

# Package ‘box’

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**Title** Write Reusable, Composable and Modular R Code

**Version** 1.2.3

**URL** <https://klmr.me/box/>, <https://github.com/klmr/box>

**BugReports** <https://github.com/klmr/box/issues>

**Description** A modern module system for R. Organise code into hierarchical, composable, reusable modules, and use it effortlessly across projects via a flexible, declarative dependency loading syntax.

**Depends** R (>= 3.6.0)

**Imports** tools

**License** MIT + file LICENSE

**Encoding** UTF-8

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**Author** Konrad Rudolph [aut, cre] (ORCID: <https://orcid.org/0000-0002-9866-7051>),  
Michael Schubert [ctb] (ORCID: <https://orcid.org/0000-0002-6862-5221>)

**Maintainer** Konrad Rudolph <[konrad.rudolph@gmail.com](mailto:konrad.rudolph@gmail.com)>

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|        |                                          |
|--------|------------------------------------------|
| export | <i>Explicitly declare module exports</i> |
|--------|------------------------------------------|

---

**Description**

`box::export` explicitly marks a source file as a **box** module. It can be used as an alternative to the `@export` tag comment to declare a module's exports.

**Usage**

`box::export(...)`

**Arguments**

...                    zero or more unquoted names that should be exported from the module.

**Details**

`box::export` can be called inside a module to specify the module's exports. If a module contains a call to `box::export`, this call overrides any declarations made via the `@export` tag comment. When a module contains multiple calls to `box::export`, the union of all thus defined names is exported.

A module can also contain an argument-less call to `box::export`. This ensures that the module does not export any names. Otherwise, a module that defines names but does not mark them as exported would be treated as a *legacy module*, and all default-visible names would be exported from it. Default-visible names are names not starting with a dot (`.`). Another use of `box::export()` is to enable a module without exports to use [module event hooks](#).

**Value**

`box::export` has no return value. It is called for its side effect.

**Note**

The preferred way of declaring exports is via the `@export` tag comment. The main purpose of `box::export` is to explicitly prevent exports, by being called without arguments.

**See Also**

[box::use](#) for information on declaring exports via `@export`.

---

|      |                                                |
|------|------------------------------------------------|
| file | <i>Find the full paths of files in modules</i> |
|------|------------------------------------------------|

---

**Description**

Find the full paths of files in modules

**Usage**

```
box::file(...)
```

```
box::file(..., module)
```

**Arguments**

|        |                                                                                                                         |
|--------|-------------------------------------------------------------------------------------------------------------------------|
| ...    | character vectors of files or subdirectories inside a module; if none is given, return the root directory of the module |
| module | a module environment                                                                                                    |

**Value**

A character vector containing the absolute paths to the files specified in ...

**Note**

If called from outside a module, the current working directory is used.

This function is similar to `system.file` for packages. Its semantics differ in the presence of non-existent files: `box::file` always returns the requested paths, even for non-existent files; whereas `system.file` returns empty strings for non-existent files, or fails (if requested via the argument `mustWork = TRUE`).

**See Also**

[system.file](#)

---

|      |                                     |
|------|-------------------------------------|
| help | <i>Display module documentation</i> |
|------|-------------------------------------|

---

**Description**

`box::help` displays help on a module's objects and functions in much the same way [help](#) does for package contents.

**Usage**

```
box::help(topic, help_type = getOption("help_type", "text"))
```

**Arguments**

|           |                                                                                                                                                                                                       |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| topic     | either the fully-qualified name of the object or function to get help for, in the format <code>module\$function</code> ; or a name that was exported and attached from an imported module or package. |
| help_type | character string specifying the output format; currently, only 'text' is supported.                                                                                                                   |

**Details**

See the vignette at `vignette('box', 'box')` for more information about displaying help for modules.

**Value**

`box::help` is called for its side effect when called directly from the command prompt.

---

|           |                                |
|-----------|--------------------------------|
| mod-hooks | <i>Hooks for module events</i> |
|-----------|--------------------------------|

---

**Description**

Modules can declare functions to be called when a module is first loaded.

**Usage**

```
.on_load(ns)

.on_unload(ns)
```

**Arguments**

|    |                                  |
|----|----------------------------------|
| ns | the module namespace environment |
|----|----------------------------------|

**Details**

To create module hooks, modules should define a function with the specified name and signature. Module hooks should *not* be exported.

When `.on_load` is called, the unlocked module namespace environment is passed to it via its parameter `ns`. This means that code in `.on_load` is permitted to modify the namespace by adding names to, replacing names in, or removing names from the namespace.

`.on_unload` is called when modules are unloaded. The (locked) module namespace is passed as an argument. It is primarily useful to clean up resources used by the module. Note that, as for packages, `.on_unload` is *not* necessarily called when R is shut down.

*Legacy modules* cannot use hooks. To use hooks, the module needs to contain an export specification (if the module should not export any names, specify an explicit, empty export list via `box::export()`).

**Value**

Any return values of the hook functions are ignored.

**Note**

The API for hook functions is still subject to change. In particular, there might in the future be a way to subscribe to module events of other modules and packages, equivalently to R package [userhooks](#).

---

|      |                            |
|------|----------------------------|
| name | <i>Get a module's name</i> |
|------|----------------------------|

---

**Description**

Get a module's name

**Usage**

```
box::name()
```

**Value**

`box::name` returns a character string containing the name of the module, or NULL if called from outside a module.

**Note**

Because this function returns NULL if not invoked inside a module, the function can be used to check whether a code is being imported as a module or called directly.

---

|                    |                            |
|--------------------|----------------------------|
| register_S3_method | <i>Register S3 methods</i> |
|--------------------|----------------------------|

---

**Description**

`box::register_S3_method` makes an S3 method for a given generic and class known inside a module.

**Usage**

```
box::register_S3_method(name, class, method)
```

**Arguments**

|        |                                                  |
|--------|--------------------------------------------------|
| name   | the name of the generic as a character string.   |
| class  | the class name as a character string.            |
| method | the function to register as a method (optional). |

## Details

If method is missing, it defaults to a function named `name.class` in the calling module. If no such function exists, an error is raised.

Methods for generics defined in the same module do not need to be registered explicitly, and indeed *should not* be registered. However, if the user wants to add a method for a known generic (defined outside the module, e.g. `print`), then this needs to be made known explicitly.

See the vignette at `vignette('box', 'box')` for more information about defining S3 methods inside modules.

## Value

`box::register_S3_method` is called for its side effect.

## Note

**Do not** call `registerS3method` inside a module, only use `box::register_S3_method`. This is important for the module's own book-keeping.

---

|             |                                        |
|-------------|----------------------------------------|
| script_path | <i>Set the base path of the script</i> |
|-------------|----------------------------------------|

---

## Description

`box::set_script_path(path)` explicitly tells **box** the path of a given script from which it is called; `box::script_path()` returns the previously set path.

## Usage

```
box::set_script_path(path)
```

```
box::script_path()
```

## Arguments

|      |                                                                                                                              |
|------|------------------------------------------------------------------------------------------------------------------------------|
| path | character string containing the relative or absolute path to the currently executing R code file, or NULL to reset the path. |
|------|------------------------------------------------------------------------------------------------------------------------------|

## Details

**box** needs to know the base path of the topmost calling R context (i.e. the script) to find relative import locations. In most cases, **box** can figure the path out automatically. However, in some cases third-party packages load code in a way in which **box** cannot find the correct path of the script any more. `box::set_script_path` can be used in these cases to set the path of the currently executing R script manually.

### Value

Both `box::script_path` and `box::set_script_path` return the previously set script path, or `NULL` if none was explicitly set. `box::set_script_path` returns its value invisibly.

### Note

**box** *should* be able to figure out the script path automatically. Using `box::set_script_path` should therefore never be necessary. **Please file an issue** if you encounter a situation that necessitates using `box::set_script_path`!

### Examples

```
box::set_script_path('scripts/my_script.r')
```

---

|        |                                             |
|--------|---------------------------------------------|
| topenv | <i>Get a module's namespace environment</i> |
|--------|---------------------------------------------|

---

### Description

Called inside a module, `box::topenv()` returns the module namespace environment. Otherwise, it behaves similarly to [topenv](#).

### Usage

```
box::topenv()
```

```
box::topenv(env)
```

### Arguments

|        |                      |
|--------|----------------------|
| module | a module environment |
|--------|----------------------|

### Value

`box::topenv()` returns the top-level module environment of the module it is called from, or the nearest top-level non-module environment otherwise; this is usually `.GlobalEnv`.

`box::topenv(env)` returns the nearest top-level environment that is a direct or indirect parent of `env`.

---

 unload

 Unload or reload modules
 

---

### Description

Given a module which has been previously loaded and is assigned to an alias `mod`, `box::unload(mod)` unloads it; `box::reload(mod)` unloads and reloads it from its source. `box::purge_cache()` marks all modules as unloaded.

### Usage

```
box::unload(mod)
```

```
box::reload(mod)
```

```
box::purge_cache()
```

### Arguments

`mod`                      a module object to be unloaded or reloaded

### Details

Unloading a module causes it to be removed from the internal cache such that the next subsequent `box::use` declaration will reload the module from its source. `box::reload` unloads and reloads the specified modules and all its transitive module dependencies. `box::reload` is *not* merely a shortcut for calling `box::unload` followed by `box::use`, because `box::unload` only unloads the specified module itself, not any dependent modules.

### Value

These functions are called for their side effect. They do not return anything.

### Note

Any other references to the loaded modules remain unchanged, and will (usually) still work. Unloading and reloading modules is primarily useful for testing during development, and *should not be used in production code*: in particular, unloading may break other module references if the `.on_unload` hook unloaded any binary shared libraries which are still referenced.

These functions come with a few restrictions. `box::unload` attempts to detach names attached by the corresponding `box::use` call. `box::reload` attempts to re-attach these same names. This only works if the corresponding `box::use` declaration is located in the same scope. `box::purge_cache` only removes the internal cache of modules, it does not actually invalidate any module references or names attached from loaded modules.

`box::unload` will execute the `.on_unload` hook of the module, if it exists. `box::reload` will re-execute the `.on_load` hook of the module and of all dependent modules during loading (after executing the corresponding `.on_unload` hooks during unloading). `box::purge_cache` will execute any existing `.on_unload` hooks in all loaded modules.



**See Also**

[box::use](#), [module hooks](#)

---

|     |                                   |
|-----|-----------------------------------|
| use | <i>Import a module or package</i> |
|-----|-----------------------------------|

---

**Description**

`box::use` imports one or more modules and/or packages, and makes them available in the calling environment.

**Usage**

```
box::use(prefix/mod, ...)

box::use(pkg, ...)

box::use(alias = prefix/mod, ...)

box::use(alias = pkg, ...)

box::use(prefix/mod[attach_list], ...)

box::use(pkg[attach_list], ...)
```

**Arguments**

|                          |                                                                                                                                               |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <code>...</code>         | further import declarations                                                                                                                   |
| <code>prefix/mod</code>  | a qualified module name                                                                                                                       |
| <code>pkg</code>         | a package name                                                                                                                                |
| <code>alias</code>       | an alias name                                                                                                                                 |
| <code>attach_list</code> | a list of names to attached, optionally with aliases of the form <code>alias = name</code> ; or the special placeholder name <code>...</code> |

**Details**

`box::use(...)` specifies a list of one or more import declarations, given as individual arguments to `box::use`, separated by comma. `box::use` permits using a trailing comma after the last import declaration. Each import declaration takes one of the following forms:

*prefix/mod*: Import a module given the qualified module name *prefix/mod* and make it available locally using the name *mod*. The *prefix* itself can be a nested name to allow importing specific submodules. *Local imports* can be specified via the prefixes starting with `.` and `..`, to override the search path and use the local path instead. See the ‘Search path’ below for details.

*pkg*: Import a package *pkg* and make it available locally using its own package name.

*alias* = *prefix/mod* **or** *alias* = *pkg*: Import a module or package, and make it available locally using the name *alias* instead of its regular module or package name.

*prefix/mod[attach\_list]* **or** *pkg[attach\_list]*: Import a module or package and attach the exported symbols listed in *attach\_list* locally. This declaration does *not* make the module/package itself available locally. To override this, provide an alias, that is, use *alias* = *prefix/mod[attach\_list]* or *alias* = *pkg[attach\_list]*.

The *attach\_list* is a comma-separated list of names, optionally with aliases assigned via *alias* = *name*. The list can also contain the special symbol `...`, which causes *all* exported names of the module/package to be imported.

See the vignette at `vignette('box', 'box')` for detailed examples of the different types of use declarations listed above.

## Value

`box::use` has no return value. It is called for its side effect.

## Import semantics

Modules and packages are loaded into dedicated namespace environments. Names from a module or package can be selectively attached to the current scope as shown above.

Unlike with `library`, attaching happens *locally*, i.e. in the caller's environment: if `box::use` is executed in the global environment, the effect is the same. Otherwise, the effect of importing and attaching a module or package is limited to the caller's local scope (`its environment()`). When used *inside a module* at module scope, the newly imported module is only available inside the module's scope, not outside it (nor in other modules which might be loaded).

Member access of (non-attached) exported names of modules and packages happens via the `$` operator. This operator does not perform partial argument matching, in contrast with the behavior of the `$` operator in base R, which matches partial names.

**Note** that replacement functions (i.e. functions of the form `fun<-`) must be *attached* to be usable, because R syntactically does not allow assignment calls where the left-hand side of the assignment contains `$`.

## Export specification

Names defined in modules can be marked as *exported* by prefixing them with an `@export` tag comment; that is, the name needs to be immediately prefixed by a comment that reads, verbatim, `#' @export`. That line may optionally be part of a **roxygen2** documentation for that name.

Alternatively, exports may be specified via the `box::export` function, but using declarative `@export` tags is generally preferred.

A module which has not declared any exports is treated as a *legacy module* and exports *all* default-visible names (that is, all names that do not start with a dot `(.)`). This usage is present only for backwards compatibility with plain R scripts, and its usage is *not recommended* when writing new modules.

To define a module that exports no names, call `box::export()` without arguments. This prevents the module from being treated as a legacy module.

## Search path

Modules are searched in the module search path, given by `getOption('box.path')`. This is a character vector of paths to search, from the highest to the lowest priority. The current directory is always considered last. That is, if a file `'a/b.r'` exists both locally in the current directory and in a module search path, the local file `'./a/b.r'` will *not* be loaded, unless the import is explicitly declared as `box::use(./a/b)`.

Modules in the module search path *must be organised in subfolders*, and must be imported fully qualified. Keep in mind that `box::use(name)` will *never* attempt to load a module; it always attempts to load a package. A common module organisation is by project, company or user name; for instance, fully qualified module names could mirror repository names on source code sharing websites (such as GitHub).

Given a declaration `box::use(a/b)` and a search path `'p'`, if the file `'p/a/b.r'` does not exist, **box** alternatively looks for a nested file `'p/a/b/___init__r'` to load. Module path names are *case sensitive* (even on case insensitive file systems), but the file extension can be spelled as either `'r'` or `'R'` (if both exist, `.r` is given preference).

The module search path can be overridden by the environment variable `R_BOX_PATH`. If set, it may consist of one or more search paths, separated by the platform's path separator (i.e. `;` on Windows, and `:` on most other platforms).

**Deprecation warning:** in the next major version, **box** will read environment variables only *once*, at package load time. Modifying the value of `R_BOX_PATH` afterwards will have no effect, unless the package is unloaded and reloaded.

The *current directory* is context-dependent: inside a module, the directory corresponds to the module's directory. Inside an R code file invoked from the command line, it corresponds to the directory containing that file. If the code is running inside a **Shiny** application or a **knitr** document, the directory of the execution is used. Otherwise (e.g. in an interactive R session), the current working directory as given by `getwd()` is used.

Local import declarations (that is, module prefixes that start with `./` or `../`) never use the search path to find the module. Instead, only the current module's directory (for `./`) or the parent module's directory (for `../`) is looked at. `../` can be nested: `../../` denotes the grandparent module, etc.

## S3 support

Modules can contain S3 generics and methods. To override known generics (= those defined outside the module), methods inside a module need to be registered using `box::register_S3_method`. See the documentation there for details.

## Module names

A module's full name consists of one or more R names separated by `/`. Since `box::use` declarations contain R expressions, the names need to be valid R names. Non-syntactic names need to be wrapped in backticks; see [Quotes](#).

Furthermore, since module names usually correspond to file or folder names, they should consist only of valid path name characters to ensure portability.

## Encoding

All module source code files are assumed to be UTF-8 encoded.

## See Also

`box::name` and `box::file` give information about loaded modules. `box::help` displays help for a module's exported names. `box::unload` and `box::reload` aid during module development by performing dynamic unloading and reloading of modules in a running R session. `box::export` can be used as an alternative to `@export` comments inside a module to declare module exports.

## Examples

```
# Set the module search path for the example module.
old_opts = options(box.path = system.file(package = 'box'))
old_env = Sys.getenv('R_BOX_PATH', NA)
Sys.unsetenv('R_BOX_PATH')

# Basic usage
# The file `mod/hello_world.r` exports the functions `hello` and `bye`.
box::use(mod/hello_world)
hello_world$hello('Robert')
hello_world$bye('Robert')

# Using an alias
box::use(world = mod/hello_world)
world$hello('John')

# Attaching exported names
box::use(mod/hello_world[hello])
hello('Jenny')
# Exported but not attached, thus access fails:
try(bye('Jenny'))

# Attach everything, give `hello` an alias:
box::use(mod/hello_world[hi = hello, ...])
hi('Eve')
bye('Eve')

# Reset the module search path
on.exit({
  options(old_opts)
  if (! is.na(old_env)) Sys.setenv(R_BOX_PATH = old_env)
})

## Not run:
# The following code illustrates different import declaration syntaxes
# inside a single `box::use` declaration:

box::use(
  global/mod,
  mod2 = ./local/mod,
  purrr,
  tbl = tibble,
  dplyr = dplyr[filter, select],
  stats[st_filter = filter, ...],
)
```

```
# This declaration makes the following names available in the caller's scope:
#
# 1. `mod`, which refers to the module environment for `global/mod`
# 2. `mod2`, which refers to the module environment for `./local/mod`
# 3. `purrr`, which refers to the package environment for 'purrr'
# 4. `tbl`, which refers to the package environment for 'tibble'
# 5. `dplyr`, which refers to the package environment for 'dplyr'
# 6. `filter` and `select`, which refer to the names exported by 'dplyr'
# 7. `st_filter`, which refers to `stats::filter`
# 8. all other exported names from the 'stats' package

## End(Not run)
```

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