

Package ‘jobqueue’

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Type Package

Title Run Interruptible Code Asynchronously

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Description Takes an R expression and returns a Job object with a \$stop() method which can be called to terminate the background job. Also provides timeouts and other mechanisms for automatically terminating a background job. The result of the expression is available synchronously via \$result or asynchronously with callbacks or through the 'promises' package framework.

URL <https://cmmr.github.io/jobqueue/>, <https://github.com/cmmr/jobqueue>

BugReports <https://github.com/cmmr/jobqueue/issues>

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Job	<i>How to Evaluate an R Expression</i>
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Description

The Job object encapsulates an expression and its evaluation parameters. It also provides a way to check for and retrieve the result.

Active bindings

`expr` R expression that will be run by this Job.

`vars` Get or set - List of variables that will be placed into the expression's environment before evaluation.

`reformat` Get or set - function (`job`) for defining `<Job>$result`.

`signal` Get or set - Conditions to signal.

`cpus` Get or set - Number of CPUs to reserve for evaluating `expr`.

`timeout` Get or set - Time limits to apply to this Job.

`proxy` Get or set - Job to proxy in place of running `expr`.

`state` Get or set - The Job's state: 'created', 'submitted', 'queued', 'dispatched', 'starting', 'running', or 'done'. *Assigning to `<Job>$state` will trigger callback hooks.*

`output` Get or set - Job's raw output. *Assigning to `<Job>$output` will change the Job's state to 'done'.*

`result` Result of `expr`. Will block until Job is finished.

`hooks` Currently registered callback hooks as a named list of functions. Set new hooks with `<Job>$on()`.

`is_done` TRUE or FALSE depending on if the Job's result is ready.

`uid` A short string, e.g. 'J16', that uniquely identifies this Job.

Methods

Public methods:

- `Job$new()`
- `Job$print()`
- `Job$on()`
- `Job$wait()`
- `Job$stop()`

Method `new()`: Creates a Job object defining how to run an expression on a background worker process.

Typically you won't need to call `Job$new()`. Instead, create a [Queue](#) and use `<Queue>$run()` to generate Job objects.

Usage:

```
Job$new(
  expr,
  vars = NULL,
  timeout = NULL,
  hooks = NULL,
  reformat = NULL,
  signal = FALSE,
  cpus = 1L,
  ...
)
```

Arguments:

`expr` A call or R expression wrapped in curly braces to evaluate on a worker. Will have access to any variables defined by `vars`, as well as the Worker's globals, packages, and init configuration. See `vignette('eval')`.

`vars` A named list of variables to make available to `expr` during evaluation. Alternatively, an object that can be coerced to a named list with `as.list()`, e.g. named vector, data.frame, or environment. Or a function (`job`) that returns such an object.

`timeout` A named numeric vector indicating the maximum number of seconds allowed for each state the job passes through, or 'total' to apply a single timeout from 'submitted' to 'done'. Or a function (`job`) that returns the same. Example: `timeout = c(total = 2.5, running = 1)`. See `vignette('stops')`.

`hooks` A named list of functions to run when the Job state changes, of the form `hooks = list(created = function (worker) {...})`. Or a function (`job`) that returns the same. Names of worker hooks are typically 'created', 'submitted', 'queued', 'dispatched', 'starting', 'running', 'done', or '*' (duplicates okay). See `vignette('hooks')`.

`reformat` Set `reformat = function (job)` to define what `<Job>$result` should return. The default, `reformat = NULL` passes `<Job>$output` to `<Job>$result` unchanged. See `vignette('results')`.

`signal` Should calling `<Job>$result` signal on condition objects? When FALSE, `<Job>$result` will return the object without taking additional action. Setting to TRUE or a character vector of condition classes, e.g. `c('interrupt', 'error', 'warning')`, will cause the equivalent of `stop(<condition>)` to be called when those conditions are produced. Alternatively, a function (`job`) that returns TRUE or FALSE. See `vignette('results')`.

`cpus` How many CPU cores to reserve for this Job. Or a function (`job`) that returns the same. Used to limit the number of Jobs running simultaneously to respect `<Queue>$max_cpus`. Does not prevent a Job from using more CPUs than reserved.

... Arbitrary named values to add to the returned Job object.

Returns: A Job object.

Method `print()`: Print method for a Job.

Usage:

`Job#print(...)`

Arguments:

... Arguments are not used currently.

Returns: This Job, invisibly.

Method `on()`: Attach a callback function to execute when the Job enters state.

Usage:

`Job$on(state, func)`

Arguments:

`state` The name of a Job state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'created' - After `Job$new()` initialization.
- 'submitted' - After `<Job>$queue` is assigned.
- 'queued' - After `stop_id` and `copy_id` are resolved.
- 'dispatched' - After `<Job>$worker` is assigned.
- 'starting' - Before evaluation begins.
- 'running' - After evaluation begins.
- 'done' - After `<Job>$output` is assigned.

Custom states can also be specified.

`func` A function that accepts a Job object as input. You can call `<Job>$stop()` or edit `<Job>$` values and the changes will be persisted (since Jobs are reference class objects). You can also edit/stop other queued jobs by modifying the Jobs in `<Job>$queue$jobs`. Return value is ignored.

Returns: A function that when called removes this callback from the Job.

Method `wait()`: Blocks until the Job enters the given state.

Usage:

`Job$wait(state = "done", timeout = NULL)`

Arguments:

`state` The name of a Job state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'created' - After `Job$new()` initialization.
- 'submitted' - After `<Job>$queue` is assigned.
- 'queued' - After `stop_id` and `copy_id` are resolved.
- 'dispatched' - After `<Job>$worker` is assigned.
- 'starting' - Before evaluation begins.
- 'running' - After evaluation begins.
- 'done' - After `<Job>$output` is assigned.

Custom states can also be specified.

`timeout` Stop the Job if it takes longer than this number of seconds, or NULL.

Returns: This Job, invisibly.

Method stop(): Stop this Job. If the Job is running, its Worker will be restarted.

Usage:

```
Job$stop(reason = "job stopped by user", cls = NULL)
```

Arguments:

reason A message to include in the 'interrupt' condition object that will be returned as the Job's result. Or a condition object.

cls Character vector of additional classes to prepend to c('interrupt', 'condition').

Returns: This Job, invisibly.

Queue

Assigns Jobs to a Set of Workers

Description

Jobs go in. Results come out.

Active bindings

hooks A named list of currently registered callback hooks.

jobs Get or set - List of [Jobs](#) currently managed by this Queue.

state The Queue's state: 'starting', 'idle', 'busy', 'stopped', or 'error.'

uid Get or set - Unique identifier, e.g. 'Q1'.

tmp The Queue's temporary directory.

workers Get or set - List of [Workers](#) used for processing Jobs.

cmd The error that caused the Queue to stop.

Methods

Public methods:

- [Queue\\$new\(\)](#)
- [Queue\\$print\(\)](#)
- [Queue\\$run\(\)](#)
- [Queue\\$submit\(\)](#)
- [Queue\\$wait\(\)](#)
- [Queue\\$on\(\)](#)
- [Queue\\$stop\(\)](#)

Method new(): Creates a pool of background processes for handling \$run() and \$submit() calls. These workers are initialized according to the globals, packages, and init arguments.

Usage:

```

Queue$new(
  globals = NULL,
  packages = NULL,
  namespace = NULL,
  init = NULL,
  max_cpus = availableCores(),
  workers = ceiling(max_cpus * 1.2),
  timeout = NULL,
  hooks = NULL,
  reformat = NULL,
  signal = FALSE,
  cpus = 1L,
  stop_id = NULL,
  copy_id = NULL
)

```

Arguments:

globals A named list of variables that all `<Job>$exprs` will have access to. Alternatively, an object that can be coerced to a named list with `as.list()`, e.g. named vector, `data.frame`, or environment.

packages Character vector of package names to load on workers.

namespace The name of a package to attach to the worker's environment.

init A call or R expression wrapped in curly braces to evaluate on each worker just once, immediately after start-up. Will have access to variables defined by `globals` and assets from `packages` and `namespace`. Returned value is ignored.

max_cpus Total number of CPU cores that can be reserved by all running Jobs (`sum(<Job>$cpus)`). Does not enforce limits on actual CPU utilization.

workers How many background [Worker](#) processes to start. Set to more than `max_cpus` to enable standby Workers to quickly swap out with Workers that need to restart.

timeout, **hooks**, **reformat**, **signal**, **cpus**, **stop_id**, **copy_id** Defaults for this Queue's `$run()` method. Here only, `stop_id` and `copy_id` must be either a function (`job`) or `NULL`. `hooks` can set queue, worker, and/or job hooks - see the "Attaching" section in `vignette('hooks')`.

Returns: A Queue object.

Method `print()`: Print method for a Queue.

Usage:

```
Queue$print(...)
```

Arguments:

`...` Arguments are not used currently.

Method `run()`: Creates a Job object and submits it to the queue for running. Any NA arguments will be replaced with their value from `Queue$new()`.

Usage:

```

Queue$run(
  expr,
  vars = list(),

```

```

    timeout = NA,
    hooks = NA,
    reformat = NA,
    signal = NA,
    cpus = NA,
    stop_id = NA,
    copy_id = NA,
    ...
  )

```

Arguments:

expr A call or R expression wrapped in curly braces to evaluate on a worker. Will have access to any variables defined by **vars**, as well as the Worker's globals, packages, and init configuration. See `vignette('eval')`.

vars A named list of variables to make available to **expr** during evaluation. Alternatively, an object that can be coerced to a named list with `as.list()`, e.g. named vector, data.frame, or environment. Or a function (**job**) that returns such an object.

timeout A named numeric vector indicating the maximum number of seconds allowed for each state the job passes through, or 'total' to apply a single timeout from 'submitted' to 'done'. Can also limit the 'starting' state for Workers. A function (**job**) can be used in place of a number. Example: `timeout = c(total = 2.5, running = 1)`. See `vignette('stops')`.

hooks A named list of functions to run when the Job state changes, of the form `hooks = list(created = function (worker) {...})`. Or a function (**job**) that returns the same. Names of worker hooks are typically 'created', 'submitted', 'queued', 'dispatched', 'starting', 'running', 'done', or '*' (duplicates okay). See `vignette('hooks')`.

reformat Set `reformat = function (job)` to define what `<Job>$result` should return. The default, `reformat = NULL` passes `<Job>$output` to `<Job>$result` unchanged. See `vignette('results')`.

signal Should calling `<Job>$result` signal on condition objects? When FALSE, `<Job>$result` will return the object without taking additional action. Setting to TRUE or a character vector of condition classes, e.g. `c('interrupt', 'error', 'warning')`, will cause the equivalent of `stop(<condition>)` to be called when those conditions are produced. Alternatively, a function (**job**) that returns TRUE or FALSE. See `vignette('results')`.

cpus How many CPU cores to reserve for this Job. Or a function (**job**) that returns the same. Used to limit the number of Jobs running simultaneously to respect `<Queue>$max_cpus`. Does not prevent a Job from using more CPUs than reserved.

stop_id If an existing Job in the Queue has the same `stop_id`, that Job will be stopped and return an 'interrupt' condition object as its result. `stop_id` can also be a function (**job**) that returns the `stop_id` to assign to a given Job. A `stop_id` of NULL disables this feature. See `vignette('stops')`.

copy_id If an existing Job in the Queue has the same `copy_id`, the newly submitted Job will become a "proxy" for that earlier Job, returning whatever result the earlier Job returns. `copy_id` can also be a function (**job**) that returns the `copy_id` to assign to a given Job. A `copy_id` of NULL disables this feature. See `vignette('stops')`.

... Arbitrary named values to add to the returned Job object.

Returns: The new Job object.

Method `submit()`: Adds a Job to the Queue for running on a background process.

Usage:

Queue\$submit(job)

Arguments:

job A **Job** object, as created by Job\$new().

Returns: This Queue, invisibly.

Method wait(): Blocks until the Queue enters the given state.

Usage:

Queue\$wait(state = "idle", timeout = NULL, signal = TRUE)

Arguments:

state The name of a Queue state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'starting' - Workers are starting.
- 'idle' - All workers are ready/idle.
- 'busy' - At least one worker is busy.
- 'stopped' - Shutdown is complete.

timeout Stop the Queue if it takes longer than this number of seconds, or NULL.

signal Raise an error if encountered (will also be recorded in <Queue>\$cmd).

Returns: This Queue, invisibly.

Method on(): Attach a callback function to execute when the Queue enters state.

Usage:

Queue\$on(state, func)

Arguments:

state The name of a Queue state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'starting' - Workers are starting.
- 'idle' - All workers are ready/idle.
- 'busy' - At least one worker is busy.
- 'stopped' - Shutdown is complete.

func A function that accepts a Queue object as input. Return value is ignored.

Returns: A function that when called removes this callback from the Queue.

Method stop(): Stop all jobs and workers.

Usage:

Queue\$stop(reason = "job queue shut down by user", cls = NULL)

Arguments:

reason Passed to <Job>\$stop() for any Jobs currently managed by this Queue.

cls Passed to <Job>\$stop() for any Jobs currently managed by this Queue.

Returns: This Queue, invisibly.

Worker

A Background Process

Description

Where [Job](#) expressions are evaluated.

Active bindings

`hooks` A named list of currently registered callback hooks.

`job` The currently running [Job](#).

`ps` The `ps:ps_handle()` object for the background process.

`state` The Worker's state: 'starting', 'idle', 'busy', or 'stopped'.

`uid` A short string, e.g. 'W11', that uniquely identifies this Worker.

`tmp` The Worker's temporary directory.

`cmd` The error that caused the Worker to stop.

Methods

Public methods:

- [Worker\\$new\(\)](#)
- [Worker\\$print\(\)](#)
- [Worker\\$start\(\)](#)
- [Worker\\$stop\(\)](#)
- [Worker\\$restart\(\)](#)
- [Worker\\$on\(\)](#)
- [Worker\\$wait\(\)](#)
- [Worker\\$run\(\)](#)

Method `new()`: Creates a background R process for running [Jobs](#).

Usage:

```
Worker$new(  
  globals = NULL,  
  packages = NULL,  
  namespace = NULL,  
  init = NULL,  
  hooks = NULL,  
  wait = TRUE,  
  timeout = Inf  
)
```

Arguments:

globals A named list of variables that all `<Job>$exprs` will have access to. Alternatively, an object that can be coerced to a named list with `as.list()`, e.g. named vector, `data.frame`, or environment.

packages Character vector of package names to load on workers.

namespace The name of a package to attach to the worker's environment.

init A call or R expression wrapped in curly braces to evaluate on each worker just once, immediately after start-up. Will have access to variables defined by `globals` and `assets` from `packages` and `namespace`. Returned value is ignored.

hooks A named list of functions to run when the Worker state changes, of the form `hooks = list(idle = function (worker) { ... })`. Names of worker hooks are typically `starting`, `idle`, `busy`, `stopped`, or `'*'` (duplicates okay). See `vignette('hooks')`.

wait If `TRUE`, blocks until the Worker is 'idle'. If `FALSE`, the Worker object is returned in the 'starting' state.

timeout How long to wait for the worker to finish starting (in seconds). If `NA`, defaults to the `Worker$new()` argument.

Returns: A Worker object.

Method `print()`: Print method for a Worker.

Usage:

```
Worker$print(...)
```

Arguments:

... Arguments are not used currently.

Returns: The Worker, invisibly.

Method `start()`: Restarts a stopped Worker.

Usage:

```
Worker$start(wait = TRUE, timeout = NA)
```

Arguments:

wait If `TRUE`, blocks until the Worker is 'idle'. If `FALSE`, the Worker object is returned in the 'starting' state.

timeout How long to wait for the worker to finish starting (in seconds). If `NA`, defaults to the `Worker$new()` argument.

Returns: The Worker, invisibly.

Method `stop()`: Stops a Worker by terminating the background process and calling `<Job>$stop(reason)` on any Jobs currently assigned to this Worker.

Usage:

```
Worker$stop(reason = "worker stopped by user", cls = NULL)
```

Arguments:

reason Passed to `<Job>$stop()` for any Jobs currently managed by this Worker.

cls Passed to `<Job>$stop()` for any Jobs currently managed by this Worker.

Returns: The Worker, invisibly.

Method `restart()`: Restarts a Worker by calling `<Worker>$stop(reason)` and `<Worker>$start()` in succession.

Usage:

```
Worker$restart(
  wait = TRUE,
  timeout = NA,
  reason = "restarting worker",
  cls = NULL
)
```

Arguments:

`wait` If TRUE, blocks until the Worker is 'idle'. If FALSE, the Worker object is returned in the 'starting' state.

`timeout` How long to wait for the worker to finish starting (in seconds). If NA, defaults to the `Worker$new()` argument.

`reason` Passed to `<Job>$stop()` for any Jobs currently managed by this Worker.

`cls` Passed to `<Job>$stop()` for any Jobs currently managed by this Worker.

Returns: The Worker, invisibly.

Method `on()`: Attach a callback function to execute when the Worker enters state.

Usage:

```
Worker$on(state, func)
```

Arguments:

`state` The name of a Worker state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'starting' - Waiting for the background process to load.
- 'idle' - Waiting for Jobs to be `$run()`.
- 'busy' - While a Job is running.
- 'stopped' - After `<Worker>$stop()` is called.

`func` A function that accepts a Worker object as input. You can call `<Worker>$stop()` and other `<Worker>$` methods.

Returns: A function that when called removes this callback from the Worker.

Method `wait()`: Blocks until the Worker enters the given state.

Usage:

```
Worker$wait(state = "idle", timeout = Inf, signal = TRUE)
```

Arguments:

`state` The name of a Worker state. Typically one of:

- '*' - Every time the state changes.
- '.next' - Only one time, the next time the state changes.
- 'starting' - Waiting for the background process to load.
- 'idle' - Waiting for Jobs to be `$run()`.
- 'busy' - While a Job is running.

- 'stopped' - After `<Worker>$stop()` is called.

`timeout` Stop the Worker if it takes longer than this number of seconds.

`signal` Raise an error if encountered (will also be recorded in `<Worker>$cmd`).

Returns: This Worker, invisibly.

Method `run()`: Assigns a Job to this Worker for evaluation on the background process.

Usage:

`Worker$run(job)`

Arguments:

`job` A **Job** object, as created by `Job$new()`.

Returns: This Worker, invisibly.

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