SSH

version 0.9
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SSH Reference Manual

Short Summaries

- Erlang Module `ssh` [page 5] - Main API of the SSH application
- Erlang Module `ssh_cm` [page 8] - SSH connection layer.
- Erlang Module `ssh_sshd` [page 19] - SSH server with erlang shell.

**ssh**

The following functions are exported:

- `start() -> ok | {error, Reason}`
  [page 5] Starts the SSH application
- `stop() -> ok | {error, Reason}`
  [page 5] Stops the SSH application
- `stop`
  [page 5] Stops the SSH application

**ssh_cli**

The following functions are exported:

- `listen(Shell)`
  [page 6] Start an SSH server with a CLI
- `listen(Shell, Port)`
  [page 6] Start an SSH server with a CLI
- `listen(Shell, Port, Options)`
  [page 6] Start an SSH server with a CLI
- `listen(Shell, Addr, Port, Options)`
  [page 6] Start an SSH server with a CLI
- `stop(Pid) -> ok | {error, Reason}`
  [page 6] Stop the listener
ssh_cm

The following functions are exported:

- `connect(Host) -> {ok, Pid} | {error, Error}`
  
  [page 8] Connect to an ssh daemon
- `connect(Host, Options) -> {ok, Pid} | {error, Error}`
  
  [page 8] Connect to an ssh daemon
- `connect(Host, Port, Options) -> {ok, Pid} | {error, Error}`
  
  [page 8] Connect to an ssh daemon
- `listen(UserFun, Options) -> ok`
  
  [page 9] Start an ssh shell
- `listen(UserFun, Port, Options) -> ok`
  
  [page 9] Start an ssh shell
- `listen(UserFun, Addr, Port, Options) -> ok`
  
  [page 9] Start an ssh shell
- `stop_listener(Pid) -> ok | {error, Reason}`
  
  [page 9] Stop the listener

ssh_sftp

The following functions are exported:

- `connect(CM) -> {ok, Pid} | {error, Reason}`
  
  [page 11] Connect to an SFTP server
- `connect(Host, Options) -> {ok, Pid} | {error, Reason}`
  
  [page 11] Connect to an SFTP server
- `connect(Host, Port, Options) -> {ok, Pid} | {error, Reason}`
  
  [page 11] Connect to an SFTP server
- `read_file(Server, File) -> {ok, Data} | {error, Reason}`
  
  [page 11] Read a file
- `write_file(Server, File, Iolist) -> ok | {error, Reason}`
  
  [page 11] Write a file
- `list_dir(Server, Path) -> {ok, Filenames} | {error, Reason}`
  
  [page 12] List directory
- `open(Server, File, Mode) -> {ok, Handle} | {error, Reason}`
  
  [page 12] Open a file and return a handle
- `opendir(Server, Path) -> {ok, Handle} | {error, Reason}`
  
  [page 12] Open a directory and return a handle
- `close(Server, Handle) -> ok | {error, Reason}`
  
  [page 12] Close an open handle
- `read(Server, Handle, Len) -> {ok, Data} | eof | {error, Error}`
  
  [page 12] Read from an open file
- `pread(Server, Handle, Position, Length) -> {ok, Data} | eof | {error, Error}`
  
  [page 12] Read from an open file
- `aread(Server, Handle, Len) -> {async, N} | {error, Error}`
  
  [page 13] Read asynchronously from an open file
• apread(Server, Handle, Position, Length) -> async, N | error, Error
  [page 13] Read asynchronously from an open file

• write(Server, Handle, Data) -> ok | error, Error
  [page 13] Write to an open file

• pwrite(Server, Handle, Position, Data) -> ok | error, Error
  [page 13] Write to an open file

• awrite(Server, Handle, Data) -> ok | error, Error
  [page 13] Write asynchronously to an open file

• apwrite(Server, Handle, Position, Data) -> ok | error, Error
  [page 13] Write asynchronously to an open file

• position(Server, Handle, Location) -> ok, NewPosition | error, Error
  [page 14] Seek position in open file

• read_file_info(Server, Name) -> ok, FileInfo | error, Reason
  [page 14] Get information about a file

• get_file_info(Server, Handle) -> ok, FileInfo | error, Reason
  [page 14] Get information about a file

• read_link_info(Server, Name) -> ok, FileInfo | error, Reason
  [page 14] Get information about a symbolic link

• write_file_info(Server, Name, Info) -> ok | error, Reason
  [page 15] Write information for a file

• read_link(Server, Name) -> ok, Target | error, Reason
  [page 15] Read symbolic link

• make_symlink(Server, Name, Target) -> ok | error, Reason
  [page 15] Create symbolic link

• rename(Server, OldName, NewName) -> ok | error, Reason
  [page 15] Rename a file

• delete(Server, Name) -> ok | error, Reason
  [page 15] Delete a file

• make_dir(Server, Name) -> ok | error, Reason
  [page 16] Create a directory

• del_dir(Server, Name) -> ok | error, Reason
  [page 16] Delete an empty directory

• stop(Server) -> ok
  [page 16] Stop sftp session

ssh_sftpd

The following functions are exported:

• listen(Port) -> ok, Pid | error, Error
  [page 17] Starts sftp server

• listen(Port, Options) -> ok, Pid | error, Error
  [page 17] Starts sftp server

• listen(Addr, Port, Options) -> ok, Pid | error, Error
  [page 17] Starts sftp server

3 SSH
ssh_ssh

The following functions are exported:

- `connect(Host)` -> ok
  [page 18] Start an ssh shell
- `connect(Host, Options)` -> ok
  [page 18] Start an ssh shell
- `connect(Host, Port, Options)` -> ok
  [page 18] Start an ssh shell

ssh_sshd

The following functions are exported:

- `listen(Port)` -> {ok, Pid} | {error, Error}
  [page 19] Connect to an ssh daemon
- `listen(Port, Options)` -> {ok, Pid} | {error, Error}
  [page 19] Connect to an ssh daemon
- `listen(Addr, Port, Options)` -> {ok, Pid} | {error, Error}
  [page 19] Connect to an ssh daemon
- `stop(Pid)` -> ok | {error, Reason}
  [page 19] Stop the listener

ssh_transport

No functions are exported.
SSH

Erlang Module

Interface module for the SSH application

Exports

\texttt{start()} \rightarrow \texttt{ok} | \{\texttt{error}, \texttt{Reason}\}

Types:
- \texttt{Reason = term()}

Starts the SSH application. Require that the crypto application has been started.

\texttt{stop()} \rightarrow \texttt{ok} | \{\texttt{error}, \texttt{Reason}\}

\texttt{stop}

Types:
- \texttt{Reason = term()}

Stops the SSH application
ssh_cli

Erlang Module

This module implements a CLI (Command Line Interface), for an SSH server. It’s used by sshd to provide an interactive erlang shell as an ssh server.

Since ssh_cli uses the group module, the CLI provides full editing just like in the erlang shell, with history (ctrl-p and ctrl-n), line editing and configurable tab expansion (completion).

A full example of how to use ssh_cli is provided in ssh/examples/ssh_sample_cli.erl.

Exports

\[
\begin{align*}
\text{listen(Shell)} & \\
\text{listen(Shell, Port)} & \\
\text{listen(Shell, Port, Options)} & \\
\text{listen(Shell, Addr, Port, Options)} & \\
\end{align*}
\]

Types:
- Shell = pid() | fun()
- Port = integer()
- Addr = string()
- Options = [{Option, Value}]
- Option = atom()
- Value = term()

Starts a daemon listening on Port. The Shell fun is a function spawning a shell process, containing a read-eval-print-loop using ordinary erlang io (e.g. get_line/1 and fprint).

The daemon’s group leader will be connected to the SSH daemon, so that the io will be sent to the remote SSH shell client.

An example of how ssh_cli can be used can be found in ssh/examples/ssh_sample_cli.erl.

The module sshd is implemented using ssh_cli.

For options, see ssh_cm:listen.

stop(Pid) -> ok | {error, Reason}

Types:
- Pid = pid()
- Reason = atom()
Stops the listener given by \texttt{Pid}, existing connections will stay open.
This module implements the SSH connection layer.

Exports

connect(Host) -> {ok, Pid} | {error, Error}
connect(Host, Options) -> {ok, Pid} | {error, Error}
connect(Host, Port, Options) -> {ok, Pid} | {error, Error}

Types:
- Host = string()
- Port = integer()
- Options = [{Option, Value}]

Connects to an SSH server. A gen_server is started and returned if connection is successful, but no channel is started, that is done with session_open/2. The Host is a string with the address of a host running an SSH server. The Port is an integer, the port to connect to. The default is 22, the registered port for SSH.

Options are:

- {user_dir, String} Sets the user directory, normally ~/.ssh (containing the files known_hosts, id_rsa<cert>, <cert>id_dsa, authorized_keys).
- {silently_accept_hosts, Boolean} When true, (default is false), hosts are added to the file known_hosts without asking the user.
- {user_interaction, Boolean} If true, which is the default, password questions and adding hosts to known_hosts will be asked interactively to the user. (This is done during connection to an SSH server.) If false, both these interactions will throw and the server will not start.
- {public_key_alg, ssh_rsa | ssh_dsa} Sets the preferred public key algorithm to use for user authentication. If the the preferred algorithm fails of some reason, the other algorithm is tried. The default is to try ssh_rsa first.
- {connect_timeout, Milliseconds | infinity} Sets the default timeout when trying to connect to an SSH server. This timeout will also affect calls later when using the SSH connection.
- {user, String} Provide a username. If this option is not given, ssh reads from the environment (LOGNAME or USER on unix, USERNAME on Windows).
- {password, String} Provide a password for password authentication. If this option is not given, the user will be asked for a password.
- {user_auth, Fun/3} Provide a fun for password authentication. The fun will be called as fun(User, Password, Opts) and should return true or false.
{key_cb, KeyCallbackModule} Provide a special call-back module for key handling. The call-back module should be modeled after the ssh_file module. The function that must be exported are: private_host_rsa_key/2, private_host_dsa_key/2, lookup_host_key/3 and add_host_key/3.

{fd, FD} Allow an existing file-descriptor to be used, given in FD. (Simply passed on to gen_tcp:listen.)

As usual, boolean options that should be true can be given as an atom instead of a tuple, e.g. silently_accept_hosts instead of {silently_accept_hosts, true}.

listen(UserFun, Options) -> ok
listen(UserFun, Port, Options) -> ok
listen(UserFun, Addr, Port, Options) -> ok

Types:
- UserFun = fun() -> Pid
- Port = integer()
- Addr = string() | any
- Options = [{Option, Value}]
- Option = atom()
- Value = term()

Starts a server listening for SSH connections on the given port. 
UserFun is a function that should spawn and return a server upon incoming connections on the given port (and address).
Port is the port that the server should listen on. Everytime a connection is made on that port, the UserFun is called, and the returned process is used as a user process for the server.
Options are:

{system_dir, String} Sets the system directory, containing the host files that identifies the host for ssh. The default is /etc/ssh, but note that SSH normally requires the host files there to be readable only by root.

{user_passwords, [{User, Password}]} Provide passwords for password authentication. They will be used when someone tries to connect to the server and public key user authentication fails. The option provides a list of valid user names and the corresponding password. User and Password are strings.

{password, String} Provide a global password that will authenticate any user (use with caution!).
If neither of these options is given, the server will be unable to authenticate with password.

{pwdfun, fun/2} Provide a function for password validation. This is called with user and password as strings, and should return true if the password is valid and false otherwise.

{fd, FD} Allow an existing file-descriptor to be used, given in FD. (Simply passed on to gen_tcp:listen.)

stop_listener(Pid) -> ok | {error, Reason}

Types:
- Pid = pid()
- Reason = atom()

Stops the listener, given by Pid, existing connections will stay open.
This module implements an SFTP (SSH FTP) client. SFTP is a secure, encrypted file transfer service available for SSH.

The errors returned are from the SFTP server, and are often not posix error codes.

Exports

\[
\text{connect}(CM) \rightarrow \{\text{ok}, \text{Pid}\} | \{\text{error}, \text{Reason}\}
\]

\[
\text{connect}(\text{Host}, \text{Options}) \rightarrow \{\text{ok}, \text{Pid}\} | \{\text{error}, \text{Reason}\}
\]

\[
\text{connect}(\text{Host}, \text{Port}, \text{Options}) \rightarrow \{\text{ok}, \text{Pid}\} | \{\text{error}, \text{Reason}\}
\]

Types:
- \(\text{Host} = \text{string}()\)
- \(\text{CM} = \text{pid}()\)
- \(\text{Port} = \text{integer}()\)
- \(\text{Options} = \{\text{Option}, \text{Value}\}\)
- \(\text{Option} = \text{atom}()\)
- \(\text{Value} = \text{term}()\)
- \(\text{Reason} = \text{term}()\)

Connects to an SFTP server. A gen_server is started and returned if connection is successful. This server is used to perform SFTP commands on the server.

For options, see ssh_cm:connect.

\[
\text{read_file}(\text{Server}, \text{File}) \rightarrow \{\text{ok}, \text{Data}\} | \{\text{error}, \text{Reason}\}
\]

Types:
- \(\text{Server} = \text{pid}()\)
- \(\text{File} = \text{string}()\)
- \(\text{Data} = \text{binary}()\)
- \(\text{Reason} = \text{term}()\)

Reads a file from the server, and returns the data in a binary, like file:read_file/1.

\[
\text{write_file}(\text{Server}, \text{File}, \text{Iolist}) \rightarrow \text{ok} | \{\text{error}, \text{Reason}\}
\]

Types:
- \(\text{Server} = \text{pid}()\)
- \(\text{File} = \text{string}()\)
- \(\text{Data} = \text{binary}()\)
list_dir(Server, Path) -> {ok, Filenames} | {error, Reason}

Types:
- Server = pid()
- Path = string()
- Filenames = [Filename]
- Filename = string()
- Reason = term()

Lists the given directory on the server, returning the filenames as a list of strings.

open(Server, File, Mode) -> {ok, Handle} | {error, Reason}

Types:
- Server = pid()
- File = string()
- Mode = [Modeflag]
- Modeflag = read | write | creat | trunc | append | binary
- Handle = term()
- Reason = term()

Opens a file on the server, and returns a handle that is used for reading or writing.

opendir(Server, Path) -> {ok, Handle} | {error, Reason}

Types:
- Server = pid()
- Path = string()
- Reason = term()

Opens a handle to a directory on the server, the handle is used for reading directory contents.

close(Server, Handle) -> ok | {error, Reason}

Types:
- Server = pid()
- Handle = term()
- Reason = term()

Closes a handle to an open file or directory on the server.

read(Server, Handle, Len) -> {ok, Data} | eof | {error, Error}

pread(Server, Handle, Position, Length) -> {ok, Data} | eof | {error, Error}

Types:
- Server = pid()
- Handle = term()
- Position = integer()
Reads Len bytes from the file referenced by Handle. Returns \( \text{ok, Data}, \) or \( \text{eof, Reason} \). If the file is opened with \text{binary}, Data is a binary, otherwise it is a string.

If the file is read past \text{eof}, only the remaining bytes will be read and returned. If no bytes are read, \text{eof} is returned.

The \text{pread} function reads from a specified position, combining the position and read functions.

\text{aread}($\text{Server, Handle, Len}$) \to \{\text{async, N} \mid \text{error, Error}\}
\text{apread}($\text{Server, Handle, Position, Length}$) \to \{\text{async, N} \mid \text{error, Error}\}

Types:
- Server = \text{pid}()
- Handle = \text{term}()
- Position = \text{integer}()
- Len = \text{integer}()
- N = \text{term}()
- Reason = \text{term}()

Reads from an open file, without waiting for the result. If the handle is valid, the function returns \{\text{async, N}\}, where N is a term guaranteed to be unique between calls of \text{aread}. The actual data is sent as a message to the calling process. This message has the form \{\text{async_reply, N, Result}\}, where Result is the result from the read, either \{\text{ok, Data}, \text{or eof}, \text{or error, Error}\}.

The \text{apread} function reads from a specified position, combining the position and \text{aread} functions.

\text{write}($\text{Server, Handle, Data}$) \to \text{ok} \mid \{\text{error, Error}\}
\text{pwrite}($\text{Server, Handle, Position, Data}$) \to \text{ok} \mid \{\text{error, Error}\}

Types:
- Server = \text{pid}()
- Handle = \text{term}()
- Position = \text{integer}()
- Data = \text{iolist}()
- Reason = \text{term}()

Write data to the file referenced by Handle. The file should be opened with \text{write} or \text{append} flag. Returns \text{ok} if successful and \{\text{error, Reason}\} otherwise.

Typical error reasons are:
- \text{ebadf} The file is not opened for writing.
- \text{enospc} There is a no space left on the device.

\text{awrite}($\text{Server, Handle, Data}$) \to \text{ok} \mid \{\text{error, Error}\}
\text{apwrite}($\text{Server, Handle, Position, Data}$) \to \text{ok} \mid \{\text{error, Error}\}
Types:
- Server = pid()
- Handle = term()
- Position = integer()
- Len = integer()
- Data = binary()
- Reason = term()

Waits to an open file, without waiting for the result. If the handle is valid, the function returns \( \text{async, } N \), where \( N \) is a term guaranteed to be unique between calls of \text{awrite}. The result of the write operation is sent as a message to the calling process. This message has the form \( \{\text{async_reply, } N, \text{ Result}\} \), where \( \text{Result} \) is the result from the write, either \( \text{ok} \), or \( \{\text{error, } Error\} \).

The \text{apwrite} writes on a specified position, combining the \text{position} and \text{awrite} operations.

\begin{verbatim}
position(Server, Handle, Location) -> \{ok, NewPosition \| \{error, Error\}

Types:
- Server = pid()
- Handle = term()
- Location = Offset \| \{bof, Offset\} \| \{cur, Offset\} \| \{eof, Offset\} \| bof \| cur \| eof
- Offset = int()
- NewPosition = integer()
- Reason = term()

Sets the file position of the file referenced by \( \text{Handle} \). Returns \( \{\text{ok, } \text{NewPosition (as an absolute offset)} \) if successful, otherwise \( \{\text{error, } \text{Reason}\} \). Location is one of the following:

\begin{itemize}
  \item Offset The same as \{bof, Offset\}.
  \item \{bof, Offset\} Absolute offset.
  \item \{cur, Offset\} Offset from the current position.
  \item \{eof, Offset\} Offset from the end of file.
  \item bof | cur | eof The same as above with Offset 0.
\end{itemize}
\end{verbatim}

\begin{verbatim}
read_file_info(Server, Name) -> \{ok, FileInfo \| \{error, Reason\}
get_file_info(Server, Handle) -> \{ok, FileInfo \| \{error, Reason\}

Types:
- Server = pid()
- Name = string()
- Handle = term()
- FileInfo = record()
- Reason = term()

Returns a \text{file_info} record from the file specified by \( \text{Name} \) or \( \text{Handle} \), like \text{file:read_file_info/2}.
\end{verbatim}

\begin{verbatim}
read_link_info(Server, Name) -> \{ok, FileInfo \| \{error, Reason\}
\end{verbatim}
Types:
- Server = pid()
- Name = string()
- Handle = term()
- FileInfo = record()
- Reason = term()

Returns a file_info record from the symbolic link specified by Name or Handle, like file:read_link_info/2.

write_file_info(Server, Name, Info) -> ok | {error, Reason}

Types:
- Server = pid()
- Name = string()
- Info = record()
- Reason = term()

Writes file information from a file_info record to the file specified by Name, like file:write_file_info.

read_link(Server, Name) -> {ok, Target} | {error, Reason}

Types:
- Server = pid()
- Name = string()
- Target = string()
- Reason = term()

Read the link target from the symbolic link specified by Name, like file:read_link/1.

make symlink(Server, Name, Target) -> ok | {error, Reason}

Types:
- Server = pid()
- Name = string()
- Target = string()
- Reason = term()

Creates a symbolic link pointing to Target with the name Name, like file:make symlink/2.

rename(Server, OldName, NewName) -> ok | {error, Reason}

Types:
- Server = pid()
- OldName = string()
- NewName = string()
- Reason = term()

Renames a file named OldName, and gives it the name NewName, like file:rename/2.

delete(Server, Name) -> ok | {error, Reason}
Types:
- Server = pid()
- Name = string()
- Reason = term()

Deletes the file specified by Name, like file:delete/1

make_dir(Server, Name) -> ok | {error, Reason}
Types:
- Server = pid()
- Name = string()
- Reason = term()

Creates a directory specified by Name. Name should be a full path to a new directory. The directory can only be created in an existing directory.

del_dir(Server, Name) -> ok | {error, Reason}
Types:
- Server = pid()
- Name = string()
- Reason = term()

Deletes a directory specified by Name. The directory should be empty, and

stop(Server) -> ok
Types:
- Server = pid()

Stops the sftp session, closing the connection. Any open files on the server will be closed.
**ssh_sftpd**

Erlang Module

This module implements an SFTP server.

**Exports**

```
listen(Port) -> {ok, Pid} | {error, Error}
listen(Port, Options) -> {ok, Pid} | {error, Error}
listen(Addr, Port, Options) -> {ok, Pid} | {error, Error}
```

Types:
- `Port = integer()`
- `Addr = string()`
- `Options = [{Option, Value}]`

Starts an SFTP server on the given port. The server listens for connection of an SFTP client.

Options are:

- `{cwd, String}` Sets the initial current working directory for the server.
- `{file_handler, CallbackModule}` Determines which module to call for communicating with the file server. Default value is `ssh_sftpd_file` that uses the file and filelib APIs to access the standard OTP file server. This option may be used to plug in the use of other file servers.
- `{root, String}` Sets the sftp root directory. The user will then not be able to see any files above this root. If for instance the root is set to `/tmp` the user will see this directory as `/` and if the user does `cd /etc` the user will end up in `/tmp/etc`.

For more options, see `ssh_cm:listen`. 

SSH
ssh_ssh

Erlang Module

This module implements a simple SSH client in erlang, providing an interactive shell to another computer.

Exports

- `connect(Host)` -> ok
- `connect(Host, Options)` -> ok
- `connect(Host, Port, Options)` -> ok

Types:
- `Host` = string()
- `Port` = integer()
- `Options` = [Option]

`connect` starts an interactive shell to an SSH server on the given `Host`. The function waits for user input, and will not return until the remote shell is ended (e.g. on `exit` from the shell).

For options, see `ssh_cm:connect`
Erlang Module

This module implements an erlang shell as an SSH server.

Exports

\[
\text{listen}(\text{Port}) \rightarrow \{\text{ok, Pid}\} | \{\text{error, Error}\}
\]

\[
\text{listen}(\text{Port}, \text{Options}) \rightarrow \{\text{ok, Pid}\} | \{\text{error, Error}\}
\]

\[
\text{listen}(\text{Addr}, \text{Port}, \text{Options}) \rightarrow \{\text{ok, Pid}\} | \{\text{error, Error}\}
\]

**Types:**
- \(\text{Addr} = \text{string()}\)
- \(\text{Port} = \text{integer()}\)
- \(\text{Options} = [{\text{Option, Value}}]\)

Create a listener on the given port. (It calls \text{ssh\_cli:listen} with \text{shell:start/0} as argument.) An SSH client can be used to connect to the listener and execute erlang commands.

Unix example:

\[1> \text{ssh\_sshd:listen}(9999, [{\text{system\_dir, "."}]})\]

\[<0.59.0>\]

On a unix shell:

bash@balin\$ ssh \(-p\) 9999 balin
Eshell V5.4.9.1 (abort with \^-G\)
1> \text{exit()}.
Connection to balin closed.
bash@balin\$

This assumes that the current dir contains a private host key.
For options, see \text{ssh\_cli:listen/3} and \text{ssh\_cm:listen/4}.

\[
\text{stop}(\text{Pid}) \rightarrow \text{ok} | \{\text{error, Reason}\}
\]

**Types:**
- \(\text{Pid} = \text{pid()}\)
- \(\text{Reason} = \text{atom()}\)

Stops the listener given by \text{Pid}.
ssh_transport

Erlang Module

This module implements the SSH connection layer, as described in draft-ietf-secsh-transport-24.
This module should not normally be called by a client application.
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