

Package ‘testthat’

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Title Unit Testing for R

Version 3.0.2

Description Software testing is important, but, in part because it is frustrating and boring, many of us avoid it. 'testthat' is a testing framework for R that is easy to learn and use, and integrates with your existing 'workflow'.

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URL <https://testthat.r-lib.org>, <https://github.com/r-lib/testthat>

BugReports <https://github.com/r-lib/testthat/issues>

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auto_test	<i>Watches code and tests for changes, rerunning tests as appropriate.</i>
-----------	--

Description

The idea behind `auto_test()` is that you just leave it running while you develop your code. Everytime you save a file it will be automatically tested and you can easily see if your changes have caused any test failures.

Usage

```
auto_test(  
  code_path,  
  test_path,  
  reporter = default_reporter(),  
  env = test_env(),  
  hash = TRUE  
)
```

Arguments

<code>code_path</code>	path to directory containing code
<code>test_path</code>	path to directory containing tests
<code>reporter</code>	test reporter to use
<code>env</code>	environment in which to execute test suite.
<code>hash</code>	Passed on to watch() . When FALSE, uses less accurate modification time stamps, but those are faster for large files.

Details

The current strategy for rerunning tests is as follows:

- if any code has changed, then those files are reloaded and all tests rerun
- otherwise, each new or modified test is run

In the future, `auto_test()` might implement one of the following more intelligent alternatives:

- Use codetools to build up dependency tree and then rerun tests only when a dependency changes.
- Mimic ruby's autotest and rerun only failing tests until they pass, and then rerun all tests.

See Also

[auto_test_package\(\)](#)

`auto_test_package` *Watches a package for changes, rerunning tests as appropriate.*

Description

Watches a package for changes, rerunning tests as appropriate.

Usage

```
auto_test_package(pkg = ".", reporter = default_reporter(), hash = TRUE)
```

Arguments

<code>pkg</code>	path to package
<code>reporter</code>	test reporter to use
<code>hash</code>	Passed on to watch() . When FALSE, uses less accurate modification time stamps, but those are faster for large files.

See Also

[auto_test\(\)](#) for details on how method works

`CheckReporter` *Check reporter: 13 line summary of problems*

Description

R CMD check displays only the last 13 lines of the result, so this report is design to ensure that you see something useful there.

See Also

Other reporters: [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

comparison-expectations

Does code return a number greater/less than the expected value?

Description

Does code return a number greater/less than the expected value?

Usage

```
expect_lt(object, expected, label = NULL, expected.label = NULL)
```

```
expect_lte(object, expected, label = NULL, expected.label = NULL)
```

```
expect_gt(object, expected, label = NULL, expected.label = NULL)
```

```
expect_gte(object, expected, label = NULL, expected.label = NULL)
```

Arguments

object	Computation and value to compare it to. Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
expected	Single numeric value to compare.
label	Used to customise failure messages. For expert use only.
expected.label	Used to customise failure messages. For expert use only.

See Also

Other expectations: [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```
a <- 9
expect_lt(a, 10)

## Not run:
expect_lt(11, 10)

## End(Not run)

a <- 11
expect_gt(a, 10)
## Not run:
expect_gt(9, 10)
```

```
## End(Not run)
```

DebugReporter	<i>Test reporter: start recovery.</i>
---------------	---------------------------------------

Description

This reporter will call a modified version of `recover()` on all broken expectations.

See Also

Other reporters: [CheckReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

describe	<i>describe: a BDD testing language</i>
----------	---

Description

A simple BDD DSL for writing tests. The language is similar to RSpec for Ruby or Mocha for JavaScript. BDD tests read like sentences and it should thus be easier to understand what the specification of a function/component is.

Usage

```
describe(description, code)
```

Arguments

description	description of the feature
code	test code containing the specs

Details

Tests using the `describe` syntax not only verify the tested code, but also document its intended behaviour. Each `describe` block specifies a larger component or function and contains a set of specifications. A specification is defined by an `it` block. Each `it` block functions as a test and is evaluated in its own environment. You can also have nested `describe` blocks.

This test syntax helps to test the intended behaviour of your code. For example: you want to write a new function for your package. Try to describe the specification first using `describe`, before you write any code. After that, you start to implement the tests for each specification (i.e. the `it` block).

Use `describe` to verify that you implement the right things and use `test_that()` to ensure you do the things right.

Examples

```

describe("matrix()", {
  it("can be multiplied by a scalar", {
    m1 <- matrix(1:4, 2, 2)
    m2 <- m1 * 2
    expect_equal(matrix(1:4 * 2, 2, 2), m2)
  })
  it("can have not yet tested specs")
})

# Nested specs:
## code
addition <- function(a, b) a + b
division <- function(a, b) a / b

## specs
describe("math library", {
  describe("addition()", {
    it("can add two numbers", {
      expect_equal(1 + 1, addition(1, 1))
    })
  })
  describe("division()", {
    it("can divide two numbers", {
      expect_equal(10 / 2, division(10, 2))
    })
    it("can handle division by 0") #not yet implemented
  })
})

```

equality-expectations *Does code return the expected value?*

Description

These functions provide two levels of strictness when comparing a computation to a reference value. `expect_identical()` is the baseline; `expect_equal()` relaxes the test to ignore small numeric differences.

In the 2nd edition, `expect_identical()` uses `identical()` and `expect_equal` uses `all.equal()`. In the 3rd edition, both functions use `waldo`. They differ only in that `expect_equal()` sets `tolerance = testthat_tolerance()` so that small floating point differences are ignored; this also implies that (e.g.) 1 and 1L are treated as equal.

Usage

```

expect_equal(
  object,
  expected,

```

```

    ...,
    tolerance = if (edition_get() >= 3) testthat_tolerance(),
    info = NULL,
    label = NULL,
    expected.label = NULL
  )

expect_identical(
  object,
  expected,
  info = NULL,
  label = NULL,
  expected.label = NULL,
  ...
)

```

Arguments

object, expected	Computation and value to compare it to. Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
...	3e: passed on to waldo::compare() . See its docs to see other ways to control comparison. 2e: passed on to compare()/identical() .
tolerance	3e: passed on to waldo::compare() . If non-NULL, will ignore small floating point differences. It uses same algorithm as all.equal() so the tolerance is usually relative (i.e. $\text{mean}(\text{abs}(x - y) / \text{mean}(\text{abs}(y))) < \text{tolerance}$), except when the differences are very small, when it becomes absolute (i.e. $\text{mean}(\text{abs}(x - y)) < \text{tolerance}$). See waldo documentation for more details. 2e: passed on to compare() , if set. It's hard to reason about exactly what tolerance means because depending on the precise code path it could be either an absolute or relative tolerance.
info	Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label .
label, expected.label	Used to customise failure messages. For expert use only.

See Also

- [expect_setequal\(\)/expect_mapequal\(\)](#) to test for set equality.
- [expect_reference\(\)](#) to test if two names point to same memory address.

Other expectations: [comparison-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```

a <- 10
expect_equal(a, 10)

# Use expect_equal() when testing for numeric equality
## Not run:
expect_identical(sqrt(2) ^ 2, 2)

## End(Not run)
expect_equal(sqrt(2) ^ 2, 2)

```

expect

The building block of all expect_ functions

Description

Call `expect()` when writing your own expectations. See vignette("custom-expectation") for details.

Usage

```

expect(
  ok,
  failure_message,
  info = NULL,
  srcref = NULL,
  trace = NULL,
  trace_env = caller_env()
)

```

Arguments

<code>ok</code>	TRUE or FALSE indicating if the expectation was successful.
<code>failure_message</code>	Message to show if the expectation failed.
<code>info</code>	Character vector continuing additional information. Included for backward compatibility only and new expectations should not use it.
<code>srcref</code>	Location of the failure. Should only needed to be explicitly supplied when you need to forward a <code>srcref</code> captured elsewhere.
<code>trace</code>	An optional backtrace created by <code>rlang::trace_back()</code> . When supplied, the expectation is displayed with the backtrace.
<code>trace_env</code>	If <code>is.null(trace)</code> , this is used to automatically generate a traceback running from <code>test_code()/test_file()</code> to <code>trace_env</code> . You'll generally only need to set this if you're wrapping an expectation inside another function.

Details

While `expect()` creates and signals an expectation in one go, `exp_signal()` separately signals an expectation that you have manually created with `new_expectation()`. Expectations are signalled with the following protocol:

- If the expectation is a failure or an error, it is signalled with `base::stop()`. Otherwise, it is signalled with `base::signalCondition()`.
- The `continue_test` restart is registered. When invoked, failing expectations are ignored and normal control flow is resumed to run the other tests.

Value

An expectation object. Signals the expectation condition with a `continue_test` restart.

See Also

[exp_signal\(\)](#)

expect_error

Does code throw an error, warning, message, or other condition?

Description

`expect_error()`, `expect_warning()`, `expect_message()`, and `expect_condition()` check that code throws an error, warning, message, or condition with a message that matches `regexp`, or a class that inherits from `class`. See below for more details.

In the 3rd edition, these functions match a single condition. All additional and non-matching (if `regexp` or `class` are used) conditions will bubble up outside the expectation. If these additional conditions are important you'll need to catch them with additional `expect_message()/expect_warning()` calls; if they're unimportant you can ignore with `suppressMessages()/suppressWarnings()`.

Usage

```
expect_error(
  object,
  regexp = NULL,
  class = NULL,
  ...,
  info = NULL,
  label = NULL
)
```

```
expect_warning(
  object,
  regexp = NULL,
  class = NULL,
```

```

    ...,
    all = FALSE,
    info = NULL,
    label = NULL
)

expect_message(
  object,
  regexp = NULL,
  class = NULL,
  ...,
  all = FALSE,
  info = NULL,
  label = NULL
)

expect_condition(
  object,
  regexp = NULL,
  class = NULL,
  ...,
  info = NULL,
  label = NULL
)

```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
regexp	Regular expression to test against. <ul style="list-style-type: none"> • A character vector giving a regular expression that must match the error message. • If NULL, the default, asserts that there should be a error, but doesn't test for a specific value. • If NA, asserts that there should be no errors.
class	Instead of supplying a regular expression, you can also supply a class name. This is useful for "classed" conditions.
...	Arguments passed on to expect_match perl logical. Should Perl-compatible regexps be used? fixed logical. If TRUE, pattern is a string to be matched as is. Overrides all conflicting arguments.
info	Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label .
label	Used to customise failure messages. For expert use only.
all	<i>DEPRECATED</i> If you need to test multiple warnings/messages you now need to use multiple calls to <code>expect_message()/ expect_warning()</code>

Value

If `regexp = NA`, the value of the first argument; otherwise the captured condition.

Testing message vs class

When checking that code generates an error, it's important to check that the error is the one you expect. There are two ways to do this. The first way is the simplest: you just provide a `regexp` that match some fragment of the error message. This is easy, but fragile, because the test will fail if the error message changes (even if its the same error).

A more robust way is to test for the class of the error, if it has one. You can learn more about custom conditions at <https://adv-r.hadley.nz/conditions.html#custom-conditions>, but in short, errors are S3 classes and you can generate a custom class and check for it using `class` instead of `regexp`.

If you are using `expect_error()` to check that an error message is formatted in such a way that it makes sense to a human, we recommend using `expect_snapshot()` instead.

See Also

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```
# Errors -----
f <- function() stop("My error!")
expect_error(f())
expect_error(f(), "My error!")

# You can use the arguments of grepl to control the matching
expect_error(f(), "my error!", ignore.case = TRUE)

# Note that `expect_error()` returns the error object so you can test
# its components if needed
err <- expect_error(rlang::abort("a", n = 10))
expect_equal(err$n, 10)

# Warnings -----
f <- function(x) {
  if (x < 0) {
    warning("** is already negative")
    return(x)
  }
  -x
}
expect_warning(f(-1))
expect_warning(f(-1), "already negative")
expect_warning(f(1), NA)

# To test message and output, store results to a variable
```

```

expect_warning(out <- f(-1), "already negative")
expect_equal(out, -1)

# Messages -----
f <- function(x) {
  if (x < 0) {
    message("**x* is already negative")
    return(x)
  }

  -x
}
expect_message(f(-1))
expect_message(f(-1), "already negative")
expect_message(f(1), NA)

```

expect_invisible	<i>Does code return a visible or invisible object?</i>
------------------	--

Description

Use this to test whether a function returns a visible or invisible output. Typically you'll use this to check that functions called primarily for their side-effects return their data argument invisibly.

Usage

```

expect_invisible(call, label = NULL)

expect_visible(call, label = NULL)

```

Arguments

call	A function call.
label	Used to customise failure messages. For expert use only.

Value

The evaluated call, invisibly.

Examples

```

expect_invisible(x <- 10)
expect_visible(x)

# Typically you'll assign the result of the expectation so you can
# also check that the value is as you expect.
greet <- function(name) {
  message("Hi ", name)
  invisible(name)
}

```

```
}  
out <- expect_invisible(greet("Hadley"))  
expect_equal(out, "Hadley")
```

expect_length

Does code return a vector with the specified length?

Description

Does code return a vector with the specified length?

Usage

```
expect_length(object, n)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
n	Expected length.

See Also

[expect_vector\(\)](#) to make assertions about the "size" of a vector

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```
expect_length(1, 1)  
expect_length(1:10, 10)  
  
## Not run:  
expect_length(1:10, 1)  
  
## End(Not run)
```

expect_named	<i>Does code return a vector with (given) names?</i>
--------------	--

Description

You can either check for the presence of names (leaving expected blank), specific names (by supplying a vector of names), or absence of names (with NULL).

Usage

```
expect_named(
  object,
  expected,
  ignore.order = FALSE,
  ignore.case = FALSE,
  info = NULL,
  label = NULL
)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
expected	Character vector of expected names. Leave missing to match any names. Use NULL to check for absence of names.
ignore.order	If TRUE, sorts names before comparing to ignore the effect of order.
ignore.case	If TRUE, lowercases all names to ignore the effect of case.
info	Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label .
label	Used to customise failure messages. For expert use only.

See Also

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```
x <- c(a = 1, b = 2, c = 3)
expect_named(x)
expect_named(x, c("a", "b", "c"))

# Use options to control sensitivity
expect_named(x, c("B", "C", "A"), ignore.order = TRUE, ignore.case = TRUE)
```

```
# Can also check for the absence of names with NULL
z <- 1:4
expect_named(z, NULL)
```

expect_output	<i>Does code print output to the console?</i>
---------------	---

Description

Test for output produced by `print()` or `cat()`. This is best used for very simple output; for more complex cases use [verify_output\(\)](#).

Usage

```
expect_output(
  object,
  regexp = NULL,
  ...,
  info = NULL,
  label = NULL,
  width = 80
)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
regexp	Regular expression to test against. <ul style="list-style-type: none"> • A character vector giving a regular expression that must match the output. • If <code>NULL</code>, the default, asserts that there should output, but doesn't check for a specific value. • If <code>NA</code>, asserts that there should be no output.
...	Arguments passed on to expect_match <p>all Should all elements of actual value match regexp (TRUE), or does only one need to match (FALSE)</p> <p>perl logical. Should Perl-compatible regexps be used?</p> <p>fixed logical. If TRUE, pattern is a string to be matched as is. Overrides all conflicting arguments.</p>
info	Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label .
label	Used to customise failure messages. For expert use only.
width	Number of characters per line of output. This does not inherit from <code>getOption("width")</code> so that tests always use the same output width, minimising spurious differences.

Value

The first argument, invisibly.

See Also

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```
str(mtcars)
expect_output(str(mtcars), "32 obs")
expect_output(str(mtcars), "11 variables")

# You can use the arguments of grepl to control the matching
expect_output(str(mtcars), "11 VARIABLES", ignore.case = TRUE)
expect_output(str(mtcars), "$ mpg", fixed = TRUE)
```

expect_setequal	<i>Does code return a vector containing the expected values?</i>
-----------------	--

Description

- `expect_setequal(x, y)` tests that every element of `x` occurs in `y`, and that every element of `y` occurs in `x`.
- `expect_mapequal(x, y)` tests that `x` and `y` have the same names, and that `x[names(y)]` equals `y`.

Usage

```
expect_setequal(object, expected)
```

```
expect_mapequal(object, expected)
```

Arguments

object	Computation and value to compare it to. Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
expected	Computation and value to compare it to. Both arguments supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.

Details

Note that `expect_setequal()` ignores names, and you will be warned if both `object` and `expected` have them.

Examples

```

expect_setequal(letters, rev(letters))
show_failure(expect_setequal(letters[-1], rev(letters)))

x <- list(b = 2, a = 1)
expect_mapequal(x, list(a = 1, b = 2))
show_failure(expect_mapequal(x, list(a = 1)))
show_failure(expect_mapequal(x, list(a = 1, b = "x")))
show_failure(expect_mapequal(x, list(a = 1, b = 2, c = 3)))

```

expect_silent	<i>Does code execute silently?</i>
---------------	------------------------------------

Description

Checks that the code produces no output, messages, or warnings.

Usage

```
expect_silent(object)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
--------	--

Value

The first argument, invisibly.

See Also

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [inheritance-expectations](#), [logical-expectations](#)

Examples

```

expect_silent("123")

f <- function() {
  message("Hi!")
  warning("Hey!!")
  print("OY!!!")
}
## Not run:
expect_silent(f())

## End(Not run)

```

expect_snapshot	<i>Snapshot testing</i>
-----------------	-------------------------

Description

[Experimental]

Snapshot tests (aka golden tests) are similar to unit tests except that the expected result is stored in a separate file that is managed by testthat. Snapshot tests are useful for when the expected value is large, or when the intent of the code is something that can only be verified by a human (e.g. this is a useful error message). Learn more in vignette("snapshotting").

- `expect_snapshot()` captures all messages, warnings, errors, and output from code.
- `expect_snapshot_output()` captures just output printed to the console.
- `expect_snapshot_error()` captures just error messages.
- `expect_snapshot_value()` captures the return value.

(These functions supersede `verify_output()`, `expect_known_output()`, `expect_known_value()`, and `expect_known_hash()`.)

Usage

```
expect_snapshot(x, cran = FALSE, error = FALSE)

expect_snapshot_output(x, cran = FALSE)

expect_snapshot_error(x, class = "error", cran = FALSE)

expect_snapshot_value(
  x,
  style = c("json", "json2", "deparse", "serialize"),
  cran = FALSE,
  ...
)
```

Arguments

<code>x</code>	Code to evaluate.
<code>cran</code>	Should these expectations be verified on CRAN? By default, they are not, because snapshot tests tend to be fragile because they often rely on minor details of dependencies.
<code>error</code>	Do you expect the code to throw an error? The expectation will fail (even on CRAN) if an unexpected error is thrown or the expected error is not thrown.
<code>class</code>	Expected class of condition, e.g. use <code>error</code> for errors, <code>warning</code> for warnings, <code>message</code> for messages. The expectation will always fail (even on CRAN) if a condition of this class isn't seen when executing <code>x</code> .

style	Serialization style to use: <ul style="list-style-type: none"> • json uses <code>jsonlite::fromJSON()</code> and <code>jsonlite::toJSON()</code>. This produces the simplest output but only works for relatively simple objects. • json2 uses <code>jsonlite::serializeJSON()</code> and <code>jsonlite::unserializeJSON()</code> which are more verbose but work for a wider range of type. • deparse uses <code>deparse()</code>, which generates a depiction of the object using R code. • <code>serialize()</code> produces a binary serialization of the object using <code>serialize()</code>. This is all but guaranteed to work for any R object, but produces a completely opaque serialization.
...	For <code>expect_snapshot_value()</code> only, passed on to <code>waldo::compare()</code> so you can control the details of the comparison.

Workflow

The first time that you run a snapshot expectation it will run `x`, capture the results, and record in `tests/testthat/snap/{test}.json`. Each test file gets its own snapshot file, e.g. `test-foo.R` will get `snap/foo.json`.

It's important to review the JSON files and commit them to git. They are designed to be human readable, and you should always review new additions to ensure that the salient information has been captured. They should also be carefully reviewed in pull requests, to make sure that snapshots have updated in the expected way.

On subsequent runs, the result of `x` will be compared to the value stored on disk. If it's different, the expectation will fail, and a new file `snap/{test}.new.json` will be created. If the change was deliberate, you can approve the change with `snapshot_accept()` and then the tests will pass the next time you run them.

Note that snapshotting can only work when executing a complete test file (with `test_file()`, `test_dir()`, or friends) because there's otherwise no way to figure out the snapshot path. If you run snapshot tests interactively, they'll just display the current value.

expect_snapshot_file *Snapshot testing for whole files*

Description

Whole file snapshot testing is designed for testing objects that don't have a convenient textual representation, with initial support for images (`.png`, `.jpg`, `.svg`), data frames (`.csv`), and text files (`.R`, `.txt`, `.json`, ...).

The first time `expect_snapshot_file()` is run, it will create `_snaps/{test}/{name}.{ext}` containing reference output. Future runs will be compared to this reference: if different, the test will fail and the new results will be saved in `_snaps/{test}/{name}.new.{ext}`. To review failures, call `snapshot_review()`.

We generally expect this function to be used via a wrapper that takes care of ensuring that output is as reproducible as possible, e.g. automatically skipping tests where it's known that images can't be reproduced exactly.

Usage

```
expect_snapshot_file(path, name = basename(path), binary = TRUE, cran = FALSE)
```

Arguments

path	Path to file to snapshot.
name	Snapshot name, taken from path by default.
binary	If FALSE, files are compared line-by-line, ignoring the difference between Windows and Mac/Linux line endings.
cran	Should these expectations be verified on CRAN? By default, they are not, because snapshot tests tend to be fragile because they often rely on minor details of dependencies.

Examples

```
# To use expect_snapshot_file() you'll typically need to start by writing
# a helper function that creates a file from your code, returning a path
save_png <- function(code, width = 400, height = 400) {
  path <- tempfile(fileext = ".png")
  png(path, width = width, height = height)
  on.exit(dev.off())
  code

  path
}
path <- save_png(plot(1:5))
path

## Not run:
expect_snapshot_file(save_png(hist(mtcars$mpg)), "plot.png")

## End(Not run)

# You'd then also provide a helper that skips tests where you can't
# be sure of producing exactly the same output
expect_snapshot_plot <- function(name, code) {
  # Other packages might affect results
  skip_if_not_installed("ggplot2", "2.0.0")
  # Or maybe the output is different on some operation systems
  skip_on_os("windows")
  # You'll need to carefully think about and experiment with these skips

  path <- save_png(code)
  expect_snapshot_file(path, paste0(name, ".png"))
}
```

expect_vector	<i>Does code return a vector with the expected size and/or prototype?</i>
---------------	---

Description

expect_vector() is a thin wrapper around `vctrs::vec_assert()`, converting the results of that function in to the expectations used by testthat. This means that it used the vctrs of ptype (prototype) and size. See details in <https://vctrs.r-lib.org/articles/type-size.html>

Usage

```
expect_vector(object, ptype = NULL, size = NULL)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
ptype	(Optional) Vector prototype to test against. Should be a size-0 (empty) generalised vector.
size	(Optional) Size to check for.

Examples

```
if (requireNamespace("vctrs") && packageVersion("vctrs") > "0.1.0.9002") {
  expect_vector(1:10, ptype = integer(), size = 10)
  show_failure(expect_vector(1:10, ptype = integer(), size = 5))
  show_failure(expect_vector(1:10, ptype = character(), size = 5))
}
```

fail	<i>Default expectations that always succeed or fail.</i>
------	--

Description

These allow you to manually trigger success or failure. Failure is particularly useful to a precondition or mark a test as not yet implemented.

Usage

```
fail(
  message = "Failure has been forced",
  info = NULL,
  trace_env = caller_env()
)

succeed(message = "Success has been forced", info = NULL)
```

Arguments

message	a string to display.
info	Character vector continuing additional information. Included for backward compatibility only and new expectations should not use it.
trace_env	If <code>is.null(trace)</code> , this is used to automatically generate a traceback running from <code>test_code()/test_file()</code> to <code>trace_env</code> . You'll generally only need to set this if you're wrapping an expectation inside another function.

Examples

```
## Not run:
test_that("this test fails", fail())
test_that("this test succeeds", succeed())

## End(Not run)
```

FailReporter	<i>Test reporter: fail at end.</i>
--------------	------------------------------------

Description

This reporter will simply throw an error if any of the tests failed. It is best combined with another reporter, such as the [SummaryReporter](#).

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

inheritance-expectations

Does code return an object inheriting from the expected base type, S3 class, or S4 class?

Description

See <https://adv-r.hadley.nz/oo.html> for an overview of R's OO systems, and the vocabulary used here.

- `expect_type(x, type)` checks that `typeof(x)` is `type`.
- `expect_s3_class(x, class)` checks that `x` is an S3 object that `inherits()` from `class`
- `expect_s3_class(x, NA)` checks that `x` isn't an S3 object.
- `expect_s4_class(x, class)` checks that `x` is an S4 object that `is()` `class`.
- `expect_s4_class(x, NA)` checks that `x` isn't an S4 object.

See [expect_vector\(\)](#) for testing properties of objects created by `vctrs`.

Usage

```
expect_type(object, type)

expect_s3_class(object, class, exact = FALSE)

expect_s4_class(object, class)
```

Arguments

<code>object</code>	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
<code>type</code>	String giving base type (as returned by <code>typeof()</code>).
<code>class</code>	Either a character vector of class names, or for <code>expect_s3_class()</code> and <code>expect_s4_class()</code> , an NA to assert that <code>object</code> isn't an S3 or S4 object.
<code>exact</code>	If FALSE, the default, checks that <code>object</code> inherits from <code>class</code> . If TRUE, checks that <code>object</code> has a class that's identical to <code>class</code> .

See Also

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [logical-expectations](#)

Examples

```
x <- data.frame(x = 1:10, y = "x", stringsAsFactors = TRUE)
# A data frame is an S3 object with class data.frame
expect_s3_class(x, "data.frame")
show_failure(expect_s4_class(x, "data.frame"))
# A data frame is built from a list:
expect_type(x, "list")

# An integer vector is an atomic vector of type "integer"
expect_type(x$x, "integer")
# It is not an S3 object
show_failure(expect_s3_class(x$x, "integer"))

# Above, we requested data.frame() converts strings to factors:
show_failure(expect_type(x$y, "character"))
expect_s3_class(x$y, "factor")
expect_type(x$y, "integer")
```

`is_testing`*Determine testing status*

Description

- `is_testing()` determine if code is being run as part of a test
- `is_parallel()` if the test is being run in parallel.
- `testing_package()` gives name of the package being tested.

These are thin wrappers that retrieve the values of environment variables. To avoid creating a run-time dependency on `testthat`, you can inline the source of these functions directly into your package.

Usage

`is_testing()``is_parallel()``testing_package()`

`JUnitReporter`*Test reporter: summary of errors in jUnit XML format.*

Description

This reporter includes detailed results about each test and summaries, written to a file (or stdout) in jUnit XML format. This can be read by the Jenkins Continuous Integration System to report on a dashboard etc. Requires the `xml2` package.

Details

To fit into the jUnit structure, `context()` becomes the `<testsuite>` name as well as the base of the `<testcase>` classname. The `test_that()` name becomes the rest of the `<testcase>` classname. The deparsed `expect_that()` call becomes the `<testcase>` name. On failure, the message goes into the `<failure>` node message argument (first line only) and into its text content (full message).

Execution time and some other details are also recorded.

References for the jUnit XML format: <http://llg.cubic.org/docs/junit/>

ListReporter	<i>List reporter: gather all test results along with elapsed time and file information.</i>
--------------	---

Description

This reporter gathers all results, adding additional information such as test elapsed time, and test filename if available. Very useful for reporting.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

LocationReporter	<i>Test reporter: location</i>
------------------	--------------------------------

Description

This reporter simply prints the location of every expectation and error. This is useful if you're trying to figure out the source of a segfault, or you want to figure out which code triggers a C/C++ breakpoint

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

logical-expectations	<i>Does code return TRUE or FALSE?</i>
----------------------	--

Description

These are fall-back expectations that you can use when none of the other more specific expectations apply. The disadvantage is that you may get a less informative error message.

Usage

```
expect_true(object, info = NULL, label = NULL)
```

```
expect_false(object, info = NULL, label = NULL)
```

Arguments

object	Object to test. Supports limited unquoting to make it easier to generate readable failures within a function or for loop. See quasi_label for more details.
info	Extra information to be included in the message. This argument is soft-deprecated and should not be used in new code. Instead see alternatives in quasi_label .
label	Used to customise failure messages. For expert use only.

Details

Attributes are ignored.

See Also

[is_false\(\)](#) for complement

Other expectations: [comparison-expectations](#), [equality-expectations](#), [expect_error\(\)](#), [expect_length\(\)](#), [expect_match\(\)](#), [expect_named\(\)](#), [expect_null\(\)](#), [expect_output\(\)](#), [expect_reference\(\)](#), [expect_silent\(\)](#), [inheritance-expectations](#)

Examples

```
expect_true(2 == 2)
# Failed expectations will throw an error
## Not run:
expect_true(2 != 2)

## End(Not run)
expect_true(!(2 != 2))
# or better:
expect_false(2 != 2)

a <- 1:3
expect_true(length(a) == 3)
# but better to use more specific expectation, if available
expect_equal(length(a), 3)
```

MinimalReporter

Test reporter: minimal.

Description

The minimal test reporter provides the absolutely minimum amount of information: whether each expectation has succeeded, failed or experienced an error. If you want to find out what the failures and errors actually were, you'll need to run a more informative test reporter.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

MultiReporter

Multi reporter: combine several reporters in one.

Description

This reporter is useful to use several reporters at the same time, e.g. adding a custom reporter without removing the current one.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

ProgressReporter

Test reporter: interactive progress bar of errors.

Description

ProgressReporter is designed for interactively use. It's goal is to give you actionable insights to help you understand the status of your code. This reporter also praises you from time-to-time if all your tests pass. It's the default reporter for [test_dir\(\)](#).

ParallelProgressReporter is very similar to ProgressReporter, but works better for packages that want parallel tests.

CompactProgressReporter is a minimal version of ProgressReporter designed for use with single files. It's the default reporter for [test_file\(\)](#).

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

RStudioReporter	<i>Test reporter: RStudio</i>
-----------------	-------------------------------

Description

This reporter is designed for output to RStudio. It produces results in any easily parsed form.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

SilentReporter	<i>Test reporter: gather all errors silently.</i>
----------------	---

Description

This reporter quietly runs all tests, simply gathering all expectations. This is helpful for programmatically inspecting errors after a test run. You can retrieve the results with the `expectations()` method.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

skip	<i>Skip a test</i>
------	--------------------

Description

`skip_if()` and `skip_if_not()` allow you to skip tests, immediately concluding a `test_that()` block without executing any further expectations. This allows you to skip a test without failure, if for some reason it can't be run (e.g. it depends on the feature of a specific operating system, or it requires a specific version of a package).

See `vignette("skipping")` for more details.

Usage

```
skip(message)

skip_if_not(condition, message = NULL)

skip_if(condition, message = NULL)

skip_if_not_installed(pkg, minimum_version = NULL)

skip_if_offline(host = "r-project.org")

skip_on_cran()

skip_on_os(os)

skip_on_travis()

skip_on_appveyor()

skip_on_ci()

skip_on_covr()

skip_on_bioc()

skip_if_translated(msgid = "'%s' not found")
```

Arguments

message	A message describing why the test was skipped.
condition	Boolean condition to check. <code>skip_if_not()</code> will skip if FALSE, <code>skip_if()</code> will skip if TRUE.
pkg	Name of package to check for
minimum_version	Minimum required version for the package
host	A string with a hostname to lookup
os	Character vector of system names. Supported values are "windows", "mac", "linux" and "solaris".
msgid	R message identifier used to check for translation: the default uses a message included in most translation packs. See the complete list in R-base.pot .

Helpers

- `skip_if_not_installed("pkg")` skips tests if package "pkg" is not installed or cannot be loaded (using `requireNamespace()`). Generally, you can assume that suggested packages are installed, and you do not need to check for them specifically, unless they are particularly difficult to install.

- `skip_if_offline()` skips if an internet connection is not available (using `curl::nslookup()`).
- `skip_if_translated("msg")` skips tests if the "msg" is translated.
- `skip_on_bioc()` skips on Bioconductor (using the `BBS_HOME` env var).
- `skip_on_cran()` skips on CRAN (using the `NOT_CRAN` env var set by devtools and friends).
- `skip_on_covr()` skips when covr is running (using the `R_COVR` env var).
- `skip_on_ci()` skips on continuous integration systems like GitHub Actions, travis, and appveyor (using the `CI` env var). It supersedes the older `skip_on_travis()` and `skip_on_appveyor()` functions.
- `skip_on_os()` skips on the specified operating system(s) ("windows", "mac", "linux", or "solaris").

Examples

```
if (FALSE) skip("No internet connection")

test_that("skip example", {
  expect_equal(1, 1L) # this expectation runs
  skip('skip')
  expect_equal(1, 2) # this one skipped
  expect_equal(1, 3) # this one is also skipped
})
```

snapshot_accept	<i>Snapshot management</i>
-----------------	----------------------------

Description

- `snapshot_accept()` accepts all modified snapshots.
- `snapshot_review()` opens a Shiny app that shows a visual diff of each modified snapshot. This is particularly useful for whole file snapshots created by `expect_snapshot_file()`.

Usage

```
snapshot_accept(files = NULL, path = "tests/testthat")

snapshot_review(files = NULL, path = "tests/testthat")
```

Arguments

<code>files</code>	Optionally, filter affects to snapshots from specified test files. Can be full path to test (<code>tests/testthat/test-foo.R</code>), file name (<code>test-foo.R</code>), or test name (<code>foo</code>).
<code>path</code>	Path to tests.

StopReporter *Test reporter: stop on error.*

Description

The default reporter, executed when `expect_that` is run interactively. It responds by `stop()`ping on failures and doing nothing otherwise. This will ensure that a failing test will raise an error.

Details

This should be used when doing a quick and dirty test, or during the final automated testing of R CMD check. Otherwise, use a reporter that runs all tests and gives you more context about the problem.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [SummaryReporter](#), [TapReporter](#), [TeamcityReporter](#)

SummaryReporter *Test reporter: summary of errors.*

Description

This is a reporter designed for interactive usage: it lets you know which tests have run successfully and as well as fully reporting information about failures and errors.

Details

You can use the `max_reports` field to control the maximum number of detailed reports produced by this reporter. This is useful when running with `auto_test()`

As an additional benefit, this reporter will praise you from time-to-time if all your tests pass.

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [TapReporter](#), [TeamcityReporter](#)

TapReporter	<i>Test reporter: TAP format.</i>
-------------	-----------------------------------

Description

This reporter will output results in the Test Anything Protocol (TAP), a simple text-based interface between testing modules in a test harness. For more information about TAP, see <http://testanything.org>

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TeamcityReporter](#)

TeamcityReporter	<i>Test reporter: Teamcity format.</i>
------------------	--

Description

This reporter will output results in the Teamcity message format. For more information about Teamcity messages, see <http://confluence.jetbrains.com/display/TCD7/Build+Script+Interaction+with+TeamCity>

See Also

Other reporters: [CheckReporter](#), [DebugReporter](#), [FailReporter](#), [ListReporter](#), [LocationReporter](#), [MinimalReporter](#), [MultiReporter](#), [ProgressReporter](#), [RStudioReporter](#), [Reporter](#), [SilentReporter](#), [StopReporter](#), [SummaryReporter](#), [TapReporter](#)

teardown_env	<i>Run code after all test files</i>
--------------	--------------------------------------

Description

This environment has no purpose other than as a handle for `withr::defer()`: use it when you want to run code after all tests have been run. Typically, you'll use `withr::defer(cleanup(), teardown_env())` immediately after you've made a mess in a `setup-*.R` file.

Usage

`teardown_env()`

test_file	<i>Run all tests in a single file</i>
-----------	---------------------------------------

Description

Helper, setup, and teardown files located in the same directory as the test will also be run.

Usage

```
test_file(path, reporter = default_compact_reporter(), package = NULL, ...)
```

Arguments

path	Path to file.
reporter	Reporter to use to summarise output. Can be supplied as a string (e.g. "summary") or as an R6 object (e.g. <code>SummaryReporter\$new()</code>). See Reporter for more details and a list of built-in reporters.
package	If these tests belong to a package, the name of the package.
...	Additional parameters passed on to <code>test_dir()</code>

Value

A list (invisibly) containing data about the test results.

Special files

There are two types of .R file that have special behaviour:

- Test files start with `test` and are executed in alphabetical order.
- Setup files start with `setup` and are executed before tests. If clean up is needed after all tests have been run, you can use `withr::defer(clean_up(), teardown_env())`. See `vignette("test-fixtures")` for more details.

There are two other types of special file that we no longer recommend using:

- Helper files start with `helper` and are executed before tests are run. They're also loaded by `devtools::load_all()`, so there's no real point to them and you should just put your helper code in `R/`.
- Teardown files start with `teardown` and are executed after the tests are run. Now we recommend interleave setup and cleanup code in `setup-` files, making it easier to check that you automatically clean up every mess that you make.

All other files are ignored by `testthat`.

Environments

Each test is run in a clean environment to keep tests as isolated as possible. For package tests, that environment that inherits from the package's namespace environment, so that tests can access internal functions and objects.

Examples

```
path <- testthat_example("success")
test_file(path)
test_file(path, reporter = "minimal")
```

test_package	<i>Run all tests in a package</i>
--------------	-----------------------------------

Description

- `test_local()` tests a local source package.
- `test_package()` tests an installed package.
- `test_check()` checks a package during R CMD check.

Tests live in `tests/testthat`.

Usage

```
test_package(package, reporter = check_reporter(), ...)
```

```
test_check(package, reporter = check_reporter(), ...)
```

```
test_local(path = ".", reporter = NULL, ...)
```

Arguments

package	If these tests belong to a package, the name of the package.
reporter	Reporter to use to summarise output. Can be supplied as a string (e.g. "summary") or as an R6 object (e.g. <code>SummaryReporter\$new()</code>). See Reporter for more details and a list of built-in reporters.
...	Additional arguments passed to <code>test_dir()</code>
path	Path to directory containing tests.

Value

A list (invisibly) containing data about the test results.

R CMD check

To run `testthat` automatically from R CMD check, make sure you have a `tests/testthat.R` that contains:

```
library(testthat)
library(yourpackage)

test_check("yourpackage")
```

Special files

There are two types of .R file that have special behaviour:

- Test files start with `test` and are executed in alphabetical order.
- Setup files start with `setup` and are executed before tests. If clean up is needed after all tests have been run, you can use `withr::defer(clean_up(), teardown_env())`. See `vignette("test-fixtures")` for more details.

There are two other types of special file that we no longer recommend using:

- Helper files start with `helper` and are executed before tests are run. They're also loaded by `devtools::load_all()`, so there's no real point to them and you should just put your helper code in R/.
- Teardown files start with `teardown` and are executed after the tests are run. Now we recommend interleave setup and cleanup code in `setup-` files, making it easier to check that you automatically clean up every mess that you make.

All other files are ignored by `testthat`.

Environments

Each test is run in a clean environment to keep tests as isolated as possible. For package tests, that environment that inherits from the package's namespace environment, so that tests can access internal functions and objects.

test_path	<i>Locate file in testing directory.</i>
-----------	--

Description

This function is designed to work both interactively and during tests, locating files in the `tests/testthat` directory

Usage

```
test_path(...)
```

Arguments

... Character vectors giving path component.

Value

A character vector giving the path.

test_that	<i>Create a test.</i>
-----------	-----------------------

Description

A test encapsulates a series of expectations about small, self-contained set of functionality. Each test is contained in a [context](#) and contains multiple expectations.

Usage

```
test_that(desc, code)
```

Arguments

desc	test name. Names should be kept as brief as possible, as they are often used as line prefixes.
code	test code containing expectations. Braces ({}) should always be used in order to get accurate location data for test failures.

Details

Tests are evaluated in their own environments, and should not affect global state.

When run from the command line, tests return NULL if all expectations are met, otherwise it raises an error.

Examples

```
test_that("trigonometric functions match identities", {
  expect_equal(sin(pi / 4), 1 / sqrt(2))
  expect_equal(cos(pi / 4), 1 / sqrt(2))
  expect_equal(tan(pi / 4), 1)
})
# Failing test:
## Not run:
test_that("trigonometric functions match identities", {
  expect_equal(sin(pi / 4), 1)
})

## End(Not run)
```

 use_catch

Use Catch for C++ Unit Testing

Description

Add the necessary infrastructure to enable C++ unit testing in R packages with **Catch** and `testthat`.

Usage

```
use_catch(dir = getwd())
```

Arguments

`dir` The directory containing an R package.

Details

Calling `use_catch()` will:

1. Create a file `src/test-runner.cpp`, which ensures that the `testthat` package will understand how to run your package's unit tests,
2. Create an example test file `src/test-example.cpp`, which showcases how you might use **Catch** to write a unit test,
3. Add a test file `tests/testthat/test-cpp.R`, which ensures that `testthat` will run your compiled tests during invocations of `devtools::test()` or R CMD check, and
4. Create a file `R/catch-routine-registration.R`, which ensures that R will automatically register this routine when `tools::package_native_routine_registration_skeleton()` is invoked.

You will also need to:

- Add `xml2` to `Suggests`, with e.g. `usethis::use_package("xml2", "Suggests")`
- Add `testthat` to `LinkingTo`, with e.g. `usethis::use_package("testthat", "LinkingTo")`

C++ unit tests can be added to C++ source files within the `src` directory of your package, with a format similar to R code tested with `testthat`. Here's a simple example of a unit test written with `testthat` + **Catch**:

```
context("C++ Unit Test") {
  test_that("two plus two is four") {
    int result = 2 + 2;
    expect_true(result == 4);
  }
}
```

When your package is compiled, unit tests alongside a harness for running these tests will be compiled into your R package, with the C entry point `run_testthat_tests()`. `testthat` will use that entry point to run your unit tests when detected.

Functions

All of the functions provided by Catch are available with the CATCH_ prefix – see [here](#) for a full list. testthat provides the following wrappers, to conform with testthat's R interface:

Function	Catch	Description
context	CATCH_TEST_CASE	The context of a set of tests.
test_that	CATCH_SECTION	A test section.
expect_true	CATCH_CHECK	Test that an expression evaluates to true.
expect_false	CATCH_CHECK_FALSE	Test that an expression evaluates to false.
expect_error	CATCH_CHECK_THROWS	Test that evaluation of an expression throws an exception.
expect_error_as	CATCH_CHECK_THROWS_AS	Test that evaluation of an expression throws an exception of a specific class.

In general, you should prefer using the testthat wrappers, as testthat also does some work to ensure that any unit tests within will not be compiled or run when using the Solaris Studio compilers (as these are currently unsupported by Catch). This should make it easier to submit packages to CRAN that use Catch.

Symbol Registration

If you've opted to disable dynamic symbol lookup in your package, then you'll need to explicitly export a symbol in your package that testthat can use to run your unit tests. testthat will look for a routine with one of the names:

```
C_run_testthat_tests
c_run_testthat_tests
run_testthat_tests
```

See [Controlling Visibility](#) and [Registering Symbols](#) in the **Writing R Extensions** manual for more information.

Advanced Usage

If you'd like to write your own Catch test runner, you can instead use the testthat::catchSession() object in a file with the form:

```
#define TESTTHAT_TEST_RUNNER
#include <testthat.h>

void run()
{
    Catch::Session& session = testthat::catchSession();
    // interact with the session object as desired
}
```

This can be useful if you'd like to run your unit tests with custom arguments passed to the Catch session.

Standalone Usage

If you'd like to use the C++ unit testing facilities provided by Catch, but would prefer not to use the regular testthat R testing infrastructure, you can manually run the unit tests by inserting a call to:

```
.Call("run_testthat_tests", PACKAGE = <pkgName>)
```

as necessary within your unit test suite.

See Also

[Catch](#), the library used to enable C++ unit testing.

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