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 18] – 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 10] Connect to an SFTP server
- `connect(Host, Options) -> {ok, Pid} | {error, Reason}`
  [page 10] Connect to an SFTP server
- `connect(Host, Port, Options) -> {ok, Pid} | {error, Reason}`
  [page 10] Connect to an SFTP server
- `read_file(Server, File) -> {ok, Data} | {error, Reason}`
  [page 10] Read a file
- `write_file(Server, File, Iolist) -> ok | {error, Reason}`
  [page 10] Write a file
- `list_dir(Server, Path) -> {ok, Filenames} | {error, Reason}`
  [page 11] List directory
- `open(Server, File, Mode) -> {ok, Handle} | {error, Reason}`
  [page 11] Open a file and return a handle
- `opendir(Server, Path) -> {ok, Handle} | {error, Reason}`
  [page 11] Open a directory and return a handle
- `close(Server, Handle) -> ok | {error, Reason}`
  [page 11] Close an open handle
- `read(Server, Handle, Len) -> {ok, Data} | {error, EOF}`
  [page 11] Read from an open file
- `pread(Server, Handle, Position, Length) -> {ok, Data} | {error, Error}`
  [page 11] Read from an open file
- `ared(Server, Handle, Len) -> {async, N} | {error, Error}`
  [page 12] Read asynchronously from an open file
The following functions are exported:

- `apread(Server, Handle, Position, Length) -> {async, N} | {error, Error}`
  [page 12] Read asynchronously from an open file
- `write(Server, Handle, Data) -> ok | {error, Error}`
  [page 12] Write to an open file
- `pwrite(Server, Handle, Position, Data) -> ok | {error, Error}`
  [page 12] Write to an open file
- `awrite(Server, Handle, Data) -> ok | {error, Error}`
  [page 12] Write asynchronously to an open file
- `apwrite(Server, Handle, Position, Data) -> ok | {error, Error}`
  [page 12] Write asynchronously to an open file
- `position(Server, Handle, Location) -> {ok, NewPosition} | {error, Error}`
  [page 13] Seek position in open file
- `read_file_info(Server, Name) -> {ok, FileInfo} | {error, Reason}`
  [page 13] Get information about a file
- `get_file_info(Server, Handle) -> {ok, FileInfo} | {error, Reason}`
  [page 13] Get information about a file
- `read_link_info(Server, Name) -> {ok, FileInfo} | {error, Reason}`
  [page 13] Get information about a symbolic link
- `write_file_info(Server, Name, Info) -> ok | {error, Reason}`
  [page 14] Write information for a file
- `read_link(Server, Name) -> {ok, Target} | {error, Reason}`
  [page 14] Read symbolic link
- `make_symlink(Server, Name, Target) -> ok | {error, Reason}`
  [page 14] Create symbolic link
- `rename(Server, OldName, NewName) -> ok | {error, Reason}`
  [page 14] Rename a file
- `delete(Server, Name) -> ok | {error, Reason}`
  [page 14] Delete a file
- `make_dir(Server, Name) -> ok | {error, Reason}`
  [page 15] Create a directory
- `del_dir(Server, Name) -> ok | {error, Reason}`
  [page 15] Delete an empty directory
- `stop(Server) -> ok`  
  [page 15] Stop sftp session

### ssh_sftpd

The following functions are exported:

- `listen(Port) -> {ok, Pid} | {error, Error}`
  [page 16] Starts sftp server
- `listen(Port, Options) -> {ok, Pid} | {error, Error}`
  [page 16] Starts sftp server
- `listen(Addr, Port, Options) -> {ok, Pid} | {error, Error}`
  [page 16] Starts sftp server
ssh_ssh

The following functions are exported:

- `connect(Host) -> ok`
  [page 17] Start an ssh shell
- `connect(Host, Options) -> ok`
  [page 17] Start an ssh shell
- `connect(Host, Port, Options) -> ok`
  [page 17] Start an ssh shell

ssh_shsd

The following functions are exported:

- `listen(Port) -> {ok, Pid}|{error, Error}`
  [page 18] Connect to an ssh daemon
- `listen(Port, Options) -> {ok, Pid}|{error, Error}`
  [page 18] Connect to an ssh daemon
- `listen(Addr, Port, Options) -> {ok, Pid}|{error, Error}`
  [page 18] Connect to an ssh daemon
- `stop(Pid) -> ok | {error, Reason}`
  [page 18] Stop the listener

ssh_transport

No functions are exported.
SSH

Erlang Module

Interface module for the SSH application

Exports

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

Types:
- \( \text{Reason} = \text{term()} \)
  
  Starts the SSH application. Require that the \text{crypto} application has been started.

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

\text{stop}

Types:
- \( \text{Reason} = \text{term()} \)
  
  Stops the SSH application
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 sshcli 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 sshcli is provided in ssh/examples/ssh_sample_cli.erl.

Exports

listen(Shell)
listen(Shell, Port)
listen(Shell, Port, Options)
listen(Shell, Addr, Port, Options)

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 sshcli can be used can be found in ssh/examples/ssh_sample_cli.erl.

The module sshd is implemented using sshcli.

For options, see sshcm: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`, `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 functions that
must be exported are: private_host_rsa_key/2, private_host_dsa_key/2,
lookup_host_key/3 and add_host_key/3.

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.

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

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

Stops the listener, given by Pid, existing connections will stay open.
Erlang Module

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

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

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

read_file(Server, File) -> {ok, Data} | {error, Reason}

Types:
- Server = pid()
- File = string()
- Data = binary()
- Reason = term()

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

write_file(Server, File, Iolist) -> ok | {error, Reason}

Types:
- Server = pid()
- File = string()
- Data = binary()
• Reason = term()

Writes a file to the server, like file:write_file/2. The file is created if it’s not there.

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 \texttt{Len} bytes from the file referenced by \texttt{Handle}. Returns \{\texttt{ok}, \texttt{Data}\}, or \texttt{eof}, or \{\texttt{error}, \texttt{Reason}\}. If the file is opened with \texttt{binary}, \texttt{Data} is a binary, otherwise it is a string.

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

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

\texttt{aread(Server, Handle, Len) -> \{async, N\} | \{error, Error\}}

\texttt{apread(Server, Handle, Position, Length) -> \{async, N\} | \{error, Error\}}

Types:
\begin{itemize}
  \item \texttt{Server = pid()}
  \item \texttt{Handle = term()}
  \item \texttt{Position = integer()}
  \item \texttt{Len = integer()}
  \item \texttt{N = term()}
  \item \texttt{Reason = term()}
\end{itemize}

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

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

\texttt{write(Server, Handle, Data) -> ok | \{error, Error\}}

\texttt{pwrite(Server, Handle, Position, Data) -> ok | \{error, Error\}}

Types:
\begin{itemize}
  \item \texttt{Server = pid()}
  \item \texttt{Handle = term()}
  \item \texttt{Position = integer()}
  \item \texttt{Data = iolist()}
  \item \texttt{Reason = term()}
\end{itemize}

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

Typical error reasons are:
\begin{itemize}
  \item \texttt{ebadf} The file is not opened for writing.
  \item \texttt{enospc} There is no space left on the device.
\end{itemize}
Types:

- Server = pid()
- Handle = term()
- Position = integer()
- Len = integer()
- Data = binary()
- Reason = term()

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

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

\textbf{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 \textit{Handle}. Returns \{ok, NewPosition\} (as an absolute offset) if successful, otherwise \{error, Reason\}. Location is one of the following:

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

\textbf{read\_file\_info}(Server, Name) -> \{ok, FileInfo | \{error, Reason\}
\textbf{get\_file\_info}(Server, Handle) -> \{ok, FileInfo | \{error, Reason\}

Types:

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

Returns a \textit{file\_info} record from the file specified by Name or Handle, like \texttt{file:read\_file\_info/2}.

\textbf{read\_link\_info}(Server, Name) -> \{ok, FileInfo | \{error, Reason\}
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`.

```prolog
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.

```prolog
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

```prolog
stop(Server) -> ok
```

Types:
- Server = pid()

Stops the sftp session, closing the connection. Any open files on the server will be closed.
This module implements an SFTP server.

Exports

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

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

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

Options are:

- \{\text{cwd}, \text{String}\} Sets the initial current working directory for the server.
- \{\text{file_handler}, \text{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.
- \{\text{root}, \text{String}\} Sets the root for the file system. The given root will be prepended to all paths, after they are converted to absolute paths. (Preventing an SFTP-client to see anything above the given root.)

For more options, see ssh_cm:listen.
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
This module implements an erlang shell as an SSH server.

Exports

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

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

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

Unix example:
```
1> ssh~sshd:listen(9999, [{system_dir, "."]})
ok
```

On a unix shell:
```
bash@balin$ ssh -p 9999 balin
Eshell V5.4.9.1 (abort with ^C)
1> exit().
Connection to balin closed.
bash@balin$
```

This assumes that the current dir contains a private host key.

For options, see ssh~cli:listen/3 and ssh~cm:listen/4.

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

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

Stops the listener given by 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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