

# Package ‘AnVIL’

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**Title** Bioconductor on the AnVIL compute environment

**Version** 1.20.1

**Description** The AnVIL is a cloud computing resource developed in part by the National Human Genome Research Institute. The AnVIL package provides end-user and developer functionality. For the end-user, AnVIL provides fast binary package installation, utilities for working with Terra / AnVIL table and data resources, and convenient functions for file movement to and from Google cloud storage. For developers, AnVIL provides programatic access to the Terra, Leonardo, Rawls, and Dockstore RESTful programming interface, including helper functions to transform JSON responses to formats more amenable to manipulation in R.

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AnVIL-package	<i>AnVIL: Bioconductor on the AnVIL compute environment</i>
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Description

The AnVIL is a cloud computing resource developed in part by the National Human Genome Research Institute. The AnVIL package provides end-user and developer functionality. For the end-user, AnVIL provides fast binary package installation, utilities for working with Terra / AnVIL table and data resources, and convenient functions for file movement to and from Google cloud storage. For developers, AnVIL provides programatic access to the Terra, Leonardo, Rawls, and Dockstore RESTful programming interface, including helper functions to transform JSON responses to formats more amenable to manipulation in R.

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`.gadget_run`*Functions to implement AnVIL gadget interfaces*

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**Description**

Functions documented on this page are primarily intended for package developers wishing to implement gadgets (graphical interfaces) to navigating AnVIL-generated tables.

`.gadget_run()` presents the user with a tibble-navigating gadget, returning the value of `DONE_FUN` if a row of the tibble is selected, or `NULL`.

**Usage**

```
.gadget_run(title, tibble, DONE_FUN)
```

**Arguments**

<code>title</code>	character(1) (required) title to appear at the base of the gadget, e.g., "AnVIL Workspaces".
<code>tibble</code>	a tibble or <code>data.frame</code> to be displayed in the gadget.
<code>DONE_FUN</code>	a function of two arguments, <code>tibble</code> and <code>row_selected</code> . The tibble is the tibble provided as an argument to <code>.gadget_run()</code> . <code>row_selected</code> is the row selected in the gadget by the user. The function is only invoked when the user selects a valid row.

**Value**

`.gadget_run()` returns the result of `DONE_FUN()` if a row has been selected by the user, or `NULL` if no row is selected (the user presses `Cancel`, or `Done` prior to selecting any row).

## Examples

```
## Not run:
tibble <- avworkspaces()
DONE_FUN <- function(tibble, row_selected) {
  selected <- slice(tibble, row_selected)
  with(selected, paste0(namespace, "/", name))
}
.gadget_run("AnVIL Example", tibble, DONE_FUN)

## End(Not run)
```

---

av-defunct

---

*TABLE, DATA, files, bucket, runtime, and disk elements*


---

## Description

DEFUNCT - AnVIL GCP functions for TABLE, DATA, files, bucket,

avtable\_import\_status() queries for the status of an 'asynchronous' table import.

avdata() returns key-value tables representing the information visualized under the DATA tab, 'REFERENCE DATA' and 'OTHER DATA' items. avdata\_import() updates (modifies or creates new, but does not delete) rows in 'REFERENCE DATA' or 'OTHER DATA' tables.

avbucket() returns the workspace bucket, i.e., the google bucket associated with a workspace. Bucket content can be visualized under the 'DATA' tab, 'Files' item.

avfiles\_ls() returns the paths of files in the workspace bucket. avfiles\_backup() copies files from the compute node file system to the workspace bucket. avfiles\_restore() copies files from the workspace bucket to the compute node file system. avfiles\_rm() removes files or directories from the workspace bucket.

avruntimes() returns a tibble containing information about runtimes (notebooks or RStudio instances, for example) that the current user has access to.

avruntime() returns a tibble with the runtimes associated with a particular google project and account number; usually there is a single runtime satisfying these criteria, and it is the runtime active in AnVIL.

'avdisks()' returns a tibble containing information about persistent disks associated with the current user.

## Usage

```
avtable_paged(
  table,
  n = Inf,
  page = 1L,
  pageSize = 1000L,
  sortField = "name",
  sortDirection = c("asc", "desc"),
  filterTerms = character(),
```

```
    filterOperator = c("and", "or"),
    namespace = avworkspace_namespace(),
    name = avworkspace_name(),
    na = c("", "NA")
)

avtable_import_status(
  job_status,
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)

avdata(namespace = avworkspace_namespace(), name = avworkspace_name())

avdata_import(
  .data,
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)

avbucket(
  namespace = avworkspace_namespace(),
  name = avworkspace_name(),
  as_path = TRUE
)

avfiles_ls(
  path = "",
  full_names = FALSE,
  recursive = FALSE,
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)

avfiles_backup(
  source,
  destination = "",
  recursive = FALSE,
  parallel = TRUE,
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)

avfiles_restore(
  source,
  destination = ".",
  recursive = FALSE,
  parallel = TRUE,
```

```

    namespace = avworkspace_namespace(),
    name = avworkspace_name()
)

avfiles_rm(
  source,
  recursive = FALSE,
  parallel = TRUE,
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)

avruntimes()

avruntime(project = gcloud_project(), account = gcloud_account())

avdisks()

```

## Arguments

table	character(1) table name as returned by, e.g., <code>avtables()</code> .
n	numeric(1) maximum number of rows to return
page	integer(1) first page of iteration
pageSize	integer(1) number of records per page. Generally, larger page sizes are more efficient.
sortField	character(1) field used to sort records when determining page order. Default is the entity field.
sortDirection	character(1) direction to sort entities ("asc" ending or "desc" ending) when paging.
filterTerms	character(1) string literal to select rows with an exact (substring) matches in column.
filterOperator	character(1) operator to use when multiple terms in <code>filterTerms=</code> , either "and" (default) or "or".
namespace	character(1) AnVIL workspace namespace as returned by, e.g., <code>avworkspace_namespace()</code>
name	character(1) AnVIL workspace name as returned by, eg., <code>avworkspace_name()</code> .
na	in <code>avtable()</code> and <code>avtable_paged()</code> , character() of strings to be interpreted as missing values. In <code>avtable_import()</code> character(1) value to use for representing NA_character_. See Details.
job_status	tibble() of job identifiers, returned by <code>avtable_import()</code> and <code>avtable_import_set()</code> .
.data	A tibble or data.frame for import as an AnVIL table.
as_path	logical(1) when TRUE (default) return bucket with prefix <code>gs://</code> (for <code>avbucket()</code> ) or <code>gs://&lt;bucket-id&gt;</code> (for <code>avfiles_ls()</code> ).
path	For <code>avfiles_ls()</code> , the character(1) file or directory path to list. For <code>avfiles_rm()</code> , the character() (perhaps with length greater than 1) of files or directory path

full_names	logical(1) return names relative to path (FALSE, default) or root of the workspace bucket?
recursive	logical(1) list files recursively?
source	character() file paths. for avfiles_backup(), source can include directory names when recursive = TRUE.
destination	character(1) a google bucket (gs://<bucket-id>/...) to write files. The default is the workspace bucket.
parallel	logical(1) backup files using parallel transfer? See ?gsutil_cp().
project	character(1) project (billing account) name, as returned by, e.g., gcloud_project() or avworkspace_namespace().
account	character(1) google account (email address associated with billing account), as returned by gcloud_account().

### Details

avfiles\_backup() can be used to back-up individual files or entire directories, recursively. When recursive = FALSE, files are backed up to the bucket with names approximately paste0(destination, "/", basename(source)). When recursive = TRUE and source is a directory path/to/foo/, files are backed up to b"/", dir(basename(source), full.names = TRUE)). Naming conventions are described in detail in gsutil\_help("cp").

avfiles\_restore() behaves in a manner analogous to avfiles\_backup(), copying files from the workspace bucket to the compute node file system.

### Value

avtable\_paged(): a tibble of data corresponding to the AnVIL table table in the specified workspace.

avdata() returns a tibble with five columns: "type" represents the origin of the data from the 'REFERENCE' or 'OTHER' data menus. "table" is the table name in the REFERENCE menu, or 'workspace' for the table in the 'OTHER' menu, the key used to access the data element, the value label associated with the data element and the value (e.g., google bucket) of the element.

avdata\_import() returns, invisibly, the subset of the input table used to update the AnVIL tables.

avbucket() returns a character(1) bucket identifier, prefixed with gs:// if as\_path = TRUE.

avfiles\_ls() returns a character vector of files in the workspace bucket.

avfiles\_backup() returns, invisibly, the status code of the gsutil\_cp() command used to back up the files.

avfiles\_rm() on success, returns a list of the return codes of gsutil\_rm(), invisibly.

avruntimes() returns a tibble with columns

- id: integer() runtime identifier.
- googleProject: character() billing account.
- tool: character() e.g., "Jupyter", "RStudio".
- status character() e.g., "Stopped", "Running".
- creator character() AnVIL account, typically "user@gmail.com".

- `createdDate` character() creation date.
- `destroyedDate` character() destruction date, or NA.
- `dateAccessed` character() date of (first?) access.
- `runtimeName` character().
- `clusterServiceAccount` character() service ('pet') account for this runtime.
- `masterMachineType` character() It is unclear which 'tool' populates which of the machineType columns).
- `workerMachineType` character().
- `machineType` character().
- `persistentDiskId` integer() identifier of persistent disk (see `avdisks()`), or NA.

`avruntime()` returns a tibble with the same structure as the return value of `avruntimes()`.

`avdisks()` returns a tibble with columns

- `id` character() disk identifier.
- `googleProject` character() billing account.
- `status`, e.g. "Ready"
- `size` integer() in GB.
- `diskType` character().
- `blockSize` integer().
- `creator` character() AnVIL account, typically "user@gmail.com".
- `createdDate` character() creation date.
- `destroyedDate` character() destruction date, or NA.
- `dateAccessed` character() date of (first?) access.
- `zone` character() e.g.. "us-central1-a".
- `name` character().

---

avworkflows-defunct      *DEFUNCT - Workflow submissions and file outputs*

---

## Description

### [Deprecated]

`avworkflows()` returns a tibble summarizing available workflows.

`avworkflow_files()` returns a tibble containing information and file paths to workflow outputs.

`avworkflow_localize()` creates or synchronizes a local copy of files with files stored in the workspace bucket and produced by the workflow.

`avworkflow_run()` submits and runs the workflow of the configuration.

`avworkflow_stop()` stops the most recently submitted workflow job from running.

`avworkflow_info()` returns a tibble containing workflow information, including workflowName, status, start and end time, inputs and outputs.



**Usage**

```
avworkflows(namespace = avworkspace_namespace(), name = avworkspace_name())
```

```
avworkflow_files(  
  submissionId = NULL,  
  workflowId = NULL,  
  bucket = avbucket(),  
  namespace = avworkspace_namespace(),  
  name = avworkspace_name()  
)
```

```
avworkflow_localize(  
  submissionId = NULL,  
  workflowId = NULL,  
  destination = NULL,  
  type = c("control", "output", "all"),  
  bucket = avbucket(),  
  dry = TRUE  
)
```

```
avworkflow_run(  
  config,  
  entityName,  
  entityType = config$rootEntityType,  
  deleteIntermediateOutputFiles = FALSE,  
  useCallCache = TRUE,  
  useReferenceDisks = FALSE,  
  namespace = avworkspace_namespace(),  
  name = avworkspace_name(),  
  dry = TRUE  
)
```

```
avworkflow_stop(  
  submissionId = NULL,  
  namespace = avworkspace_namespace(),  
  name = avworkspace_name(),  
  dry = TRUE  
)
```

```
avworkflow_info(  
  submissionId = NULL,  
  namespace = avworkspace_namespace(),  
  name = avworkspace_name()  
)
```

**Arguments**

namespace	character(1) AnVIL workspace namespace as returned by, e.g., avworkspace_namespace()
-----------	--

name	character(1) AnVIL workspace name as returned by, eg., <code>avworkspace_name()</code> .
submissionId	a character() of workflow submission ids, or a tibble with column <code>submissionId</code> , or NULL / missing. See 'Details'.
workflowId	a character(1) of internal identifier associated with one workflow in the submission, or NULL / missing.
bucket	character(1) DEPRECATED (ignored in the current release) name of the google bucket in which the workflow products are available, as <code>gs://...</code> . Usually the bucket of the active workspace, returned by <code>avbucket()</code> .
destination	character(1) file path to the location where files will be synchronized. For directories in the current working directory, be sure to prepend with <code>"/"</code> . When NULL, the <code>submissionId</code> is used as the destination. <code>destination</code> may also be a google bucket, in which case the workflow files are synchronized from the workspace to a second bucket.
type	character(1) copy "control" (default), "output", or "all" files produced by a workflow.
dry	logical(1) when TRUE (default), report the consequences but do not perform the action requested. When FALSE, perform the action.
config	a <code>avworkflow_configuration</code> object of the workflow that will be run. Only <code>entityType</code> and method configuration name and namespace are used from <code>config</code> ; other configuration values must be communicated to AnVIL using <code>avworkflow_configuration_set()</code> .
entityName	character(1) or NULL name of the set of samples to be used when running the workflow. NULL indicates that no sample set will be used.
entityType	character(1) or NULL type of root entity used for the workflow. NULL means that no root entity will be used.
deleteIntermediateOutputFiles	logical(1) whether or not to delete intermediate output files when the workflow completes.
useCallCache	logical(1) whether or not to read from cache for this submission.
useReferenceDisks	logical(1) whether or not to use pre-built disks for common genome references. Default: FALSE.

## Details

For `avworkflow_files()`, the `submissionId` is the identifier associated with the submission of one (or more) workflows, and is present in the return value of `avworkflow_jobs()`; the example illustrates how the first row of `avworkflow_jobs()` (i.e., the most recently completed workflow) can be used as input to `avworkflow_files()`. When `submissionId` is not provided, the return value is for the most recently submitted workflow of the namespace and name of `avworkspace()`.

`avworkflow_localize()`. `type = "control"` files summarize workflow progress; they can be numerous but are frequently small and quickly synchronized. `type = "output"` files are the output products of the workflow stored in the workspace bucket. Depending on the workflow, outputs may be large, e.g., aligned reads in bam files. See `gsutil_cp()` to copy individual files from the bucket to the local drive.

`avworkflow_localize()` treats `submissionId=` in the same way as `avworkflow_files()`: when missing, files from the most recent workflow job are candidates for localization.

`avworkflow_run()` invisibly returns a slightly modified config object. The new config object has an added `LastSubmissionId` value that identifies the submitted job.

## Value

`avworkflows()` returns a tibble. Each workflow is in a 'namespace' and has a 'name', as illustrated in the example. Columns are

- `name`: workflow name.
- `namespace`: workflow namespace (often the same as the workspace namespace).
- `rootEntityType`: name of the `avtable()` used to retrieve inputs.
- `methodRepoMethod.methodUri`: source of the method, e.g., a dockstore URI.
- `methodRepoMethod.sourceRepo`: source repository, e.g., dockstore.
- `methodRepoMethod.methodPath`: path to method, e.g., a dockerstore method might reference a github repository.
- `methodRepoMethod.methodVersion`: the version of the method, e.g., 'main' branch of a github repository.

`avworkflow_files()` returns a tibble with columns

- `file`: `character()` 'base name' of the file in the bucket.
- `workflow`: `character()` name of the workflow the file is associated with.
- `task`: `character()` name of the task in the workflow that generated the file.
- `path`: `character()` full path to the file in the google bucket.
- `submissionId`: `character()` internal identifier associated with the submission the files belong to.
- `workflowId`: `character()` internal identifier associated with each workflow (e.g., row of an `avtable()` used as input) in the submission.
- `submissionRoot`: `character()` path in the workspace bucket to the root of files created by this submission.
- `namespace`: `character()` AnVIL workspace namespace (billing account) associated with the `submissionId`.
- `name`: `character(1)` AnVIL workspace name associated with the `submissionId`.

`avworkflow_localize()` prints a message indicating the number of files that are (if `dry = FALSE`) or would be localized. If no files require localization (i.e., local files are not older than the bucket files), then no files are localized. `avworkflow_localize()` returns a tibble of file name and bucket path of files to be synchronized.

`avworkflow_run()` returns config, invisibly. Note that config has an added `LastSubmissionId` value for the submission ID of the last run workflow.

`avworkflow_stop()` returns (invisibly) `TRUE` on successfully requesting that the workflow stop, `FALSE` if the workflow is already aborting, aborted, or done.

`avworkflow_info()` returns a tibble with columns: `submissionId`, `workflowId`, `workflowName`, `status`, `start`, `end`, `inputs` and `outputs`.

---

 avworkflow\_config-defunct

*DEFUNCT - Workflow configuration*


---

## Description

### [Deprecated]

Functions on this help page facilitate getting, updating, and setting workflow configuration parameters. See `?avworkflows` for additional relevant functionality.

`avworkflow_namespace()` and `avworkflow_name()` are utility functions to record the workflow namespace and name required when working with workflow configurations. `avworkflow()` provides a convenient way to provide workflow namespace and name in a single command, `namespace/name`.

`avworkflow_configuration_get()` returns a list structure describing an existing workflow configuration.

`avworkflow_configuration_inputs()` returns a data.frame template for the inputs defined in a workflow configuration. This template can be used to provide custom inputs for a configuration.

`avworkflow_configuration_outputs()` returns a data.frame template for the outputs defined in a workflow configuration. This template can be used to provide custom outputs for a configuration.

`avworkflow_configuration_update()` returns a list structure describing a workflow configuration with updated inputs and / or outputs.

`avworkflow_configuration_set()` updates an existing configuration in Terra / AnVIL, e.g., changing inputs to the workflow.

`avworkflow_configuration_template()` returns a template for defining workflow configurations. This template can be used as a starting point for providing a custom configuration.

## Usage

```
avworkflow_namespace(workflow_namespace = NULL)
```

```
avworkflow_name(workflow_name = NULL)
```

```
avworkflow(workflow = NULL)
```

```
avworkflow_configuration_get(
  workflow_namespace = avworkflow_namespace(),
  workflow_name = avworkflow_name(),
  namespace = avworkspace_namespace(),
  name = avworkspace_name()
)
```

```
avworkflow_configuration_inputs(config)
```

```
avworkflow_configuration_outputs(config)
```

```

avworkflow_configuration_update(
  config,
  inputs = avworkflow_configuration_inputs(config),
  outputs = avworkflow_configuration_outputs(config)
)

avworkflow_configuration_set(
  config,
  namespace = avworkspace_namespace(),
  name = avworkspace_name(),
  dry = TRUE
)

avworkflow_configuration_template()

## S3 method for class 'avworkflow_configuration'
print(x, ...)

```

## Arguments

workflow_namespace	character(1) AnVIL workflow namespace, as returned by, e.g., the namespace column of avworkflows().
workflow_name	character(1) AnVIL workflow name, as returned by, e.g., the name column of avworkflows().
workflow_namespace	character(1) representing the combined workflow namespace and name, as namespace/name.
namespace	character(1) AnVIL workspace namespace as returned by, e.g., avworkspace_namespace().
name	character(1) AnVIL workspace name as returned by, eg., avworkspace_name().
config	a named list describing the full configuration, e.g., created from editing the return value of avworkflow_configuration_set() or avworkflow_configuration_template().
inputs	the new inputs to be updated in the workflow configuration. If none are specified, the inputs from the original configuration will be used and no changes will be made.
outputs	the new outputs to be updated in the workflow configuration. If none are specified, the outputs from the original configuration will be used and no changes will be made.
dry	logical(1) when TRUE (default), report the consequences but do not perform the action requested. When FALSE, perform the action.
x	Object of class avworkflow_configuration.
...	additional arguments to print(); unused.

## Details

The exact format of the configuration is important.

One common problem is that a scalar character vector "bar" is interpreted as a json 'array' ["bar"] rather than a json string "bar". Enclose the string with jsonlite::unbox("bar") in the configuration list if the length 1 character vector in R is to be interpreted as a json string.

A second problem is that an unquoted unboxed character string `unbox("foo")` is required by AnVIL to be quoted. This is reported as a `warning()` about invalid inputs or outputs, and the solution is to provide a quoted string `unbox('"foo"')`.

## Value

`avworkflow_namespace()`, and `avworkflow_name()` return `character(1)` identifiers. `avworkflow()` returns the `character(1)` concatenated namespace and name. The value returned by `avworkflow_name()` will be percent-encoded (e.g., spaces " " replaced by "%20").

`avworkflow_configuration_get()` returns a list structure describing the configuration. See `avworkflow_configuration_` for the structure of a typical workflow.

`avworkflow_configuration_inputs()` returns a `data.frame` providing a template for the configuration inputs, with the following columns:

- `inputType`
- `name`
- `optional`
- `attribute`

The only column of interest to the user is the `attribute` column, this is the column that should be changed for customization.

`avworkflow_configuration_outputs()` returns a `data.frame` providing a template for the configuration outputs, with the following columns:

- `name`
- `outputType`
- `attribute`

The only column of interest to the user is the `attribute` column, this is the column that should be changed for customization.

`avworkflow_configuration_update()` returns a list structure describing the updated configuration.

`avworkflow_configuration_set()` returns an object describing the updated configuration. The return value includes invalid or unused elements of the config input. Invalid or unused elements of config are also reported as a warning.

`avworkflow_configuration_template()` returns a list providing a template for configuration lists, with the following structure:

- `namespace` `character(1)` configuration namespace.
- `name` `character(1)` configuration name.
- `rootEntityType` `character(1)` or missing. the name of the table (from `avtables()`) containing the entities referenced in inputs, etc., by the keyword 'this.'
- `prerequisites` named list (possibly empty) of prerequisites.
- `inputs` named list (possibly empty) of inputs. Form of input depends on method, and might include, e.g., a reference to a field in a table referenced by `avtables()` or a character string defining an input constant.

- outputs named list (possibly empty) of outputs.
- methodConfigVersion integer(1) identifier for the method configuration.
- methodRepoMethod named list describing the method, with character(1) elements described in the return value for avworkflows().
  - methodUri
  - sourceRepo
  - methodPath
  - methodVersion. The REST specification indicates that this has type integer, but the documentation indicates either integer or string.
- deleted logical(1) of uncertain purpose.

### See Also

The help page `?avworkflows` for discovering, running, stopping, and retrieving outputs from workflows.

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avworkspace_gadget	<i>Graphical user interfaces for common AnVIL operations</i>
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### Description

`workspace()` allows choice of workspace for subsequent use. It is the equivalent of displaying workspaces with `avworkspaces()`, and setting the selected workspace with `avworkspace()`.

`browse_workspace()` uses `browseURL()` to open a browser window pointing to the Terra workspace.

`table()` allows choice of table in the current workspace (selected by `avworkspace()` or `workspace()`) to be returned as a tibble. It is equivalent to invoking `avtables()` to show available tables, and `avtable()` to retrieve the selected table.

`workflow()` allows choice of workflow for retrieval. It is the equivalent of `avworkflows()` for listing available workflows, and `avworkflow_configuration_get()` for retrieving the workflow.

### Usage

```
avworkspace_gadget()
```

```
browse_workspace(use_avworkspace = TRUE)
```

```
avtable_gadget()
```

```
avworkflow_gadget()
```

### Arguments

`use_avworkspace`

logical(1) when TRUE (default), use the selected workspace (via `workspace()` or `avworkspace()` if available. If FALSE or no workspace is currently selected, use `workspace()` to allow the user to select the workspace.

**Value**

`workspace()` returns the selected workspace as a character(1) using the format namespace/name, or character(0) if no workspace is selected.

`browse_workspace()` returns the status of a `system()` call to launch the browser, invisibly.

`table()` returns a tibble representing the selected AnVIL table.

`workflow()` returns an `avworkflow_configuration` object representing the inputs and outputs of the selected workflow. This can be edited and updated as described in the "Running an AnVIL workflow within R" vignette.

**Examples**

```
## Not run:
workspace()
browse_workspace(use_avworkspace = FALSE)
tbl <- table()
wkflw <- avworkflow_gadget()

## End(Not run)
```

---

 drs-defunct

---

*DEFUNCT - DRS (Data Repository Service) URL management*


---

**Description**

`drs_stat()` resolves zero or more DRS URLs to their google bucket location.

`drs_access_url()` returns a vector of 'signed' URLs that allow access to restricted resources via standard https protocols.

`drs_cp()` copies 0 or more DRS URIs to a google bucket or local folder

**Usage**

```
drs_stat(source = character(), region = "US")
```

```
drs_access_url(source = character(), region = "US")
```

```
drs_cp(source, destination, ..., overwrite = FALSE)
```

**Arguments**

**source** character() DRS URLs (beginning with 'drs://') to resources managed by the 'martha' DRS resolution server.

**region** character(1) Google cloud 'region' in which the DRS resource is located. Most data is located in "US" (the default); in principle "auto" allows for discovery of the region, but sometimes fails. Regions are enumerated at <https://cloud.google.com/storage/docs/locations#available-locations>.



destination	character(1), google cloud bucket or local file system destination path.
...	additional arguments, passed to <code>gsutil_cp()</code> for file copying.
overwrite	logical(1) indicating that source fileNames present in destination should downloaded again.

## Details

`drs_stat()` sends requests in parallel to the DRS server, using 8 forked processes (by default) to speed up queries. Use `options(mc.cores = 16L)`, for instance, to set the number of processes to use.

`drs_stat()` uses the AnVIL 'pet' account associated with a runtime. The pet account is discovered by default when evaluated on an AnVIL runtime (e.g., in RStudio or a Jupyter notebook in the AnVIL), or can be found in the return value of `avruntimes()`.

Errors reported by the DRS service are communicated to the user, but can be cryptic. The DRS service itself is called 'martha'. Errors mentioning martha might commonly involve a mal-formed DRS uri. Martha uses a service called 'bond' to establish credentials with registered third party entities such as Kids First. Errors mentioning bond might involve absence of credentials, within Terra, to access the resource; check that, in the Terra / AnVIL graphical user interface, the user profiles 'External Entities' includes the organization to which the DRS uri is being resolved.

## Value

`drs_stat()` returns a tibble with the following columns:

- `fileName`: character() (resolver sometimes returns null).
- `size`: integer() (resolver sometimes returns null).
- `contentType`: character() (resolver sometimes returns null).
- `gsUri`: character() (resolver sometimes returns null).
- `timeCreated`: character() (the time created formatted using ISO 8601; resolver sometimes returns null).
- `timeUpdated`: character() (the time updated formatted using ISO 8601; resolver sometimes returns null).
- `bucket`: character() (resolver sometimes returns null).
- `name`: character() (resolver sometimes returns null).
- `googleServiceAccount`: list() (null unless the DOS url belongs to a Bond supported host).
- `hashes`: list() (contains the hashes type and their checksum value; if unknown. it returns null)

`drs_access_url()` returns a vector of https URLs corresponding to the vector of DRS URIs provided as inputs to the function.

`drs_cp()` returns a tibble like `drs_stat()`, but with additional columns

- `simple`: logical() value indicating whether resolution used a simple signed URL (TRUE) or auxiliary service account.
- `destination`: character() full path to retrieved object(s)

gcloud-defunct

*DEFUNCT - gcloud command line utility interface***Description****[Deprecated]**

These functions invoke the gcloud command line utility. See [gsutil](#) for details on how gcloud is located.

`gcloud_exists()` tests whether the `gcloud()` command can be found on this system. After finding the binary location, it runs `gcloud version` to identify potentially misconfigured installations. See 'Details' section of `gsutil` for where the application is searched.

`gcloud_account()`: report the current gcloud account via `gcloud config get-value account`.

`gcloud_project()`: report the current gcloud project via `gcloud config get-value project`.

`gcloud_help()`: queries gcloud for help for a command or sub-command via `gcloud help ....`

`gcloud_cmd()` allows arbitrary gcloud command execution via `gcloud ....` Use pre-defined functions in preference to this.

`gcloud_storage()` allows arbitrary gcloud storage command execution via `gcloud storage ....` Typically used for bucket management commands such as `rm` and `cp`.

`gcloud_storage_buckets()` provides an interface to the `gcloud storage buckets` command. This command can be used to create a new bucket via `gcloud storage buckets create ....`

**Usage**

```
gcloud_exists()
```

```
gcloud_account(account = NULL)
```

```
gcloud_project(project = NULL)
```

```
gcloud_help(...)
```

```
gcloud_cmd(cmd, ...)
```

```
gcloud_storage(cmd, ...)
```

```
gcloud_storage_buckets(bucket_cmd = "create", bucket, ...)
```

**Arguments**

`account` character(1) Google account (e.g., `user@gmail.com`) to use for authentication.

`project` character(1) billing project name.

`...` Additional arguments appended to gcloud commands.

`cmd` character(1) representing a command used to evaluate `gcloud cmd ....`

bucket_cmd	character(1) representing a buckets command typically used to create a new bucket. It can also be used to add-iam-policy-binding or remove-iam-policy-binding to a bucket.
bucket	character(1) representing a unique bucket name to be created or modified.

### Value

gcloud\_exists() returns TRUE when the gcloud application can be found, FALSE otherwise.

gcloud\_account() returns a character(1) vector containing the active gcloud account, typically a gmail email address.

gcloud\_project() returns a character(1) vector containing the active gcloud project.

gcloud\_help() returns an unquoted character() vector representing the text of the help manual page returned by gcloud help ....

gcloud\_cmd() returns a character() vector representing the text of the output of gcloud cmd ...

---

gsutil-defunct	<i>DEFUNCT - gsutil command line utility interface</i>
----------------	--

---

### Description

These functions invoke the gsutil command line utility. See the "Details:" section if you have gsutil installed but the package cannot find it.

gsutil\_requester Pays(): does the google bucket require that the requester pay for access?

gsutil\_ls(): List contents of a google cloud bucket or, if source is missing, all Cloud Storage buckets under your default project ID

gsutil\_exists(): check if the bucket or object exists.

gsutil\_stat(): print, as a side effect, the status of a bucket, directory, or file.

gsutil\_cp(): copy contents of source to destination. At least one of source or destination must be Google cloud bucket; source can be a character vector with length greater than 1. Use gsutil\_help("cp") for gsutil help.

gsutil\_rm(): remove contents of a google cloud bucket.

gsutil\_rsync(): synchronize a source and a destination. If the destination is on the local file system, it must be a directory or not yet exist (in which case a directory will be created).

gsutil\_cat(): concatenate bucket objects to standard output

gsutil\_help(): print 'man' page for the gsutil command or subcommand. Note that only commandes documented on this R help page are supported.

gsutil\_pipe(): create a pipe to read from or write to a gooogole bucket object.

**Usage**

```

gsutil_requester Pays(source)

gsutil_ls(source = character(), ..., recursive = FALSE)

gsutil_exists(source)

gsutil_stat(source)

gsutil_cp(source, destination, ..., recursive = FALSE, parallel = TRUE)

gsutil_rm(source, ..., force = FALSE, recursive = FALSE, parallel = TRUE)

gsutil_rsync(
  source,
  destination,
  ...,
  exclude = NULL,
  dry = TRUE,
  delete = FALSE,
  recursive = FALSE,
  parallel = TRUE
)

gsutil_cat(source, ..., header = FALSE, range = integer())

gsutil_help(cmd = character(0))

gsutil_pipe(source, open = "r", ...)

```

**Arguments**

source	character(1), (character() for gsutil_requester Pays(), gsutil_ls(), gsutil_exists(), gsutil_cp()) paths to a google storage bucket, possibly with wild-cards for file-level pattern matching.
...	additional arguments passed as-is to the gsutil subcommand.
recursive	logical(1); perform operation recursively from source?. Default: FALSE.
destination	character(1), google cloud bucket or local file system destination path.
parallel	logical(1), perform parallel multi-threaded / multi-processing (default is TRUE).
force	logical(1): continue silently despite errors when removing multiple objects. Default: FALSE.
exclude	character(1) a python regular expression of bucket paths to exclude from synchronization. E.g., '.*(\\.png \\.txt)\$' excludes '.png' and '.txt' files.
dry	logical(1), when TRUE (default), return the consequences of the operation without actually performing the operation.

delete	logical(1), when TRUE, remove files in destination that are not in source. Exercise caution when you use this option: it's possible to delete large amounts of data accidentally if, for example, you erroneously reverse source and destination.
header	logical(1) when TRUE annotate each
range	(optional) integer(2) vector used to form a range from-to of bytes to concatenate. NA values signify concatenation from the start (first position) or to the end (second position) of the file.
cmd	character() (optional) command name, e.g., "ls" for help.
open	character(1) either "r" (read) or "w" (write) from the bucket.

### Details

The gsutil system command is required. The search for gsutil starts with environment variable GLOUD\_SDK\_PATH providing a path to a directory containing a bin directory containingin gsutil, gcloud, etc. The path variable is searched for first as an option() and then system variable. If no option or global variable is found, Sys.which() is tried. If that fails, gsutil is searched for on defined paths. On Windows, the search tries to find Google\\Cloud SDK\\google-cloud-sdk\\bin\\gsutil.cmd in the LOCAL APP DATA, Program Files, and Program Files (x86) directories. On linux / macOS, the search continues with ~/google-cloud-sdk.

gsutil\_rsync(): To make "gs://mybucket/data" match the contents of the local directory "data" you could do:

```
gsutil_rsync("data", "gs://mybucket/data", delete = TRUE)
```

To make the local directory "data" the same as the contents of gs://mybucket/data:

```
gsutil_rsync("gs://mybucket/data", "data", delete = TRUE)
```

If destination is a local path and does not exist, it will be created.

### Value

gsutil\_requester Pays(): named logical() vector TRUE when requester-pays is enabled.

gsutil\_ls(): character() listing of source content.

gsutil\_exists(): logical(1) TRUE if bucket or object exists.

gsutil\_stat(): tibble() summarizing status of each bucket member.

gsutil\_cp(): exit status of gsutil\_cp(), invisibly.

gsutil\_rm(): exit status of gsutil\_rm(), invisibly.

gsutil\_rsync(): exit status of gsutil\_rsync(), invisibly.

gsutil\_cat() returns the content as a character vector.

gsutil\_help(): character() help text for subcommand cmd.

gsutil\_pipe() an unopened R pipe(); the mode is *not* specified, and the pipe must be used in the appropriate context (e.g., a pipe created with open = "r" for input as read.csv())

---

localize-defunct	<i>DEFUNCT - Copy packages, folders, or files to or from google buckets</i>
------------------	---

---

### Description

#### [Deprecated]

localize(): recursively synchronizes files from a Google storage bucket (source) to the local file system (destination). This command acts recursively on the source directory, and does not delete files in destination that are not in 'source'.

delocalize(): synchronize files from a local file system (source) to a Google storage bucket (destination). This command acts recursively on the source directory, and does not delete files in destination that are not in source.

### Usage

```
localize(source, destination, dry = TRUE)
```

```
delocalize(source, destination, unlink = FALSE, dry = TRUE)
```

### Arguments

source	character(1), a google storage bucket or local file system directory location.
destination	character(1), a google storage bucket or local file system directory location.
dry	logical(1), when TRUE (default), return the consequences of the operation without actually performing the operation.
unlink	logical(1) remove (unlink) the file or directory in source. Default: FALSE.

### Value

localize(): exit status of function gsutil\_rsync().

delocalize(): exit status of function gsutil\_rsync()

---

Service	<i>RESTful service constructor</i>
---------	------------------------------------

---

### Description

RESTful service constructor

**Usage**

```

Service(
  service,
  host,
  config = httr::config(),
  authenticate = TRUE,
  api_url = character(),
  package = "AnVIL",
  schemes = "https",
  api_reference_url = api_url,
  api_reference_md5sum = character(),
  api_reference_version = character(),
  api_reference_headers = NULL
)

```

**Arguments**

<code>service</code>	<code>character(1)</code> The Service class name, e.g., "terra".
<code>host</code>	<code>character(1)</code> host name that provides the API resource, e.g., "leonardo.dsde-prod.broadinstitute.org".
<code>config</code>	<code>httr::config()</code> curl options
<code>authenticate</code>	<code>logical(1)</code> use credentials from authentication service file 'auth.json' in the specified package?
<code>api_url</code>	<code>optional character(1)</code> url location of OpenAPI .json or .yaml service definition.
<code>package</code>	<code>character(1)</code> (default AnVIL) The package where 'api.json' yaml and (optionally) 'auth.json' files are located.
<code>schemes</code>	<code>character(1)</code> (default 'https') Specifies the transfer protocol supported by the API service.
<code>api_reference_url</code>	<code>character(1)</code> path to reference API. See Details.
<code>api_reference_md5sum</code>	<code>character(1)</code> the result of <code>tools::md5sum()</code> applied to the reference API.
<code>api_reference_version</code>	<code>character(1)</code> the version of the reference API. This is used to check that the version of the service matches the version of the reference API. It is usually set by the service generation function, e.g., <code>AnVIL::Rawls()</code> .
<code>api_reference_headers</code>	<code>character()</code> header(s) to be used (e.g., <code>c(Authorization = paste("Bearer", token))</code> ) when retrieving the API reference for validation.

**Details**

This function creates a RESTful interface to a service provided by a host, e.g., "leonardo.dsde-prod.broadinstitute.org". The function requires an OpenAPI .json or .yaml specification as well as an (optional) .json authentication token. These files are located in the source directory of a package, at `<package>/inst/service/<service>/api.json` and `<package>/inst/service/<service>/auth.json`, or at `api_url`.

When provided, the `api_reference_md5sum` is used to check that the file described at `api_reference_url` has the same checksum as an author-validated version.

The service is usually a singleton, created at the package level during `.onLoad()`.

### Value

An object of class `Service`.

### Examples

```
.MyService <- setClass("MyService", contains = "Service")

MyService <- function() {
  .MyService(Service("my_service", host="my.api.org"))
}
```

---

Services

*RESTful services useful for AnVIL developers*

---

### Description

RESTful services useful for AnVIL developers

### Usage

```
empty_object

operations(x, ..., .deprecated = FALSE)

## S4 method for signature 'Service'
operations(x, ..., auto_unbox = FALSE, .deprecated = FALSE)

schemas(x)

tags(x, .tags, .deprecated = FALSE)

## S4 method for signature 'Service'
x$name

Leonardo()

Terra()

Rawls()

Dockstore()

TDR()
```



## Arguments

<code>x</code>	A Service instance, usually a singleton provided by the package and documented on this page, e.g., <code>leonardo</code> or <code>terra</code> .
<code>...</code>	additional arguments passed to methods or, for operations, <code>Service-method</code> , to the internal <code>get_operation()</code> function.
<code>.deprecated</code>	optional logical(1) include deprecated operations?
<code>auto_unbox</code>	logical(1) If FALSE (default) do not automatically 'unbox' R scalar values from JSON arrays to JSON scalars.
<code>.tags</code>	optional character() of tags to use to filter operations.
<code>name</code>	A symbol representing a defined operation, e.g., <code>leonardo\$listRuntimes()</code> .

## Details

Note the services `Terra()`, `Rawls()`, and `Leonardo()` require the `AnVILGCP` package for authentication to the Google Cloud Platform. See `?AnVILGCP::gcloud_access_token()` for details.

When using `$` to select a service, some arguments appear in 'body' of the REST request. Specify these using the `.__body__=` argument, as illustrated for `createBillingProjectFull()`, below.

## Value

`empty_object` returns a representation to be used as arguments in function calls expecting the empty json object `{}`.

`Leonardo()` creates the API of the Leonardo container deployment service at <https://leonardo.dsde-prod.broadinstitute.org/api-docs.yaml>.

`Terra()` creates the API of the Terra cloud computational environemnt at <https://api.firecloud.org/>.

`Rawls()` creates the API of the Rawls cloud computational environemnt at <https://rawls.dsde-prod.broadinstitute.org>.

`Dockstore()` represents the API of the Dockstore platform to share Docker-based tools in CWL or WDL or Nextflow at <https://dockstore.org>

`TDR()` creates the API of the Terra Data Repository to work with snapshot data in the Terra Data Repository at <https://data.terra.bio>.

## Examples

```
empty_object

library(AnVILGCP)
if (gcloud_exists()) {
  ## Arguments to be used as the 'body' (`.__body__=`) of a REST query
  Terra()$createBillingProjectFull # 6 arguments...
  args(Terra()$createBillingProjectFull) # ... passed as `.__body__ = list(...)`
}
library(AnVILGCP)
if (gcloud_exists())
  Leonardo()
```

```
library(AnVILGCP)
if (gcloud_exists()) {
  tags(Terra())
  tags(Terra(), "Billing")
}

library(AnVILGCP)
if (gcloud_exists()) {
  tags(Rawls())
  tags(Rawls(), "billing")
}

Dockstore()

library(AnVILGCP)
if (gcloud_exists())
  TDR()
```

---

**utilities***Utilities for managing library paths*

---

**Description**

`add_libpaths()`: Add local library paths to `.libPaths()`.

**Usage**

```
add_libpaths(paths)
```

**Arguments**

<code>paths</code>	<code>character()</code> : vector of directories to add to <code>.libPaths()</code> . Paths that do not exist will be created.
--------------------	--

**Value**

`add_libpaths()`: updated `.libPaths()`, invisibly.

**Examples**

```
## Not run: add_libpaths("/tmp/host-site-library")
```

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