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# **GCSFs Documentation**

***Release 2025.5.1***

**Continuum Analytics**

**Jul 09, 2025**



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A pythonic file-system interface to [Google Cloud Storage](#).

Please file issues and requests on [github](#) and we welcome pull requests.

This package depends on [fsspec](#), and inherits many useful behaviours from there, including integration with Dask, and the facility for key-value dict-like objects of the type used by zarr.



## INSTALLATION

The GCSFS library can be installed using conda:

```
conda install -c conda-forge gcsfs
```

or pip:

```
pip install gcsfs
```

or by cloning the repository:

```
git clone https://github.com/fsspec/gcsfs/  
cd gcsfs/  
pip install .
```





## EXAMPLES

Locate and read a file:

```
>>> import gcsfs
>>> fs = gcsfs.GCSFileSystem(project='my-google-project')
>>> fs.ls('my-bucket')
['my-file.txt']
>>> with fs.open('my-bucket/my-file.txt', 'rb') as f:
...     print(f.read())
b'Hello, world'
```

(see also `walk()` and `glob()`)

Read with delimited blocks:

```
>>> fs.read_block(path, offset=1000, length=10, delimiter=b'\n')
b'A whole line of text\n'
```

Write with blocked caching:

```
>>> with fs.open('mybucket/new-file', 'wb') as f:
...     f.write(2*2**20 * b'a')
...     f.write(2*2**20 * b'a') # data is flushed and file closed
>>> fs.du('mybucket/new-file')
{'mybucket/new-file': 4194304}
```

Because GCSFS faithfully copies the Python file interface it can be used smoothly with other projects that consume the file interface like `gzip` or `pandas`.

```
>>> with fs.open('mybucket/my-file.csv.gz', 'rb') as f:
...     g = gzip.GzipFile(fileobj=f) # Decompress data with gzip
...     df = pd.read_csv(g)         # Read CSV file with Pandas
```



## CREDENTIALS

Several modes of authentication are supported:

- if `token=None` (default), GCSFS will attempt to use your default gcloud credentials or, attempt to get credentials from the google metadata service, or fall back to anonymous access. This will work for most users without further action. Note that the default project may also be found, but it is often best to supply this anyway (only affects bucket- level operations).
- if `token='cloud'`, we assume we are running within google (compute or container engine) and fetch the credentials automatically from the metadata service.
- if `token=dict(...)` or `token=<filepath>`, you may supply a token generated by the `gcloud` utility. This can be
  - a python dictionary
  - the path to a file containing the JSON returned by logging in with the gcloud CLI tool (e.g., `~/.config/gcloud/application_default_credentials.json` or `~/.config/gcloud/legacy_credentials/<YOUR GOOGLE USERNAME>/adc.json`)
  - the path to a service account key
  - a `google.auth.credentials.Credentials` object

Note that `~` will not be automatically expanded to the user home directory, and must be manually expanded with a utility like `os.path.expanduser()`.

- you can also generate tokens via OAuth2 in the browser using `token='browser'`, which gcsfs then caches in a special file, `~/.gcs_tokens`, and can subsequently be accessed with `token='cache'`.
- anonymous only access can be selected using `token='anon'`, e.g. to access public resources such as 'anaconda-public-data'.

The acquired session tokens are *not* preserved when serializing the instances, so it is safe to pass them to worker processes on other machines if using in a distributed computation context. If credentials are given by a file path, however, then this file must exist on every machine.



## INTEGRATION

The libraries `intake`, `pandas` and `dask` accept URLs with the prefix “`gcs://`”, and will use `gcsfs` to complete the IO operation in question. The IO functions take an argument `storage_options`, which will be passed to `GCSFileSystem`, for example:

```
df = pd.read_excel("gcs://bucket/path/file.xls",  
                  storage_options={"token": "anon"})
```

This gives the chance to pass any credentials or other necessary arguments needed to `gcsfs`.



## ASYNC

`gcsfs` is implemented using `aiohttp`, and offers async functionality. A number of methods of `GCSFileSystem` are `async`, for each of these, there is also a synchronous version with the same name and lack of a “\_” prefix.

If you wish to call `gcsfs` from async code, then you should pass `asynchronous=True`, `loop=loop` to the constructor (the latter is optional, if you wish to use both async and sync methods). You must also explicitly await the client creation before making any GCS call.

```
async def run_program():
    gcs = GCSFileSystem(asynchronous=True)
    print(await gcs._ls(""))

asyncio.run(run_program()) # or call from your async code
```

Concurrent async operations are also used internally for bulk operations such as `pipe/cat`, `get/put`, `cp/mv/rm`. The async calls are hidden behind a synchronisation layer, so are designed to be called from normal code. If you are *not* using async-style programming, you do not need to know about how this works, but you might find the implementation interesting.

For every synchronous function there is asynchronous one prefixed by `_`, but the `open` operation does not support async operation. If you need it to open some file in async manner, it's better to asynchronously download it to temporary location and working with it from there.





## PROXY

`gcsfs` uses `aiohttp` for calls to the storage api, which by default ignores `HTTP_PROXY/HTTPS_PROXY` environment variables. To read proxy settings from the environment provide `session_kwargs` as follows:

```
fs = GCSFileSystem(project='my-google-project', session_kwargs={'trust_env': True})
```

For further reference check [aiohttp proxy support](#).



## CONTENTS

### 7.1 API

<i>GCSFileSystem</i> (*args, **kwargs)	Connect to Google Cloud Storage.
<i>GCSFileSystem.cat</i> (path[, recursive, on_error])	Fetch (potentially multiple) paths' contents
<i>GCSFileSystem.du</i> (path[, total, maxdepth, ...])	Space used by files and optionally directories within a path
<i>GCSFileSystem.exists</i> (path, **kwargs)	Is there a file at the given path
<i>GCSFileSystem.get</i> (rpath, lpath[, recursive, ...])	Copy file(s) to local.
<i>GCSFileSystem.glob</i> (path[, maxdepth])	Find files by glob-matching.
<i>GCSFileSystem.info</i> (path, **kwargs)	Give details of entry at path
<i>GCSFileSystem.ls</i> (path[, detail])	List objects at path.
<i>GCSFileSystem.mkdir</i> (path[, acl, ...])	New bucket
<i>GCSFileSystem.mv</i> (path1, path2[, recursive, ...])	Move file(s) from one location to another
<i>GCSFileSystem.open</i> (path[, mode, block_size, ...])	Return a file-like object from the filesystem
<i>GCSFileSystem.put</i> (lpath, rpath[, recursive, ...])	Copy file(s) from local.
<i>GCSFileSystem.read_block</i> (fn, offset, length)	Read a block of bytes from
<i>GCSFileSystem.rm</i> (path[, recursive, ...])	Delete files.
<i>GCSFileSystem.tail</i> (path[, size])	Get the last size bytes from file
<i>GCSFileSystem.touch</i> (path[, truncate])	Create empty file, or update timestamp
<i>GCSFileSystem.get_mapper</i> ([root, check, ...])	Create key/value store based on this file-system

<i>GCSFile</i> (gcsfs, path[, mode, block_size, ...])	
<i>GCSFile.close</i> ()	Close file
<i>GCSFile.flush</i> ([force])	Write buffered data to backend store.
<i>GCSFile.info</i> ()	File information about this path
<i>GCSFile.read</i> ([length])	Return data from cache, or fetch pieces as necessary
<i>GCSFile.seek</i> (loc[, whence])	Set current file location
<i>GCSFile.tell</i> ()	Current file location
<i>GCSFile.write</i> (data)	Write data to buffer.

**class** gcsfs.core.GCSFileSystem(\*args, \*\*kwargs)

Connect to Google Cloud Storage.

The following modes of authentication are supported:

- `token=None`, GCSFS will attempt to guess your credentials in the following order: gcloud CLI default, gcsfs cached token, google compute metadata service, anonymous.

- `token='google_default'`, your default gcloud credentials will be used, which are typically established by doing `gcloud login` in a terminal.
- `token='cache'`, credentials from previously successful gcsfs authentication will be used (use this after “browser” auth succeeded)
- `token='anon'`, no authentication is performed, and you can only access data which is accessible to all Users (in this case, the project and access level parameters are meaningless)
- `token='browser'`, you get an access code with which you can authenticate via a specially provided URL
- if `token='cloud'`, we assume we are running within google compute or google container engine, and query the internal metadata directly for a token.
- you may supply a token generated by the `[gcloud]`(<https://cloud.google.com/sdk/docs/>) utility; this is either a python dictionary, the name of a file containing the JSON returned by logging in with the gcloud CLI tool, or a Credentials object. gcloud typically stores its tokens in locations such as `~/.config/gcloud/application_default_credentials.json`, `~/.config/gcloud/credentials`, or `~\AppData\Roaming\gcloud\credentials`, etc.

Specific methods, (eg. `ls`, `info`, ...) may return object details from GCS. These detailed listings include the [object resource]([https://cloud.google.com/storage/docs/json\\_api/v1/objects#resource](https://cloud.google.com/storage/docs/json_api/v1/objects#resource))

GCS *does not* include “directory” objects but instead generates directories by splitting [object names](<https://cloud.google.com/storage/docs/key-terms>). This means that, for example, a directory does not need to exist for an object to be created within it. Creating an object implicitly creates it’s parent directories, and removing all objects from a directory implicitly deletes the empty directory.

`GCSFileSystem` generates listing entries for these implied directories in listing apis with the object properties:

- “**name**”  
[string] The “{bucket}/{name}” path of the dir, used in calls to `GCSFileSystem` or `GCSFile`.
- “**bucket**”  
[string] The name of the bucket containing this object.
- “**kind**” : ‘storage#object’
- “**size**” : 0
- “**storageClass**” : ‘DIRECTORY’
- **type**: ‘directory’ (fsspec compat)

`GCSFileSystem` maintains a per-implied-directory cache of object listings and fulfills all object information and listing requests from cache. This implied, for example, that objects created via other processes *will not* be visible to the `GCSFileSystem` until the cache refreshed. Calls to `GCSFileSystem.open` and calls to `GCSFile` are not affected by this cache.

Note that directory listings are cached by default, because fetching those listings can be expensive. This is contrary to local filesystem behaviour. The cache will be cleared if writing from this instance, but it can become stale and return incorrect results if the storage is written to from another process/machine. If you anticipate this possibility, you can set the `use_listings_cache` and `listings_expiry_time` arguments to configure the caching, call `.invalidate_cache()` when required, or pass `refresh=True` to the various listing methods.

In the default case the cache is never expired. This may be controlled via the `cache_timeout` `GCSFileSystem` parameter or via explicit calls to `GCSFileSystem.invalidate_cache`.

NOTE on “exclusive” mode: `mode==“create”` (in pipe and put) and `open(mode=“xb”)` are supported on an experimental basis. The test harness does not currently support this, so use at your own risk.

### Parameters

- **project** (*string*) – *project\_id* to work under. Note that this is not the same as, but often very similar to, the project name. This is required in order to list all the buckets you have access to within a project and to create/delete buckets, or update their access policies. If `token='google_default'`, the value is overridden by the default, if `token='anon'`, the value is ignored.
- **access** (*one of {'read\_only', 'read\_write', 'full\_control'}*) – Full control implies read/write as well as modifying metadata, e.g., access control.
- **token** (*None, dict or string*) – (see description of authentication methods, above)
- **consistency** (*'none', 'size', 'md5'*) – Check method when writing files. Can be overridden in `open()`.
- **cache\_timeout** (*float, seconds*) – Cache expiration time in seconds for object metadata cache. Set `cache_timeout <= 0` for no caching, `None` for no cache expiration.
- **secure\_serialize** (*bool (deprecated)*)
- **requester\_pays** (*bool, or str default False*) – Whether to use requester-pays requests. This will include your project ID *project* in requests as the *userProject*, and you'll be billed for accessing data from requester-pays buckets. Optionally, pass a project-id here as a string to use that as the *userProject*.
- **session\_kwargs** (*dict*) – passed on to `aiohttp.ClientSession`; can contain, for example, proxy settings.
- **endpoint\_url** (*str*) – If given, use this URL (format `protocol://host:port`, *without* any path part) for communication. If not given, defaults to the value of environment variable `"STORAGE_EMULATOR_HOST"`; if that is not set either, will use the standard Google endpoint.
- **default\_location** (*str*) – Default location where buckets are created, like `'US'` or `'EUROPE-WEST3'`. You can find a list of all available locations here: <https://cloud.google.com/storage/docs/locations#available-locations>
- **version\_aware** (*bool*) – Whether to support object versioning. If enabled this will require the user to have the necessary permissions for dealing with versioned objects.

### property buckets

Return list of available project buckets.

**cat**(*path, recursive=False, on\_error='raise', \*\*kwargs*)

Fetch (potentially multiple) paths' contents

#### Parameters

- **recursive** (*bool*) – If `True`, assume the path(s) are directories, and get all the contained files
- **on\_error** (*"raise", "omit", "return"*) – If `raise`, an underlying exception will be raised (converted to `KeyError` if the type is in `self.missing_exceptions`); if `omit`, keys with exception will simply not be included in the output; if `"return"`, all keys are included in the output, but the value will be bytes or an exception instance.
- **kwargs** (*passed to cat\_file*)

#### Returns

- **dict of {path (contents)}** *if there are multiple paths*
- *or the path has been otherwise expanded*

**cat\_file**(*path*, *start=None*, *end=None*, *\*\*kwargs*)

Get the content of a file

**Parameters**

- **path** (*URL of file on this filesystems*)
- **start** (*int*) – Bytes limits of the read. If negative, backwards from end, like usual python slices. Either can be None for start or end of file, respectively
- **end** (*int*) – Bytes limits of the read. If negative, backwards from end, like usual python slices. Either can be None for start or end of file, respectively
- **kwargs** (passed to `open()`.)

**cat\_ranges**(*paths*, *starts*, *ends*, *max\_gap=None*, *on\_error='return'*, *\*\*kwargs*)

Get the contents of byte ranges from one or more files

**Parameters**

- **paths** (*list*) – A list of of filepaths on this filesystems
- **starts** (*int or list*) – Bytes limits of the read. If using a single int, the same value will be used to read all the specified files.
- **ends** (*int or list*) – Bytes limits of the read. If using a single int, the same value will be used to read all the specified files.

**checksum**(*path*)

Unique value for current version of file

If the checksum is the same from one moment to another, the contents are guaranteed to be the same. If the checksum changes, the contents *might* have changed.

This should normally be overridden; default will probably capture creation/modification timestamp (which would be good) or maybe access timestamp (which would be bad)

**classmethod clear\_instance\_cache**()

Clear the cache of filesystem instances.

**Notes**

Unless overridden by setting the `cachable` class attribute to `False`, the filesystem class stores a reference to newly created instances. This prevents Python's normal rules around garbage collection from working, since the instances `refcount` will not drop to zero until `clear_instance_cache` is called.

**copy**(*path1*, *path2*, *recursive=False*, *maxdepth=None*, *on\_error=None*, *\*\*kwargs*)

Copy within two locations in the filesystem

**on\_error**

[“raise”, “ignore”] If raise, any not-found exceptions will be raised; if ignore any not-found exceptions will cause the path to be skipped; defaults to raise unless recursive is true, where the default is ignore

**cp**(*path1*, *path2*, *\*\*kwargs*)

Alias of `AbstractFileSystem.copy`.

**created**(*path*)

Return the created timestamp of a file as a `datetime.datetime`

**classmethod** `current()`

Return the most recently instantiated FileSystem

If no instance has been created, then create one with defaults

**delete**(*path*, *recursive=False*, *maxdepth=None*)

Alias of *AbstractFileSystem.rm*.

**disk\_usage**(*path*, *total=True*, *maxdepth=None*, *\*\*kwargs*)

Alias of *AbstractFileSystem.du*.

**download**(*rpath*, *lpath*, *recursive=False*, *\*\*kwargs*)

Alias of *AbstractFileSystem.get*.

**du**(*path*, *total=True*, *maxdepth=None*, *withdirs=False*, *\*\*kwargs*)

Space used by files and optionally directories within a path

Directory size does not include the size of its contents.

**Parameters**

- **path** (*str*)
- **total** (*bool*) – Whether to sum all the file sizes
- **maxdepth** (*int* or *None*) – Maximum number of directory levels to descend, *None* for unlimited.
- **withdirs** (*bool*) – Whether to include directory paths in the output.
- **kwargs** (passed to *find*)

**Returns**

- Dict of {**path** (*size*) if *total=False*, or *int* otherwise, where *numbers*}
- refer to bytes used.

**end\_transaction()**

Finish write transaction, non-context version

**exists**(*path*, *\*\*kwargs*)

Is there a file at the given path

**expand\_path**(*path*, *recursive=False*, *maxdepth=None*, *\*\*kwargs*)

Turn one or more globs or directories into a list of all matching paths to files or directories.

*kwargs* are passed to *glob* or *find*, which may in turn call *ls*

**find**(*path*, *maxdepth=None*, *withdirs=False*, *detail=False*, *\*\*kwargs*)

List all files below *path*.

Like posix *find* command without conditions

**Parameters**

- **path** (*str*)
- **maxdepth** (*int* or *None*) – If not *None*, the maximum number of levels to descend
- **withdirs** (*bool*) – Whether to include directory paths in the output. This is *True* when used by *glob*, but users usually only want files.
- **ls.** (*kwargs* are passed to)

**static from\_dict**(*dct: dict[str, Any]*) → AbstractFileSystem

Recreate a filesystem instance from dictionary representation.

See `.to_dict()` for the expected structure of the input.

**Parameters**

**dct** (*Dict[str, Any]*)

**Return type**

file system instance, not necessarily of this particular class.

**Warning**

This can import arbitrary modules (as determined by the `cls` key). Make sure you haven't installed any modules that may execute malicious code at import time.

**static from\_json**(*blob: str*) → AbstractFileSystem

Recreate a filesystem instance from JSON representation.

See `.to_json()` for the expected structure of the input.

**Parameters**

**blob** (*str*)

**Return type**

file system instance, not necessarily of this particular class.

**Warning**

This can import arbitrary modules (as determined by the `cls` key). Make sure you haven't installed any modules that may execute malicious code at import time.

**property fsid**

Persistent filesystem id that can be used to compare filesystems across sessions.

**get**(*rpath, lpath, recursive=False, callback=<fsspec.callbacks.NoOpCallback object>, maxdepth=None, \*\*kwargs*)

Copy file(s) to local.

Copies a specific file or tree of files (if `recursive=True`). If `lpath` ends with a `"/"`, it will be assumed to be a directory, and target files will go within. Can submit a list of paths, which may be glob-patterns and will be expanded.

Calls `get_file` for each source.

**get\_file**(*rpath, lpath, callback=<fsspec.callbacks.NoOpCallback object>, outfile=None, \*\*kwargs*)

Copy single remote file to local

**get\_mapper**(*root="", check=False, create=False, missing\_exceptions=None*)

Create key/value store based on this file-system

Makes a `MutableMapping` interface to the FS at the given root path. See `fsspec.mapping.FSMap` for further details.

**getxattr**(*path, attr*)

Get user-defined metadata attribute



**glob**(*path*, *maxdepth=None*, *\*\*kwargs*)

Find files by glob-matching.

Pattern matching capabilities for finding files that match the given pattern.

#### Parameters

- **path** (*str*) – The glob pattern to match against
- **maxdepth** (*int* or *None*) – Maximum depth for '\*' patterns. Applied on the first '\*' found. Must be at least 1 if provided.
- **kwargs** – Additional arguments passed to `find` (e.g., `detail=True`)

#### Return type

List of matched paths, or dict of paths and their info if `detail=True`

#### Notes

Supported patterns: - '\*': Matches any sequence of characters within a single directory level - '\*\*': Matches any number of directory levels (must be an entire path component) - '?': Matches exactly one character - '[abc]': Matches any character in the set - '[a-z]': Matches any character in the range - '[!abc]': Matches any character NOT in the set

Special behaviors: - If the path ends with '/', only folders are returned - Consecutive '\*' characters are compressed into a single '\*' - Empty brackets '[]' never match anything - Negated empty brackets '[!]' match any single character - Special characters in character classes are escaped properly

Limitations: - '\*' must be a complete path component (e.g., 'a/\*\*/b', not 'a\*\*b') - No brace expansion ('{a,b}.txt') - No extended glob patterns ('+(pattern)', '!(pattern)')

**head**(*path*, *size=1024*)

Get the first *size* bytes from file

**info**(*path*, *\*\*kwargs*)

Give details of entry at path

Returns a single dictionary, with exactly the same information as `ls` would with `detail=True`.

The default implementation calls `ls` and could be overridden by a shortcut. `kwargs` are passed on to `ls()`.

Some file systems might not be able to measure the file's size, in which case, the returned dict will include `'size': None`.

#### Returns

- **dict with keys** (*name (full path in the FS), size (in bytes), type (file),*
- *directory, or something else) and other FS-specific keys.*

**invalidate\_cache**(*path=None*)

Invalidate listing cache for given path, it is reloaded on next use.

#### Parameters

**path** (*string* or *None*) – If *None*, clear all listings cached else listings at or under given path.

**isdir**(*path*)

Is this entry directory-like?

**isfile**(*path*)

Is this entry file-like?

**lexists**(*path*, *\*\*kwargs*)

If there is a file at the given path (including broken links)

**listdir**(*path*, *detail=True*, *\*\*kwargs*)

Alias of *AbstractFileSystem.ls*.

**ls**(*path*, *detail=True*, *\*\*kwargs*)

List objects at path.

This should include subdirectories and files at that location. The difference between a file and a directory must be clear when details are requested.

The specific keys, or perhaps a *FileInfo* class, or similar, is TBD, but must be consistent across implementations. Must include:

- full path to the entry (without protocol)
- size of the entry, in bytes. If the value cannot be determined, will be *None*.
- type of entry, “file”, “directory” or other

Additional information may be present, appropriate to the file-system, e.g., generation, checksum, etc.

May use *refresh=True|False* to allow use of *self.\_ls\_from\_cache* to check for a saved listing and avoid calling the backend. This would be common where listing may be expensive.

#### Parameters

- **path** (*str*)
- **detail** (*bool*) – if *True*, gives a list of dictionaries, where each is the same as the result of *info(path)*. If *False*, gives a list of paths (*str*).
- **kwargs** (may have additional backend-specific options, such as *version*) – information

#### Returns

- List of strings if *detail* is *False*, or list of directory information
- dicts if *detail* is *True*.

**makedir**(*path*, *create\_parents=True*, *\*\*kwargs*)

Alias of *AbstractFileSystem.mkdir*.

**makedirs**(*path*, *exist\_ok=False*)

Recursively make directories

Creates directory at path and any intervening required directories. Raises exception if, for instance, the path already exists but is a file.

#### Parameters

- **path** (*str*) – leaf directory name
- **exist\_ok** (*bool* (*False*)) – If *False*, will error if the target already exists

**merge**(*path*, *paths*, *acl=None*)

Concatenate objects within a single bucket

**mkdir**(*path*, *acl='projectPrivate'*, *default\_acl='bucketOwnerFullControl'*, *location=None*, *create\_parents=True*, *enable\_versioning=False*, *enable\_object\_retention=False*, *iam\_configuration=None*, *\*\*kwargs*)

New bucket

If path is more than just a bucket, will create bucket if create\_parents=True; otherwise is a noop. If create\_parents is False and bucket does not exist, will produce FileNotFoundError.

#### Parameters

- **path** (*str*) – bucket name. If contains '/' (i.e., looks like subdir), will have no effect because GCS doesn't have real directories.
- **acl** (*string, one of bACLs*) – access for the bucket itself. See: <https://cloud.google.com/storage/docs/access-control/lists#predefined-acl>
- **default\_acl** (*str, one of ACLs*) – default ACL for objects created in this bucket
- **location** (*Optional[str]*) – Location where buckets are created, like 'US' or 'EUROPE-WEST3'. If not provided, defaults to *self.default\_location*. You can find a list of all available locations here: <https://cloud.google.com/storage/docs/locations#available-locations>
- **create\_parents** (*bool*) – If True, creates the bucket in question, if it doesn't already exist
- **enable\_versioning** (*bool*) – If True, creates the bucket in question with object versioning enabled.
- **enable\_object\_retention** (*bool*) – If True, creates the bucket in question with object retention permanently enabled.
- **iam\_configuration** (*dict*) – If provided, sets the IAM policy for the bucket. This argument allows setting properties such as *{publicAccessPrevention: "enforced"}* and *{"uniformBucketLevelAccess": {"enabled": True}}*. If passed, *acl* and *default\_acl* are explicitly ignored.
- **\*\*kwargs** – Additional parameters passed to the API call request body. See: [https://cloud.google.com/storage/docs/json\\_api/v1/buckets/insert#request-body](https://cloud.google.com/storage/docs/json_api/v1/buckets/insert#request-body) for all possible options. Pass nested parameters as dictionaries, e.g.: *{"autoclass": {"enabled": True}}*

**makedirs**(*path, exist\_ok=False*)

Alias of *AbstractFileSystem.makedirs*.

**modified**(*path*)

Return the modified timestamp of a file as a *datetime.datetime*

**move**(*path1, path2, \*\*kwargs*)

Alias of *AbstractFileSystem.mv*.

**mv**(*path1, path2, recursive=False, maxdepth=None, \*\*kwargs*)

Move file(s) from one location to another

**open**(*path, mode='rb', block\_size=None, cache\_options=None, compression=None, \*\*kwargs*)

Return a file-like object from the filesystem

The resultant instance must function correctly in a context with *block*.

#### Parameters

- **path** (*str*) – Target file
- **mode** (*str like 'rb', 'w'*) – See builtin *open()* Mode "x" (exclusive write) may be implemented by the backend. Even if it is, whether it is checked up front or on commit, and whether it is atomic is implementation-dependent.

- **block\_size** (*int*) – Some indication of buffering - this is a value in bytes
- **cache\_options** (*dict*, *optional*) – Extra arguments to pass through to the cache.
- **compression** (*string* or *None*) – If given, open file using compression codec. Can either be a compression name (a key in `fsspec.compression.compr`) or “infer” to guess the compression from the filename suffix.
- **encoding** (*passed on to TextIOWrapper for text mode*)
- **errors** (*passed on to TextIOWrapper for text mode*)
- **newline** (*passed on to TextIOWrapper for text mode*)

**pipe**(*path*, *value=None*, *\*\*kwargs*)

Put value into path

(counterpart to cat)

#### Parameters

- **path** (*string* or *dict(str, bytes)*) – If a string, a single remote location to put value bytes; if a dict, a mapping of {path: bytesvalue}.
- **value** (*bytes*, *optional*) – If using a single path, these are the bytes to put there. Ignored if **path** is a dict

**pipe\_file**(*path*, *value*, *mode='overwrite'*, *\*\*kwargs*)

Set the bytes of given file

**put**(*lpath*, *rpath*, *recursive=False*, *callback=<fsspec.callbacks.NoOpCallback object>*, *maxdepth=None*, *\*\*kwargs*)

Copy file(s) from local.

Copies a specific file or tree of files (if *recursive=True*). If *rpath* ends with a “/”, it will be assumed to be a directory, and target files will go within.

Calls `put_file` for each source.

**put\_file**(*lpath*, *rpath*, *callback=<fsspec.callbacks.NoOpCallback object>*, *mode='overwrite'*, *\*\*kwargs*)

Copy single file to remote

**read\_block**(*fn*, *offset*, *length*, *delimiter=None*)

Read a block of bytes from

Starting at *offset* of the file, read *length* bytes. If *delimiter* is set then we ensure that the read starts and stops at delimiter boundaries that follow the locations *offset* and *offset + length*. If *offset* is zero then we start at zero. The bytestring returned WILL include the end delimiter string.

If *offset+length* is beyond the eof, reads to eof.

#### Parameters

- **fn** (*string*) – Path to filename
- **offset** (*int*) – Byte offset to start read
- **length** (*int*) – Number of bytes to read. If *None*, read to end.
- **delimiter** (*bytes* (*optional*)) – Ensure reading starts and stops at delimiter bytestring

## Examples

```
>>> fs.read_block('data/file.csv', 0, 13)
b'Alice, 100\nBo'
>>> fs.read_block('data/file.csv', 0, 13, delimiter=b'\n')
b'Alice, 100\nBob, 200\n'
```

Use `length=None` to read to the end of the file. `>>> fs.read_block('data/file.csv', 0, None, delimiter=b'\n')`  
 # doctest: +SKIP `b'Alice, 100\nBob, 200\nCharlie, 300'`

### See also

`fsspec.utils.read_block()`

**read\_bytes**(*path*, *start=None*, *end=None*, *\*\*kwargs*)

Alias of `AbstractFileSystem.cat_file`.

**read\_text**(*path*, *encoding=None*, *errors=None*, *newline=None*, *\*\*kwargs*)

Get the contents of the file as a string.

#### Parameters

- **path** (*str*) – URL of file on this filesystems
- **encoding** (same as *open*.)
- **errors** (same as *open*.)
- **newline** (same as *open*.)

**rename**(*path1*, *path2*, *\*\*kwargs*)

Alias of `AbstractFileSystem.mv`.

**rm**(*path*, *recursive=False*, *maxdepth=None*, *batchsize=20*)

Delete files.

#### Parameters

- **path** (*str or list of str*) – File(s) to delete.
- **recursive** (*bool*) – If file(s) are directories, recursively delete contents and then also remove the directory
- **maxdepth** (*int or None*) – Depth to pass to walk for finding files to delete, if recursive. If None, there will be no limit and infinite recursion may be possible.

**rm\_file**(*path*)

Delete a file

**rmdir**(*bucket*)

Delete an empty bucket

#### Parameters

**bucket** (*str*) – bucket name. If contains `'/'` (i.e., looks like subdir), will have no effect because GCS doesn't have real directories.

**setxattrs**(*path*, *content\_type=None*, *content\_encoding=None*, *fixed\_key\_metadata=None*, *\*\*kwargs*)

Set/delete/add writable metadata attributes

Note: uses PATCH method (update), leaving unedited keys alone. fake-gcs-server:latest does not seem to support this.

#### Parameters

- **content\_type** (*str*) – If not None, set the content-type to this value
- **content\_encoding** (*str*) – This parameter is deprecated, you may use `fixed_key_metadata` instead. If not None, set the content-encoding. See <https://cloud.google.com/storage/docs/transcoding>
- **fixed\_key\_metadata** (*dict*) –

Google metadata, in key/value pairs, supported keys:

- `cache_control`
- `content_disposition`
- `content_encoding`
- `content_language`
- `custom_time`

More info: <https://cloud.google.com/storage/docs/metadata#mutable>

- **kw\_args** (*key-value pairs like field="value" or field=None*) – value must be string to add or modify, or None to delete

#### Return type

Entire metadata after update (even if only path is passed)

**sign**(*path*, *expiration=100*, *\*\*kwargs*)

Create a signed URL representing the given path.

#### Parameters

- **path** (*str*) – The path on the filesystem
- **expiration** (*int*) – Number of seconds to enable the URL for

#### Returns

URL – The signed URL

#### Return type

str

**size**(*path*)

Size in bytes of file

**sizes**(*paths*)

Size in bytes of each file in a list of paths

**start\_transaction**()

Begin write transaction for deferring files, non-context version

**stat**(*path*, *\*\*kwargs*)

Alias of `AbstractFileSystem.info`.

**tail**(*path*, *size=1024*)

Get the last size bytes from file

**to\_dict**(\**, include\_password: bool = True*) → dict[str, Any]

JSON-serializable dictionary representation of this filesystem instance.

**Parameters**

**include\_password**(*bool*, *default* *True*) – Whether to include the password (if any) in the output.

**Returns**

- Dictionary with keys *cls* (the python location of this class),
- *protocol* (text name of this class's protocol, first one in case of
- multiple), *args* (positional args, usually empty), and all other
- *keyword arguments as their own keys*.

**Warning**

Serialized filesystems may contain sensitive information which have been passed to the constructor, such as passwords and tokens. Make sure you store and send them in a secure environment!

**to\_json**(\**, include\_password: bool = True*) → str

JSON representation of this filesystem instance.

**Parameters**

**include\_password**(*bool*, *default* *True*) – Whether to include the password (if any) in the output.

**Returns**

- JSON string with keys *cls* (the python location of this class),
- *protocol* (text name of this class's protocol, first one in case of
- multiple), *args* (positional args, usually empty), and all other
- *keyword arguments as their own keys*.

**Warning**

Serialized filesystems may contain sensitive information which have been passed to the constructor, such as passwords and tokens. Make sure you store and send them in a secure environment!

**touch**(*path*, *truncate=True*, *\*\*kwargs*)

Create empty file, or update timestamp

**Parameters**

- **path** (*str*) – file location
- **truncate** (*bool*) – If True, always set file size to 0; if False, update timestamp and leave file unchanged, if backend allows this

**property transaction**

A context within which files are committed together upon exit

Requires the file class to implement *.commit()* and *.discard()* for the normal and exception cases.

**transaction\_type**

alias of Transaction

**tree**(*path*: str = '/', *recursion\_limit*: int = 2, *max\_display*: int = 25, *display\_size*: bool = False, *prefix*: str = '', *is\_last*: bool = True, *first*: bool = True, *indent\_size*: int = 4) → str

Return a tree-like structure of the filesystem starting from the given path as a string.

**Parameters**

- **path** (Root path to start traversal from)
- **recursion\_limit** (Maximum depth of directory traversal)
- **max\_display** (Maximum number of items to display per directory)
- **display\_size** (Whether to display file sizes)
- **prefix** (Current line prefix for visual tree structure)
- **is\_last** (Whether current item is last in its level)
- **first** (Whether this is the first call (displays root path))
- **indent\_size** (Number of spaces by indent)

**Returns**

str

**Return type**

A string representing the tree structure.

**Example**

```
>>> from fsspec import filesystem
```

```
>>> fs = filesystem('ftp', host='test.rebex.net', user='demo', password=
↳ 'password')
>>> tree = fs.tree(display_size=True, recursion_limit=3, indent_size=8, max_
↳ display=10)
>>> print(tree)
```

**ukey**(*path*)

Hash of file properties, to tell if it has changed

**unstrip\_protocol**(*name*: str) → str

Format FS-specific path to generic, including protocol

**upload**(*lpath*, *rpath*, *recursive*=False, *\*\*kwargs*)

Alias of *AbstractFileSystem.put*.

**url**(*path*)

Get HTTP URL of the given path

**walk**(*path*, *maxdepth*=None, *topdown*=True, *on\_error*='omit', *\*\*kwargs*)

Return all files under the given path.

List all files, recursing into subdirectories; output is iterator-style, like `os.walk()`. For a simple list of files, `find()` is available.

When `topdown` is True, the caller can modify the `dirnames` list in-place (perhaps using `del` or slice assignment), and `walk()` will only recurse into the subdirectories whose names remain in `dirnames`; this can be



used to prune the search, impose a specific order of visiting, or even to inform `walk()` about directories the caller creates or renames before it resumes `walk()` again. Modifying dirnames when `topdown` is `False` has no effect. (see `os.walk`)

Note that the “files” outputted will include anything that is not a directory, such as links.

#### Parameters

- **path** (*str*) – Root to recurse into
- **maxdepth** (*int*) – Maximum recursion depth. `None` means limitless, but not recommended on link-based file-systems.
- **topdown** (*bool* (`True`)) – Whether to walk the directory tree from the top downwards or from the bottom upwards.
- **on\_error** ("*omit*", "*raise*", *a callable*) – if `omit` (default), path with exception will simply be empty; If `raise`, an underlying exception will be raised; if callable, it will be called with a single `OSError` instance as argument
- **kwargs** (passed to `ls`)

**write\_bytes**(*path*, *value*, *\*\*kwargs*)

Alias of `AbstractFileSystem.pipe_file`.

**write\_text**(*path*, *value*, *encoding=None*, *errors=None*, *newline=None*, *\*\*kwargs*)

Write the text to the given file.

An existing file will be overwritten.

#### Parameters

- **path** (*str*) – URL of file on this filesystems
- **value** (*str*) – Text to write.
- **encoding** (same as *open*.)
- **errors** (same as *open*.)
- **newline** (same as *open*.)

```
class gcsfs.core.GCSFile(gcsfs, path, mode='rb', block_size=5242880, autocommit=True,
                        cache_type='readahead', cache_options=None, acl=None, consistency='md5',
                        metadata=None, content_type=None, timeout=None, fixed_key_metadata=None,
                        generation=None, kms_key_name=None, **kwargs)
```

**close()**

Close file

Finalizes writes, discards cache

**commit()**

If not auto-committing, finalize file

**discard()**

Cancel in-progress multi-upload

Should only happen during discarding this write-mode file

**fileno()**

Return underlying file descriptor if one exists.

Raise `OSError` if the IO object does not use a file descriptor.

**flush**(*force=False*)

Write buffered data to backend store.

Writes the current buffer, if it is larger than the block-size, or if the file is being closed.

**Parameters**

**force** (*bool*) – When closing, write the last block even if it is smaller than blocks are allowed to be. Disallows further writing to this file.

**info**()

File information about this path

**isatty**()

Return whether this is an ‘interactive’ stream.

Return False if it can’t be determined.

**read**(*length=-1*)

Return data from cache, or fetch pieces as necessary

**Parameters**

**length** (*int* (-1)) – Number of bytes to read; if <0, all remaining bytes.

**readable**()

Whether opened for reading

**readinto**(*b*)

mirrors builtin file’s readinto method

<https://docs.python.org/3/library/io.html#io.RawIOBase.readinto>

**readline**()

Read until and including the first occurrence of newline character

Note that, because of character encoding, this is not necessarily a true line ending.

**readlines**()

Return all data, split by the newline character, including the newline character

**readuntil**(*char=b'\n', blocks=None*)

Return data between current position and first occurrence of char

char is included in the output, except if the end of the tile is encountered first.

**Parameters**

- **char** (*bytes*) – Thing to find
- **blocks** (*None* or *int*) – How much to read in each go. Defaults to file blocksize - which may mean a new read on every call.

**seek**(*loc, whence=0*)

Set current file location

**Parameters**

- **loc** (*int*) – byte location
- **whence** (*{0, 1, 2}*) – from start of file, current location or end of file, resp.

**seekable**()

Whether is seekable (only in read mode)

**tell()**

Current file location

**truncate**(*size=None, /*)

Truncate file to size bytes.

File pointer is left unchanged. Size defaults to the current IO position as reported by tell(). Return the new size.

**url()**

HTTP link to this file's data

**writable()**

Whether opened for writing

**write**(*data*)

Write data to buffer.

Buffer only sent on flush() or if buffer is greater than or equal to blocksize.

**Parameters**

**data** (*bytes*) – Set of bytes to be written.

**writelines**(*lines, /*)

Write a list of lines to stream.

Line separators are not added, so it is usual for each of the lines provided to have a line separator at the end.

## 7.2 For Developers

We welcome contributions to gcsfs!

Please file issues and requests on [github](#) and we welcome pull requests.

### 7.2.1 Testing

The testing framework supports using your own GCS-compliant endpoint, by setting the “STORAGE\_EMULATOR\_HOST” environment variable. If this is not set, then an emulator will be spun up using [docker](#) and [fake-gcs-server](#). This emulator has almost all the functionality of real GCS. A small number of tests run differently or are skipped.

If you want to actually test against real GCS, then you should set STORAGE\_EMULATOR\_HOST to “<https://storage.googleapis.com>” and also provide appropriate GCSFS\_TEST\_BUCKET and GCSFS\_TEST\_PROJECT, as well as setting your default google credentials (or providing them via the fsspec config).

## 7.3 GCSFS and FUSE

Warning, this functionality is **experimental**.

[FUSE](#) is a mechanism to mount user-level filesystems in unix-like systems (linux, osx, etc.). GCSFS is able to use FUSE to present remote data/keys as if they were a directory on your local file-system. This allows for standard shell command manipulation, and loading of data by libraries that can only handle local file-paths (e.g., netCDF/HDF5).

### 7.3.1 Requirements

In addition to a standard installation of GCSFS, you also need:

- libfuse as a system install. The way to install this will depend on your OS. Examples include `sudo apt-get install fuse`, `sudo yum install fuse` and download from [osxfuse](#).
- `fusepy`, which can be installed via conda or pip
- `pandas`, which can also be installed via conda or pip (this library is used only for its timestring parsing).

### 7.3.2 Usage

FUSE functionality is available via the `fsspec.fuse` module. See the docstrings for further details.

```
gcs = gcsfs.GCSFileSystem(..)
from fsspec.fuse import run
run(gcs, "bucket/path", "local/path", foreground=True, threads=False)
```

### 7.3.3 Caveats

This functionality is experimental. The command usage may change, and you should expect exceptions.

Furthermore:

- although mutation operations tentatively work, you should not at the moment depend on `gcsfuse` as a reliable system that won't lose your data.
- permissions on GCS are complicated, so all files will be shown as fully-open `0o777`, regardless of state. If a read fails, you likely don't have the right permissions.

## 7.4 Changelog

Note: in some releases, there are no changes, because we always guarantee releasing in step with `fsspec`.

### 7.4.1 2025.5.1

- Fix token timezone comparison (#683, 688)

### 7.4.2 2025.5.0

- Avoid deprecated `utcnow` (#680)
- Add support for specifying Cloud KMS keys when creating files (#679)
- Yet another fix for `isdir` (#676)
- Create warning for appending mode 'a' operations (#675)
- add `userProject` to batch deletion query (#673)

### 7.4.3 2025.3.2

no changes

#### 7.4.4 2025.3.1

- Fix find with path not ending with “/” (#668)
- remove “beta” note from doc (#666)
- don’t check expiry of creds that don’t expire (#665)

#### 7.4.5 2025.3.0

- Improvements for credentials refresh under high load (#658)

#### 7.4.6 2025.2.0

- guess upload file MIME types (#655)
- better shutdown cleanup (#657)

#### 7.4.7 2024.12.0

- Exclusive write (#651)
- Avoid IndexError on integer seconds (#649)
- note on non-posixness (#648)
- handle cache\_timeout=0 (#646)

#### 7.4.8 2024.10.0

- Remove race condition in credentials (#643)
- fix md5 hash order logic (#640)

#### 7.4.9 2024.9.0

- In case error in a pure string (#631)

#### 7.4.10 2024.6.1

no changes

#### 7.4.11 2024.6.0

- Add seek(0) to request data to prevent issues on retries (#624)

#### 7.4.12 2024.5.0

- swap order of “gcs”, “gs” protocols (#620)
- fix get\_file for relative lpath (#618)

#### 7.4.13 2024.3.1

- fix expiration= for sign() (#613)
- do populate dircache in ls() (#612)
- allow passing extra options to mkdir (#610)
- credentials docs (#609)

- retry in bulk rm (#608)
- clean up loop on close (#606)

#### 7.4.14 2024.2.0

- doc for passing tokens (#603)

#### 7.4.15 2023.12.2

no changes

#### 7.4.16 2023.12.1

no changes

#### 7.4.17 2023.12.0

- use same version when paginating list (#591)
- fix double asterisk glob test (#589)

#### 7.4.18 2023.10.0

- Fix for transactions of small files (#586)

#### 7.4.19 2023.9.2

- CI updates (#582)

#### 7.4.20 2023.9.1

- small fixes following #573 (#578)

#### 7.4.21 2023.9.0

- bulk operations edge cases (#576, 572)
- inventory report based file listing (#573)
- pickle HttpError (#571)
- avoid warnings (#569)
- maxdepth in find() (#566)
- invalidate dircache (#564)
- standard metadata field names (#563)
- performance of building cache in find() (#561)

#### 7.4.22 2023.6.0

- allow raw/session token for auth (#554)
- fix listings\_expiry\_time kwargs (#551)
- allow setting fixed metadata on put/pipe (#550)

#### 7.4.23 2023.5.0

- Allow emulator host without protocol (#548)
- Prevent upload retry from closing the file being sent (#540)

#### 7.4.24 2023.4.0

No changes

#### 7.4.25 2023.3.0

- Don't let find() mess up dircache (#531)
- Drop py3.7 (#529)
- Update docs (#528)
- Make times UTC (#527)
- Use BytesIO for large bodies (#525)
- Fix: Don't append generation when it is absent (#523)
- get/put/cp consistency tests (#521)

#### 7.4.26 2023.1.0

- Support create time (#516, 518)
- defer async session creation (#513, 514)
- support listing of file versions (#509)
- fix sign following versioned split protocol (#513)

#### 7.4.27 2022.11.0

- implement object versioning (#504)

#### 7.4.28 2022.10.0

- bump fsspec to 2022.10.0 (#503)

#### 7.4.29 2022.8.1

- don't install prerelease aiohttp (#490)

#### 7.4.30 2022.7.1

- Try cloud auth by default (#479)

#### 7.4.31 2022.5.0

- invalidate listings cache for simple put/pipe (#474)
- conform \_mkdir and \_cat\_file to upstream (#471)

### 7.4.32 2022.3.0

(note that this release happened in 2022.4, but we label as 2022.3 to match fsspec)

- bucket exists workaround (#464)
- dirmarkers (#459)
- check connection (#457)
- browser connection now uses local server (#456)
- bucket location (#455)
- ensure auth is closed (#452)

### 7.4.33 2022.02.0

- fix list\_buckets without cache (#449)
- drop py36 (#445)

### 7.4.34 2022.01.0

- update refname for versions (#442)

### 7.4.35 2021.11.1

- don't touch cache when doing find with a prefix (#437)

### 7.4.36 2021.11.0

- move to fsspec org
- add support for google fixed\_key\_metadata (#429)
- deprecate *content\_encoding* parameter of setxattrs method (#429)
- use emulator for resting instead of vcrpy (#424)

### 7.4.37 2021.10.1

- url signing (#411)
- default callback (#422)

### 7.4.38 2021.10.0

- min version for decorator
- default callback in get (#422)

### 7.4.39 2021.09.0

- correctly recognise 404 (#419)
- fix for .details due to upstream (#417)
- callbacks in get/put (#416)
- “%” in paths (#415)



#### 7.4.40 2021.08.1

- don't retry 404s (#406)

#### 7.4.41 2021.07.0

- fix find/glob with a prefix (#399)

#### 7.4.42 2021.06.1

- kwargs to aiohttpClient session
- graceful timeout when disconnecting at finalise (#397)

#### 7.4.43 2021.06.0

- negative ranges in cat\_file (#394)

#### 7.4.44 2021.05.0

- no credentials bug fix (#390)
- use googleapis.com (#388)
- more retries (#387, 385, 380)
- Code cleanup (#381)
- license to match stated one (#378)
- deps updated (#376)

#### 7.4.45 Version 2021.04.0

- switch to calver and fsspec pin

#### 7.4.46 Version 0.8.0

- keep up with fsspec 0.9.0 async
- one-shot find
- consistency checkers
- retries for intermittent issues
- timeouts
- partial cat
- http error status
- CI to GHA

#### 7.4.47 Version 0.7.0

- async operations via aiohttp

#### 7.4.48 Version 0.6.0

- **API-breaking:** Changed requester-pays handling for `GCSFileSystem`.

The `user_project` keyword has been removed, and has been replaced with the `requester_pays` keyword. If you're working with a `requester_pays` bucket you will need to explicitly pass `requester_pays=True`. This will include your `project` ID in requests made to GCS.

#### 7.4.49 Version 0.5.3

- `GCSFileSystem` now validates that the `project` provided, if any, matches the Google default project when using `token='google_default'` to authenticate (PR #219).
- Fixed bug in `GCSFileSystem.cat` on objects in requester-pays buckets (PR #217).

#### 7.4.50 Version 0.5.2

- Fixed bug in `user_project` fallback for default Google authentication (PR #213)

#### 7.4.51 Version 0.5.1

- `user_project` now falls back to the `project` if provided (PR #208)

#### 7.4.52 Version 0.5.0

- Added the ability to make requester-pays requests with the `user_project` parameter (PR #206)

#### 7.4.53 Version 0.4.0

- Improved performance when serializing filesystem objects (PR #182)
- Fixed authorization errors when using `gcsfs` within multithreaded code (PR #183, PR #192)
- Added contributing instructions (PR #185)
- Improved performance for `gcsfs.GCSFileSystem.info()` (PR #187)
- Fixed bug in `gcsfs.GCSFileSystem.info()` raising an error (PR #190)

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