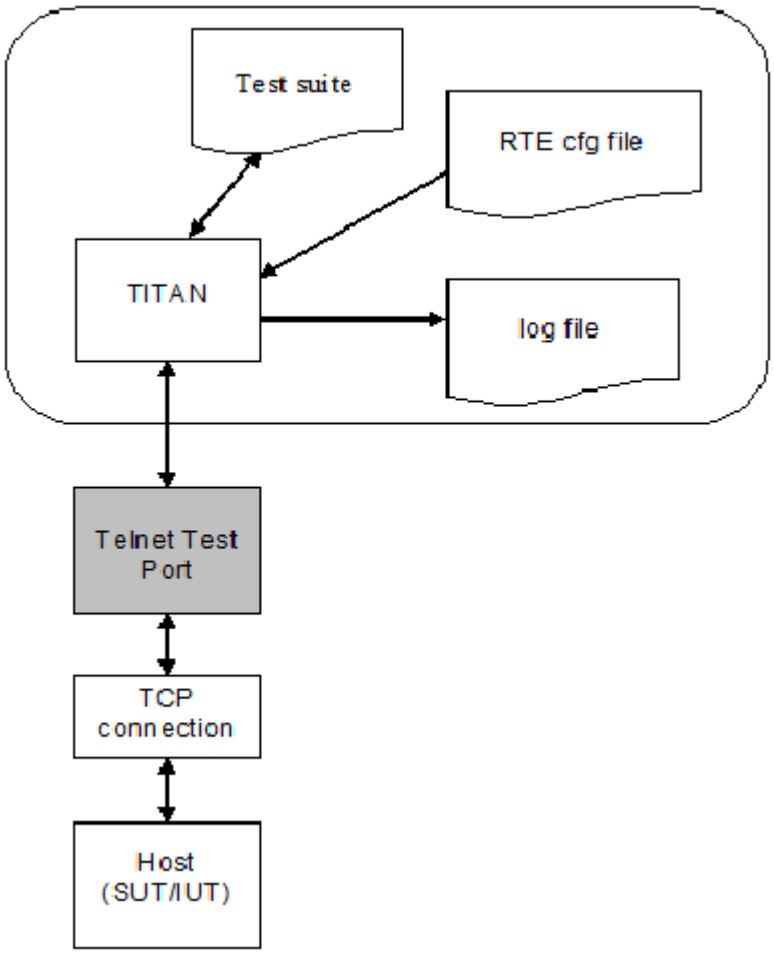
The test port establishes connection between the TTCN-3 test executor and SUT or accepts connection from the SUT, and transmits/receives messages.

The Test Port

Overview

The Telnet test port is an adaptation between the TITAN RTE and the SUT/IUT using standard telnet protocol. The telnet protocol is described in [5].

See the overview of a test system using Telnet test port below:



In client mode operation the Telnet test port works as a telnet terminal. It can send and receive charstring values. The test port does telnet login automatically on executing the TTCN-3 map operation, unless the test port parameter `CTRL_LOGIN_SKIPPED` is set to `"yes"`. (This parameter is case-insensitive.)

In server mode operation the Telnet Test Port works as a telnet server. It can receive commands, in charstring format, from the SUT and it can send the answers received from the test suite back to the SUT. The Test Port automatically sends the prompt with the answer set in Test Port parameter `CTRL_SERVER_PROMPT`, see Telnet Test Port Parameters in the Test Port Configuration File. The Test Port, on executing the TTCN-3 map operation, is waiting for connections on port set in `CTRL_PORTNUM` and does telnet login automatically. The connection to the client can be closed with the appropriate ASP, see [4].

NOTE	The Test Port never closes the connection to the client automatically.

Installation

Since the Telnet test port is used as a part of the TTCN-3 test environment this requires TTCN-3 Test Executor to be installed before any operation of the Telnet test port. For more details on the installation of TTCN-3 Test Executor see the relevant section of [3].

The following is needed to use the Telnet test port:

- Copy the source files (*TELNETasp_PT.cc*, *TELNETasp_PT.hh*) and the definition module

(*TELNETasp_PortType.ttcn*) into the directory of the test suite or create symbolic links to them.

- Import the module *TELNETasp_PortType* (TTCN-3 language, defines the test port) to the module(s) where the Telnet test port is used.
- Generate *Makefile* and compile the test suite according to [2].
- Add the required test port parameters to the runtime configuration file as described in section Telnet Test Port Parameters in the Test Port Configuration File of this document.

Do not modify the files supplied otherwise we will not be able to give technical support.

Configuration

The executable test program behavior is determined via the run-time configuration file. This is a simple text file, which contains various sections (e.g. `[TESTPORT_PARAMETERS]`) after each other. The usual suffix of configuration files is *."cfg"*. For further information on the configuration file see [2].

Telnet Test Port Parameters in the Test Port Configuration File

General parameter:

- `DEBUG`

  Set to `"YES"` if you need to debug the test port, otherwise set to `"NO"`.

- `MAP_RECV_TIMEOUT`

  The receive timeout during map operation in milliseconds. The default value is `10000 (10 sec)`. Negative value disables the timeout.

Parameters used by the Telnet test port in client mode operation:

Type	Name	Description
charstring	`CTRL_HOSTNAME`	Name of the host (IUT)
integer	`CTRL_PORTNUM`	TCP port number of the host (IUT)
charstring	`CTRL_USERNAME`	Username used for telnet login
charstring	`CTRL_PASSWORD`	Password used for telnet login
charstring	`CTRL_DOMAIN`	Domain used for telnet login
charstring	`CTRL_READMODE`	When to pass an incoming message to ttcn
charstring	`PROMPTx`	Prompt string
charstring	`REGEX_PROMPTx`	Prompt containing wildcards
charstring	`CTRL_LOGIN_SKIPPED`	User authentication is skipped
charstring	`CTRL_TERMINAL_TYPE`	Telnet terminal type

Type	Name	Description
charstring	CTRL_ECHO	Telnet echo option
charstring	CTRL_CRLF	Determines if CR should be sent before line feed.
Integer	CTRL_WINDOW_WIDTH	Width for telnet window size option
integer	CTRL_WINDOW_HEIGHT	Height for telnet window size option
charstring	CTRL_DETECT_SERVER_DISCONNETED	Setting test port behaviour when the server terminates the connection
charstring	CTRL_DETECT_CONNECTION_	Setting test port behaviour regarding the handling the result of a connection attempt
charstring	CTRL_CLIENT_CLEANUP_LINEFEED	Enabling the filtering of linefeeds directly preceding prompts from incoming messages
charstring	empty_echo	Enabling send empty message if the command doesn't have output
charstring	raw_regex_prompt<id>	regcomp based prompt

The parameter CTRL_HOSTNAME is the hostname of the remote workstation to which the test port will connect. This parameter is mandatory.

The parameter CTRL_PORTNUM is the port number of the remote host (specified by CTRL_HOSTNAME) that the test port tries to connect to. The value "7" means the test port will attempt to connect through telnet echo login. In this case the login procedure is skipped. This parameter is mandatory.

The CTRL_USERNAME and CTRL_PASSWORD parameters are mandatory and are used to authenticate the user on the remote machine.

The parameter CTRL_DOMAIN is only used if the host is asking for the domain in the login procedure. This parameter is optional, but a dynamic test case error occurs if the host requests the domain and this parameter is not set.

The parameter CTRL_READMODE controls when to pass incoming messages to TTCN. The possible values are:

- "buffered"
- "unbuffered"

If it is set to "buffered" then the test port waits until the prompt arrives and every message received before the prompt is passed to TTCN in one message.

If it is set to "unbuffered" then the test port passes data received between two new line sequences (or until the prompt) to TTCN.

The default value is "buffered".

The parameters PROMPT and REGEX_PROMPT are of type charstring. PROMPT is used to specify the exact prompt strings that are used on the remote machine. REGEX_PROMPT serves the same functionality but it can contain wildcards. Multiple PROMPT and REGEX_PROMPT parameters can be given in the configuration file, but each has to have a number (ID) concatenated to the parameter name (for an example see chapter Configuration Fil8). Specifying two prompts (either normal or with wildcards) with the same ID results in the latter overriding the former. At least one PROMPT or REGEX_PROMPT parameter must be provided that is not an empty string.

The CTRL_LOGIN_SKIPPED parameter is used when user authentication (username and password) is not required. The possible values are "yes" and "no". The default value is "no". The values are case-insensitive.

The parameter CTRL_TERMINAL_TYPE specifies the telnet terminal-type option that is described in [8].

The parameter CTRL_ECHO sets telnet echo option, see [6]. Possible values are "yes" for enabling echo and "no" for disabling it. Echo is disabled by default. The values are case-insensitive. The telnet echo option (if enabled) is sent to the server regardless of the filter settings.

The term "echo option" is used for the Telnet echo option used during the negotiation of the set up of a Telnet session as defined in [6].

Parameter CTRL_CRLF specifies whether to send CR before LF (as new line) after sending a command. It might be needed to enable this option when connecting to a host running Windows. Possible values are the same as for the parameter CTRL_ECHO.

The parameters CTRL_WINDOW_WIDTH and CTRL_WINDOW_HEIGHT specify the (initial) telnet window size option (see [7]).

The CTRL_DETECT_SERVER_DISCONNETED parameter determines the behavior of the test port if the test port detects that the server terminates the communication. If this parameter is set to "yes", the test port indicates the connection termination by passing an integer value 0 to the test suite. After this the test port has to be unmapped and mapped again if the user wants to use the test port in the actual test case further. If this value is set to "no", dynamic test case error occurs when the server terminates the connection. The default value is "no". The values are case-insensitive.

The CTRL_DETECT_CONNECTION_ESTABLISHMENT_RESULT parameter determines whether the test port should provide feedback to the user in case of a connection attempt. If this parameter is set to "yes" the test port indicates the result of the connection by passing an integer value 2 to the test suite if the attempt succeeded and 0 if failed. Thus the user can decide whether to attempt another mapping or discard further communication and neither does a failed connection attempt necessarily result in a dynamic test case error. If this value is set to "no", dynamic test case error occurs after a failed connection attempt. The default value is "no". The values are case-insensitive.

The table below summarizes the responses to a connection attempt. "CDSD" and "CDCEF" stand for CTRL_DETECT_SERVER_DISCONNETED and CTRL_ DETECT_CONNECTION_ESTABLISHMENT_RESULT, respectively. The prefix "¬" stands for a value "no", omitting the prefix implies the opposite. A dash in each cell separates the successful and failed connection attempts; the integer above the dash means a success, whereas the integer below indicates a failure. Finally a "D" stands for a dynamic test case

error and a hyphen means no response.

	CDCER	¬ CDCER
CDSD	2 / 0	- / D
¬CDSD	2 / D	- / D

The `CTRL_CLIENT_CLEANUP_LINEFEED` parameter determines whether the test port in client mode should filter out linefeeds directly preceding the prompt from the incoming messages received by the client. If this parameter is set to `"yes"`, the test port will filter out all such linefeeds. If this value is set to `"no"` the messages remain unchanged. The default value is `"yes"`. The values are case-insensitive.

NOTE Only linefeeds between the real message and the prompt are filtered. The mechanism only searches for linefeeds until the first non-linefeed character.

The `empty_echo` parameter determines whether the test port sends an empty charstring if the issued command has no printout. If the parameter is set to `"yes"` the test port sends an empty charstring to the test case before the prompt. If the value is set to `"no"` the test port does not send the empty charstring before the prompt.

The `raw_regex_prompt<prompt_id>` is used for specify the prompt string used on the remote host as regcomp supported POSIX regexp. It should have at least two subexpressions. The second subexpression selects the prompt. The regexp should match the entire buffer as it received.

Parameters used by the Telnet Test Port in server mode operation:

Type	Name	Description
integer	`CTRL_PORTNUM`	TCP port number to listen for incoming connections(IUT)
charstring	`CTRL_USERNAME_CLIENT`	Username used for telnet login
charstring	`CTRL_PASSWORD_CLIENT`	Password used for telnet login
charstring	`CTRL_LOGIN_SKIPPED`	User authentication is skipped
charstring	`CTRL_MODE`	Use the Test Port in client or server mode operation
charstring	`CTRL_SERVER_PROMPT`	Prompt string
charstring	`CTRL_LOGINNAME_PROMPT`	Prompt string
charstring	`CTRL_PASSWORD_PROMPT`	Prompt string
charstring	`CTRL_SERVER_ATTACH_PROMPT`	Enabling attaching of prompts to outgoing messages
charstring	`CTRL_CLIENT_SERVER_DISCONNETED`	Setting test port behavior when the client terminates the connection
charstring	`CTRL_SERVER_FAILSAFE_SENDING`	Setting test port behavior when a message sending fails

The parameter CTRL_PORTNUM is the port number of the local host on which the Test Port is listening for new connection from the SUT. This parameter is mandatory.

The Test Port accepts connection from a client which sent a username and password set in the CTRL_USERNAME_CLIENT and CTRL_PASSWORD_CLIENT parameters.

The CTRL_LOGIN_SKIPPED parameter is used when user authentication (username and password) is not required. The possible values are "yes" and "no". The default value is "no". The values are case-insensitive.

The CTRL_MODE parameter is to choose during run time between client and server mode of operation. Acceptable values are: "client" or "server" Default value is "client".

The parameter CTRL_SERVER_PROMPT is of type charstring and here must be specified the exact prompt string. The Test Port will send this prompt to the client after every message. One CTRL_SERVER_PROMPT parameter must be provided.

The CTRL_LOGINNAME_PROMPT parameter is the charstring to send to prompt the client for the login name. The default value is: "login":

The CTRL_PASSWORD_PROMPT parameter is the charstring to send to prompt the client for the password. The default value is: "password":

The CTRL_DETECT_CLIENT_DISCONNECTED parameter determines the behavior of the test port if the test port detects that the client terminates the communication. If this parameter is set to "yes", the test port indicates the connection termination by passing an integer value 3 to the test suite. If this value is set to "no", the user of the test port in server mode will not receive any notification, and a dynamic test case error might occur (depending on the CTRL_SERVER_FAILSAFE_SENDING parameter) when a new message is attempted to be sent. The default value is "no". The values are case-insensitive.

The CTRL_SERVER_ATTACH_PROMPT parameter determines whether the test port in server mode should attach the server prompt to every outgoing messages sent by the server. If this parameter is set to "yes", the test port will attach the prompt to every such message. If this value is set to "no", the message remains unchanged. The default value is "yes". The values are case-insensitive.

NOTE	Enabling the parameter and setting the prompt to a `'' string will result in passing a linefeed to the user. This is especially important when it is sent to the client on a connection attempt.

The CTRL_SERVER_FAILSAFE_SENDING parameter determines whether the test port in server mode should return and error or a warning in case a message sending fails. If this parameter is set to "yes", the test port will return a warning after such sending attempts. If this value is set to "no", , an error is returned. The default value is "no". The values are case-insensitive.

The empty_echo parameter determines whether the test port sends an empty charstring if the issued command has no printout. If the parameter is set to "yes", the test port sends an empty charstring to the test case before the prompt. If the value is set to "no", the test port do not send the empty charstring before the prompt.

Error Messages

`TCP send failed. (<reason>)`

Send operation failed.

`Error accepting connection <reason>`

Occurs only in server mode operation. The Test Port couldn't accept connection from a client, i.e. an `accept()` operation failed.

`Error closing file descriptor <file_descriptor>. (<reason>)`

The Test Port couldn't close `<file_descriptor>`, i.e. a `close()` operation failed.

`Error listening on port <port_number>. (<reason>)`

Occurs only in server mode operation. The Test Port could not listen on port `<port_number>`, i.e. a `listen()` operation failed.

`Error reading from file descriptor <file_descriptor>. (<reason>)`

The Test Port couldn't read from a file descriptor, i.e. a `recv()` operation failed.

`Error binding socket to port <port_number>. (<reason>)`

Occurs only in server mode operation. The Test Port couldn't bind a socket to port `<port_number>`, i.e. a `bind()` operation failed.

`Missing mandatory parameter: <parameter_name>`

The mandatory parameter `<parameter_name>` was not set in the configuration file.

`Missing mandatory parameter: at least one "PROMPT" parameter must be provided`

`PROMPT parameter should be given as PROMPT<number> := ``value''.`

`Error converting string in "…" in parameter name "PROMPT"… to number.`

`REGEX_PROMPT parameter should be given as "REGEX_PROMPT"<number> := ``value''.`

`Error converting string in "…" in parameter name "REGEX_PROMPT"… to number.`

`PROMPT parameter must contain at least one character`

`REGEX_PROMPT parameter must contain at least one character`

`Unable to connect to <ctrl_hostname> as <ctrl_username>`

The specified `ctrl_username`/`ctrl_password` pair is not valid on `ctrl_hostname`.

`Invalid value for: <parameter>`

The value of the parameter is different from the allowed ones.

`Socket creation failed`

There was an error creating the socket.

`Unable to resolve hostname: <my_hostname>`

The host name `<my_hostname>` cannot be resolved.

`setsockopt(SO_REUSEADDR) failed`

There was an error setting the socket option `SO_REUSEADDR`.

`Error connecting <my_hostname>`

There was an error connecting the host.

`Error connecting <my_hostname>. Address already in use.`

This error means an address is already in use. Probably a kernel error.

`Socket error or the server closed the connection.`

The server closed the connection or an error occurred while waiting for the host to accept the login.

`Unsupported port number!`

The specified port number is not supported. Supported ports are 23 and 7.

`*Socket error or the server closed the connection (in Event_Handler).`

The server closed the connection.

`Missing parameter CTRL_DOMAIN`

The parameter `CTRL_DOMAIN` was not set but the host was requesting it.

`Not enough memory!`

A memory allocation error occurred.

`Error sending window size: not connected.`

There was an attempt to send the window size from TTCN-3, but the test port is not connected to the host.

`Prompt parameter with wildcards shouldn't start with "": "…"`

`Prompt parameter with wildcards shouldn't end with "": "…"`

`Width of window size should be greater than 0 and less than 65536.`

`Height of window size should be greater than 0 and less than 65536.`

`Cannot convert pattern "…" to POSIX-equivalent.`

`Login incorrect!`

Occurs only in server mode operation. The client tried to connect with an invalid username or password. Before this message the username and password sent by the client will be logged.

Warning Messages

`Dropping partial message.`

This message is printed in case of `unmap` operation if the receive buffer is not empty.

`Duplicated prompt string '<prompt_value>'`

`Using prompt '<prompt_value1>' that is a substring of prompt '<prompt_value2>' might cause problems.`

`Server refused window size negotiation.`

`Unable to decode Terminal Type sub-negotiation.`

`Send operation failed: the port is disconnected.`

`Send operation failed: the client has not logged in.`

`user_map() was called to a mapped port`

`Mode is not defined. Test Port will operate in client mode operation.`

`TCP send failed. (<reason>)`

Send operation failed due to a disconnected client.

Examples

Configuration File

Using the client:

```
[LOGGING]
LogFile := "Telnet.log"

[EXECUTE]
Telnet.control

[TESTPORT_PARAMETERS]
system.telnet.CTRL_HOSTNAME := "my_hostname"
system.telnet.CTRL_PORTNUM := "23"
system.telnet.CTRL_USERNAME := "egbotat"
system.telnet.CTRL_PASSWORD := "abcd"
system.telnet.CTRL_READMODE := "buffered"
system.telnet.CTRL_LOGIN_SKIPPED := "no"
system.telnet.PROMPT1 := "Enter command: "
system.telnet.PROMPT2 := "egbotat ~> "
system.telnet.REGEX_PROMPT3 := "egbotat?*[>#]?"
system.telnet.CTRL_DETECT_SERVER_DISCONNECTED := "yes"
system.telnet.CTRL_DETECT_CONNECTION_ESTABLISHMENT_
RESULT := "yes"
system.telnet. CTRL_CLIENT_CLEANUP_LINEFEED := "no"
system.telnet.CTRL_TERMINAL_TYPE := "xterm"
system.telnet.CTRL_ECHO := "no"
system.telnet.CTRL_CRLF := "yes"
system.telnet.CTRL_WINDOW_WITDH := "80"
system.telnet.CTRL_WINDOW_HEIGHT := "24"
system.T_Client_PCO.RAW_REGEX_PROMPT1 := "^(.*)(ezolm >)(.*)$"
```

Using the server:

```
[LOGGING]
LogFile := "Telnet.log"

[EXECUTE]
Telnet.control

[TESTPORT_PARAMETERS]
system.telnet.CTRL_PORTNUM := "23"
system.telnet.CTRL_LOGIN_SKIPPED := "no"
system.telnet.CTRL_USERNAME_CLIENT := "egergft"
system.telnet.CTRL_PASSWORD_CLIENT := "asdfg"
system.telnet.CTRL_SERVER_PROMPT := "Enter command: ".
system.telnet.CTRL_LOGINNAME_PROMPT := "The LoginName: "
system.telnet.CTRL_PASSWORD_PROMPT := "The Password: "
system.telnet.CTRL_MODE := "server"
system.telnet.CTRL_SERVER_ATTACH_PROMPT := "yes"
system.telnet.CTRL_DETECT_SERVER_DISCONNECTED := "yes"
system.telnet.CTRL_SERVER_FAILSAFE_SENDING := "yes"
```

Terminology

No specific terminology is used.

Abbreviations

ASP

Abstract Service Primitive

IUT

Implementation Under Test

SUT

System Under Test

TTCN-3

Testing and Test Control Notation version 3

TCP

Transmission Control Protocol

RTE

RunTime Environment

References

[1] ETSI ES 201 873-1 v3.1.1 (2005-06)
The Testing and Test Control Notation version 3. Part 1: Core Language

[2] Programmer's Technical Reference for TITAN TTCN-3 Test Executor

[3] TITAN Installation Guide

[4] Telnet Test Port for TTCN-3 Toolset with TITAN, Function Specification

[5] RFC 854
Telnet protocol specification

[6] RFC 857
Telnet echo option

[7] RFC 1073
Telnet Window Size Option

[8] RFC 1091
Telnet Terminal-Type Option