

Package: mirai (via r-universe)

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Type Package

Title Minimalist Async Evaluation Framework for R

Version 2.0.1.9000

Description Designed for simplicity, a 'mirai' evaluates an R expression asynchronously in a parallel process, locally or distributed over the network, with the result automatically available upon completion. Modern networking and concurrency built on 'nanonext' and 'NNG' (Nanomsg Next Gen) ensure reliable and efficient scheduling, over fast inter-process communications or TCP/IP secured by TLS. Advantages include being inherently queued thus handling many more tasks than available processes, no storage on the file system, support for otherwise non-exportable reference objects, an event-driven promises implementation, and built-in asynchronous parallel map.

License GPL (>= 3)

BugReports <https://github.com/shikokuchuo/mirai/issues>

URL <https://shikokuchuo.net/mirai/>,
<https://github.com/shikokuchuo/mirai/>

Encoding UTF-8

Depends R (>= 3.6)

Imports nanonext (>= 1.4.0)

Enhances parallel, promises

Suggests cli, litedown

VignetteBuilder litedown

RoxygenNote 7.3.2

Repository <https://shikokuchuo.r-universe.dev>

RemoteUrl <https://github.com/shikokuchuo/mirai>

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Contents

mirai-package	2
as.promise.mirai	3
call_mirai	4
collect_mirai	5
daemon	7
daemons	9
dispatcher	13
everywhere	14
host_url	16
is_mirai	17
is_mirai_error	18
launch_local	19
make_cluster	21
mirai	23
mirai_map	25
remote_config	28
serial_config	31
status	32
stop_mirai	33
unresolved	34
with.miraiDaemons	35
Index	37

 mirai-package

mirai: Minimalist Async Evaluation Framework for R

Description

Designed for simplicity, a 'mirai' evaluates an R expression asynchronously in a parallel process, locally or distributed over the network, with the result automatically available upon completion. Modern networking and concurrency built on 'nanonext' and 'NNG' (Nanomsg Next Gen) ensure reliable and efficient scheduling, over fast inter-process communications or TCP/IP secured by TLS. Advantages include being inherently queued thus handling many more tasks than available processes, no storage on the file system, support for otherwise non-exportable reference objects, an event-driven promises implementation, and built-in asynchronous parallel map.

Notes

For local mirai requests, the default transport for inter-process communications is platform-dependent: abstract Unix domain sockets on Linux, Unix domain sockets on MacOS, Solaris and other POSIX platforms, and named pipes on Windows.

This may be overridden, if desired, by specifying 'url' in the [daemons](#) interface and launching daemons using [launch_local](#).

Reference Manual

```
vignette("mirai", package = "mirai")
```

Author(s)

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See Also

Useful links:

- <https://shikokuchuo.net/mirai/>
- <https://github.com/shikokuchuo/mirai/>
- Report bugs at <https://github.com/shikokuchuo/mirai/issues>

as.promise.mirai *Make Mirai Promise*

Description

Creates a ‘promise’ from a ‘mirai’.

Usage

```
## S3 method for class 'mirai'  
as.promise(x)
```

Arguments

x an object of class ‘mirai’.

Details

This function is an S3 method for the generic `as.promise` for class ‘mirai’.

Requires the **promises** package.

Allows a ‘mirai’ to be used with the promise pipe `%>%`, which schedules a function to run upon resolution of the ‘mirai’.

Value

A ‘promise’ object.

Examples

```

if (interactive() && requireNamespace("promises", quietly = TRUE)) {

  library(promises)

  p <- as.promise(mirai("example"))
  print(p)
  is.promise(p)

  p2 <- mirai("completed") %...>% identity()
  p2$then(cat)
  is.promise(p2)

}

```

call_mirai	<i>mirai (Call Value)</i>
------------	---------------------------

Description

call_mirai waits for the ‘mirai’ to resolve if still in progress, storing the value at \$data, and returns the ‘mirai’ object.

call_mirai_ is a variant of call_mirai that allows user interrupts, suitable for interactive use.

Usage

```
call_mirai(x)
```

```
call_mirai_(x)
```

Arguments

x a ‘mirai’ object, or list of ‘mirai’ objects.

Details

Both functions accept a list of ‘mirai’ objects, such as that returned by [mirai_map](#) as well as individual ‘mirai’.

They will wait for the asynchronous operation(s) to complete if still in progress (blocking).

x[] may also be used to wait for and return the value of a mirai x, and is the equivalent of call_mirai_(x)\$data.

Value

The passed object (invisibly). For a ‘mirai’, the retrieved value is stored at \$data.

Alternatively

The value of a ‘mirai’ may be accessed at any time at `$data`, and if yet to resolve, an ‘unresolved’ logical NA will be returned instead.

Using `unresolved` on a ‘mirai’ returns TRUE only if it has yet to resolve and FALSE otherwise. This is suitable for use in control flow statements such as `while` or `if`.

Errors

If an error occurs in evaluation, the error message is returned as a character string of class ‘miraiError’ and ‘errorValue’. `is_mirai_error` may be used to test for this. The elements of the original condition are accessible via `$` on the error object. A stack trace is also available at `$stack.trace`.

If a daemon crashes or terminates unexpectedly during evaluation, an ‘errorValue’ 19 (Connection reset) is returned.

`is_error_value` tests for all error conditions including ‘mirai’ errors, interrupts, and timeouts.

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  # using call_mirai()
  df1 <- data.frame(a = 1, b = 2)
  df2 <- data.frame(a = 3, b = 1)
  m <- mirai(as.matrix(rbind(df1, df2)), df1 = df1, df2 = df2, .timeout = 1000)
  call_mirai(m)$data

  # using unresolved()
  m <- mirai(
    {
      res <- rnorm(n)
      res / rev(res)
    },
    n = 1e6
  )
  while (unresolved(m)) {
    cat("unresolved\n")
    Sys.sleep(0.1)
  }
  str(m$data)
}
```

Description

Waits for the ‘mirai’ to resolve if still in progress, and returns its value directly. It is a more efficient version of and equivalent to `call_mirai(x)$data`.

Usage

```
collect_mirai(x, options = NULL)
```

Arguments

`x` a ‘mirai’ object, or list of ‘mirai’ objects.
`options` (if ‘x’ is a list of mirai) a character vector comprising any combination of collection options for `mirai_map`, such as `".flat"` or `c(".progress", ".stop")`.

Details

This function will wait for the asynchronous operation(s) to complete if still in progress, blocking but interruptible.

`x[]` may also be used to wait for and return the value of a mirai `x`, and is equivalent to `collect_mirai(x)`.

Value

An object (the return value of the ‘mirai’), or a list of such objects (the same length as ‘x’, preserving names).

Alternatively

The value of a ‘mirai’ may be accessed at any time at `$data`, and if yet to resolve, an ‘unresolved’ logical NA will be returned instead.

Using `unresolved` on a ‘mirai’ returns TRUE only if it has yet to resolve and FALSE otherwise. This is suitable for use in control flow statements such as `while` or `if`.

Errors

If an error occurs in evaluation, the error message is returned as a character string of class ‘miraiError’ and ‘errorValue’. `is_mirai_error` may be used to test for this. The elements of the original condition are accessible via `$` on the error object. A stack trace is also available at `$stack.trace`.

If a daemon crashes or terminates unexpectedly during evaluation, an ‘errorValue’ 19 (Connection reset) is returned.

`is_error_value` tests for all error conditions including ‘mirai’ errors, interrupts, and timeouts.

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  # using collect_mirai()
  df1 <- data.frame(a = 1, b = 2)
```

```
df2 <- data.frame(a = 3, b = 1)
m <- mirai(as.matrix(rbind(df1, df2)), df1 = df1, df2 = df2, .timeout = 1000)
collect_mirai(m)

# using x[]
m[]

# mirai_map with collection options
daemons(1, dispatcher = FALSE)
m <- mirai_map(1:3, rnorm)
collect_mirai(m, c(".flat", ".progress"))
daemons(0)

}
```

daemon

Daemon Instance

Description

Starts up an execution daemon to receive [mirai](#) requests. Awaits data, evaluates an expression in an environment containing the supplied data, and returns the value to the host caller. Daemon settings may be controlled by [daemons](#) and this function should not need to be invoked directly, unless deploying manually on remote resources.

Usage

```
daemon(
  url,
  dispatcher = FALSE,
  ...,
  asyncdial = FALSE,
  autoexit = TRUE,
  cleanup = TRUE,
  output = FALSE,
  idletime = Inf,
  walltime = Inf,
  maxtasks = Inf,
  id = NULL,
  tls = NULL,
  rs = NULL
)
```

Arguments

`url` the character host or dispatcher URL to dial into, including the port to connect to, e.g. `'tcp://hostname:5555'` or `'tls+tcp://10.75.32.70:5555'`.

dispatcher	[default FALSE] logical value, which should be set to TRUE if using dispatcher and FALSE otherwise.
...	reserved but not currently used.
asyncdial	[default FALSE] whether to perform dials asynchronously. The default FALSE will error if a connection is not immediately possible (for instance if <code>daemons</code> has yet to be called on the host, or the specified port is not open etc.). Specifying TRUE continues retrying (indefinitely) if not immediately successful, which is more resilient but can mask potential connection issues.
autoexit	[default TRUE] logical value, whether the daemon should exit automatically when its socket connection ends. If a signal from the <code>tools</code> package, such as <code>tools::SIGINT</code> , or an equivalent integer value is supplied, this signal is additionally raised on exit (see 'Persistence' section below).
cleanup	[default TRUE] logical value, whether to perform cleanup of the global environment and restore attached packages and options to an initial state after each evaluation.
output	[default FALSE] logical value, to output generated stdout / stderr if TRUE, or else discard if FALSE. Specify as TRUE in the '...' argument to <code>daemons</code> or <code>launch_local</code> to provide redirection of output to the host process (applicable only for local daemons).
idletime	[default Inf] integer milliseconds maximum time to wait for a task (idle time) before exiting.
walltime	[default Inf] integer milliseconds soft walltime (time limit) i.e. the minimum amount of real time elapsed before exiting.
maxtasks	[default Inf] integer maximum number of tasks to execute (task limit) before exiting.
id	[default NULL] (optional) integer daemon ID provided to dispatcher to track connection status. Causes <code>status</code> to report this ID under <code>\$events</code> when the daemon connects and disconnects.
tls	[default NULL] required for secure TLS connections over 'tls+tcp://'. Either the character path to a file containing X.509 certificate(s) in PEM format, comprising the certificate authority certificate chain starting with the TLS certificate and ending with the CA certificate, or a length 2 character vector comprising [i] the certificate authority certificate chain and [ii] the empty string ' '.
rs	[default NULL] the initial value of <code>.Random.seed</code> . This is set automatically using L'Ecuyer-CMRG RNG streams generated by the host process and should not be independently supplied.

Details

The network topology is such that daemons dial into the host or dispatcher, which listens at the 'url' address. In this way, network resources may be added or removed dynamically and the host or dispatcher automatically distributes tasks to all available daemons.

Value

Invisibly, an integer exit code: 0L for normal termination, and a positive value if a self-imposed limit was reached: 1L (idletime), 2L (walltime), 3L (maxtasks).

Persistence

The ‘autoexit’ argument governs persistence settings for the daemon. The default TRUE ensures that it will exit cleanly once its socket connection has ended.

Instead of TRUE, supplying a signal from the **tools** package, such as `tools::SIGINT`, or an equivalent integer value, sets this signal to be raised when the socket connection ends. For instance, supplying SIGINT allows a potentially more immediate exit by interrupting any ongoing evaluation rather than letting it complete.

Setting to FALSE allows the daemon to persist indefinitely even when there is no longer a socket connection. This allows a host session to end and a new session to connect at the URL where the daemon is dialled in. Daemons must be terminated with `daemons(NULL)` in this case, which sends explicit exit signals to all connected daemons.

 daemons

Daemons (Set Persistent Processes)

Description

Set ‘daemons’ or persistent background processes to receive [mirai](#) requests. Specify ‘n’ to create daemons on the local machine. Specify ‘url’ to receive connections from remote daemons (for distributed computing across the network). Specify ‘remote’ to optionally launch remote daemons via a remote configuration. By default, dispatcher ensures optimal scheduling.

Usage

```
daemons(
  n,
  url = NULL,
  remote = NULL,
  dispatcher = TRUE,
  ...,
  force = TRUE,
  seed = NULL,
  serial = NULL,
  tls = NULL,
  pass = NULL,
  .compute = "default"
)
```

Arguments

n	integer number of daemons to launch.
url	[default NULL] if specified, a character string comprising a URL at which to listen for remote daemons, including a port accepting incoming connections, e.g. ‘tcp://hostname:5555’ or ‘tcp://10.75.32.70:5555’. Specify a URL with scheme ‘tls+tcp://’ to use secure TLS connections (for details see Distributed Computing section below). Auxiliary function <code>host_url</code> may be used to construct a valid host URL.

remote	[default NULL] required only for launching remote daemons, a configuration generated by remote_config or ssh_config .
dispatcher	[default TRUE] logical value, whether to use dispatcher. Dispatcher runs in a separate process to ensure optimal scheduling, although this may not always be required (for details see Dispatcher section below).
...	(optional) additional arguments passed through to daemon if launching daemons. These include 'asyncdial', 'autoexit', 'cleanup', 'output', 'maxtasks', 'idletime' and 'walltime'.
force	[default TRUE] logical value whether to always reset daemons and apply new settings for a compute profile, even if already set. If FALSE, applying new settings requires daemons to be explicitly reset first using <code>daemons(0)</code> .
seed	[default NULL] (optional) supply a random seed (single value, interpreted as an integer). This is used to initialise the L'Ecuyer-CMRG RNG streams sent to each daemon. Note that reproducible results can be expected only for <code>dispatcher = 'none'</code> , as the unpredictable timing of task completions would otherwise influence the tasks sent to each daemon. Even for <code>dispatcher = 'none'</code> , reproducibility is not guaranteed if the order in which tasks are sent is not deterministic.
serial	[default NULL] (optional, requires dispatcher) a configuration created by serial_config to register serialization and unserialization functions for normally non-exportable reference objects, such as Arrow Tables or torch tensors.
tls	[default NULL] (optional for secure TLS connections) if not supplied, zero-configuration single-use keys and certificates are automatically generated. If supplied, either the character path to a file containing the PEM-encoded TLS certificate and associated private key (may contain additional certificates leading to a validation chain, with the TLS certificate first), or a length 2 character vector comprising [i] the TLS certificate (optionally certificate chain) and [ii] the associated private key.
pass	[default NULL] (required only if the private key supplied to 'tls' is encrypted with a password) For security, should be provided through a function that returns this value, rather than directly.
.compute	[default 'default'] character value for the compute profile to use (each compute profile has its own independent set of daemons).

Details

Use `daemons(0)` to reset daemon connections:

- All connected daemons and/or dispatchers exit automatically.
- **mirai** reverts to the default behaviour of creating a new background process for each request.
- Any unresolved 'mirai' will return an 'errorValue' 19 (Connection reset) after a reset.
- Calling `daemons` with revised (or even the same) settings for the same compute profile resets daemons before applying the new settings if `force = TRUE`.

If the host session ends, all connected dispatcher and daemon processes automatically exit as soon as their connections are dropped (unless the daemons were started with `autoexit = FALSE`). If a daemon is processing a task, it will exit as soon as the task is complete.

To reset persistent daemons started with `autoexit = FALSE`, use `daemons(NULL)` instead, which also sends exit signals to all connected daemons prior to resetting.

For historical reasons, `daemons()` with no arguments returns the value of `status`.

Value

The integer number of daemons launched locally (zero if specifying 'url' / using a remote launcher).

Local Daemons

Daemons provide a potentially more efficient solution for asynchronous operations as new processes no longer need to be created on an *ad hoc* basis.

Supply the argument 'n' to set the number of daemons. New background `daemon` processes are automatically created on the local machine connecting back to the host process, either directly or via dispatcher.

Dispatcher

By default `dispatcher = TRUE` launches a background process running `dispatcher`. Dispatcher connects to daemons on behalf of the host and ensures optimal FIFO scheduling of tasks.

Specifying `dispatcher = FALSE`, uses the default behaviour without additional dispatcher logic. In this case daemons connect directly to the host and tasks are distributed in a round-robin fashion. Optimal scheduling is not guaranteed as the duration of tasks cannot be known *a priori*, hence tasks can be queued at one daemon while other daemons remain idle. However, this provides the most resource-light approach, suited to working with similar-length tasks, or where concurrent tasks typically do not exceed available daemons.

Distributed Computing

Specifying 'url' as a character string allows tasks to be distributed across the network. 'n' is not required in this case, and disregarded if supplied.

Supply a URL with a 'tcp://' scheme, such as 'tcp://10.75.32.70:5555'. The host / dispatcher listens at this address, utilising a single port. Individual daemons (started with `daemon`) may then dial in to this URL. Host / dispatcher automatically adjusts to the number of daemons actually connected, allowing dynamic upscaling or downscaling as required.

Switching the URL scheme to 'tls+tcp://' automatically upgrades the connection to use TLS. The auxiliary function `host_url` may be used to construct a valid host URL based on the computer's hostname.

IPv6 addresses are also supported and must be enclosed in square brackets [] to avoid confusion with the final colon separating the port. For example, port 5555 on the IPv6 loopback address ::1 would be specified as 'tcp://[::1]:5555'.

Specifying the wildcard value zero for the port number e.g. 'tcp://[::1]:0' will automatically assign a free ephemeral port. Use `status` to inspect the actual assigned port at any time.

Specify 'remote' with a call to `remote_config` or `ssh_config` to launch daemons on remote machines. Otherwise, `launch_remote` may be used to generate the shell commands to deploy daemons manually on remote resources.

Compute Profiles

By default, the ‘default’ compute profile is used. Providing a character value for ‘.compute’ creates a new compute profile with the name specified. Each compute profile retains its own daemons settings, and may be operated independently of each other. Some usage examples follow:

local / remote daemons may be set with a host URL and specifying ‘.compute’ as ‘remote’, which creates a new compute profile. Subsequent `mirai` calls may then be sent for local computation by not specifying the ‘.compute’ argument, or for remote computation to connected daemons by specifying the ‘.compute’ argument as ‘remote’.

cpu / gpu some tasks may require access to different types of daemon, such as those with GPUs. In this case, `daemons()` may be called to set up host URLs for CPU-only daemons and for those with GPUs, specifying the ‘.compute’ argument as ‘cpu’ and ‘gpu’ respectively. By supplying the ‘.compute’ argument to subsequent `mirai` calls, tasks may be sent to either ‘cpu’ or ‘gpu’ daemons as appropriate.

Note: further actions such as resetting daemons via `daemons(0)` should be carried out with the desired ‘.compute’ argument specified.

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  # Create 2 local daemons (using dispatcher)
  daemons(2)
  status()
  # Reset to zero
  daemons(0)

  # Create 2 local daemons (not using dispatcher)
  daemons(2, dispatcher = FALSE)
  status()
  # Reset to zero
  daemons(0)

  # Set up dispatcher accepting TLS over TCP connections
  daemons(url = host_url(tls = TRUE))
  status()
  # Reset to zero
  daemons(0)

  # Set host URL for remote daemons to dial into
  daemons(url = host_url(), dispatcher = FALSE)
  status()
  # Reset to zero
  daemons(0)

  # Use with() to evaluate with daemons for the duration of the expression
  with(
    daemons(2),
    {
      m1 <- mirai(Sys.getpid())
    }
  )
}
```

```
        m2 <- mirai(Sys.getpid())
        cat(m1[], m2[], "\n")
    }
)

}

## Not run:
# Launch daemons on remotes 'nodeone' and 'nodetwo' using SSH
# connecting back directly to the host URL over a TLS connection:

daemons(n = 1L,
        url = host_url(tls = TRUE),
        remote = ssh_config(c('ssh://nodeone', 'ssh://nodetwo')),
        dispatcher = FALSE)

# Launch 4 daemons on the remote machine 10.75.32.90 using SSH tunnelling
# over port 5555 ('url' hostname must be '127.0.0.1'):

daemons(n = 4L,
        url = 'tcp://127.0.0.1:5555',
        remote = ssh_config('ssh://10.75.32.90', tunnel = TRUE, port = 5555))

## End(Not run)
```

dispatcher

Dispatcher

Description

Dispatches tasks from a host to daemons for processing, using FIFO scheduling, queuing tasks as required. Daemon / dispatcher settings may be controlled by `daemons` and this function should not need to be invoked directly.

Usage

```
dispatcher(
  host,
  url = NULL,
  n = NULL,
  ...,
  tls = NULL,
  pass = NULL,
  rs = NULL,
  monitor = NULL
)
```

Arguments

host	the character host URL to dial (where tasks are sent from), including the port to connect to e.g. 'tcp://hostname:5555' or 'tcp://10.75.32.70:5555'.
url	(optional) the character URL dispatcher should listen at (and daemons should dial in to), including the port to connect to e.g. 'tcp://hostname:5555' or 'tcp://10.75.32.70:5555'. Specify 'tls+tcp://' to use secure TLS connections.
n	(optional) if specified, the integer number of daemons to launch. In this case, a local url is automatically generated.
...	(optional) additional arguments passed through to daemon . These include 'asyn-dial', 'autoexit', and 'cleanup'.
tls	[default NULL] (required for secure TLS connections) either the character path to a file containing the PEM-encoded TLS certificate and associated private key (may contain additional certificates leading to a validation chain, with the TLS certificate first), or a length 2 character vector comprising [i] the TLS certificate (optionally certificate chain) and [ii] the associated private key.
pass	[default NULL] (required only if the private key supplied to 'tls' is encrypted with a password) For security, should be provided through a function that returns this value, rather than directly.
rs	[default NULL] the initial value of .Random.seed. This is set automatically using L'Ecuyer-CMRG RNG streams generated by the host process and should not be independently supplied.
monitor	unused legacy parameter - do not specify this value.

Details

The network topology is such that a dispatcher acts as a gateway between the host and daemons, ensuring that tasks received from the host are dispatched on a FIFO basis for processing. Tasks are queued at the dispatcher to ensure tasks are only sent to daemons that can begin immediate execution of the task.

Value

Invisible NULL.

everywhere

Evaluate Everywhere

Description

Evaluate an expression 'everywhere' on all connected daemons for the specified compute profile - this must be set prior to calling this function. Designed for performing setup operations across daemons by loading packages or exporting common data. Resultant changes to the global environment, loaded packages and options are persisted regardless of a daemon's 'cleanup' setting.

Usage

```
everywhere(.expr, ..., .args = list(), .compute = "default")
```

Arguments

<code>.expr</code>	an expression to evaluate asynchronously (of arbitrary length, wrapped in { } where necessary), or else a pre-constructed language object.
<code>...</code>	(optional) either named arguments (name = value pairs) specifying objects referenced, but not defined, in <code>.expr</code> , or an environment containing such objects. See ‘evaluation’ section below.
<code>.args</code>	(optional) either a named list specifying objects referenced, but not defined, in <code>.expr</code> , or an environment containing such objects. These objects will remain local to the evaluation environment as opposed to those supplied in <code>...</code> above - see ‘evaluation’ section below.
<code>.compute</code>	[default ‘default’] character value for the compute profile to use (each compute profile has its own independent set of daemons).

Details

This function should be called when no other mirai operations are in progress. If necessary, wait for all mirai operations to complete. This is as this function does not force a synchronization point, and using concurrently with other mirai operations does not guarantee the timing of when the instructions will be received, or that they will be received on each daemon.

Value

A list of mirai executed on each daemon. This may be waited for and inspected using [call_mirai](#) or [collect_mirai](#).

Evaluation

The expression `.expr` will be evaluated in a separate R process in a clean environment (not the global environment), consisting only of the objects supplied to `.args`, with the objects passed as `...` assigned to the global environment of that process.

As evaluation occurs in a clean environment, all undefined objects must be supplied through `...` and/or `.args`, including self-defined functions. Functions from a package should use namespaced calls such as `mirai::mirai()`, or else the package should be loaded beforehand as part of `.expr`.

For evaluation to occur *as if* in your global environment, supply objects to `...` rather than `.args`, e.g. for free variables or helper functions defined in function bodies, as scoping rules may otherwise prevent them from being found.

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  daemons(1)
  # export common data by a super-assignment expression:
```

```

everywhere(y <- 3)
# '...' variables are assigned to the global environment
# '.expr' may be specified as an empty {} in such cases:
everywhere({}, a = 1, b = 2)
m <- mirai(a + b - y == 0L)
m[]
# everywhere() returns a list of mirai which may be waited for and inspected
mlist <- everywhere("just a normal operation")
collect_mirai(mlist)
mlist <- everywhere(stop("error"))
collect_mirai(mlist)
daemons(0)

# loading a package on all daemons
daemons(1, dispatcher = FALSE)
everywhere(library(parallel))
m <- mirai("package:parallel" %in% search())
m[]
daemons(0)

}

```

host_url

URL Constructors

Description

host_url constructs a valid host URL (at which daemons may connect) based on the computer's hostname. This may be supplied directly to the 'url' argument of [daemons](#).

local_url constructs a random URL suitable for local daemons.

Usage

```
host_url(tls = FALSE, port = 0)
```

```
local_url()
```

Arguments

tls	[default FALSE] logical value whether to use TLS in which case the scheme used will be 'tls+tcp://'.
port	[default 0] numeric port to use. This should be open to connections from the network addresses the daemons are connecting from. '0' is a wildcard value that automatically assigns a free ephemeral port.

Details

host_url relies on using the host name of the computer rather than an IP address and typically works on local networks, although this is not always guaranteed. If unsuccessful, substitute an IPv4 or IPv6 address in place of the hostname.

local_url generates a random URL for the platform's default inter-process communications transport: abstract Unix domain sockets on Linux, Unix domain sockets on MacOS, Solaris and other POSIX platforms, and named pipes on Windows.

Value

A character string comprising a valid URL.

Examples

```
host_url()
host_url(tls = TRUE)
host_url(tls = TRUE, port = 5555)

local_url()
```

is_mirai

Is mirai / mirai_map

Description

Is the object a 'mirai' or 'mirai_map'.

Usage

```
is_mirai(x)

is_mirai_map(x)
```

Arguments

x an object.

Value

Logical TRUE if 'x' is of class 'mirai' or 'mirai_map' respectively, FALSE otherwise.

Examples

```
if (interactive()) {  
  # Only run examples in interactive R sessions  
  
  daemons(1, dispatcher = FALSE)  
  df <- data.frame()  
  m <- mirai(as.matrix(df), df = df)  
  is_mirai(m)  
  is_mirai(df)  
  
  mp <- mirai_map(1:3, runif)  
  is_mirai_map(mp)  
  is_mirai_map(mp[])  
  daemons(0)  
  
}
```

is_mirai_error

Error Validators

Description

Validator functions for error value types created by **mirai**.

Usage

```
is_mirai_error(x)  
  
is_mirai_interrupt(x)  
  
is_error_value(x)
```

Arguments

x an object.

Details

Is the object a ‘miraiError’. When execution in a ‘mirai’ process fails, the error message is returned as a character string of class ‘miraiError’ and ‘errorValue’. The elements of the original condition are accessible via \$ on the error object. A stack trace is also available at \$stack.trace.

Is the object a ‘miraiInterrupt’. When an ongoing ‘mirai’ is sent a user interrupt, it will resolve to an empty character string classed as ‘miraiInterrupt’ and ‘errorValue’.

Is the object an ‘errorValue’, such as a ‘mirai’ timeout, a ‘miraiError’ or a ‘miraiInterrupt’. This is a catch-all condition that includes all returned error values.

Value

Logical value TRUE or FALSE.

Examples

```
if (interactive()) {
# Only run examples in interactive R sessions

m <- mirai(stop())
call_mirai(m)
is_mirai_error(m$data)
is_mirai_interrupt(m$data)
is_error_value(m$data)
m$data$stack.trace

m2 <- mirai(Sys.sleep(1L), .timeout = 100)
call_mirai(m2)
is_mirai_error(m2$data)
is_mirai_interrupt(m2$data)
is_error_value(m2$data)

}
```

launch_local

Launch Daemon

Description

launch_local spawns a new background Rscript process calling [daemon](#) with the specified arguments.

launch_remote returns the shell command for deploying daemons as a character vector. If a configuration generated by [remote_config](#) or [ssh_config](#) is supplied then this is used to launch the daemon on the remote machine.

Usage

```
launch_local(n = 1L, ..., tls = NULL, .compute = "default")

launch_remote(
  n = 1L,
  remote = remote_config(),
  ...,
  tls = NULL,
  .compute = "default"
)
```

Arguments

n	integer number of daemons. or for launch_remote only, a 'miraiCluster' or 'miraiNode'.
...	(optional) arguments passed through to <code>daemon</code> . These include 'autoexit', 'cleanup', 'output', 'maxtasks', 'idletime' and 'walltime'. Only supply to override arguments originally provided to <code>daemons</code> , otherwise those will be used instead.
tls	[default NULL] required for secure TLS connections over 'tls+tcp://'. Zero-configuration TLS certificates generated by <code>daemons</code> are automatically passed to the daemon, without requiring to be specified here. Otherwise, supply either the character path to a file containing X.509 certificate(s) in PEM format, comprising the certificate authority certificate chain, or a length 2 character vector comprising [i] the certificate authority certificate chain and [ii] the empty string ''.
.compute	[default 'default'] character value for the compute profile to use (each compute profile has its own independent set of daemons).
remote	required only for launching remote daemons, a configuration generated by <code>remote_config</code> or <code>ssh_config</code> . An empty <code>remote_config</code> does not effect any daemon launches but returns the shell commands for deploying manually on remote machines.

Details

These functions may be used to re-launch daemons that have exited after reaching time or task limits.

Daemons must already be set for launchers to work.

The generated command contains the argument 'rs' specifying the length 7 L'Ecuyer-CMRG random seed supplied to the daemon. The values will be different each time the function is called.

Value

For **launch_local**: Integer number of daemons launched.

For **launch_remote**: A character vector of daemon launch commands, classed as 'miraiLaunchCmd'. The printed output may be copy / pasted directly to the remote machine.

Examples

```
if (interactive()) {
# Only run examples in interactive R sessions

daemons(url = host_url(), dispatcher = FALSE)
status()
launch_local(1L, cleanup = FALSE)
launch_remote(1L, cleanup = FALSE)
Sys.sleep(1)
status()
daemons(0)

daemons(url = host_url(tls = TRUE))
```

```

status()
launch_local(2L, output = TRUE)
Sys.sleep(1)
status()
daemons(0)

}

```

make_cluster

Make Mirai Cluster

Description

make_cluster creates a cluster of type 'miraiCluster', which may be used as a cluster object for any function in the **parallel** base package such as [clusterApply](#) or [parLapply](#).

stop_cluster stops a cluster created by make_cluster.

Usage

```
make_cluster(n, url = NULL, remote = NULL, ...)
```

```
stop_cluster(cl)
```

Arguments

n	integer number of nodes (automatically launched on the local machine unless 'url' is supplied).
url	[default NULL] (specify for remote nodes) the character URL on the host for remote nodes to dial into, including a port accepting incoming connections, e.g. 'tcp://10.75.37.40:5555'. Specify a URL with the scheme 'tls+tcp://' to use secure TLS connections.
remote	[default NULL] (specify to launch remote nodes) a remote launch configuration generated by remote_config or ssh_config . If not supplied, nodes may be deployed manually on remote resources.
...	additional arguments passed onto daemons .
cl	a 'miraiCluster'.

Value

For **make_cluster**: An object of class 'miraiCluster' and 'cluster'. Each 'miraiCluster' has an automatically assigned ID and 'n' nodes of class 'miraiNode'. If 'url' is supplied but not 'remote', the shell commands for deployment of nodes on remote resources are printed to the console.

For **stop_cluster**: invisible NULL.

Remote Nodes

Specify 'url' and 'n' to set up a host connection for remote nodes to dial into. 'n' defaults to one if not specified.

Also specify 'remote' to launch the nodes using a configuration generated by [remote_config](#) or [ssh_config](#). In this case, the number of nodes is inferred from the configuration provided and 'n' is disregarded.

If 'remote' is not supplied, the shell commands for deploying nodes manually on remote resources are automatically printed to the console.

[launch_remote](#) may be called at any time on a 'miraiCluster' to return the shell commands for deployment of all nodes, or on a 'miraiNode' to return the command for a single node.

Status

Call [status](#) on a 'miraiCluster' to check the number of currently active connections as well as the host URL.

Errors

Errors are thrown by the 'parallel' mechanism if one or more nodes failed (quit unexpectedly). The resulting 'errorValue' returned is 19 (Connection reset). Other types of error, e.g. in evaluation, should result in the usual 'miraiError' being returned.

Note

The default behaviour of clusters created by this function is designed to map as closely as possible to clusters created by the **parallel** package. However, '...' arguments are passed onto [daemons](#) for additional customisation if desired, although resultant behaviour may not always be supported.

Examples

```
if (interactive()) {  
  # Only run examples in interactive R sessions  
  
  cl <- make_cluster(2)  
  cl  
  cl[[1L]]  
  
  Sys.sleep(0.5)  
  status(cl)  
  
  stop_cluster(cl)  
  
}
```

mirai	<i>mirai (Evaluate Async)</i>
-------	-------------------------------

Description

Evaluate an expression asynchronously in a new background R process or persistent daemon (local or remote). This function will return immediately with a ‘mirai’, which will resolve to the evaluated result once complete.

Usage

```
mirai(.expr, ..., .args = list(), .timeout = NULL, .compute = "default")
```

Arguments

<code>.expr</code>	an expression to evaluate asynchronously (of arbitrary length, wrapped in { } where necessary), or else a pre-constructed language object.
<code>...</code>	(optional) either named arguments (name = value pairs) specifying objects referenced, but not defined, in ‘.expr’, or an environment containing such objects. See ‘evaluation’ section below.
<code>.args</code>	(optional) either a named list specifying objects referenced, but not defined, in ‘.expr’, or an environment containing such objects. These objects will remain local to the evaluation environment as opposed to those supplied in ‘...’ above - see ‘evaluation’ section below.
<code>.timeout</code>	[default NULL] for no timeout, or an integer value in milliseconds. A mirai will resolve to an ‘errorValue’ 5 (timed out) if evaluation exceeds this limit.
<code>.compute</code>	[default ‘default’] character value for the compute profile to use (each compute profile has its own independent set of daemons).

Details

This function will return a ‘mirai’ object immediately.

The value of a mirai may be accessed at any time at `$data`, and if yet to resolve, an ‘unresolved’ logical NA will be returned instead.

`unresolved` may be used on a mirai, returning TRUE if a ‘mirai’ has yet to resolve and FALSE otherwise. This is suitable for use in control flow statements such as `while` or `if`.

Alternatively, to call (and wait for) the result, use `call_mirai` on the returned ‘mirai’. This will block until the result is returned.

Specify ‘.compute’ to send the mirai using a specific compute profile (if previously created by `daemons`), otherwise leave as ‘default’.

Value

A ‘mirai’ object.

Evaluation

The expression `‘.expr’` will be evaluated in a separate R process in a clean environment (not the global environment), consisting only of the objects supplied to `‘.args’`, with the objects passed as `‘...’` assigned to the global environment of that process.

As evaluation occurs in a clean environment, all undefined objects must be supplied though `‘...’` and/or `‘.args’`, including self-defined functions. Functions from a package should use namespaced calls such as `mirai::mirai()`, or else the package should be loaded beforehand as part of `‘.expr’`.

For evaluation to occur *as if* in your global environment, supply objects to `‘...’` rather than `‘.args’`, e.g. for free variables or helper functions defined in function bodies, as scoping rules may otherwise prevent them from being found.

Timeouts

Specifying the `‘.timeout’` argument ensures that the mirai always resolves. However, the task may not have completed and still be ongoing in the daemon process. Use `stop_mirai` instead to explicitly stop and interrupt a task.

Errors

If an error occurs in evaluation, the error message is returned as a character string of class `‘miraiError’` and `‘errorValue’`. `is_mirai_error` may be used to test for this. The elements of the original condition are accessible via `$` on the error object. A stack trace is also available at `$stack.trace`.

If a daemon crashes or terminates unexpectedly during evaluation, an `‘errorValue’` 19 (Connection reset) is returned.

`is_error_value` tests for all error conditions including `‘mirai’` errors, interrupts, and timeouts.

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  # specifying objects via '...'
  n <- 3
  m <- mirai(x + y + 2, x = 2, y = n)
  m
  m$data
  Sys.sleep(0.2)
  m$data

  # passing the calling environment to '...'
  df1 <- data.frame(a = 1, b = 2)
  df2 <- data.frame(a = 3, b = 1)
  m <- mirai(as.matrix(rbind(df1, df2)), environment(), .timeout = 1000)
  m[]

  # using unresolved()
  m <- mirai(
    {
      res <- rnorm(n)
    }
  )
}
```



```

    res / rev(res)
  },
  n = 1e6
)
while (unresolved(m)) {
  cat("unresolved\n")
  Sys.sleep(0.1)
}
str(m$data)

# evaluating scripts using source() in '.expr'
n <- 10L
file <- tempfile()
cat("r <- rnorm(n)", file = file)
m <- mirai({source(file); r}, file = file, n = n)
call_mirai(m)$data
unlink(file)

# use source(local = TRUE) when passing in local variables via '.args'
n <- 10L
file <- tempfile()
cat("r <- rnorm(n)", file = file)
m <- mirai({source(file, local = TRUE); r}, .args = list(file = file, n = n))
call_mirai(m)$data
unlink(file)

# passing a language object to '.expr' and a named list to '.args'
expr <- quote(a + b + 2)
args <- list(a = 2, b = 3)
m <- mirai(.expr = expr, .args = args)
collect_mirai(m)

}

```

mirai_map

mirai Map

Description

Asynchronous parallel map of a function over a list or vector using **mirai**, with optional **promises** integration. Performs multiple map over the rows of a dataframe or matrix.

Usage

```
mirai_map(.x, .f, ..., .args = list(), .promise = NULL, .compute = "default")
```

Arguments

<code>.x</code>	a list or atomic vector. Also accepts a matrix or dataframe, in which case multiple map is performed over its rows.
<code>.f</code>	a function to be applied to each element of <code>.x</code> , or row of <code>.x</code> as the case may be.
<code>...</code>	(optional) named arguments (name = value pairs) specifying objects referenced, but not defined, in <code>.f</code> .
<code>.args</code>	(optional) further constant arguments to <code>.f</code> , provided as a list.
<code>.promise</code>	(optional) if supplied, registers a promise against each mirai. Either a function, supplied to the 'onFulfilled' argument of <code>promises::then()</code> or a list of 2 functions, supplied respectively to 'onFulfilled' and 'onRejected' for <code>promises::then()</code> . Using this argument requires the promises package.
<code>.compute</code>	[default 'default'] character value for the compute profile to use (each compute profile has its own independent set of daemons).

Details

Sends each application of function `.f` on an element of `.x` (or row of `.x`) for computation in a separate `mirai` call.

This simple and transparent behaviour is designed to make full use of **mirai** scheduling to minimise overall execution time.

Facilitates recovery from partial failure by returning all 'miraiError' / 'errorValue' as the case may be, thus allowing only the failures to be re-run.

Note: requires daemons to have previously been set. If not, then one local daemon is set before the function proceeds.

Value

A 'mirai_map' (list of 'mirai' objects).

Collection Options

`x[]` collects the results of a 'mirai_map' `x` and returns a list. This will wait for all asynchronous operations to complete if still in progress, blocking but user-interruptible.

`x[.flat]` collects and flattens map results to a vector, checking that they are of the same type to avoid coercion. Note: errors if an 'errorValue' has been returned or results are of differing type.

`x[.progress]` collects map results whilst showing a progress bar from the **cli** package, if installed, with completion percentage and ETA, or else a simple text progress indicator. Note: if the map operation completes too quickly then the progress bar may not show at all.

`x[.stop]` collects map results applying early stopping, which stops at the first failure and cancels remaining operations. Note: operations already in progress continue to completion, although their results are not collected.

The options above may be combined in the manner of:

`x[.stop, .progress]` which applies early stopping together with a progress indicator.

Multiple Map

If `.x` is a matrix or dataframe (or other object with 'dim' attributes), *multiple* map is performed over its **rows**.

This allows map over 2 or more arguments, and `.f` should accept at least as many arguments as there are columns. If the dataframe has names, or the matrix column dimnames, named arguments are provided to `.f`.

To map over **columns** instead, first wrap a dataframe in `as.list`, or transpose a matrix using `t`.

Examples

```
if (interactive()) {
# Only run examples in interactive R sessions

daemons(4)

# perform and collect mirai map
mm <- mirai_map(c(a = 1, b = 2, c = 3), rnorm)
mm
mm[]

# map with constant args specified via '.args'
mirai_map(1:3, rnorm, .args = list(n = 5, sd = 2))[]

# flatmap with helper function passed via '...'
mirai_map(
  10^(0:9),
  function(x) rnorm(1L, valid(x)),
  valid = function(x) min(max(x, 0L), 100L)
)[.flat]

# unnamed matrix multiple map: arguments passed to function by position
(mat <- matrix(1:4, nrow = 2L))
mirai_map(mat, function(x = 10, y = 0, z = 0) x + y + z)[.flat]

# named matrix multiple map: arguments passed to function by name
dimnames(mat)[[2L]] <- c("y", "z")
mirai_map(mat, function(x = 10, y = 0, z = 0) x + y + z)[.flat]

# dataframe multiple map: using a function taking '...' arguments
df <- data.frame(a = c("Aa", "Bb"), b = c(1L, 4L))
mirai_map(df, function(...) sprintf("%s: %d", ...))[.flat]

# indexed map over a vector (using a dataframe)
v <- c("egg", "got", "ten", "nap", "pie")
mirai_map(
  data.frame(1:length(v), v),
  sprintf,
  .args = list(fmt = "%d_%s")
)[.flat]

# return a 'mirai_map' object, check for resolution, collect later
```

```

mp <- mirai_map(2:4, function(x) runif(1L, x, x + 1))
unresolved(mp)
mp
mp[.flat]
unresolved(mp)

# progress indicator counts up from 0 to 4 seconds
res <- mirai_map(1:4, Sys.sleep)[.progress]

daemons(0)

# generates warning as daemons not set
# stops early when second element returns an error
tryCatch(mirai_map(list(1, "a", 3), sum)[.stop], error = identity)

# promises example that outputs the results, including errors, to the console
if (requireNamespace("promises", quietly = TRUE)) {
daemons(1, dispatcher = FALSE)
m1 <- mirai_map(
  1:30,
  function(i) {Sys.sleep(0.1); if (i == 30) stop(i) else i},
  .promise = list(
    function(x) cat(paste(x, "")),
    function(x) { cat(conditionMessage(x), "\n"); daemons(0) }
  )
)
}
}
}

```

remote_config

Generic and SSH Remote Launch Configuration

Description

remote_config provides a flexible generic framework for generating the shell commands to deploy daemons remotely.

ssh_config generates a remote configuration for launching daemons over SSH, with the option of SSH tunnelling.

Usage

```

remote_config(
  command = NULL,
  args = c("", "."),
  rscript = "Rscript",
  quote = FALSE
)

```

```
ssh_config(
  remotes,
  port,
  tunnel = FALSE,
  timeout = 10,
  command = "ssh",
  rscript = "Rscript"
)
```

Arguments

command	the command used to effect the daemon launch on the remote machine as a character string (e.g. 'ssh'). Defaults to 'ssh' for ssh_config, although may be substituted for the full path to a specific SSH application. The default NULL for remote_config does not effect any launches, but causes launch_remote to return the shell commands for manual deployment on remote machines.
args	(optional) arguments passed to 'command', as a character vector that must include "." as an element, which will be substituted for the daemon launch command. Alternatively, a list of such character vectors to effect multiple launches (one for each list element).
rscript	(optional) name / path of the Rscript executable on the remote machine. The default assumes 'Rscript' is on the executable search path. Prepend the full path if necessary. If launching on Windows, 'Rscript' should be replaced with 'Rscript.exe'.
quote	[default FALSE] logical value whether or not to quote the daemon launch command (not required for Slurm 'srun' for example, but required for 'ssh' or Slurm 'sbatch').
remotes	the character URL or vector of URLs to SSH into, using the 'ssh://' scheme and including the port open for SSH connections (defaults to 22 if not specified), e.g. 'ssh://10.75.32.90:22' or 'ssh://nodename'.
port	(required only if using SSH tunnelling) integer local port number to use on 127.0.0.1.
tunnel	[default FALSE] logical value whether to use SSH reverse tunnelling. If TRUE, a tunnel is created between the same ports on the local and remote machines. See the 'SSH Tunnelling' section below for how to correctly specify required settings.
timeout	[default 10] maximum time allowed for connection setup in seconds.

Value

A list in the required format to be supplied to the 'remote' argument of [launch_remote](#), [daemons](#), or [make_cluster](#).

SSH Direct Connections

The simplest use of SSH is to execute the daemon launch command on a remote machine, for it to dial back to the host / dispatcher URL.

It is assumed that SSH key-based authentication is already in place. The relevant port on the host must also be open to inbound connections from the remote machine.

SSH Tunnelling

Use of SSH tunnelling provides a convenient way to launch remote daemons without requiring the remote machine to be able to access the host. Often firewall configurations or security policies may prevent opening a port to accept outside connections.

In these cases SSH tunnelling offers a solution by creating a tunnel once the initial SSH connection is made. For simplicity, this SSH tunnelling implementation uses the same port on both the side of the host and that of the daemon. SSH key-based authentication must also already be in place.

Tunnelling requires the hostname for the the 'url' argument to `daemons` be '127.0.0.1'. This is as the tunnel is created between 127.0.0.1:port on each machine. The host listens to port on its machine and the remotes each dial into port on their own respective machines.

Examples

```
# Slurm srun example
remote_config(
  command = "srun",
  args = c("--mem 512", "-n 1", "."),
  rscript = file.path(R.home("bin"), "Rscript")
)

# Slurm sbatch requires 'quote = TRUE'
remote_config(
  command = "sbatch",
  args = c("--mem 512", "-n 1", "--wrap", "."),
  rscript = file.path(R.home("bin"), "Rscript"),
  quote = TRUE
)

# SSH also requires 'quote = TRUE'
remote_config(
  command = "/usr/bin/ssh",
  args = c("-fTp 22 10.75.32.90", "."),
  quote = TRUE
)

# can be used to start local daemons with special configurations
remote_config(
  command = "Rscript",
  rscript = "--default-packages=NULL --vanilla"
)

# simple SSH example
ssh_config(
  remotes = c("ssh://10.75.32.90:222", "ssh://nodename"),
  timeout = 5
)
```

```
# SSH tunnelling example
ssh_config(
  remotes = c("ssh://10.75.32.90:222", "ssh://nodename"),
  port = 5555,
  tunnel = TRUE
)

## Not run:

# launch 2 daemons on the remote machines 10.75.32.90 and 10.75.32.91 using
# SSH, connecting back directly to the host URL over a TLS connection:

daemons(
  url = host_url(tls = TRUE),
  remote = ssh_config(
    remotes = c("ssh://10.75.32.90:222", "ssh://10.75.32.91:222"),
    timeout = 1
  )
)

# launch 2 nodes on the remote machine 10.75.32.90 using SSH tunnelling over
# port 5555 ('url' hostname must be '127.0.0.1'):

cl <- make_cluster(
  url = "tcp://127.0.0.1:5555",
  remote = ssh_config(
    remotes = c("ssh://10.75.32.90", "ssh://10.75.32.90"),
    port = 5555,
    tunnel = TRUE,
    timeout = 1
  )
)

## End(Not run)
```

serial_config

Create Serialization Configuration

Description

Returns a serialization configuration, which may be set to perform custom serialization and un-serialization of normally non-exportable reference objects, allowing these to be used seamlessly between different R sessions. This feature utilises the 'refhook' system of R native serialization. Once set, the functions apply to all mirai requests for a specific compute profile.

Usage

```
serial_config(class, sfunc, ufunc, vec = FALSE)
```

Arguments

<code>class</code>	character string of the class of object custom serialization functions are applied to, e.g. 'ArrowTabular' or 'torch_tensor'.
<code>sfunc</code>	a function that accepts a reference object inheriting from 'class' (or a list of such objects) and returns a raw vector.
<code>ufunc</code>	a function that accepts a raw vector and returns a reference object (or list of such objects).
<code>vec</code>	[default FALSE] whether or not the serialization functions are vectorized. If FALSE, they should accept and return reference objects individually e.g. <code>arrow::write_to_raw</code> and <code>arrow::read_ipc_stream</code> . If TRUE, they should accept and return a list of reference objects, e.g. <code>torch::torch_serialize</code> and <code>torch::torch_load</code> .

Value

A list comprising the configuration. This should be passed to the 'serial' argument of [daemons](#).

Examples

```
cfg <- serial_config("test_cls", function(x) serialize(x, NULL), unserialize)
cfg
```

status

Status Information

Description

Retrieve status information for the specified compute profile, comprising current connections and daemons status.

Usage

```
status(.compute = "default")
```

Arguments

`.compute` [default 'default'] character compute profile (each compute profile has its own set of daemons for connecting to different resources).
or a 'miraiCluster' to obtain its status.

Value

A named list comprising:

- **connections** - integer number of active daemon connections.
- **daemons** - character URL at which host / dispatcher is listening, or else `0L` if daemons have not yet been set.
- **mirai** (present only if using dispatcher) - a named integer vector comprising: **awaiting** - number of tasks queued for execution at dispatcher, **executing** - number of tasks sent to a daemon for execution, and **completed** - number of tasks for which the result has been received (either completed or cancelled).

Events

If dispatcher is used combined with daemon IDs, an additional element **events** will report the positive integer ID when the daemon connects and the negative value when it disconnects. Only the events since the previous status query are returned.

Examples

```
if (interactive()) {
# Only run examples in interactive R sessions

status()
daemons(url = "tcp://[::1]:0")
status()
daemons(0)

}
```

stop_mirai	<i>mirai (Stop)</i>
------------	---------------------

Description

Stops a 'mirai' if still in progress, causing it to resolve immediately to an 'errorValue' 20 (Operation canceled).

Usage

```
stop_mirai(x)
```

Arguments

x a 'mirai' object, or list of 'mirai' objects.

Details

Using dispatcher allows cancellation of ‘mirai’. In the case that the ‘mirai’ is awaiting execution, it is discarded from the queue and never evaluated. In the case it is already in execution, an interrupt will be sent.

A successful cancellation request does not guarantee successful cancellation: the task, or a portion of it, may have already completed before the interrupt is received. Even then, compiled code is not always interruptible. This should be noted, particularly if the code carries out side effects during execution, such as writing to files, etc.

Value

Logical TRUE if the cancellation request was successful (was awaiting execution or in execution), or else FALSE (if already completed or previously cancelled). Will always return FALSE if not using dispatcher.

Or a vector of logical values if supplying a list of ‘mirai’, such as those returned by [mirai_map](#).

Examples

```
if (interactive()) {
  # Only run examples in interactive R sessions

  m <- mirai(Sys.sleep(n), n = 5)
  stop_mirai(m)
  m$data

}
```

 unresolved

Query if a mirai is Unresolved

Description

Query whether a ‘mirai’, ‘mirai’ value or list of ‘mirai’ remains unresolved. Unlike [call_mirai](#), this function does not wait for completion.

Usage

```
unresolved(x)
```

Arguments

x a ‘mirai’ object or list of ‘mirai’ objects, or a ‘mirai’ value stored at \$data.

Details

Suitable for use in control flow statements such as while or if.

Note: querying resolution may cause a previously unresolved ‘mirai’ to resolve.

Value

Logical TRUE if 'aio' is an unresolved 'mirai' or 'mirai' value or the list contains at least one unresolved 'mirai', or FALSE otherwise.

Examples

```
if (interactive()) {  
  # Only run examples in interactive R sessions  
  
  m <- mirai(Sys.sleep(0.1))  
  unresolved(m)  
  Sys.sleep(0.3)  
  unresolved(m)  
  
}
```

with.miraiDaemons *With Mirai Daemons*

Description

Evaluate an expression with daemons that last for the duration of the expression. Ensure each mirai within the statement is explicitly called (or their values collected) so that daemons are not reset before they have all completed.

Usage

```
## S3 method for class 'miraiDaemons'  
with(data, expr, ...)
```

Arguments

data	a call to daemons .
expr	an expression to evaluate.
...	not used.

Details

This function is an S3 method for the generic with for class 'miraiDaemons'.

Value

The return value of 'expr'.

Examples

```
if (interactive()) {  
  # Only run examples in interactive R sessions  
  
  with(  
    daemons(2, dispatcher = FALSE),  
    {  
      m1 <- mirai(Sys.getpid())  
      m2 <- mirai(Sys.getpid())  
      cat(m1[], m2[], "\n")  
    }  
  )  
  
  status()  
}
```

Index

as.list, 27
as.promise.mirai, 3

call_mirai, 4, 15, 23, 34
call_mirai_(call_mirai), 4
clusterApply, 21
collect_mirai, 5, 15

daemon, 7, 10, 11, 14, 19, 20
daemons, 2, 7, 8, 9, 13, 16, 20–23, 29, 30, 32, 35
dispatcher, 11, 13

everywhere, 14

host_url, 9, 11, 16

is_error_value, 5, 6, 24
is_error_value(is_mirai_error), 18
is_mirai, 17
is_mirai_error, 5, 6, 18, 24
is_mirai_interrupt(is_mirai_error), 18
is_mirai_map(is_mirai), 17

launch_local, 2, 8, 19
launch_remote, 11, 22, 29
launch_remote(launch_local), 19
local_url(host_url), 16

make_cluster, 21, 29
mirai, 7, 9, 12, 23, 26
mirai-package, 2
mirai_map, 4, 6, 25, 34

parLapply, 21

remote_config, 10, 11, 19–22, 28

serial_config, 10, 31
ssh_config, 10, 11, 19–22
ssh_config(remote_config), 28

status, 8, 11, 22, 32
stop_cluster(make_cluster), 21
stop_mirai, 24, 33

t, 27

unresolved, 5, 6, 23, 34

with.miraiDaemons, 35