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**BioBlend** is a Python library for interacting with Galaxy and CloudMan APIs.

BioBlend is supported and tested on:

- Python 3.6, 3.7, 3.8 and 3.9
- Galaxy release_17.09 and later.

BioBlend’s goal is to make it easier to script and automate the running of Galaxy analyses, administering of a Galaxy server, and cloud infrastructure provisioning and scaling via CloudMan. In practice, it makes it possible to do things like this:

- Interact with Galaxy via a straightforward API:

```python
from bioblend.galaxy import GalaxyInstance
gi = GalaxyInstance('<Galaxy IP>', key='your API key')
libs = gi.libraries.get_libraries()
gi.workflows.show_workflow('workflow ID')
gi.workflows.run_workflow('workflow ID', input_dataset_map)
```

- Interact with Galaxy via an object-oriented API:

```python
from bioblend.galaxy.objects import GalaxyInstance
gi = GalaxyInstance('URL', 'API_KEY')
wf = gi.workflows.list()[0]
hist = gi.histories.list()[0]
inputs = hist.get_datasets()[:2]
input_map = dict(zip(wf.input_labels, inputs))
params = {'Paste1': {'delimiter': 'U'}}
wf.run(input_map, 'wf_output', params=params)
```

- Create a CloudMan compute cluster, via an API and directly from your local machine:

```python
from bioblend.cloudman import CloudManConfig
from bioblend.cloudman import CloudManInstance
cfg = CloudManConfig('<your cloud access key>', '<your cloud secret key>', 'My␣˓ →CloudMan', '<ami-ID>', 'm1.small', '<password>')
cmi = CloudManInstance.launch_instance(cfg)
cmi.get_status()
```

- Reconnect to an existing CloudMan instance and manipulate it:
from bioblend.cloudman import CloudManInstance

cki = CloudManInstance("<instance IP>", "<password>")
cki.add_nodes(3)
cluster_status = cki.get_status()
cki.remove_nodes(2)

Note: Although this library allows you to blend these two services into a cohesive unit, the library itself can be used with either service irrespective of the other. For example, you can use it to just manipulate CloudMan clusters or to script the interactions with an instance of Galaxy running on your laptop.

1.1 About the library name

The library was originally called just Blend but we renamed it to reflect more of its domain and make it bit more unique so it can be easier to find. The name was intended to be short and easily pronounceable. In its original implementation, the goal was to provide a lot more support for CloudMan and other integration capabilities, allowing them to be blended together via code. BioBlend fit the bill.
Stable releases of BioBlend are best installed via `pip` from PyPI:

```
$ python3 -m pip install bioblend
```

Alternatively, the most current source code from our Git repository can be installed with:

```
$ python3 -m pip install git+https://github.com/galaxyproject/bioblend
```

After installing the library, you will be able to simply import it into your Python environment with `import bioblend`. For details on the available functionality, see the API documentation.

BioBlend requires a number of Python libraries. These libraries are installed automatically when BioBlend itself is installed, regardless whether it is installed via PyPi or by running `python3 setup.py install` command. The current list of required libraries is always available from `setup.py` in the source code repository.

If you also want to run tests locally, some extra libraries are required. To install them, run:

```
$ python3 setup.py test
```
To get started using BioBlend, install the library as described above. Once the library becomes available on the given system, it can be developed against. The developed scripts do not need to reside in any particular location on the system.

It is probably best to take a look at the example scripts in docs/examples source directory and browse the API documentation. Beyond that, it’s up to your creativity :).
Anyone interested in contributing or tweaking the library is more than welcome to do so. To start, simply fork the Git repository on Github and start playing with it. Then, issue pull requests.
BioBlend’s API focuses around and matches the services it wraps. Thus, there are two top-level sets of APIs, each corresponding to a separate service and a corresponding step in the automation process. Note that each of the service APIs can be used completely independently of one another.

Effort has been made to keep the structure and naming of those API’s consistent across the library but because they do bridge different services, some discrepancies may exist. Feel free to point those out and/or provide fixes.

For Galaxy, an alternative object-oriented API is also available. This API provides an explicit modeling of server-side Galaxy instances and their relationships, providing higher-level methods to perform operations such as retrieving all datasets for a given history, etc. Note that, at the moment, the oo API is still incomplete, providing access to a more restricted set of Galaxy modules with respect to the standard one.

5.1 Galaxy API

API used to manipulate genomic analyses within Galaxy, including data management and workflow execution.

5.1.1 API documentation for interacting with Galaxy

GalaxyInstance

class bioblend.galaxy.GalaxyInstance(url, key=None, email=None, password=None, verify=True)
A base representation of a connection to a Galaxy instance, identified by the server URL and user credentials.

After you have created a GalaxyInstance object, access various modules via the class fields. For example, to work with histories and get a list of all the user’s histories, the following should be done:

```python
from bioblend import galaxy

gi = galaxy.GalaxyInstance(url='http://127.0.0.1:8000', key='your_api_key')

hl = gi.histories.get_histories()
```

Parameters

- **url (str)** – A FQDN or IP for a given instance of Galaxy. For example: http://127.0.0.1:8080. If a Galaxy instance is served under a prefix (e.g., http://127.0.0.1:8080/galaxy/), supply the entire URL including the prefix (note that the prefix must end with a slash). If a Galaxy instance has HTTP Basic authentication with username and password, then the credentials should be included in the URL, e.g. http://user:pass@host:port/galaxy/
• **key** *(str)* – User’s API key for the given instance of Galaxy, obtained from the user preferences. If a key is not supplied, an email address and password must be and the key will automatically be created for the user.

• **email** *(str)* – Galaxy e-mail address corresponding to the user. Ignored if key is supplied directly.

• **password** *(str)* – Password of Galaxy account corresponding to the above e-mail address. Ignored if key is supplied directly.

• **verify** *(bool)* – Whether to verify the server’s TLS certificate

```python
__init__(url, key=None, email=None, password=None, verify=True)
```

A base representation of a connection to a Galaxy instance, identified by the server URL and user credentials.

After you have created a `GalaxyInstance` object, access various modules via the class fields. For example, to work with histories and get a list of all the user’s histories, the following should be done:

```python
from bioblend import galaxy
gi = galaxy.GalaxyInstance(url='http://127.0.0.1:8000', key='your_api_key')
hl = gi.histories.get_histories()
```

**Parameters**

- **url** *(str)* – A FQDN or IP for a given instance of Galaxy. For example: `http://127.0.0.1:8080`. If a Galaxy instance is served under a prefix (e.g., `http://127.0.0.1:8080/galaxy/`), supply the entire URL including the prefix (note that the prefix must end with a slash). If a Galaxy instance has HTTP Basic authentication with username and password, then the credentials should be included in the URL, e.g. `http://user:pass@host:port/galaxy/

- **key** *(str)* – User’s API key for the given instance of Galaxy, obtained from the user preferences. If a key is not supplied, an email address and password must be and the key will automatically be created for the user.

- **email** *(str)* – Galaxy e-mail address corresponding to the user. Ignored if key is supplied directly.

- **password** *(str)* – Password of Galaxy account corresponding to the above e-mail address. Ignored if key is supplied directly.

- **verify** *(bool)* – Whether to verify the server’s TLS certificate

```python
property get_retry_delay
property max_get_attempts
```
Config

Contains possible interaction dealing with Galaxy configuration.

```python
class bioblend.galaxy.config.ConfigClient(galaxy_instance)
A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

get_config()
Get a list of attributes about the Galaxy instance. More attributes will be present if the user is an admin.

   Return type  list
   Returns
   A list of attributes. For example:

   ```json
   {'allow_library_path_paste': False,
    'allow_user_creation': True,
    'allow_user_dataset_purge': True,
    'allow_user_deletion': False,
    'enable_unique_workflow_defaults': False,
    'ftp_upload_dir': '/SOMEWHER/galaxy/ftp_dir',
    'ftp_upload_site': 'galaxy.com',
    'library_import_dir': 'None',
    'logo_url': None,
    'support_url': 'https://galaxyproject.org/support',
    'terms_url': None,
    'user_library_import_dir': 'None',
    'wiki_url': 'https://galaxyproject.org/'}
   ```

get_version()
Get the current version of the Galaxy instance.

   Return type  dict
   Returns
   Version of the Galaxy instance For example:

   ```json
   {'extra': {}, 'version_major': '17.01'}
   ```
```
Datasets

Contains possible interactions with the Galaxy Datasets

class bioblend.galaxy.datasets.DatasetClient(galaxy_instance)
A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

download_dataset(dataset_id, file_path=None, use_default_filename=True, require_ok_state=True, maxwait=12000)

Download a dataset to file or in memory. If the dataset state is not ‘ok’, a DatasetStateException will be thrown, unless require_ok_state=False.

Parameters

• dataset_id (str) – Encoded dataset ID

• file_path (str) – If this argument is provided, the dataset will be streamed to disk at that path (should be a directory if use_default_filename=True). If the file_path argument is not provided, the dataset content is loaded into memory and returned by the method (Memory consumption may be heavy as the entire file will be in memory).

• use_default_filename (bool) – If True, the exported file will be saved as file_path/%s, where %s is the dataset name. If False, file_path is assumed to contain the full file path including the filename.

• require_ok_state (bool) – If False, datasets will be downloaded even if not in an ‘ok’ state, issuing a DatasetStateWarning rather than raising a DatasetStateException.

• maxwait (float) – Total time (in seconds) to wait for the dataset state to become terminal. If the dataset state is not terminal within this time, a DatasetTimeoutException will be thrown.

Return type dict

Returns If a file_path argument is not provided, returns a dict containing the file content. Otherwise returns nothing.


Get the latest datasets, or select another subset by specifying optional arguments for filtering (e.g. a history ID).

Since the number of datasets may be very large, limit and offset parameters are required to specify the desired range.

If the user is an admin, this will return datasets for all the users, otherwise only for the current user.

Parameters

• limit (int) – Maximum number of datasets to return.

• offset (int) – Return datasets starting from this specified position. For example, if limit is set to 100 and offset to 200, datasets 200-299 will be returned.
• **name** *(str)* – Dataset name to filter on.

• **extension** *(str or list of str)* – Dataset extension (or list of extensions) to filter on.

• **state** *(str or list of str)* – Dataset state (or list of states) to filter on.

• **visible** *(bool)* – Optionally filter datasets by their visible attribute.

• **deleted** *(bool)* – Optionally filter datasets by their deleted attribute.

• **purged** *(bool)* – Optionally filter datasets by their purged attribute.

• **tool_id** *(str)* – Tool ID to filter on.

• **tag** *(str)* – Dataset tag to filter on.

• **history_id** *(str)* – Encoded history ID to filter on.

• **create_time_min** *(str)* – Show only datasets created after the provided time and date, which should be formatted as **YYYY-MM-DDTHH-MM-SS**.

• **create_time_max** *(str)* – Show only datasets created before the provided time and date, which should be formatted as **YYYY-MM-DDTHH-MM-SS**.

• **update_time_min** *(str)* – Show only datasets last updated after the provided time and date, which should be formatted as **YYYY-MM-DDTHH-MM-SS**.

• **update_time_max** *(str)* – Show only datasets last updated before the provided time and date, which should be formatted as **YYYY-MM-DDTHH-MM-SS**.

• **order** *(str)* – One or more of the following attributes for ordering datasets: **create_time** (default), **extension**, **hid**, **history_id**, **name**, **update_time**. Optionally, **-asc** or **-dsc** (default) can be appended for ascending and descending order respectively. Multiple attributes can be stacked as a comma-separated list of values, e.g. **create_time-asc, hid-dsc**.

**Return type** list

**Param** A list of datasets

**module** = 'datasets'

**publish_dataset** *(dataset_id: str, published: bool = False)*

Make a dataset publicly available or private. For more fine-grained control (assigning different permissions to specific roles), use the **update_permissions()** method.

**Parameters**

• **dataset_id** *(str)* – dataset ID

• **published** *(bool)* – Whether to make the dataset published (True) or private (False).

**Return type** dict

**Returns** Current roles for all available permission types.

**Note:** This method can only be used with Galaxy release_19.05 or later.

**show_dataset** *(dataset_id, deleted=False, hda_ldda='hda')*

Get details about a given dataset. This can be a history or a library dataset.

**Parameters**

• **dataset_id** *(str)* – Encoded dataset ID
• **deleted** *(bool)* – Whether to return results for a deleted dataset

• **hda_ldda** *(str)* – Whether to show a history dataset (‘hda’ - the default) or library dataset (‘ldda’).

**Return type**: *dict*

**Returns**: Information about the HDA or LDDA

**update_permissions**(dataset_id: *str*, access_ids: *Optional[list] = None*, manage_ids: *Optional[list] = None*, modify_ids: *Optional[list] = None*)

Set access, manage or modify permissions for a dataset to a list of roles.

**Parameters**

• **dataset_id** *(str)* – dataset ID

• **access_ids** *(list)* – role IDs which should have access permissions for the dataset.

• **manage_ids** *(list)* – role IDs which should have manage permissions for the dataset.

• **modify_ids** *(list)* – role IDs which should have modify permissions for the dataset.

**Return type**: *dict*

**Returns**: Current roles for all available permission types.

**Note**: This method can only be used with Galaxy `release_19.05` or later.

**wait_for_dataset**(dataset_id, maxwait=12000, interval=3, check=True)

Wait until a dataset is in a terminal state.

**Parameters**

• **dataset_id** *(str)* – dataset ID

• **maxwait** *(float)* – Total time (in seconds) to wait for the dataset state to become terminal. If the dataset state is not terminal within this time, a `DatasetTimeoutException` will be raised.

• **interval** *(float)* – Time (in seconds) to wait between 2 consecutive checks.

• **check** *(bool)* – Whether to check if the dataset terminal state is ‘ok’.

**Return type**: *dict*

**Returns**: Details of the given dataset.

**exception** `bioblend.galaxy.datasets.DatasetStateException`

**exception** `bioblend.galaxy.datasets.DatasetStateWarning`

**exception** `bioblend.galaxy.datasets.DatasetTimeoutException`
Datatypes

Contains possible interactions with the Galaxy Datatype

class bioblend.galaxy.datatypes.DatatypesClient(galaxy_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

get_datatypes(extension_only=False, upload_only=False)

Get the list of all installed datatypes.

Parameters

• extension_only (bool) – Return only the extension rather than the datatype name

• upload_only (bool) – Whether to return only datatypes which can be uploaded

Return type list

Returns

A list of datatype names. For example:

```
['snpmatrix',
'snptest',
'tabular',
'taxonomy',
'twobit',
'txt',
'vcf',
'wig',
'xgmml',
'xml']
```

get_sniffers()

Get the list of all installed sniffers.

Return type list

Returns

A list of sniffer names. For example:

```
['galaxy.datatypes.tabular:Vcf',
'galaxy.datatypes.binary:TwoBit',
'galaxy.datatypes.binary:Bam',
'galaxy.datatypes.binary:Sff',
'galaxy.datatypes.xml:Phyloxml',
'galaxy.datatypes.xml:GenericXml',
'galaxy.datatypes.sequence:Maf',
'galaxy.datatypes.sequence:Lav',
'galaxy.datatypes.sequence:csFasta']
```

module = 'datatypes'
**Folders**

Contains possible interactions with the Galaxy library folders

```python
class bioblend.galaxy.folders.FoldersClient(galaxy_instance)
    # A generic Client interface defining the common fields.

    # All clients must define the following field (which will be used as part of the URL composition
    # (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries'
    # | 'histories' | ...

    create_folder(parent_folder_id, name, description=None)
        # Create a folder.

        Parameters
        • parent_folder_id (str) – Folder's description
        • name (str) – name of the new folder
        • description (str) – folder's description

        Return type dict

        Returns  details of the updated folder

    delete_folder(folder_id, undelete=False)
        # Marks the folder with the given id as deleted (or removes the deleted mark if the undelete param is True).

        Parameters
        • folder_id (str) – the folder's encoded id, prefixed by ‘F’
        • undelete (bool) – If set to True, the folder will be undeleted (i.e. the deleted mark will be removed)

        Returns  detailed folder information

        Return type dict

    get_permissions(folder_id, scope)
        # Get the permissions of a folder.

        Parameters
        • folder_id (str) – the folder’s encoded id, prefixed by ‘F’
        • scope (str) – scope of permissions, either ‘current’ or ‘available’

        Return type dict

        Returns  dictionary including details of the folder

    module = 'folders'
```

```python
set_permissions(folder_id, action='set_permissions', add_ids=None, manage_ids=None,
                modify_ids=None)
    # Set the permissions of a folder.

    Parameters
    • folder_id (str) – the folder’s encoded id, prefixed by ‘F’
    • action (str) – action to execute, only “set_permissions” is supported.
    • add_ids (list of str) – list of role IDs which can add datasets to the folder
    • manage_ids (list of str) – list of role IDs which can manage datasets in the folder
```
• **modify_ids** *(list of str)* – list of role IDs which can modify datasets in the folder

  **Return type** dict

  **Returns** dictionary including details of the folder

**show_folder** *(folder_id, contents=False)*
Display information about a folder.

  **Parameters**

  • **folder_id** *(str)* – the folder’s encoded id, prefixed by ‘F’

  • **contents** *(bool)* – True to get the contents of the folder, rather than just the folder details.

  **Return type** dict

  **Returns** dictionary including details of the folder

**update_folder** *(folder_id, name, description=None)*
Update folder information.

  **Parameters**

  • **folder_id** *(str)* – the folder’s encoded id, prefixed by ‘F’

  • **name** *(str)* – name of the new folder

  • **description** *(str)* – folder’s description

  **Return type** dict

  **Returns** details of the updated folder

---

**Forms**

Contains possible interactions with the Galaxy Forms

**class** `bioblend.galaxy.forms.FormsClient(galaxy_instance)`

A generic Client interface defining the common fields.

All clients *must* define the following field (which will be used as part of the URL composition (e.g., `http://<galaxy_instance>/api/libraries`): `self.module = 'workflows' | 'libraries' | 'histories' | ...`

**create_form**(form_xml_text)

Create a new form.

  **Parameters** `form_xml_text` *(str)* – Form xml to create a form on galaxy instance

  **Return type** str

  **Returns** Unique URL of newly created form with encoded id

**get_forms**()

Get the list of all forms.

  **Return type** list

  **Returns**

  Displays a collection (list) of forms. For example:
module = 'forms'

show_form(form_id)

Get details of a given form.

Parameters  form_id (str) – Encoded form ID

Return type  dict

Returns

A description of the given form. For example:

```python
{"desc": 'here it is ',
 'fields': [],
 'form_definition_current_id': 'f2db41e1fa331b3e',
 'id': 'f2db41e1fa331b3e',
 'layout': [],
 'model_class': 'FormDefinition',
 'name': 'First form',
 'url': '/api/forms/f2db41e1fa331b3e'}
```

FTP files

Contains possible interactions with the Galaxy FTP Files

```python
class bioblend.galaxy.ftpfiles.FTPFilesClient(galaxy_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

get_ftp_files(deleted=False)

Get a list of local files.

Parameters  deleted (bool) – Whether to include deleted files

Return type  list

Returns  A list of dicts with details on individual files on FTP

module = 'ftp_files'
```
Genomes

Contains possible interactions with the Galaxy Histories

```python
class bioblend.galaxy.genomes.GenomeClient(galaxy_instance)
  A generic Client interface defining the common fields.

  All clients must define the following field (which will be used as part of the URL composition
  (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries'
  | 'histories' | ...

  get_genomes()
    Returns a list of installed genomes

      Returns List of installed genomes

  install_genome(func='download', source=None, dbkey=None, ncbi_name=None, ensembl_dbkey=None,
                 url_dbkey=None, indexers=None)
    Download and/or index a genome.

      Parameters
      • dbkey (str) – DB key of the build to download, ignored unless ‘UCSC’ is specified as the
        source
      • ncbi_name (str) – NCBI’s genome identifier, ignored unless NCBI is specified as the
        source
      • ensembl_dbkey (str) – Ensembl’s genome identifier, ignored unless Ensembl is specified
        as the source
      • url_dbkey (str) – DB key to use for this build, ignored unless URL is specified as the
        source
      • source (str) – Data source for this build. Can be: UCSC, Ensembl, NCBI, URL
      • indexers (list) – POST array of indexers to run after downloading (indexers[] = first,
        indexers[] = second, ...)
      • func (str) – Allowed values: ‘download’, Download and index; ‘index’, Index only

      Returns dict

  show_genome(id, num=None, chrom=None, low=None, high=None)
    Returns information about build <id>

      Parameters
      • id (str) – Genome build ID to use
      • num (str) – num
      • chrom (str) – chrom
      • low (str) – low
      • high (str) – high

      Returns Information about the genome build
```

5.1. Galaxy API
Groups

Contains possible interactions with the Galaxy Groups

class bioblend.galaxy.groups.GroupsClient(galaxy_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

add_group_role(group_id, role_id)

Add a role to the given group.

Parameters

- group_id (str) – Encoded group ID
- role_id (str) – Encoded role ID to add to the group

Return type: dict

Returns: Added group role's info

add_group_user(group_id, user_id)

Add a user to the given group.

Parameters

- group_id (str) – Encoded group ID
- user_id (str) – Encoded user ID to add to the group

Return type: dict

Returns: Added group user's info

create_group(group_name, user_ids=None, role_ids=None)

Create a new group.

Parameters

- group_name (str) – A name for the new group
- user_ids (list) – A list of encoded user IDs to add to the new group
- role_ids (list) – A list of encoded role IDs to add to the new group

Return type: list

Returns

A (size 1) list with newly created group details, like:

```python
[
    {'id': '7c9636938c3e83bf',
     'model_class': 'Group',
     'name': 'My Group Name',
     'url': '/api/groups/7c9636938c3e83bf'}
]
```

delete_group_role(group_id, role_id)

Remove a role from the given group.

Parameters

- group_id (str) – Encoded group ID
- role_id (str) – Encoded role ID to remove from the group
Return type  dict
Returns  The role which was removed

delete_group_user (group_id, user_id)
Remove a user from the given group.

Parameters
  • group_id (str) – Encoded group ID
  • user_id (str) – Encoded user ID to remove from the group

Return type  dict
Returns  The user which was removed

get_group_roles (group_id)
Get the list of roles associated to the given group.

Parameters  group_id (str) – Encoded group ID

Return type  list of dicts
Returns  List of group roles’ info

get_group_users (group_id)
Get the list of users associated to the given group.

Parameters  group_id (str) – Encoded group ID

Return type  list of dicts
Returns  List of group users’ info

groups ()
Get all (not deleted) groups.

Return type  list
Returns

A list of dicts with details on individual groups. For example:

```
[{'id': '33abac023ff186c2',
  'model_class': 'Group',
  'name': 'Listeria',
  'url': '/api/groups/33abac023ff186c2'},
 {'id': '73187219cd372cf8',
  'model_class': 'Group',
  'name': 'LPN',
  'url': '/api/groups/73187219cd372cf8'}]
```

module = 'groups'

show_group (group_id)
Get details of a given group.

Parameters  group_id (str) – Encoded group ID

Return type  dict
Returns
A description of group For example:
update_group(group_id, group_name=None, user_ids=None, role_ids=None)

Update a group.

Parameters

- **group_id** (str) – Encoded group ID
- **group_name** (str) – A new name for the group. If None, the group name is not changed.
- **user_ids** (list) – New list of encoded user IDs for the group. It will substitute the previous list of users (with [] if not specified)
- **role_ids** (list) – New list of encoded role IDs for the group. It will substitute the previous list of roles (with [] if not specified)

Return type: None

Returns: None

Histories

Contains possible interactions with the Galaxy Histories

**class bioblend.galaxy.histories.HistoryClient(galaxy_instance)**

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): `self.module = 'workflows' | 'libraries' | 'histories' | ...`

**copy_content(history_id, content_id, source='hda')**

Copy existing content (e.g. a dataset) to a history.

Parameters

- **history_id** (str) – ID of the history to which the content should be copied
- **content_id** (str) – ID of the content to copy
- **source** (str) – Source of the content to be copied: ‘hda’ (for a history dataset, the default), ‘hdca’ (for a dataset collection), ‘library’ (for a library dataset) or ‘library_folder’ (for all datasets in a library folder).

Return type: dict

Returns: Information about the copied content

**copy_dataset(history_id, dataset_id, source='hda')**

Copy a dataset to a history.

Parameters

- **history_id** (str) – history ID to which the dataset should be copied
• **dataset_id**(str) – dataset ID

• **source**(str) – Source of the dataset to be copied: ‘hda’ (the default), ‘library’ or ‘library_folder’

**Return type** dict

**Returns** Information about the copied dataset

`create_dataset_collection`(history_id, collection_description)

Create a new dataset collection

**Parameters**

• **history_id**(str) – Encoded history ID

• **collection_description** (bioblend.galaxy.dataset_collections.CollectionDescription) – a description of the dataset collection For example:

```python
{ 'collection_type': 'list',
  'element_identifiers': [{'id': 'f792763bee8d277a',
                            'name': 'element 1',
                            'src': 'hda'},
                          {'id': 'f792763bee8d277a',
                            'name': 'element 2',
                            'src': 'hda'}],
  'name': 'My collection list'}
```

**Return type** dict

**Returns** Information about the new HDCA

`create_history`(name=None)

Create a new history, optionally setting the name.

**Parameters** name(str) – Optional name for new history

**Return type** dict

**Returns** Dictionary containing information about newly created history

`create_history_tag`(history_id, tag)

Create history tag

**Parameters**

• **history_id**(str) – Encoded history ID

• **tag**(str) – Add tag to history

**Return type** dict

**Returns**

A dictionary with information regarding the tag. For example:

```python
{'id': 'f792763bee8d277a',
 'model_class': 'HistoryTagAssociation',
 'user_tname': 'NGS_PE_RUN',
 'user_value': None}
```

`delete_dataset`(history_id, dataset_id, purge=False)

Mark corresponding dataset as deleted.

5.1. Galaxy API
Parameters

- **history_id** *(str)* – Encoded history ID
- **dataset_id** *(str)* – Encoded dataset ID
- **purge** *(bool)* – if True, also purge (permanently delete) the dataset

**Return type**: None

**Returns**: None

Note: For the purge option to work, the Galaxy instance must have the `allow_user_dataset_purge` option set to `true` in the `config/galaxy.yml` configuration file.

**delete_dataset_collection**(history_id, dataset_collection_id)
Mark corresponding dataset collection as deleted.

Parameters

- **history_id** *(str)* – Encoded history ID
- **dataset_collection_id** *(str)* – Encoded dataset collection ID

**Return type**: None

**Returns**: None

**delete_history**(history_id, purge=False)
Delete a history.

Parameters

- **history_id** *(str)* – Encoded history ID
- **purge** *(bool)* – if True, also purge (permanently delete) the history

**Return type**: dict

**Returns**: An error object if an error occurred or a dictionary containing: id (the encoded id of the history), deleted (if the history was marked as deleted), purged (if the history was purged).

Note: For the purge option to work, the Galaxy instance must have the `allow_user_dataset_purge` option set to `true` in the `config/galaxy.yml` configuration file.

**download_history**(history_id, jeha_id, outf, chunk_size=4096)
Download a history export archive. Use `export_history()` to create an export.

Parameters

- **history_id** *(str)* – history ID
- **jeha_id** *(str)* – jeha ID (this should be obtained via `export_history()`)
- **outf** *(file)* – output file object, open for writing in binary mode
- **chunk_size** *(int)* – how many bytes at a time should be read into memory

**Return type**: None

**Returns**: None
**export_history** *(history_id, gzip=True, include_hidden=False, include_deleted=False, wait=False, maxwait=None)*

Start a job to create an export archive for the given history.

**Parameters**

- **history_id** *(str)* – history ID
- **gzip** *(bool)* – create .tar.gz archive if True, else .tar
- **include_hidden** *(bool)* – whether to include hidden datasets in the export
- **include_deleted** *(bool)* – whether to include deleted datasets in the export
- **wait** *(bool)* – if True, block until the export is ready; else, return immediately
- **maxwait** *(float)* – Total time (in seconds) to wait for the export to become ready. When set, implies that wait is True.

**Return type** str

**Returns** jeha_id of the export, or empty if wait is False and the export is not ready.

**get_histories** *(history_id=None, name=None, deleted=False, published=None, slug=None)*

Get all histories, or select a subset by specifying optional arguments for filtering (e.g. a history name).

**Parameters**

- **history_id** *(str)* – Encoded history ID to filter on
  
  Deprecated since version 0.15.0: To get details of a history for which you know the ID, use the much more efficient show_history() instead.

- **name** *(str)* – History name to filter on.

- **deleted** *(bool)* – whether to filter for the deleted histories (True) or for the non-deleted ones (False)

- **published** *(bool or None)* – whether to filter for the published histories (True) or for the non-published ones (False). If not set, no filtering is applied. Note the filtering is only applied to the user’s own histories; to access all histories published by any user, use the get_published_histories method.

- **slug** *(str)* – History slug to filter on

**Return type** list

**Returns** List of history dicts.

**get_most_recently_used_history**()

Returns the current user’s most recently used history (not deleted).

**Return type** dict

**Returns** History representation

**get_published_histories** *(name=None, deleted=False, slug=None)*

Get all published histories (by any user), or select a subset by specifying optional arguments for filtering (e.g. a history name).

**Parameters**

- **name** *(str)* – History name to filter on.

- **deleted** *(bool)* – whether to filter for the deleted histories (True) or for the non-deleted ones (False)
• **slug** *(str)* – History slug to filter on
  
  **Return type**  list
  
  **Returns**  List of history dicts.

**get_status** *(history_id)*

Returns the state of this history

  **Parameters**  `history_id` *(str)* – Encoded history ID
  
  **Return type**  dict
  
  **Returns**  A dict documenting the current state of the history. Has the following keys: ‘state’ = This is the current state of the history, such as ok, error, new etc. ‘state_details’ = Contains individual statistics for various dataset states. ‘percent_complete’ = The overall number of datasets processed to completion.

**import_history** *(file_path=None, url=None)*

Import a history from an archive on disk or a URL.

  **Parameters**
  
  • `file_path` *(str)* – Path to exported history archive on disk.
  
  • `url` *(str)* – URL for an exported history archive

  **module** = `'histories'`

**open_history** *(history_id)*

Open Galaxy in a new tab of the default web browser and switch to the specified history.

  **Parameters**  `history_id` *(str)* – ID of the history to switch to
  
  **Return type**  `NoneType`
  
  **Returns**  None

  **Warning:** After opening the specified history, all previously opened Galaxy tabs in the browser session will have the current history changed to this one, even if the interface still shows another history. Refreshing any such tab is recommended.

**show_dataset** *(history_id, dataset_id)*

Get details about a given history dataset.

  **Parameters**
  
  • `history_id` *(str)* – Encoded history ID
  
  • `dataset_id` *(str)* – Encoded dataset ID

  **Return type**  `dict`
  
  **Returns**  Information about the dataset

**show_dataset_collection** *(history_id, dataset_collection_id)*

Get details about a given history dataset collection.

  **Parameters**
  
  • `history_id` *(str)* – Encoded history ID
  
  • `dataset_collection_id` *(str)* – Encoded dataset collection ID

  **Return type**  `dict`
**Returns** Information about the dataset collection

`show_dataset_provenance(history_id, dataset_id, follow=False)`

Get details related to how dataset was created (id, job_id, tool_id, stdout, stderr, parameters, inputs, etc...).

**Parameters**

- `history_id` (str) – Encoded history ID
- `dataset_id` (str) – Encoded dataset ID
- `follow` (bool) – If True, recursively fetch dataset provenance information for all inputs and their inputs, etc.

**Return type** dict

**Returns**

Dataset provenance information For example:

```json
{'id': '6fbd9b2274c62ebe',
 'job_id': '5471ba76f274f929',
 'parameters': {'chromInfo': '/usr/local/galaxy/galaxy-dist/tool-data/shared/ucsc/chrom/mm9.len',
 'dbkey': 'mm9',
 'experiment_name': '"H3K4me3_TAC_MACS2"',
 'input_chipseq_file1': {'id': '6f0a311a444290f2',
 'uuid': 'null'},
 'input_control_file1': {'id': 'c21816a91f5dc24e',
 'uuid': '16f8ee5e-228f-41e2-921e-a07866edce06'},
'major_command': {'gsize': "2716965481.0", "bdg": "False", "__current_case__": 0, "advanced_options": {'advanced_options_selector': "off", '__current_case__': 1}, 'input_chipseq_file1': 104715, "xls_to_interval": "False", "major_command_selector": "callpeak", 'input_control_file1': 104721, "pq_options": {'pq_options_selector': "qvalue", 'qvalue': "0.05", '__current_case__': 1}, "bw": "300", "nomodel_type": {'nomodel_type_selector': "create_model", '__current_case__': 1}}},
 'stdout': '',
 'stderr': '',
 'tool_id': 'toolshed.g2.bx.psu.edu/repos/ziru-zhou/macs2/modencode_peakcalling_macs2/2.0.10.2',
 'uuid': '5c0c43f5-8d93-44bd-939d-305e82f13c6'}
```

`show_history(history_id, contents=False, deleted=None, visible=None, details=None, types=None)`

Get details of a given history. By default, just get the history meta information.

**Parameters**

- `history_id` (str) – Encoded history ID to filter on
- `contents` (bool) – When True, instead of the history details, return a list with info for all datasets in the given history. Note that inside each dataset info dict, the id which should be used for further requests about this history dataset is given by the value of the id (not dataset_id) key.
- `deleted` (bool or None) – When contents=True, whether to filter for the deleted datasets (True) or for the non-deleted ones (False). If not set, no filtering is applied.
• **visible** *(bool or None)* – When `contents=True`, whether to filter for the visible datasets (True) or for the hidden ones (False). If not set, no filtering is applied.

• **details** *(str)* – When `contents=True`, include dataset details. Set to ‘all’ for the most information.

• **types** *(list)* – When `contents=True`, filter for history content types. If set to ['dataset'], return only datasets. If set to ['dataset_collection'], return only dataset collections. If not set, no filtering is applied.

**Return type** dict or list of dicts

**Returns** details of the given history or list of dataset info

**Note:** As an alternative to using the `contents=True` parameter, consider using `gi.datasets.get_datasets(history_id=history_id)` which offers more extensive functionality for filtering and ordering the results.

**show_matching_datasets**(history_id, name_filter=None)
Get dataset details for matching datasets within a history.

**Parameters**

• **history_id** *(str)* – Encoded history ID

• **name_filter** *(str)* – Only datasets whose name matches the name_filter regular expression will be returned; use plain strings for exact matches and None to match all datasets in the history

**Return type** list

**Returns** List of dictionaries

**undelete_history**(history_id)
Undelete a history

**Parameters**

**history_id** *(str)* – Encoded history ID

**Return type** str

**Returns** ‘OK’ if it was deleted

**update_dataset**(history_id, dataset_id, **kwds)
Update history dataset metadata. Some of the attributes that can be modified are documented below.

**Parameters**

• **history_id** *(str)* – Encoded history ID

• **dataset_id** *(str)* – ID of the dataset

• **name** *(str)* – Replace history dataset name with the given string

• **datatype** *(str)* – Replace the datatype of the history dataset with the given string. The string must be a valid Galaxy datatype, both the current and the target datatypes must allow datatype changes, and the dataset must not be in use as input or output of a running job (including uploads), otherwise an error will be raised.

• **genome_build** *(str)* – Replace history dataset genome build (dbkey)

• **annotation** *(str)* – Replace history dataset annotation with given string

• **deleted** *(bool)* – Mark or unmark history dataset as deleted
visible (bool) – Mark or unmark history dataset as visible

Return type  dict

Returns  details of the updated dataset

Changed in version 0.8.0: Changed the return value from the status code (type int) to a dict.

**update_dataset_collection**(*history_id, dataset_collection_id, **kwds*)

Update history dataset collection metadata. Some of the attributes that can be modified are documented below.

Parameters

- **history_id** (str) – Encoded history ID
- **dataset_collection_id** (str) – Encoded dataset_collection ID
- **name** (str) – Replace history dataset collection name with the given string
- **deleted** (bool) – Mark or unmark history dataset collection as deleted
- **visible** (bool) – Mark or unmark history dataset collection as visible

Return type  dict

Returns  the updated dataset collection attributes

Changed in version 0.8.0: Changed the return value from the status code (type int) to a dict.

**update_history**(*history_id, **kwds*)

Update history metadata information. Some of the attributes that can be modified are documented below.

Parameters

- **history_id** (str) – Encoded history ID
- **name** (str) – Replace history name with the given string
- **annotation** (str) – Replace history annotation with given string
- **deleted** (bool) – Mark or unmark history as deleted
- **purged** (bool) – If True, mark history as purged (permanently deleted).
- **published** (bool) – Mark or unmark history as published
- **importable** (bool) – Mark or unmark history as importable
- **tags** (list) – Replace history tags with the given list

Return type  dict

Returns  details of the updated history

Changed in version 0.8.0: Changed the return value from the status code (type int) to a dict.

**upload_dataset_from_library**(*history_id, lib_dataset_id*)

Upload a dataset into the history from a library. Requires the library dataset ID, which can be obtained from the library contents.

Parameters

- **history_id** (str) – Encoded history ID
- **lib_dataset_id** (str) – Encoded library dataset ID

Return type  dict

Returns  Information about the newly created HDA
Invocations

Contains possible interactions with the Galaxy workflow invocations

class bioblend.galaxy.invocations.InvocationClient(galaxy_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

cancel_invocation(invocation_id)

Cancel the scheduling of a workflow.

Parameters
invocation_id (str) – Encoded workflow invocation ID

Return type
dict

Returns
The workflow invocation being cancelled

get_invocation_biocompute_object(invocation_id)

Get a BioCompute object for an invocation.

Parameters
invocation_id (str) – Encoded workflow invocation ID

Return type
dict

Returns
The BioCompute object

get_invocation_report(invocation_id)

Get a Markdown report for an invocation.

Parameters
invocation_id (str) – Encoded workflow invocation ID

Return type
dict

Returns
The invocation report. For example:

```json
{
    'markdown': 'Workflow Execution Summary of Example workflow
    Workflow Inputs
    Workflow Outputs
    `galaxy
    workflow_display(workflow_id=f2db41e1fa331b3e)\n    'render_format': 'markdown',
    'workflows': {'f2db41e1fa331b3e': {'name': 'Example workflow'}}
}
```

get_invocation_report_pdf(invocation_id, file_path, chunk_size=4096)

Get a PDF report for an invocation.

Parameters

- invocation_id (str) – Encoded workflow invocation ID
- file_path (str) – Path to save the report

get_invocation_step_jobs_summary(invocation_id)

Get a detailed summary of an invocation, listing all jobs with their job IDs and current states.

Parameters
invocation_id (str) – Encoded workflow invocation ID
Return type  list of dicts

Returns

The invocation step jobs summary. For example:

```json
[
    {
        'populated_state': 'ok',
        'states': {'ok': 1},
        'model': 'Job',
        'id': 'e85a3be143d5905b'},

    {
        'populated_state': 'ok',
        'states': {'running': 1},
        'model': 'Job',
        'id': 'c9468f6b6d5c5f1'}

    {
        'populated_state': 'ok',
        'states': {'new': 1},
        'model': 'Job',
        'id': '2a56795cad3c7db3'}
]
```

`get_invocation_summary(invocation_id)`

Get a summary of an invocation, stating the number of jobs which succeed, which are paused and which have errored.

Parameters

- **invocation_id** (str) – Encoded workflow invocation ID

Return type  dict

Returns

The invocation summary. For example:

```json
{"states": {'paused': 4, 'error': 2, 'ok': 2},
 'model': 'WorkflowInvocation',
 'id': 'a799d38679e985db',
 'populated_state': 'ok'}
```

`get_invocations(workflow_id=None, history_id=None, user_id=None, include_terminal=True, limit=None, view='collection', step_details=False)`

Get all workflow invocations, or select a subset by specifying optional arguments for filtering (e.g. a workflow ID).

Parameters

- **workflow_id** (str) – Encoded workflow ID to filter on
- **history_id** (str) – Encoded history ID to filter on
- **user_id** (str) – Encoded user ID to filter on. This must be your own user ID if you are not an admin user.
- **include_terminal** (bool) – Whether to include terminal states.
- **limit** (int) – Maximum number of invocations to return - if specified, the most recent invocations will be returned.
- **view** (str) – Level of detail to return per invocation, either ‘element’ or ‘collection’.
• **step_details** *(bool)* – If ‘view’ is ‘element’, also include details on individual steps.

**Return type**  list

**Returns**

A list of workflow invocations. For example:

```json
[
  {
    'history_id': '2f94e8ae9edff68a',
    'id': 'df7a1f0c02a5b08e',
    'model_class': 'WorkflowInvocation',
    'state': 'new',
    'update_time': '2015-10-31T22:00:22',
    'uuid': 'c8aa2b1c-801a-11e5-a9e5-8ca98228593c',
    'workflow_id': '03501d7626bd192f'
  }
]
```

**module** = 'invocations'


Rerun a workflow invocation. For more extensive documentation of all parameters, see the *gi.workflows.invoke_workflow()* method.

**Parameters**

• **invocation_id** *(str)* – Encoded workflow invocation ID to be rerun

• **inputs_update** *(dict)* – If different datasets should be used to the original invocation, this should contain a mapping of workflow inputs to the new datasets and dataset collections.

• **params_update** *(dict)* – If different non-dataset tool parameters should be used to the original invocation, this should contain a mapping of the new parameter values.

• **history_id** *(str)* – The encoded history ID where to store the workflow outputs. Alternatively, **history_name** may be specified to create a new history.

• **history_name** *(str)* – Create a new history with the given name to store the workflow outputs. If both **history_id** and **history_name** are provided, **history_name** is ignored. If neither is specified, a new ‘Unnamed history’ is created.

• **import_inputs_to_history** *(bool)* – If True, used workflow inputs will be imported into the history. If False, only workflow outputs will be visible in the given history.

• **allow_tool_state_corrections** *(bool)* – If True, allow Galaxy to fill in missing tool state when running workflows. This may be useful for workflows using tools that have changed over time or for workflows built outside of Galaxy with only a subset of inputs defined.

• **replacement_params** *(dict)* – pattern-based replacements for post-job actions

• **inputs_by** *(str)* – Determines how inputs are referenced. Can be “step_index|step_uuid” (default), “step_index”, “step_id”, “step_uuid”, or “name”.

• **parameters_normalized** *(bool)* – Whether Galaxy should normalize the input parameters to ensure everything is referenced by a numeric step ID. Default is False, but when setting parameters for a subworkflow, True is required.

**Return type**  dict
Returns A dict describing the new workflow invocation.

Note: This method can only be used with Galaxy release_21.01 or later.

run_invocation_step_action(invocation_id, step_id, action)

Execute an action for an active workflow invocation step. The nature of this action and what is expected will vary based on the the type of workflow step (the only currently valid action is True/False for pause steps).

Parameters

- invocation_id (str) – Encoded workflow invocation ID
- step_id (str) – Encoded workflow invocation step ID
- action (object) – Action to use when updating state, semantics depends on step type.

Return type dict

Returns Representation of the workflow invocation step

show_invocation(invocation_id)

Get a workflow invocation dictionary representing the scheduling of a workflow. This dictionary may be sparse at first (missing inputs and invocation steps) and will become more populated as the workflow is actually scheduled.

Parameters invocation_id (str) – Encoded workflow invocation ID

Return type dict

Returns

The workflow invocation. For example:

```json
{
    'history_id': '2f94e8ae9edff68a',
    'id': 'df7a1f0c02a5b08e',
    'inputs': {'0': {'id': 'a7db2fac67043c7e',
                     'src': 'hda',
                     'uuid': '7932ffe0-2340-4952-8857-dbaa50f1f46a'}},
    'model_class': 'WorkflowInvocation',
    'state': 'ready',
    'steps': [{
        'action': None,
        'id': 'd413a19dec13d11e',
        'job_id': None,
        'model_class': 'WorkflowInvocationStep',
        'order_index': 0,
        'state': None,
        'update_time': '2015-10-31T22:00:26',
        'workflow_step_id': 'cbbbf59e8f08c98c',
        'workflow_step_label': None,
        'workflow_step_uuid': 'b81250fd-3278-4e6a-b269-56a1f01ef485'},
        {
        'action': None,
        'id': '2f94e8ae9edff68a',
        'job_id': 'e89067bb68bee7a0',
        'model_class': 'WorkflowInvocationStep',
        'order_index': 1,
        'state': 'new',
        'update_time': '2015-10-31T22:00:26',
```
show_invocation_step(invocation_id, step_id)

See the details of a particular workflow invocation step.

Parameters

- **invocation_id (str)** – Encoded workflow invocation ID
- **step_id (str)** – Encoded workflow invocation step ID

Return type dict

Returns

The workflow invocation step. For example:

```json
{
    'action': None,
    'id': '63cd3858d057a6d1',
    'job_id': None,
    'model_class': 'WorkflowInvocationStep',
    'order_index': 2,
    'state': None,
    'update_time': '2015-10-31T22:11:14',
    'workflow_step_id': '52e496b945151ee8',
    'workflow_step_label': None,
    'workflow_step_uuid': '4060554c-1dd5-4287-9040-8b4f281cf9dc'
}
```
Jobs

Contains possible interactions with the Galaxy Jobs

class bioblend.galaxy.jobs.JobsClient(galaxy_instance)
    A generic Client interface defining the common fields.

    All clients must define the following field (which will be used as part of the URL composition
    (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' |
    'histories' | ...

cancel_job(job_id: str)
    Cancel a job, deleting output datasets.

        Parameters job_id (str) – job ID
        Return type bool
        Returns True if the job was successfully cancelled, False if it was already in a terminal state
        before the cancellation.

get_common_problems(job_id: str) → dict
    Query inputs and jobs for common potential problems that might have resulted in job failure.

        Parameters job_id (str) – job ID
        Return type dict
        Returns dict containing potential problems

    Note: This method is only supported by Galaxy 19.05 or later.

get_destination_params(job_id: str) → dict
    Get destination parameters for a job, describing the environment and location where the job is run.

        Parameters job_id (str) – job ID
        Return type dict
        Returns Destination parameters for the given job

    Note: This method is only supported by Galaxy 20.05 or later and requires the user to be an admin.

get_inputs(job_id: str) → List[dict]
    Get dataset inputs used by a job.

        Parameters job_id (str) – job ID
        Return type list of dicts
        Returns Inputs for the given job

get_jobs(state=None, history_id=None, invocation_id=None, tool_id=None, workflow_id=None,
            user_id=None, date_range_min=None, date_range_max=None, limit=500, offset=0,
            user_details=False)
    Get all jobs, or select a subset by specifying optional arguments for filtering (e.g. a state).

    If the user is an admin, this will return jobs for all the users, otherwise only for the current user.

        Parameters
            • state (str or list of str) – Job states to filter on.
• **history_id (str)** – Encoded history ID to filter on.

• **invocation_id (string)** – Encoded workflow invocation ID to filter on.

• **tool_id (str or list of str)** – Tool IDs to filter on.

• **workflow_id (string)** – Encoded workflow ID to filter on.

• **user_id (str)** – Encoded user ID to filter on. Only admin users can access the jobs of other users.

• **date_range_min (str)** – Minimum job update date (in YYYY-MM-DD format) to filter on.

• **date_range_max (str)** – Maximum job update date (in YYYY-MM-DD format) to filter on.

• **limit (int)** – Maximum number of jobs to return.

• **offset (int)** – Return jobs starting from this specified position. For example, if limit is set to 100 and offset to 200, jobs 200-299 will be returned.

• **user_details (bool)** – If True and the user is an admin, add the user email to each returned job dictionary.

**Return type** list of dict

**Returns**

Summary information for each selected job. For example:

```
[{
    'create_time': '2014-03-01T16:48:640550',
    'exit_code': 0,
    'id': 'ebfb8f50c6abde6d',
    'model_class': 'Job',
    'state': 'ok',
    'tool_id': 'faata2tab',
    'update_time': '2014-03-01T16:50.657399'},
{
    'create_time': '2014-03-01T16:05:34.851246',
    'exit_code': 0,
    'id': '1cd8e2f6b131e891',
    'model_class': 'Job',
    'state': 'ok',
    'tool_id': 'upload1',
    'update_time': '2014-03-01T16:05:39.558458'}]
```

**Note:**

The following filtering options can only be used with Galaxy release_21.05 or later: user_id, limit, offset, workflow_id, invocation_id

**get_metrics (job_id: str)** → List[dict]

Return job metrics for a given job.

**Parameters**  
job_id (str) – job ID

**Return type** list

**Returns** list containing job metrics
**Note:** Calling `show_job()` with `full_details=True` also returns the metrics for a job if the user is an admin. This method allows to fetch metrics even as a normal user as long as the Galaxy instance has the `expose_potentially_sensitive_job_metrics` option set to `true` in the `config/galaxy.yml` configuration file.

```python
def get_outputs(job_id: str) -> List[dict]
    Get dataset outputs produced by a job.

    Parameters
    job_id (str) -- job ID

    Return type
    list of dict

    Returns
    Outputs of the given job
```

```python
def get_state(job_id: str) -> str
    Display the current state for a given job of the current user.

    Parameters
    job_id (str) -- job ID

    Return type
    str

    Returns
    state of the given job among the following values: new, queued, running, waiting, ok.
    If the state cannot be retrieved, an empty string is returned.
```

New in version 0.5.3.

```python
module = 'jobs'
```

```python
def report_error(job_id: str, dataset_id: str, message: str, email: Optional[str] = None) -> dict
    Report an error for a given job and dataset to the server administrators.

    Parameters
    job_id (str) -- job ID
    dataset_id (str) -- Dataset ID
    message (str) -- Error message
    email (str) -- Email for error report submission. If not specified, the email associated with the Galaxy user account is used by default.

    Return type
    dict

    Returns
    dict containing job error reply
```

**Note:** This method is only supported by Galaxy 20.01 or later.

```python
def rerun_job(job_id, remap=False, tool_inputs_update=None, history_id=None)
    Rerun a job.

    Parameters
    job_id (str) -- job ID
    remap (bool) -- when True, the job output(s) will be remapped onto the dataset(s) created by the original job; if other jobs were waiting for this job to finish successfully, they will be resumed using the new outputs of this tool run. When False, new job output(s) will be created. Note that if Galaxy does not permit remapping for the job in question, specifying True will result in an error.
```
• **tool Inputs update** ([dict](#)) – dictionary specifying any changes which should be made to tool parameters for the rerun job.

• **history id** ([str](#)) – ID of the history in which the job should be executed; if not specified, the same history will be used as the original job run.

**Return type**: [dict](#)

**Returns**: Information about outputs and the rerun job

**Note**: This method can only be used with Galaxy release 21.01 or later.

### resume_job

```python
resume_job(job_id: str) -> dict
```

Resume a job if it is paused.

**Parameters**

- **job_id** ([str](#)) – job ID

**Return type**: [dict](#)

**Returns**: dict containing output dataset associations

**Note**: This method is only supported by Galaxy 18.09 or later.

### search_jobs

```python
search_jobs(tool_id: str, inputs: dict, state: Optional[str] = None) -> List[dict]
```

Return jobs matching input parameters.

**Parameters**

- **tool_id** ([str](#)) – only return jobs associated with this tool ID
- **inputs** ([dict](#)) – return only jobs that have matching inputs
- **state** ([str](#)) – only return jobs in this state

**Return type**: list of dicts

**Returns**: Summary information for each matching job

This method is designed to scan the list of previously run jobs and find records of jobs with identical input parameters and datasets. This can be used to minimize the amount of repeated work by simply recycling the old results.

Changed in version 0.16.0: Replaced the job info parameter with separate tool_id, inputs and state.

**Note**: This method is only supported by Galaxy 18.01 or later.

### show_job

```python
show_job(job_id, full_details=False)
```

Get details of a given job of the current user.

**Parameters**

- **job_id** ([str](#)) – job ID
- **full_details** ([bool](#)) – when True, the complete list of details for the given job.

**Return type**: [dict](#)

**Returns**: A description of the given job. For example:
show_job_lock() → bool

Show whether the job lock is active or not. If it is active, no jobs will dispatch on the Galaxy server.

Return type bool

Returns Status of the job lock

Note: This method is only supported by Galaxy 20.05 or later and requires the user to be an admin.

update_job_lock(active=False) → bool

Update the job lock status by setting active to either True or False. If True, all job dispatching will be blocked.

Return type bool

Returns Updated status of the job lock

Note: This method is only supported by Galaxy 20.05 or later and requires the user to be an admin.

wait_for_job(job_id, maxwait=12000, interval=3, check=True)

Wait until a job is in a terminal state.

Parameters

• job_id (str) – job ID

• maxwait (float) – Total time (in seconds) to wait for the job state to become terminal. If the job state is not terminal within this time, a TimeoutException will be raised.

• interval (float) – Time (in seconds) to wait between 2 consecutive checks.

• check (bool) – Whether to check if the job terminal state is ‘ok’.

Return type dict

Returns Details of the given job.
Libraries

Contains possible interactions with the Galaxy Data Libraries

```python
class bioblend.galaxy.libraries.LibraryClient(galaxy_instance)
```

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

```python
copy_from_dataset(library_id, dataset_id, folder_id=None, message='')
```

Copy a Galaxy dataset into a library.

Parameters

- **library_id** (str) – id of the library where to place the uploaded file
- **dataset_id** (str) – id of the dataset to copy from
- **folder_id** (str) – id of the folder where to place the uploaded files. If not provided, the root folder will be used
- **message** (str) – message for copying action

Return type dict

Returns LDDA information

```python
create_folder(library_id, folder_name, description=None, base_folder_id=None)
```

Create a folder in a library.

Parameters

- **library_id** (str) – library id to use
- **folder_name** (str) – name of the new folder in the data library
- **description** (str) – description of the new folder in the data library
- **base_folder_id** (str) – id of the folder where to create the new folder. If not provided, the root folder will be used

Return type list

Returns List with a single dictionary containing information about the new folder

```python
create_library(name, description=None, synopsis=None)
```

Create a data library with the properties defined in the arguments.

Parameters

- **name** (str) – Name of the new data library
- **description** (str) – Optional data library description
- **synopsis** (str) – Optional data library synopsis

Return type dict

Returns Details of the created library. For example:

```python
{
    'id': 'f740ab636b360a70',
    'name': 'Library from bioblend',
    'url': '/api/libraries/f740ab636b360a70'
}
```
delete_library(`library_id`)  
Delete a data library.

**Parameters**  
`library_id (str)` – Encoded data library ID identifying the library to be deleted

**Return type**  
dict

**Returns**  
Information about the deleted library

**Warning:** Deleting a data library is irreversible - all of the data from the library will be permanently deleted.

delete_library_dataset(`library_id`, `dataset_id`, `purged=False`)  
Delete a library dataset in a data library.

**Parameters**
- `library_id (str)` – library id where dataset is found in
- `dataset_id (str)` – id of the dataset to be deleted
- `purged (bool)` – Indicate that the dataset should be purged (permanently deleted)

**Return type**  
dict

**Returns**
A dictionary containing the dataset id and whether the dataset has been deleted. For example:

```json
{
    'deleted': True,
    'id': '60e680a037f41974'
}
```

get_dataset_permissions(`dataset_id`)  
Get the permissions for a dataset.

**Parameters**  
`dataset_id (str)` – id of the dataset

**Return type**  
dict

**Returns**
dictionary with all applicable permissions’ values

get_folders(`library_id`, `folder_id=None`, `name=None`)  
Get all the folders in a library, or select a subset by specifying a folder name for filtering.

**Parameters**
- `library_id (str)` – library id to use
- `folder_id (str)` – filter for folder by folder id
  
  **Deprecated since version 0.16.0:** To get details of a folder for which you know the ID, use the much more efficient `show_folder()` instead.

- `name (str)` – Folder name to filter on. For name specify the full path of the folder starting from the library’s root folder, e.g. /subfolder/subsubfolder.

**Return type**  
list

**Returns**  
list of dicts each containing basic information about a folder

get_libraries(`library_id=None`, `name=None`, `deleted=False`)  
Get all libraries, or select a subset by specifying optional arguments for filtering (e.g. a library name).

**Parameters**
• **library_id** *(str)* – filter for library by library id
  
  Deprecated since version 0.16.0: To get details of a library for which you know the ID, use the much more efficient `show_library()` instead.

• **name** *(str)* – Library name to filter on.

• **deleted** *(bool)* – If False (the default), return only non-deleted libraries. If True, return only deleted libraries. If None, return both deleted and non-deleted libraries.

  **Return type** list

  **Returns** list of dicts each containing basic information about a library

**get_library_permissions**(library_id)

Get the permissions for a library.

  **Parameters** library_id *(str)* – id of the library

  **Return type** dict

  **Returns** dictionary with all applicable permissions' values

`module = 'libraries'`

**set_dataset_permissions**(dataset_id, access_in=None, modify_in=None, manage_in=None)

Set the permissions for a dataset. Note: it will override all security for this dataset even if you leave out a permission type.

  **Parameters**

  • dataset_id *(str)* – id of the dataset

  • access_in *(list)* – list of role ids

  • modify_in *(list)* – list of role ids

  • manage_in *(list)* – list of role ids

  **Return type** dict

  **Returns** dictionary with all applicable permissions' values

**set_library_permissions**(library_id, access_in=None, modify_in=None, add_in=None, manage_in=None)

Set the permissions for a library. Note: it will override all security for this library even if you leave out a permission type.

  **Parameters**

  • library_id *(str)* – id of the library

  • access_in *(list)* – list of role ids

  • modify_in *(list)* – list of role ids

  • add_in *(list)* – list of role ids

  • manage_in *(list)* – list of role ids

  **Return type** dict

  **Returns** General information about the library

**show_dataset**(library_id, dataset_id)

Get details about a given library dataset. The required `library_id` can be obtained from the datasets's library content details.
Parameters

- **library_id** *(str)* – library id where dataset is found in
- **dataset_id** *(str)* – id of the dataset to be inspected

Return type: dict

Returns: A dictionary containing information about the dataset in the library

`show_folder(library_id, folder_id)`

Get details about a given folder. The required `folder_id` can be obtained from the folder’s library content details.

Parameters

- **library_id** *(str)* – library id to inspect folders in
- **folder_id** *(str)* – id of the folder to be inspected

Return type: dict

Returns: Information about the folder

`show_library(library_id, contents=False)`

Get information about a library.

Parameters

- **library_id** *(str)* – filter for library by library id
- **contents** *(bool)* – whether to get contents of the library (rather than just the library details)

Return type: dict

Returns: details of the given library

`update_library_dataset(dataset_id, **kwds)`

Update library dataset metadata. Some of the attributes that can be modified are documented below.

Parameters

- **dataset_id** *(str)* – id of the dataset to be deleted
- **name** *(str)* – Replace library dataset name with the given string
- **misc_info** *(str)* – Replace library dataset misc_info with given string
- **file_ext** *(str)* – Replace library dataset extension (must exist in the Galaxy registry)
- **genome_build** *(str)* – Replace library dataset genome build (dbkey)
- **tags** *(list)* – Replace library dataset tags with the given list

Return type: dict

Returns: details of the updated dataset

`upload_file_contents(library_id, pasted_content, folder_id=None, file_type='auto', dbkey='?', tags=None)`

Upload pasted_content to a data library as a new file.

Parameters

- **library_id** *(str)* – id of the library where to place the uploaded file
- **pasted_content** *(str)* – Content to upload into the library
• folder_id (str) – id of the folder where to place the uploaded file. If not provided, the root folder will be used
• file_type (str) – Galaxy file format name
• dbkey (str) – Dbkey
• tags (list) – A list of tags to add to the datasets

Return type  list
Returns  List with a single dictionary containing information about the LDDA

upload_file_from_local_path(library_id, file_local_path, folder_id=None, file_type='auto', dbkey='?', tags=None)

Read local file contents from file_local_path and upload data to a library.

Parameters
• library_id (str) – id of the library where to place the uploaded file
• file_local_path (str) – path of local file to upload
• folder_id (str) – id of the folder where to place the uploaded file. If not provided, the root folder will be used
• file_type (str) – Galaxy file format name
• dbkey (str) – Dbkey
• tags (list) – A list of tags to add to the datasets

Return type  list
Returns  List with a single dictionary containing information about the LDDA

upload_file_from_server(library_id, server_dir, folder_id=None, file_type='auto', dbkey='?', link_data_only=None, roles='', preserve_dirs=False, tag_using_filenames=False, tags=None)

Upload all files in the specified subdirectory of the Galaxy library import directory to a library.

Note: For this method to work, the Galaxy instance must have the library_import_dir option configured in the config/galaxy.yml configuration file.

Parameters
• library_id (str) – id of the library where to place the uploaded file
• server_dir (str) – relative path of the subdirectory of library_import_dir to upload. All and only the files (i.e. no subdirectories) contained in the specified directory will be uploaded
• folder_id (str) – id of the folder where to place the uploaded files. If not provided, the root folder will be used
• file_type (str) – Galaxy file format name
• dbkey (str) – Dbkey
• link_data_only (str) – either ‘copy_files’ (default) or ‘link_to_files’. Setting to ‘link_to_files’ symlinks instead of copying the files
• roles (str) – ???
• **preserve_dirs (bool)** – Indicate whether to preserve the directory structure when importing dir

• **tag_using_filenames (bool)** – Indicate whether to generate dataset tags from filenames.

  Changed in version 0.14.0: Changed the default from True to False.

• **tags (list)** – A list of tags to add to the datasets

Return type  list

Returns  List with a single dictionary containing information about the LDDA

**upload_file_from_url**(*library_id, file_url, folder_id=None, file_type='auto', dbkey='?', tags=None*)

Upload a file to a library from a URL.

Parameters

• **library_id (str)** – id of the library where to place the uploaded file

• **file_url (str)** – URL of the file to upload

• **folder_id (str)** – id of the folder where to place the uploaded file. If not provided, the root folder will be used

• **file_type (str)** – Galaxy file format name

• **dbkey (str)** – Dbkey

• **tags (list)** – A list of tags to add to the datasets

Return type  list

Returns  List with a single dictionary containing information about the LDDA

**upload_from_galaxy_filesystem**(*library_id, filesystem_paths, folder_id=None, file_type='auto', dbkey='?', link_data_only=None, roles='', preserve_dirs=False, tag_using_filenames=False, tags=None*)

Upload a set of files already present on the filesystem of the Galaxy server to a library.

**Note:** For this method to work, the Galaxy instance must have the **allow_path_paste** option set to true in the config/galaxy.yml configuration file.

Parameters

• **library_id (str)** – id of the library where to place the uploaded file

• **filesystem_paths (str)** – file paths on the Galaxy server to upload to the library, one file per line

• **folder_id (str)** – id of the folder where to place the uploaded files. If not provided, the root folder will be used

• **file_type (str)** – Galaxy file format name

• **dbkey (str)** – Dbkey

• **link_data_only (str)** – either ‘copy_files’ (default) or ‘link_to_files’. Setting to ‘link_to_files’ symlinks instead of copying the files

• **roles (str)** – ??
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- `preserve_dirs (bool)` – Indicate whether to preserve the directory structure when importing dir.

- `tag_using_filenames (bool)` – Indicate whether to generate dataset tags from filenames.
  
  Changed in version 0.14.0: Changed the default from `True` to `False`.

- `tags (list)` – A list of tags to add to the datasets

  **Return type** list

  **Returns** List with a single dictionary containing information about the LDDA

  `wait_for_dataset(library_id, dataset_id, maxwait=12000, interval=3)`

  Wait until the library dataset state is terminal (‘ok’, ‘empty’, ‘error’, ‘discarded’ or ‘failed_metadata’).

  **Parameters**

  - `library_id (str)` – library id where dataset is found in

  - `dataset_id (str)` – id of the dataset to wait for

  - `maxwait (float)` – Total time (in seconds) to wait for the dataset state to become terminal. If the dataset state is not terminal within this time, a `DatasetTimeoutException` will be thrown.

  - `interval (float)` – Time (in seconds) to wait between 2 consecutive checks.

  **Return type** dict

  **Returns** A dictionary containing information about the dataset in the library

---

**Quotas**

Contains possible interactions with the Galaxy Quota

**class** `bioblend.galaxy.quotas.QuotaClient(galaxy_instance)`

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): `self.module` = 'workflows' | 'libraries' | 'histories' | ...

**create_quota(name, description, amount, operation, default='no', in_users=None, in_groups=None)**

Create a new quota

**Parameters**

- `name (str)` – Name for the new quota. This must be unique within a Galaxy instance.

- `description (str)` – Quota description

- `amount (str)` – Quota size (E.g. 10000MB, 99 gb, 0.2T, unlimited)

- `operation (str)` – One of (+, -, =)

- `default (str)` – Whether or not this is a default quota. Valid values are no, unregistered, registered. None is equivalent to no.

- `in_users (list of str)` – A list of user IDs or user emails.

- `in_groups (list of str)` – A list of group IDs or names.
Return type  dict

Returns
A description of quota. For example:

```json
{
'url': '/galaxy/api/quotas/386f14984287a0f7',
'model_class': 'Quota',
'message': "Quota 'Testing' has been created with 1 associated users... and 0 associated groups.",
'id': '386f14984287a0f7',
'name': 'Testing'}
```

delete_quota(quota_id)
Delete a quota

Before a quota can be deleted, the quota must not be a default quota.

Parameters quota_id (str) – Encoded quota ID.

Return type  str

Returns
A description of the changes, mentioning the deleted quota. For example:

"Deleted 1 quotas: Testing-B"

get_quotas(deleted=False)
Get a list of quotas

Parameters deleted (bool) – Only return quota(s) that have been deleted

Return type  list

Returns
A list of dicts with details on individual quotas. For example:

```json
[{
'id': '0604c8a56abe9a50',
'model_class': 'Quota',
'name': 'test',
'url': '/api/quotas/0604c8a56abe9a50'},
{
'id': '1ee267091d0190af',
'model_class': 'Quota',
'name': 'workshop',
'url': '/api/quotas/1ee267091d0190af'}]
```

module = 'quotas'

show_quota(quote_id, deleted=False)
Display information on a quota

Parameters

- quota_id (str) – Encoded quota ID
- deleted (bool) – Search for quota in list of ones already marked as deleted

Return type  dict

Returns
A description of quota. For example:
undelete_quota(quotaid)
Undelete a quota

Parameters

- quota_id (str) – Encoded quota ID.

Returns

A description of the changes, mentioning the undeleted quota. For example:

"Undeleted 1 quotas: Testing-B"

update_quota(quotaid, name=None, description=None, amount=None, operation=None, default='no', in_users=None, in_groups=None)
Update an existing quota

Parameters

- quota_id (str) – Encoded quota ID
- name (str) – Name for the new quota. This must be unique within a Galaxy instance.
- description (str) – Quota description. If you supply this parameter, but not the name, an error will be thrown.
- amount (str) – Quota size (E.g. 10000MB, 99 gb, 0.2T, unlimited)
- operation (str) – One of (+, -, =). If you wish to change this value, you must also provide the amount, otherwise it will not take effect.
- default (str) – Whether or not this is a default quota. Valid values are no, unregistered, registered. Calling this method with default="no" on a non-default quota will throw an error. Not passing this parameter is equivalent to passing no.
- in_users (list of str) – A list of user IDs or user emails.
- in_groups (list of str) – A list of group IDs or names.

Returns

A semicolon separated list of changes to the quota. For example:

"Quota 'Testing-A' has been renamed to 'Testing-B'; Quota 'Testing-e' is now '-100.0 GB'; Quota 'Testing-B' is now the default for unregistered users"
Roles

Contains possible interactions with the Galaxy Roles

```python
class bioblend.galaxy.roles.RolesClient(galaxy_instance)
    A generic Client interface defining the common fields.
    All clients must define the following field (which will be used as part of the URL composition
e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries'
    | 'histories' | ...

create_role(role_name, description, user_ids=None, group_ids=None)
    Create a new role.
    Parameters
    • role_name (str) – A name for the new role
    • description (str) – Description for the new role
    • user_ids (list) – A list of encoded user IDs to add to the new role
    • group_ids (list) – A list of encoded group IDs to add to the new role
    Return type dict
    Returns
    Details of the newly created role. For example:

    ```json
    {  
    "description": "desc",  
    "url": "/api/roles/ebfb8f50c6abde6d",  
    "model_class": "Role",  
    "type": "admin",  
    "id": "ebfb8f50c6abde6d",  
    "name": "Foo"  
    }
    ```

    Changed in version 0.15.0: Changed the return value from a 1-element list to a dict.
```

get_roles()
    Displays a collection (list) of roles.
    Return type list
    Returns
    A list of dicts with details on individual roles. For example:

    ```json
    [{  
    "id": "f2db41e1fa331b3e",  
    "model_class": "Role",  
    "name": "Foo",  
    "url": "/api/roles/f2db41e1fa331b3e"},  
    {"id": "f597429621d6eb2b",  
    "model_class": "Role",  
    "name": "Bar",  
    "url": "/api/roles/f597429621d6eb2b"}]
    ```

module = 'roles'

show_role(role_id)
    Display information on a single role
    Parameters role_id (str) – Encoded role ID
**Return type**  dict

**Returns**
Details of the given role. For example:

```json
{
    "description": "Private Role for Foo",
    "id": "f2db41e1fa331b3e",
    "model_class": "Role",
    "name": "Foo",
    "type": "private",
    "url": "/api/roles/f2db41e1fa331b3e"
}
```

---

**Tools**

Contains possible interaction dealing with Galaxy tools.

```python
class bioblend.galaxy.tools.ToolClient(galaxy_instance)
```

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): `self.module = 'workflows' | 'libraries' | 'histories' | ...`

**get_citations**(tool_id: str) → List[dict]
Get BibTeX citations for a given tool ID.

**Parameters**
- **tool_id** (str) – id of the requested tool

**Return type**  list of dicts

**Param**  list containing the citations

**get_tool_panel**()
Get a list of available tool elements in Galaxy’s configured toolbox.

**Return type**  list

**Returns**  List containing tools (if not in sections) or tool sections with nested tool descriptions.

**See also:**
bioblend.galaxy.toolshed.get_repositories()

**get_tools**(tool_id=None, name=None, trackster=None)
Get all tools, or select a subset by specifying optional arguments for filtering (e.g. a tool name).

**Parameters**
- **tool_id** (str) – id of the requested tool
  
  Deprecated since version 0.16.0: To get details of a tool for which you know the ID, use the much more efficient `show_tool()` instead.

- **name** (str) – Tool name to filter on.

- **trackster** (bool) – whether to return only tools that are compatible with Trackster

**Return type**  list

**Returns**  List of tool descriptions.
See also:
bioblend.galaxy_toolshed.get_repositories()

**install_dependencies(tool_id)**
Install dependencies for a given tool via a resolver. This works only for Conda currently. This functionality is available only to Galaxy admins.

*Parameters*
*tool_id (str)* – id of the requested tool

*Return type* dict

*Returns* Tool requirement status

```python
module = 'tools'
```

**paste_content(content, history_id, **kwds)**
Upload a string to a new dataset in the history specified by `history_id`.

*Parameters*
*content (str)* – content of the new dataset to upload or a list of URLs (one per line) to upload

*history_id (str)* – id of the history where to upload the content

*Return type* dict

*Returns* Information about the created upload job

See `upload_file()` for the optional parameters.

**put_url(content, history_id, **kwds)**
Upload a string to a new dataset in the history specified by `history_id`.

*Parameters*
*content (str)* – content of the new dataset to upload or a list of URLs (one per line) to upload

*history_id (str)* – id of the history where to upload the content

*Return type* dict

*Returns* Information about the created upload job

See `upload_file()` for the optional parameters.

**requirements(tool_id)**
Return the resolver status for a specific tool. This functionality is available only to Galaxy admins.

*Parameters*
*tool_id (str)* – id of the requested tool

*Return type* list

*Returns* List containing a resolver status dict for each tool requirement. For example:

```python
[{'cacheable': False,
  'dependency_resolver': {'auto_init': True,
                           'auto_install': False,
                           'can_uninstall_dependencies': True,
                           'ensure_channels': 'iuc,conda-forge,
                                            bioconda,defaults',
                           'model_class': 'CondaDependencyResolver'},
  ...]
```

(continues on next page)
run_tool(history_id, tool_id, tool_inputs, input_format='legacy')

Runs tool specified by tool_id in history indicated by history_id with inputs from dict tool_inputs.

Parameters

- **history_id** (str) – encoded ID of the history in which to run the tool
- **tool_id** (str) – ID of the tool to be run
- **tool_inputs** (dict) – dictionary of input datasets and parameters for the tool (see below)
- **input_format** (string) – input format for the payload. Possible values are the default 'legacy' (where inputs nested inside conditionals or repeats are identified with e.g. `<conditional_name>|<input_name>`) or '21.01' (where inputs inside conditionals or repeats are nested elements).

Return type  dict

Returns

Information about outputs and job For example:

```json
{
    'implicit_collections': [],
    'jobs': [{
        'create_time': '2019-05-08T12:26:16.067372',
        'exit_code': None,
        'id': '7dd125b61b35d782',
        'model_class': 'Job',
        'state': 'new',
        'tool_id': 'cut1',
        'update_time': '2019-05-08T12:26:16.067389'
    }],
    'output_collections': [],
    'outputs': [{
        'create_time': '2019-05-08T12:26:15.997739',
        'data_type': 'galaxy.datatypes.tabular.Tabular',
        'deleted': False,
        'file_ext': 'tabular',
        'file_size': 0,
        'genome_build': '?',
        'hda_ldda': 'hda',
        'hid': 42,
        'history_content_type': 'dataset',
        'history_id': 'df8fe5ddadbf3ab1',
        'id': 'aeb65580396167f3',
    }
```
The `tool_inputs` dict should contain input datasets and parameters in the (largely undocumented) format used by the Galaxy API. Some examples can be found in Galaxy’s API test suite.

**show_tool**(tool_id, io_details=False, link_details=False)

Get details of a given tool.

**Parameters**

- `tool_id` (*str*) – id of the requested tool
- `io_details` (*bool*) – whether to get also input and output details
- `link_details` (*bool*) – whether to get also link details

**Return type** dict

**Returns** Information about the tool’s interface

**uninstall_dependencies**(tool_id: *str*) → dict

Uninstall dependencies for a given tool via a resolver. This works only for Conda currently. This functionality is available only to Galaxy admins.

**Parameters**

- `tool_id` (*str*) – id of the requested tool

**Return type** dict

**Returns** Tool requirement status

**upload_file**(path, history_id, **keywords)

Upload the file specified by *path* to the history specified by *history_id*.

**Parameters**

- `path` (*str*) – path of the file to upload
- `history_id` (*str*) – id of the history where to upload the file
- `file_name` (*str*) – (optional) name of the new history dataset
- `file_type` (*str*) – (optional) Galaxy datatype for the new dataset, default is auto
- `dbkey` (*str*) – (optional) genome dbkey
• **to_posix_lines** *(bool)* – if True (the default), convert universal line endings to POSIX line endings. Set to False when uploading a gzip, bz2 or zip archive containing a binary file

• **space_to_tab** *(bool)* – whether to convert spaces to tabs. Default is False. Applicable only if to_posix_lines is True

**Return type** dict

**Returns** Information about the created upload job

**upload_from_ftp** *(path, history_id, **keywords)*

Upload the file specified by path from the user's FTP directory to the history specified by history_id.

**Parameters**

• **path** *(str)* – path of the file in the user's FTP directory

• **history_id** *(str)* – id of the history where to upload the file

See **upload_file()** for the optional parameters.

**Return type** dict

**Returns** Information about the created upload job

---

**Tool data tables**

Contains possible interactions with the Galaxy Tool data tables

**class** bioblend.galaxy.tool_data.ToolDataClient(galaxy_instance)**

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

**delete_data_table** *(data_table_id, values)*

Delete an item from a data table.

**Parameters**

• **data_table_id** *(str)* – ID of the data table

• **values** *(str)* – a "|" separated list of column contents, there must be a value for all the columns of the data table

**Return type** dict

**Returns** Remaining contents of the given data table

**get_data_tables()**

Get the list of all data tables.

**Return type** list

**Returns**

A list of dicts with details on individual data tables. For example:

```python
[{
    "model_class": "TabularToolDataTable",
    "name": "fasta_indexes"
},
{
    "model_class": "TabularToolDataTable",
    "name": "bwa_indexes"
}]
```
module = 'tool_data'

reload_data_table(data_table_id)
   Reload a data table.
   Parameters data_table_id (str) – ID of the data table
   Return type dict
   Returns
   A description of the given data table and its content. For example:

   ```
   {'columns': ['value', 'dbkey', 'name', 'path'],
    'fields': [['test id',
                 'test',
                'test name',
                '/opt/galaxy-dist/tool-data/test/seq/test id.fa']],
    'model_class': 'TabularToolDataTable',
    'name': 'all_fasta'}
   ```

show_data_table(data_table_id)
   Get details of a given data table.
   Parameters data_table_id (str) – ID of the data table
   Return type dict
   Returns
   A description of the given data table and its content. For example:

   ```
   {'columns': ['value', 'dbkey', 'name', 'path'],
    'fields': [['test id',
                 'test',
                'test name',
                '/opt/galaxy-dist/tool-data/test/seq/test id.fa']],
    'model_class': 'TabularToolDataTable',
    'name': 'all_fasta'}
   ```

**ToolShed**

Interaction with a Galaxy Tool Shed.

class bioblend.galaxy.toolshed.ToolShedClient(galaxy_instance)
   A generic Client interface defining the common fields.
   All clients must define the following field (which will be used as part of the URL composition
   (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

get_repositories()
   Get the list of all installed Tool Shed repositories on this Galaxy instance.
   Return type list
   Returns
   a list of dictionaries containing information about repositories present in the Tool Shed. For example:
Changed in version 0.4.1: Changed method name from `get_tools` to `get_repositories` to better align with the Tool Shed concepts

See also:

`bioblend.galaxy.tools.get_tool_panel()`

```python
install_repository_revision(tool_shed_url, name, owner, changeset_revision, install_tool_dependencies=False, install_repository_dependencies=False, install_resolver_dependencies=False, tool_panel_section_id=None, new_tool_panel_section_label=None)
```

Install a specified repository revision from a specified Tool Shed into this Galaxy instance. This example demonstrates installation of a repository that contains valid tools, loading them into a section of the Galaxy tool panel or creating a new tool panel section. You can choose if tool dependencies or repository dependencies should be installed through the Tool Shed, (use `install_tool_dependencies` or `install_repository_dependencies`) or through a resolver that supports installing dependencies (use `install_resolver_dependencies`). Note that any combination of the three dependency resolving variables is valid.

Installing the repository into an existing tool panel section requires the tool panel config file (e.g., `tool_conf.xml`, `shed_tool_conf.xml`, etc) to contain the given tool panel section:

```xml
<section id="from_test_tool_shed" name="From Test Tool Shed" version=""> </section>
```

**Parameters**

- `tool_shed_url (str)` – URL of the Tool Shed from which the repository should be installed from (e.g., `https://testtoolshed.g2.bx.psu.edu`)
- `name (str)` – The name of the repository that should be installed
- `owner (str)` – The name of the repository owner
- `changeset_revision (str)` – The revision of the repository to be installed
- `install_tool_dependencies (bool)` – Whether or not to automatically handle tool dependencies (see `https://galaxyproject.org/toolshed/tool-dependency-recipes/` for more details)
- `install_repository_dependencies (bool)` – Whether or not to automatically handle repository dependencies (see `https://galaxyproject.org/toolshed/defining-repository-dependencies/` for more details)
- `install_resolver_dependencies (bool)` – Whether or not to automatically install resolver dependencies (e.g. conda).
- `tool_panel_section_id (str)` – The ID of the Galaxy tool panel section where the tool should be inserted under. Note that you should specify either this parameter or the `new_tool_panel_section_label`. If both are specified, this one will take precedence.
• **new_tool_panel_section_label** *(str)* – The name of a Galaxy tool panel section that should be created and the repository installed into.

```python
module = 'tool_shed_repositories'
```

**show_repository** *(toolShed_id)*
Get details of a given Tool Shed repository as it is installed on this Galaxy instance.

**Parameters**
- **toolShed_id** *(str)* – Encoded toolShed ID

**Return type** dict

**Returns**
Information about the tool For example:

```python
{'changeset_revision': 'b17455fb6222',
 'ctx_rev': '8',
 'owner': 'aaron',
 'status': 'Installed',
 'url': '/api/tool_shed_repositories/82de4a4c7135b20a'}
```

Changed in version 0.4.1: Changed method name from show_tool to show_repository to better align with the Tool Shed concepts

**uninstall_repository_revision** *(name, owner, changeset_revision, tool_shed_url, remove_from_disk=True)*
Uninstalls a specified repository revision from this Galaxy instance.

**Parameters**
- **name** *(str)* – The name of the repository
- **owner** *(str)* – The owner of the repository
- **changeset_revision** *(str)* – The revision of the repository to uninstall
- **tool_shed_url** *(str)* – URL of the Tool Shed from which the repository was installed from (e.g., https://testtoolshed.g2.bx.psu.edu)
- **remove_from_disk** *(bool)* – whether to also remove the repository from disk (the default) or only deactivate it

**Return type** dict

**Returns**
If successful, a dictionary with a message noting the removal

---

**Users**

Contains possible interaction dealing with Galaxy users.

Most of these methods must be executed by a registered Galaxy admin user.

**class bioblend.galaxy.users.UserClient(galaxy_instance)**
A generic Client interface defining the common fields.

All clients *must* define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

---

5.1. Galaxy API
create_local_user(username, user_email, password)
Create a new Galaxy local user.

Note: For this method to work, the Galaxy instance must have the `allow_user_creation` option set to `true` and `use_remote_user` option set to `false` in the `config/galaxy.yml` configuration file.

Parameters
- **username** (str) – username of the user to be created
- **user_email** (str) – email of the user to be created
- **password** (str) – password of the user to be created

Return type dict
Returns a dictionary containing information about the created user

create_remote_user(user_email)
Create a new Galaxy remote user.

Note: For this method to work, the Galaxy instance must have the `allow_user_creation` and `use_remote_user` options set to `true` in the `config/galaxy.yml` configuration file. Also note that setting `use_remote_user` will require an upstream authentication proxy server; however, if you do not have one, access to Galaxy via a browser will not be possible.

Parameters **user_email** (str) – email of the user to be created

Return type dict
Returns a dictionary containing information about the created user

create_user_apikey(user_id)
Create a new API key for a given user.

Parameters **user_id** (str) – encoded user ID

Return type str
Returns the API key for the user

delete_user(user_id, purge=False)
Delete a user.

Note: For this method to work, the Galaxy instance must have the `allow_user_deletion` option set to `true` in the `config/galaxy.yml` configuration file.

Parameters
- **user_id** (str) – encoded user ID
- **purge** (bool) – if True, also purge (permanently delete) the history

Return type dict
Returns a dictionary containing information about the deleted user
get_current_user()
Display information about the user associated with this Galaxy connection.

Return type  dict
Returns  a dictionary containing information about the current user

get_user_apikey(user_id)
Get the current API key for a given user.

Parameters  user_id (str) – encoded user ID
Return type  str
Returns  the API key for the user

get_users(deleted=False, f_email=None, f_name=None, f_any=None)
Get a list of all registered users. If deleted is set to True, get a list of deleted users.

Parameters
- deleted (bool) – Whether to include deleted users
- f_email (str) – filter for user emails. The filter will be active for non-admin users only if the Galaxy instance has the expose_user_email option set to true in the config/galaxy.yml configuration file.
- f_name (str) – filter for user names. The filter will be active for non-admin users only if the Galaxy instance has the expose_user_name option set to true in the config/galaxy.yml configuration file.
- f_any (str) – filter for user email or name. Each filter will be active for non-admin users only if the Galaxy instance has the corresponding expose_user_* option set to true in the config/galaxy.yml configuration file.

Return type  list
Returns  a list of dicts with user details. For example:

```py
[{
'email': 'a_user@example.com',
'id': 'dda47097d9189f15',
'url': '/api/users/dda47097d9189f15'}]
```

module = 'users'

show_user(user_id, deleted=False)
Display information about a user.

Parameters
- user_id (str) – encoded user ID
- deleted (bool) – whether to return results for a deleted user

Return type  dict
Returns  a dictionary containing information about the user

update_user(user_id, **kwds)
Update user information. Some of the attributes that can be modified are documented below.

Parameters
- user_id (str) – encoded user ID
- **username** (*str*) – Replace user name with the given string
- **email** (*str*) – Replace user email with the given string

**Return type** dict

**Returns** details of the updated user

---

**Visual**

Contains possible interactions with the Galaxy visualization

```python
from bioblend.galaxy.visual import VisualClient

class bioblend.galaxy.visual.VisualClient(galaxy_instance):
    A generic Client interface defining the common fields.
    All clients must define the following field (which will be used as part of the URL composition
e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' |
'histories' | ...

get_visualizations()
Get the list of all visualizations.

**Return type** list

**Returns**
A list of dicts with details on individual visualizations. For example:

```python
{{
  'dbkey': 'eschColi_K12',
  'id': 'df1c7c96fc427c2d',
  'title': 'AVTest1',
  'type': 'trackster',
  'url': '/api/visualizations/df1c7c96fc427c2d'},
  {'dbkey': 'mm9',
  'id': 'a669f50f8bf55b02',
  'title': 'Bam to Bigwig',
  'type': 'trackster',
  'url': '/api/visualizations/a669f50f8bf55b02'}}
```

```python
module = 'visualizations'

show_visualization(visual_id)
Get details of a given visualization.

**Parameters**

- **visual_id** (*str*) – Encoded visualization ID

**Return type** dict

**Returns**
A description of the given visualization. For example:

```python
{{
  'annotation': None,
  'dbkey': 'mm9',
  'id': '18df9134ea75e49c',
  'latest_revision': { ... },
  'model_class': 'Visualization',
  'revisions': ['aa90649bb3ec7dcb', '20622bc6249c0c71']}
```
```
Workflows

Contains possible interactions with the Galaxy Workflows

```python
class bioblend.galaxy.workflows.WorkflowClient(galaxy_instance)
    A generic Client interface defining the common fields.

    All clients must define the following field (which will be used as part of the URL composition
    (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries'
    | 'histories' | ...

cancel_invocation(workflow_id, invocation_id)
    Cancel the scheduling of a workflow.

    Parameters
    • workflow_id (str) – Encoded workflow ID
    • invocation_id (str) – Encoded workflow invocation ID

    Return type dict

    Returns The workflow invocation being cancelled

delete_workflow(workflow_id)
    Delete a workflow identified by workflow_id.

    Parameters workflow_id (str) – Encoded workflow ID

    Return type str

    Returns A message about the deletion

    Warning: Deleting a workflow is irreversible - all workflow data will be permanently deleted.

export_workflow_dict(workflow_id, version=None)
    Exports a workflow.

    Parameters
    • workflow_id (str) – Encoded workflow ID
    • version (int) – Workflow version to export

    Return type dict

    Returns Dictionary representing the requested workflow

export_workflow_to_local_path(workflow_id, file_local_path, use_default_filename=True)
    Exports a workflow in JSON format to a given local path.

    Parameters
```
BioBlend Documentation, Release 0.15.0

- **workflow_id** (str) – Encoded workflow ID

- **file_local_path** (str) – Local path to which the exported file will be saved. (Should not contain filename if use_default_name=True)

- **use_default_filename** (bool) – If the use_default_name parameter is True, the exported file will be saved as file_local_path/Galaxy-Workflow-%s.ga, where %s is the workflow name. If use_default_name is False, file_local_path is assumed to contain the full file path including filename.

  Return type None
  Returns None

**extract_workflow_from_history**(history_id, workflow_name=None, job_ids=None, dataset_hids=None, dataset_collection_hids=None)

Extract a workflow from a history.

Parameters

- **history_id** (str) – Encoded history ID

- **workflow_name** (str) – Name of the workflow to create

- **job_ids** (list) – Optional list of job IDs to filter the jobs to extract from the history

- **dataset_hids** (list) – Optional list of dataset hids corresponding to workflow inputs when extracting a workflow from history

- **dataset_collection_hids** (list) – Optional list of dataset collection hids corresponding to workflow inputs when extracting a workflow from history

  Return type dict
  Returns A description of the created workflow

**get_invocations**(workflow_id)

Get a list containing all the workflow invocations corresponding to the specified workflow.

For more advanced filtering use InvocationClient.get_invocations().

Parameters **workflow_id** (str) – Encoded workflow ID

Return type list

Returns A list of workflow invocations. For example:

```python
[{'history_id': '2f94e8ae9edff68a',
  'id': 'df7a1f0c02a5b08e',
  'model_class': 'WorkflowInvocation',
  'state': 'new',
  'update_time': '2015-10-31T22:00:22',
  'uuid': 'c8aa2b1c-801a-11e5-a9e5-8ca98228593c',
  'workflow_id': '03501d7626bd192f'}]
```

**get_workflow_inputs**(workflow_id, label)

Get a list of workflow input IDs that match the given label. If no input matches the given label, an empty list is returned.

Parameters

- **workflow_id** (str) – Encoded workflow ID
• **label** *(str)* – label to filter workflow inputs on

**Return type** list

**Returns** list of workflow inputs matching the label query

### get_workflows

*(workflow_id=None, name=None, published=False)*

Get all workflows, or select a subset by specifying optional arguments for filtering (e.g. a workflow name).

**Parameters**

- **workflow_id** *(str)* – Encoded workflow ID
  
  Deprecated since version 0.16.0: To get details of a workflow for which you know the ID, use the much more efficient `show_workflow()` instead.

- **name** *(str)* – Workflow name to filter on.

- **published** *(bool)* – if True, return also published workflows

**Return type** list

**Returns**

A list of workflow dicts. For example:

```
[{
'**id**': '92c56938c2f9b315',
'**name**': 'Simple',
'**url**': '/api/workflows/92c56938c2f9b315'}]
```

### import_shared_workflow

*(workflow_id)*

Imports a new workflow from the shared published workflows.

**Parameters** **workflow_id** *(str)* – Encoded workflow ID

**Return type** dict

**Returns**

A description of the workflow. For example:

```
{
'**id**': 'ee0e2b4b696d9092',
'**model_class**': 'StoredWorkflow',
'**name**': 'Super workflow that solves everything!',
'**published**': False,
'tags': [],
'**url**': '/api/workflows/ee0e2b4b696d9092'}
```

### import_workflow_dict

*(workflow_dict, publish=False)*

Imports a new workflow given a dictionary representing a previously exported workflow.

**Parameters**

- **workflow_dict** *(dict)* – dictionary representing the workflow to be imported

- **publish** *(bool)* – if True the uploaded workflow will be published; otherwise it will be visible only by the user which uploads it (default)

**Return type** dict

**Returns**

Information about the imported workflow. For example:
import_workflow_from_local_path(file_local_path, publish=False)

Imports a new workflow given the path to a file containing a previously exported workflow.

Parameters

• file_local_path (str) – File to upload to the server for new workflow

• publish (bool) – if True the uploaded workflow will be published; otherwise it will be visible only by the user which uploads it (default)

Return type dict

Returns

Information about the imported workflow. For example:

```
{
'name': 'Training: 16S rRNA sequencing with mothur: main tutorial',
'tags': [],
'deleted': false,
'latest_workflow_uuid': '368c6165-ccbe-4945-8a3c-d27982206d66',
'url': '/api/workflows/94bac0a90086bdcf',
'number_of_steps': 44,
'published': false,
'owner': 'jane-doe',
'model_class': 'StoredWorkflow',
'id': '94bac0a90086bdcf'
}
```


Invoke the workflow identified by workflow_id. This will cause a workflow to be scheduled and return an object describing the workflow invocation.

Parameters

• workflow_id (str) – Encoded workflow ID

• inputs (dict) – A mapping of workflow inputs to datasets and dataset collections. The datasets source can be a LibraryDatasetDatasetAssociation (ldda), LibraryDataset (ld), HistoryDatasetAssociation (hda), or HistoryDatasetCollectionAssociation (hdca).

The map must be in the following format: `{<input_index>: {'id': <encoded dataset ID>, 'src': [ldda, ld, hda, hdca]}}` (e.g. `{2: {'id': '29beef4fadeed09f', 'src': 'hda'}})
This map may also be indexed by the UUIDs of the workflow steps, as indicated by the
\texttt{uuid} property of steps returned from the Galaxy API. Alternatively workflow steps may
be addressed by the label that can be set in the workflow editor. If using \texttt{uuid} or \texttt{label} you
need to also set the \texttt{inputs_by} parameter to \texttt{step_uuid} or \texttt{name}.

- \textbf{params (dict)} – A mapping of non-datasets tool parameters (see below)
- \textbf{history_id (str)} – The encoded history ID where to store the workflow output. Alter-
natively, \texttt{history_name} may be specified to create a new history.
- \textbf{history_name (str)} – Create a new history with the given name to store the workflow
output. If both \texttt{history_id} and \texttt{history_name} are provided, \texttt{history_name} is ignored. If
neither is specified, a new ‘Unnamed history’ is created.
- \textbf{import inputs to history (bool)} – If True, used workflow inputs will be imported
into the history. If False, only workflow outputs will be visible in the given history.
- \textbf{allow tool state corrections (bool)} – If True, allow Galaxy to fill in missing tool
state when running workflows. This may be useful for workflows using tools that have
changed over time or for workflows built outside of Galaxy with only a subset of inputs
defined.
- \textbf{replacement_params (dict)} – pattern-based replacements for post-job actions (see be-
low)
- \textbf{inputs_by (str)} – Determines how inputs are referenced. Can be “step_index|step_uuid”
(default), “step_index”, “step_id”, “step_uuid”, or “name”.
- \textbf{parameters_normalized (bool)} – Whether Galaxy should normalize \texttt{params} to ensure
everything is referenced by a numeric step ID. Default is False, but when setting \texttt{params}
for a subworkflow, True is required.

Return type \texttt{dict}

Returns

A dict containing the workflow invocation describing the scheduling of the workflow. For example:

\begin{verbatim}
{'history_id': '2f94e8ae9edff68a',
 'id': 'df7a1f0c02a5b08e',
 'inputs': {'0': {'id': 'a7db2fac67043c7e',
 'src': 'hda',
 'uuid': '7932ffe0-2340-4952-8857-dbaa50f1f46a'}},
 'model_class': 'WorkflowInvocation',
 'state': 'ready',
 'steps': [{
 'action': None,
 'id': 'd413a19dec1d11e',
 'job_id': None,
 'model_class': 'WorkflowInvocationStep',
 'order_index': 0,
 'state': None,
 'update_time': '2015-10-31T22:00:26',
 'workflow_step_id': 'cbbbf59e8f08c98c',
 'workflow_step_label': None,
 'workflow_step_uuid': 'b81250fd-3278-4e6a-b269-56a1f01ef485'}],

(continues on next page)
\end{verbatim}
The params dict should be specified as follows:

```python
{STEP_ID: PARAM_DICT, ...}
```

where PARAM_DICT is:

```python
{PARAM_NAME: VALUE, ...}
```

For backwards compatibility, the following (deprecated) format is also supported for params:

```python
{TOOL_ID: PARAM_DICT, ...}
```

in which case PARAM_DICT affects all steps with the given tool id. If both by-tool-id and by-step-id specifications are used, the latter takes precedence.

Finally (again, for backwards compatibility), PARAM_DICT can also be specified as:

```python
{'param': PARAM_NAME, 'value': VALUE}
```

Note that this format allows only one parameter to be set per step.

For a repeat parameter, the names of the contained parameters needs to be specified as `<repeat name>_<repeat index>|<param name>`, with the repeat index starting at 0. For example, if the tool XML contains:

```xml
<repeat name="cutoff" title="Parameters used to filter cells" min="1">
  <param name="name" type="text" value="n_genes" label="Name of param...">
    <option value="n_genes">n_genes</option>
    <option value="n_counts">n_counts</option>
  </param>
  <param name="min" type="float" min="0" value="0" label="Min value"/>
</repeat>
```

then the PARAM_DICT should be something like:

```python
{...
  "cutoff_0|name": "n_genes",
  "cutoff_0|min": "2",
  "cutoff_1|name": "n_counts",
  "cutoff_1|min": "4",
  ...
}
```
At the time of this writing, it is not possible to change the number of times the contained parameters are repeated. Therefore, the parameter indexes can go from 0 to \(n-1\), where \(n\) is the number of times the repeated element was added when the workflow was saved in the Galaxy UI.

The `replacement_params` dict should map parameter names in post-job actions (PJAs) to their runtime values. For instance, if the final step has a PJA like the following:

```json
{
    'RenameDatasetAction\text{out_file1}': {
        'action_arguments': {
            'newname': '$\{output\}$',
            'action_type': 'RenameDatasetAction',
            'output_name': 'out_file1'
        },
        'action_type': 'RenameDatasetAction',
        'output_name': 'out_file1'
    }
}
```

then the following renames the output dataset to ‘foo’:

```python
replacement_params = {'output': 'foo'}
```

see also this email thread.

**Warning:** Historically, the `run_workflow` method consumed a `dataset_map` data structure that was indexed by unencoded workflow step IDs. These IDs would not be stable across Galaxy instances. The new `inputs` property is instead indexed by either the `order_index` property (which is stable across workflow imports) or the step UUID which is also stable.

```python
module = 'workflows'
refactor_workflow(workflow_id, actions, dry_run=False)
```

Refactor workflow with given actions.

**Parameters**

- `workflow_id` (str) – Encoded workflow ID
- `actions` (list of dicts) –
  
  **Actions to use for refactoring the workflow.** The following actions are supported:
  
  - `update_step_label`, `update_step_position`, `update_output_label`, `update_name`,
  - `update_annotation`, `update_license`, `update_creator`, `update_report`, `add_step`,
  - `add_input`, `disconnect`, `connect`, `fill_defaults`, `fill_step_defaults`, `extract_input`, `extract_legacy_parameter`, `remove_unlabeled_workflow_outputs`, `upgrade_all_steps`,
  - `upgrade_subworkflow`, `upgrade_tool`.

An example value for the `actions` argument might be:

```python
actions = [
    {"action_type": "add_input", "type": "data", "label": "foo"},
    {"action_type": "update_step_label", "label": "bar", "step": {"label": "foo"}}
]
```

- `dry_run` (bool) – When true, perform a dry run where the existing workflow is preserved. The refactored workflow is returned in the output of the method, but not saved on the Galaxy server.

**Return type** dict

**Returns** Dictionary containing logged messages for the executed actions and the refactored workflow.
run_invocation_step_action(workflow_id, invocation_id, step_id, action)

Execute an action for an active workflow invocation step. The nature of this action and what is expected will vary based on the type of workflow step (the only currently valid action is True/False for pause steps).

Parameters

• workflow_id (str) – Encoded workflow ID
• invocation_id (str) – Encoded workflow invocation ID
• step_id (str) – Encoded workflow invocation step ID
• action (object) – Action to use when updating state, semantics depends on step type.

Return type  dict

Returns  Representation of the workflow invocation step

run_workflow(workflow_id, dataset_map=None, params=None, history_id=None, history_name=None, import_inputs_to_history=False, replacement_params=None)

Run the workflow identified by workflow_id.

Deprecated since version 0.7.0: Use invoke_workflow() instead.

Parameters

• workflow_id (str) – Encoded workflow ID
• dataset_map (dict) – A mapping of workflow inputs to datasets. The datasets source can be a LibraryDatasetDatasetAssociation (ldda), LibraryDataset (ld), or HistoryDatasetAssociation (hda). The map must be in the following format: {'<input>': {'id': <encoded dataset ID>, 'src': ['ldda, ld, hda']}} (e.g. {'23': {'id': '29bee4fafe0d09f', 'src': 'ld'}})
• params (dict) – A mapping of non-datasets tool parameters (see below)
• history_id (str) – The encoded history ID where to store the workflow output. Alternatively, history_name may be specified to create a new history.
• history_name (str) – Create a new history with the given name to store the workflow output. If both history_id and history_name are provided, history_name is ignored. If neither is specified, a new ‘Unnamed history’ is created.
• import_inputs_to_history (bool) – If True, used workflow inputs will be imported into the history. If False, only workflow outputs will be visible in the given history.
• replacement_params (dict) – pattern-based replacements for post-job actions (see below)

Return type  dict

Returns  A dict containing the history ID where the outputs are placed as well as output dataset IDs. For example:

```
{'history': '64177123325c9cfd',
 'outputs': ['aa4d3084af404259']}
```

The params dict should be specified as follows:

```
{STEP_ID: PARAM_DICT, ...}
```
where PARAM_DICT is:

```
{PARAM_NAME: VALUE, ...}
```

For backwards compatibility, the following (deprecated) format is also supported for params:

```
{TOOL_ID: PARAM_DICT, ...}
```

in which case PARAM_DICT affects all steps with the given tool id. If both by-tool-id and by-step-id specifications are used, the latter takes precedence.

Finally (again, for backwards compatibility), PARAM_DICT can also be specified as:

```
{'param': PARAM_NAME, 'value': VALUE}
```

Note that this format allows only one parameter to be set per step.

The replacement_params dict should map parameter names in post-job actions (PJAs) to their runtime values. For instance, if the final step has a PJA like the following:

```
{'RenameDatasetActionout_file1': {'action_arguments': {'newname': '${output}'},
     'action_type': 'RenameDatasetAction',
     'output_name': 'out_file1'}}
```

then the following renames the output dataset to ‘foo’:

```
replacement_params = {'output': 'foo'}
```

see also this email thread.

**Warning:** This method waits for the whole workflow to be scheduled before returning and does not scale to large workflows as a result. This method has therefore been deprecated in favor of `invoke_workflow()`, which also features improved default behavior for dataset input handling.

**show_invocation(workflow_id, invocation_id)**

Get a workflow invocation object representing the scheduling of a workflow. This object may be sparse at first (missing inputs and invocation steps) and will become more populated as the workflow is actually scheduled.

Parameters

- `workflow_id` *(str)* – Encoded workflow ID
- `invocation_id` *(str)* – Encoded workflow invocation ID

Return type  dict

Returns

The workflow invocation. For example:

```
{'history_id': '2f94e8ae9edff68a',
 'id': 'df7a1f00c02a5b08e',
 'inputs': {'0': {'id': 'a7db2fac67043c7e',
          'src': 'hda',
          'uuid': '7932ffe0-2340-4952-8857-dbaa50f1f46a'}},
 'model_class': 'WorkflowInvocation',
```
'state': 'ready',
'steps': [{
'action': None,
'id': 'd413a19dec13d11e',
'job_id': None,
'model_class': 'WorkflowInvocationStep',
'order_index': 0,
'state': None,
'update_time': '2015-10-31T22:00:26',
'workflow_step_id': 'cbbbbf59e8f08c98c',
'workflow_step_label': None,
'workflow_step_uuid': 'b81250fd-3278-4e6a-b269-56a1f01ef485'},
{
'action': None,
'id': '2f94e8ae9edff68a',
'job_id': 'e89067bb68bee7a0',
'model_class': 'WorkflowInvocationStep',
'order_index': 1,
'state': 'new',
'update_time': '2015-10-31T22:00:26',
'workflow_step_id': '964b37715ec9bd22',
'workflow_step_label': None,
'workflow_step_uuid': 'e62440b8-e911-408b-b124-e05435d3125e'}],
'update_time': '2015-10-31T22:00:26',
uuid: 'c8aa2b1c-801a-11e5-a9e5-8ca98228593c',
'workflow_id': '03501d7626bd192f'}

show_invocation_step(workflow_id, invocation_id, step_id)

See the details of a particular workflow invocation step.

**Parameters**

- **workflow_id** *(str)* – Encoded workflow ID
- **invocation_id** *(str)* – Encoded workflow invocation ID
- **step_id** *(str)* – Encoded workflow invocation step ID

**Return type** dict

**Returns**

The workflow invocation step. For example:

{  
'action': None,  
'id': '63cd3858d057a6d1',  
'job_id': None,  
'model_class': 'WorkflowInvocationStep',  
'order_index': 2,  
'state': None,  
'update_time': '2015-10-31T22:11:14',  
'workflow_step_id': '52e496b945151ee8',  
'workflow_step_label': None,  
'workflow_step_uuid': '4060554c-1dd5-4287-9040-8b4f281cf9dc'}
**show_versions**(*workflow_id*)
Get versions for a workflow.

**Parameters**
- **workflow_id** (*str*) – Encoded workflow ID

**Return type**
list of dicts

**Returns**
Ordered list of version descriptions for this workflow

**show_workflow**(*workflow_id*, *version=None*)
Display information needed to run a workflow.

**Parameters**
- **workflow_id** (*str*) – Encoded workflow ID
- **version** (*int*) – Workflow version to show

**Return type**
dict

**Returns**
A description of the workflow and its inputs. For example:

```
{
'id': '92c56938c2f9b315',
'inputs': {'23': {'label': 'Input Dataset', 'value': ''}},
'name': 'Simple',
'url': '/api/workflows/92c56938c2f9b315'}
```

**update_workflow**(*workflow_id*, **kwds*)
Update a given workflow.

**Parameters**
- **workflow_id** (*str*) – Encoded workflow ID
- **workflow** (*dict*) – dictionary representing the workflow to be updated
- **name** (*str*) – New name of the workflow
- **annotation** (*str*) – New annotation for the workflow
- **menu_entry** (*bool*) – Whether the workflow should appear in the user’s menu
- **tags** (*list of str*) – Replace workflow tags with the given list
- **published** (*bool*) – Whether the workflow should be published or unpublished

**Return type**
dict

**Returns**
Dictionary representing the updated workflow

### 5.1.2 Object-oriented Galaxy API

**class** bioblend.galaxy.objects.galaxy_instance.GalaxyInstance(*url*, *api_key=None*, *email=None*, *
*password=None*, *verify=True*)

A representation of an instance of Galaxy, identified by a URL and a user’s API key.

**Parameters**
- **url** (*str*) – a FQDN or IP for a given instance of Galaxy. For example: http://127.0.0.1:8080
- **api_key** (*str*) – user’s API key for the given instance of Galaxy, obtained from the Galaxy web UI.

5.1. Galaxy API
This is actually a factory class which instantiates the entity-specific clients.

Example: get a list of all histories for a user with API key ‘foo’:

```python
from bioblend.galaxy.objects import *
gi = GalaxyInstance('http://127.0.0.1:8080', 'foo')
histories = gi.histories.list()
```

### Client

Clients for interacting with specific Galaxy entity types.

Classes in this module should not be instantiated directly, but used via their handles in `GalaxyInstance`.

```python
class bioblend.galaxy.objects.client.ObjClient(obj_gi)
```

#### Abstract Methods

- **abstract get(id_) → bioblend.galaxy.objects.wrappersWrapper**
  
  Retrieve the object corresponding to the given id.

- **abstract get_previews() → list**
  
  Get a list of object previews.

  Previews entity summaries provided by REST collection URIs, e.g. http://host:port/api/libraries. Being the most lightweight objects associated to the various entities, these are the ones that should be used to retrieve their basic info.

  **Return type** list

  **Returns** a list of object previews

- **abstract list() → list**
  
  Get a list of objects.

  This method first gets the entity summaries, then gets the complete description for each entity with an additional GET call, so may be slow.

  **Return type** list

  **Returns** a list of objects

#### bioblend.galaxy.objects.client.ObjDatasetContainerClient(obj_gi)

#### bioblend.galaxy.objects.client.ObjHistoryClient(obj_gi)

Interacts with Galaxy histories.

- **create(name=None)**
  
  Create a new Galaxy history, optionally setting its name.

  **Return type** History

  **Returns** the history just created

- **delete(id_=None, name=None, purge=False)**
  
  Delete the history with the given id or name.

  Note that the same name can map to multiple histories.

  **Parameters** purge (bool) – if True, also purge (permanently delete) the history

  **Note:** For the purge option to work, the Galaxy instance must have the allow_user_dataset_purge option set to true in the config/galaxy.yml configuration file.
get(id_)
    Retrieve the history corresponding to the given id.

    Return type  History
    Returns  the history corresponding to id_

get_previews(name=None, deleted=False)
    Get a list of object previews.
    Previews entity summaries provided by REST collection URIs, e.g. http://host:port/api/libraries. Being the most lightweight objects associated to the various entities, these are the ones that should be used to retrieve their basic info.

    Return type  list
    Returns  a list of object previews

list(name=None, deleted=False)
    Get histories owned by the user of this Galaxy instance.

    Parameters
    •  name (str) – return only histories with this name
    •  deleted (bool) – if True, return histories that have been deleted

    Return type  list of History

class bioblend.galaxy.objects.client.ObjInvocationClient(obj_gi)
    Interacts with Galaxy Invocations.

    get(id_) → bioblend.galaxy.objects.wrappers.Invocation
        Get an invocation by ID.

        Return type  Invocation
        Param  invocation object

    get_previews() → List[bioblend.galaxy.objects.wrappers.InvocationPreview]
        Get previews of all invocations.

        Return type  list of InvocationPreview
        Param  previews of invocations

    list(workflow=None, history=None, include_terminal=True, limit=None) →
        List[bioblend.galaxy.objects.wrappers.Invocation]
        Get full listing of workflow invocations, or select a subset by specifying optional arguments for filtering (e.g. a workflow).

        Parameters
        •  workflow (wrappers.Workflow) – Include only invocations associated with this workflow
        •  history (str) – Include only invocations associated with this history
        •  include_terminal – bool
        •  limit (int) – Maximum number of invocations to return - if specified, the most recent invocations will be returned.

        Param  Whether to include invocations in terminal states
        Return type  list of Invocation
BioBlend Documentation, Release 0.15.0

Param invocation objects

class bioblend.galaxy.objects.client.ObjJobClient(obj_gi)
Interacts with Galaxy jobs.

get(id_, full_details=False)
Retrieve the job corresponding to the given id.

Parameters full_details (bool) – if True, return the complete list of details for the given job.

Return type Job

Returns the job corresponding to id_

get_previews()
Get a list of object previews.

Previews entity summaries provided by REST collection URIs, e.g. http://host:port/api/libraries. Being the most lightweight objects associated to the various entities, these are the ones that should be used to retrieve their basic info.

Return type list

Returns a list of object previews

list()
Get the list of jobs of the current user.

Return type list of Job

class bioblend.galaxy.objects.client.ObjLibraryClient(obj_gi)
Interacts with Galaxy libraries.

create(name, description=None, synopsis=None)
Create a data library with the properties defined in the arguments.

Return type Library

Returns the library just created

delete(id_=None, name=None)
Delete the library with the given id or name.

Note that the same name can map to multiple libraries.

Warning: Deleting a data library is irreversible - all of the data from the library will be permanently deleted.

get(id_)
Retrieve the data library corresponding to the given id.

Return type Library

Returns the library corresponding to id_

get_previews(name=None, deleted=False)
Get a list of object previews.

Previews entity summaries provided by REST collection URIs, e.g. http://host:port/api/libraries. Being the most lightweight objects associated to the various entities, these are the ones that should be used to retrieve their basic info.

Return type list

Chapter 5. API Documentation
Returns a list of object previews

$\text{list}(\text{name} = \text{None}, \text{deleted} = \text{False})$

Get libraries owned by the user of this Galaxy instance.

Parameters

- $\text{name} (\text{str})$ – return only libraries with this name
- $\text{deleted} (\text{bool})$ – if True, return libraries that have been deleted

Return type list of Library

class bioblend.galaxy.objects.client.ObjToolClient(obj_gi)

Interacts with Galaxy tools.

$\text{get}(\text{id}_, \text{io_details}=\text{False}, \text{link_details}=\text{False})$

Retrieve the tool corresponding to the given id.

Parameters

- $\text{io_details} (\text{bool})$ – if True, get also input and output details
- $\text{link_details} (\text{bool})$ – if True, get also link details

Return type Tool

Returns the tool corresponding to $\text{id}_$

$\text{get_previews}(\text{name} = \text{None}, \text{trackster}=\text{None})$

Get the list of tools installed on the Galaxy instance.

Parameters

- $\text{name} (\text{str})$ – return only tools with this name
- $\text{trackster} (\text{bool})$ – if True, only tools that are compatible with Trackster are returned

Return type list of Tool

$\text{list}(\text{name} = \text{None}, \text{trackster}=\text{None})$

Get the list of tools installed on the Galaxy instance.

Parameters

- $\text{name} (\text{str})$ – return only tools with this name
- $\text{trackster} (\text{bool})$ – if True, only tools that are compatible with Trackster are returned

Return type list of Tool

class bioblend.galaxy.objects.client.ObjWorkflowClient(obj_gi)

Interacts with Galaxy workflows.

$\text{delete}(\text{id}_=\text{None}, \text{name}=\text{None})$

Delete the workflow with the given id or name.

Note that the same name can map to multiple workflows.

Warning: Deleting a workflow is irreversible - all of the data from the workflow will be permanently deleted.

$\text{get}(\text{id}_)$

Retrieve the workflow corresponding to the given id.

Return type Workflow
Returns the workflow corresponding to id_

get_previews(name=None, published=False)
Get a list of object previews.
Previews entity summaries provided by REST collection URIs, e.g. `http://host:port/api/libraries`. Being the most lightweight objects associated to the various entities, these are the ones that should be used to retrieve their basic info.

Return type list
Returns a list of object previews

import_new(src, publish=False)
Imports a new workflow into Galaxy.

Parameters

- **src**(dict or str) – deserialized (dictionary) or serialized (str) JSON dump of the workflow (this is normally obtained by exporting a workflow from Galaxy).
- **publish**(bool) – if True the uploaded workflow will be published; otherwise it will be visible only by the user which uploads it (default).

Return type Workflow
Returns the workflow just imported

import_shared(id_)
Imports a shared workflow to the user’s space.

Parameters id(str) – workflow id

Return type Workflow
Returns the workflow just imported

list(name=None, published=False)
Get workflows owned by the user of this Galaxy instance.

Parameters

- **name**(str) – return only workflows with this name
- **published**(bool) – if True, return also published workflows

Return type list of Workflow

Wrappers

A basic object-oriented interface for Galaxy entities.

class bioblend.galaxy.objects.wrappers.Dataset(*args, **kwargs)
Abstract base class for Galaxy datasets.

Parameters

- **wrapped**(dict) – JSON-serializable dictionary
- **parent**(Wrapper) – the parent of this wrapper
- **gi**(GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'data_type', 'file_ext', 'file_name', 'file_size', 'genome_build', 'misc_info', 'name', 'state')
POLLING_INTERVAL = 1

download(file_object, chunk_size=4096)
Open dataset for reading and save its contents to file_object.

Parameters file_object (file) – output file object

See get_stream() for info on other params.

get_contents(chunk_size=4096)
Open dataset for reading and return its full contents.

See get_stream() for param info.

get_stream(chunk_size=4096)
Open dataset for reading and return an iterator over its contents.

Parameters chunk_size (int) – read this amount of bytes at a time

peek(chunk_size=4096)
Open dataset for reading and return the first chunk.

See get_stream() for param info.

refresh()
Re-fetch the attributes pertaining to this object.

Returns: self

wait(polling_interval=1, break_on_error=True)
Wait for this dataset to come out of the pending states.

Parameters

- polling_interval (float) – polling interval in seconds
- break_on_error (bool) – if True, raise a RuntimeError exception if the dataset ends in the ‘error’ state.

Warning: This is a blocking operation that can take a very long time. Also, note that this method does not return anything; however, this dataset is refreshed (possibly multiple times) during the execution.

class bioblend.galaxy.objects.wrappers.DatasetCollection(*args, **kwargs)
Abstract base class for Galaxy dataset collections.

Parameters

- wrapped (dict) – JSON-serializable dictionary
- parent (Wrapper) – the parent of this wrapper
- gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'collection_type', 'deleted', 'name', 'state')

abstract delete()

refresh()

Re-fetch the attributes pertaining to this object.

Returns: self

class bioblend.galaxy.objects.wrappers.DatasetContainer(*args, **kwargs)
Abstract base class for dataset containers (histories and libraries).
Parameters `content_infos` (list of `ContentInfo`) – info objects for the container’s contents

abstract property `API_MODULE`  

`BASE_ATTRS: Tuple[str, ...] = ('id', 'deleted', 'name')`

property `dataset_ids`

Return the ids of the contained datasets.

`get_dataset(ds_id)`

Retrieve the dataset corresponding to the given id.

Parameters `ds_id` (str) – dataset id  

Return type `HistoryDatasetAssociation` or `LibraryDataset`  

Returns the dataset corresponding to `ds_id`

`get_datasets(name=None)`

Get all datasets contained inside this dataset container.

Parameters `name` (str) – return only datasets with this name  

Return type list of `HistoryDatasetAssociation` or list of `LibraryDataset`

Returns datasets with the given name contained inside this container

Note: when filtering library datasets by name, specify their full paths starting from the library’s root folder, e.g., `/seqdata/reads.fastq`. Full paths are available through the `content_infos` attribute of `Library` objects.

`preview()``

`refresh()`  

Re-fetch the attributes pertaining to this object.  

Returns: self

`class bioblend.galaxy.objects.wrappers.Folder(*args, **kwargs)`

Maps to a folder in a Galaxy library.

Parameters

- `wrapped` (dict) – JSON-serializable dictionary  
- `parent` (`Wrapper`) – the parent of this wrapper  
- `gi` (`GalaxyInstance`) – the GalaxyInstance through which we can access this wrapper

`BASE_ATTRS: Tuple[str, ...] = ('id', 'deleted', 'description', 'item_count', 'name')`

property `parent`

The parent folder of this folder. The parent of the root folder is `None`.

Return type `Folder`  

Returns the parent of this folder

`refresh()`  

Re-fetch the attributes pertaining to this object.  

Returns: self

`class bioblend.galaxy.objects.wrappers.History(*args, **kwargs)`

Maps to a Galaxy history.
Parameters `content_infos` (list of `ContentInfo`) – info objects for the container’s contents

```
API_MODULE = 'histories'
```

```
BASE_ATTRS: Tuple[str, ...] = ('id', 'deleted', 'name', 'annotation', 'published', 'state', 'state_ids', 'state_details', 'tags')
```

```
CONTENT_INFO_TYPE
    alias of bioblend.galaxy.objects.wrappers.HistoryContentInfo

DSC_TYPE
    alias of bioblend.galaxy.objects.wrappers.HistoryDatasetCollectionAssociation

DS_TYPE
    alias of bioblend.galaxy.objects.wrappers.HistoryDatasetAssociation
```

```
create_dataset_collection(collection_description)
    Create a new dataset collection in the history by providing a collection description.
    
    Parameters  
    collection_description (bioblend.galaxy.dataset_collections.
        CollectionDescription) – a description of the dataset collection
    
    Return type  
    HistoryDatasetCollectionAssociation

    Returns  
    the new dataset collection
```

delete(purge=False)
    Delete this history.

    Parameters  
    purge (bool) – if True, also purge (permanently delete) the history
```

```
Note:  
For the purge option to work, the Galaxy instance must have the allow_user_dataset_purge option set to true in the config/galaxy.yml configuration file.
```

download(jeha_id, outf, chunk_size=4096)
    Download an export archive for this history. Use `export()` to create an export and get the required jeha_id. See `download_history()` for parameter and return value info.

```
export(gzip=True, include_hidden=False, include_deleted=False, wait=False, maxwait=None)
    Start a job to create an export archive for this history. See `export_history()` for parameter and return value info.
```

def get_dataset_collection(dsc_id)
    Retrieve the dataset collection corresponding to the given id.

    Parameters  
    dsc_id (str) – dataset collection id
    
    Return type  
    HistoryDatasetCollectionAssociation

    Returns  
    the dataset collection corresponding to dsc_id
```

```
import_dataset(lds)
    Import a dataset into the history from a library.

    Parameters  
    lds (LibraryDataset) – the library dataset to import
    
    Return type  
    HistoryDatasetAssociation

    Returns  
    the imported history dataset
```

```
paste_content(content, **kwargs)
    Upload a string to a new dataset in this history.

    Parameters  
    content (str) – content of the new dataset to upload
```

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See `upload_file()` for the optional parameters (except file_name).

**Return type** `HistoryDatasetAssociation`

**Returns** the uploaded dataset

`update(**kwds)`
Update history metadata information. Some of the attributes that can be modified are documented below.

**Parameters**
- `name (str)` – Replace history name with the given string
- `annotation (str)` – Replace history annotation with the given string
- `deleted (bool)` – Mark or unmark history as deleted
- `purged (bool)` – If True, mark history as purged (permanently deleted).
- `published (bool)` – Mark or unmark history as published
- `importable (bool)` – Mark or unmark history as importable
- `tags (list)` – Replace history tags with the given list

`upload_dataset(path, **kwargs)`
Upload the file specified by `path` to this history.

**Parameters**
- `path (str)` – path of the file to upload

See `upload_file()` for the optional parameters.

**Return type** `HistoryDatasetAssociation`

**Returns** the uploaded dataset

`upload_file(path, **kwargs)`
Upload the file specified by `path` to this history.

**Parameters**
- `path (str)` – path of the file to upload

See `upload_file()` for the optional parameters.

**Return type** `HistoryDatasetAssociation`

**Returns** the uploaded dataset

`upload_from_ftp(path, **kwargs)`
Upload the file specified by `path` from the user’s FTP directory to this history.

**Parameters**
- `path (str)` – path of the file in the user’s FTP directory

See `upload_file()` for the optional parameters.

**Return type** `HistoryDatasetAssociation`

**Returns** the uploaded dataset

```python
class bioblend.galaxy.objects.wrappers.HistoryContentInfo(*args, **kwargs)

Instances of this class wrap dictionaries obtained by getting /api/histories/<ID>/contents from Galaxy.

**Parameters**
- `wrapped (dict)` – JSON-serializable dictionary
- `parent (Wrapper)` – the parent of this wrapper
- `gi (GalaxyInstance)` – the GalaxyInstance through which we can access this wrapper
```

```python
BASE_ATTRS: Tuple[str, ...] = ('id', 'name', 'type', 'deleted', 'state', 'visible')
```
class bioblend.galaxy.objects.wrappers.HistoryDatasetAssociation(*args, **kwargs)
Maps to a Galaxy HistoryDatasetAssociation.

Parameters

• wrapped (dict) – JSON-serializable dictionary
• parent (Wrapper) – the parent of this wrapper
• gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'data_type', 'file_ext', 'file_name', 'file_size', 'genome_build', 'misc_info', 'name', 'state', 'annotation', 'deleted', 'purged', 'tags', 'visible')

SRC = 'hda'
delete(purge=False)
Delete this history dataset.

Parameters purge (bool) – if True, also purge (permanently delete) the dataset

Note: For the purge option to work, the Galaxy instance must have the allow_user_dataset_purge option set to true in the config/galaxy.yml configuration file.

update(**kwds)
Update this history dataset metadata. Some of the attributes that can be modified are documented below.

Parameters

• name (str) – Replace history dataset name with the given string
• genome_build (str) – Replace history dataset genome build (dbkey)
• annotation (str) – Replace history dataset annotation with given string
• deleted (bool) – Mark or unmark history dataset as deleted
• visible (bool) – Mark or unmark history dataset as visible

class bioblend.galaxy.objects.wrappers.HistoryDatasetCollectionAssociation(*args, **kwargs)
Maps to a Galaxy HistoryDatasetCollectionAssociation.

Parameters

• wrapped (dict) – JSON-serializable dictionary
• parent (Wrapper) – the parent of this wrapper
• gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'collection_type', 'deleted', 'name', 'state', 'tags', 'visible', 'elements')

SRC = 'hdca'
delete()
Delete this dataset collection.

class bioblend.galaxy.objects.wrappers.HistoryPreview(*args, **kwargs)
Models Galaxy history 'previews'.

Instances of this class wrap dictionaries obtained by getting /api/histories from Galaxy.

Parameters
• **wrapped** (*dict*) – JSON-serializable dictionary
• **parent** (*Wrapper*) – the parent of this wrapper
• **gi** (*GalaxyInstance*) – the GalaxyInstance through which we can access this wrapper

**BASE_ATTRS**: `Tuple[str, ...] = ('id', 'deleted', 'name', 'annotation', 'published', 'purged', 'tags')`

```python
class bioblend.galaxy.objects.wrappers.Job(*args, **kwargs)
Maps to a Galaxy job.

Parameters

• **wrapped** (*dict*) – JSON-serializable dictionary
• **parent** (*Wrapper*) – the parent of this wrapper
• **gi** (*GalaxyInstance*) – the GalaxyInstance through which we can access this wrapper

**BASE_ATTRS**: `Tuple[str, ...] = ('id', 'state')`
```

```python
class bioblend.galaxy.objects.wrappers.Library(*args, **kwargs)
Maps to a Galaxy library.

Parameters

• **content_infos** (list of `ContentInfo`) – info objects for the container’s contents

**API_MODULE** = 'libraries'

**BASE_ATTRS**: `Tuple[str, ...] = ('id', 'deleted', 'name', 'description', 'synopsis')`

**CONTENT_INFO_TYPE**

alias of `bioblend.galaxy.objects.wrappers.LibraryContentInfo`

**DS_TYPE**

alias of `bioblend.galaxy.objects.wrappers.LibraryDataset`

```python
@copy_from_dataset(hda, folder=None, message='"
Copy a history dataset into this library.

Parameters

• **hda** (*HistoryDatasetAssociation*) – history dataset to copy into the library

See `upload_data()` for info on other params.
```

```python
@create_folder(name, description=None, base_folder=None)
Create a folder in this library.

Parameters

• **name** (*str*) – folder name
• **description** (*str*) – optional folder description
• **base_folder** (*Folder*) – parent folder, or **None** to create in the root folder

Return type **Folder**

Returns the folder just created
```

```python
@delete()
Delete this library.
```

```python
@property
@folder_ids
Return the ids of the contained folders.
```

```python
@get_folder(f_id)
Retrieve the folder corresponding to the given id.
```
Return type: **Folder**

Returns: the folder corresponding to `f_id`

**property root_folder**

The root folder of this library.

Return type: **Folder**

Returns: the root folder of this library

**upload_data(data, folder=None, **kwargs)**

Upload data to this library.

Parameters

- **data** *(str)* – dataset contents
- **folder** *(Folder)* – a folder object, or `None` to upload to the root folder

Return type: **LibraryDataset**

Returns: the dataset object that represents the uploaded content

Optional keyword arguments: `file_type`, `dbkey`.

**upload_from_galaxy_fs(paths, folder=None, link_data_only=None, **kwargs)**

Upload data to this library from filesystem paths on the server.

Note: For this method to work, the Galaxy instance must have the `allow_path_paste` option set to `true` in the `config/galaxy.yml` configuration file.

Parameters

- **paths** *(str or Iterable of str)* – server-side file paths from which data should be read
- **link_data_only** *(str)* – either ‘copy_files’ (default) or ‘link_to_files’. Setting to ‘link_to_files’ symlinks instead of copying the files

Return type: list of **LibraryDataset**

Returns: the dataset objects that represent the uploaded content

See `upload_data()` for info on other params.

**upload_from_local(path, folder=None, **kwargs)**

Upload data to this library from a local file.

Parameters **path** *(str)* – local file path from which data should be read

See `upload_data()` for info on other params.

**upload_from_url(url, folder=None, **kwargs)**

Upload data to this library from the given URL.

Parameters **url** *(str)* – URL from which data should be read

See `upload_data()` for info on other params.

**class bioblend.galaxy.objects.wrappers.LibraryContentInfo(*args, **kwargs)**

Instances of this class wrap dictionaries obtained by getting `/api/libraries/<ID>/contents` from Galaxy.

Parameters

- **wrapped** *(dict)* – JSON-serializable dictionary
**class** bioblend.galaxy.objects.wrappers.LibraryDataset(*args, **kwargs)
Maps to a Galaxy LibraryDataset.

**Parameters**

- **wrapped** *(dict)* – JSON-serializable dictionary
- **parent** *(Wrapper)* – the parent of this wrapper
- **gi** *(GalaxyInstance)* – the GalaxyInstance through which we can access this wrapper

**SRC** = 'ld'

**delete(purged=False)**
Delete this library dataset.

**Parameters**

- **purged** *(bool)* – if True, also purge (permanently delete) the dataset

**update(****kwds**)
Update this library dataset metadata. Some of the attributes that can be modified are documented below.

**Parameters**

- **name** *(str)* – Replace history dataset name with the given string
- **genome_build** *(str)* – Replace history dataset genome build (dbkey)

**class** bioblend.galaxy.objects.wrappers.LibraryDatasetDatasetAssociation(*args, **kwargs)
Maps to a Galaxy LibraryDatasetDatasetAssociation.

**Parameters**

- **wrapped** *(dict)* – JSON-serializable dictionary
- **parent** *(Wrapper)* – the parent of this wrapper
- **gi** *(GalaxyInstance)* – the GalaxyInstance through which we can access this wrapper

**BASE_ATTRS**: Tuple[str, ...] = ('id', 'data_type', 'file_ext', 'file_name', 'file_size', 'genome_build', 'misc_info', 'name', 'state', 'deleted')

**SRC** = 'ldda'

**class** bioblend.galaxy.objects.wrappers.LibraryPreview(*args, **kwargs)
Models Galaxy library 'previews'.

**Parameters**

- **wrapped** *(dict)* – JSON-serializable dictionary
- **parent** *(Wrapper)* – the parent of this wrapper
- **gi** *(GalaxyInstance)* – the GalaxyInstance through which we can access this wrapper

**class** bioblend.galaxy.objects.wrappers.Step(*args, **kwargs)
Workflow step.

Steps are the main building blocks of a Galaxy workflow. A step can be: an input (type data_collection_input, data_input or parameter_input), a computational tool (type tool), a subwork-
flow (type subworkflow) or a pause (type pause).

**Parameters**
• wrapped (dict) – JSON-serializable dictionary
• parent (Wrapper) – the parent of this wrapper
• gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'input_steps', 'name', 'tool_id',
'tool_inputs', 'tool_version', 'type')

class bioblend.galaxy.objects.wrappers.Tool(*args, **kwargs)
Maps to a Galaxy tool.

Parameters

• wrapped (dict) – JSON-serializable dictionary
• parent (Wrapper) – the parent of this wrapper
• gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'name', 'version')

POLLING_INTERVAL = 10

run(inputs, history, wait=False, polling_interval=10)
Execute this tool in the given history with inputs from dict inputs.

Parameters

• inputs (dict) – dictionary of input datasets and parameters for the tool (see below)
• history (History) – the history where to execute the tool
• wait (bool) – whether to wait while the returned datasets are in a pending state
• polling_interval (float) – polling interval in seconds

Return type list of HistoryDatasetAssociation

Returns list of output datasets

The inputs dict should contain input datasets and parameters in the (largely undocumented) format used by the Galaxy API. Some examples can be found in Galaxy’s API test suite. The value of an input dataset can also be a Dataset object, which will be automatically converted to the needed format.

class bioblend.galaxy.objects.wrappers.Workflow(*args, **kwargs)
Workflows represent ordered sequences of computations on Galaxy.

A workflow defines a sequence of steps that produce one or more results from an input dataset.

Parameters

• wrapped (dict) – JSON-serializable dictionary
• parent (Wrapper) – the parent of this wrapper
• gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'deleted', 'inputs', 'latest_workflow_uuid',
'name', 'owner', 'published', 'steps', 'tags')

POLLING_INTERVAL = 10

convert_input_map(input_map)
Convert input_map to the format required by the Galaxy web API.

Parameters input_map (dict) – a mapping from input labels to datasets

Return type dict

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Returns a mapping from input slot ids to dataset ids in the format required by the Galaxy web API.

**property data_collection_input_ids**
Return the ids of data collection input steps for this workflow.

**property data_input_ids**
Return the ids of data input steps for this workflow.

**delete()**
Delete this workflow.

**Warning:** Deleting a workflow is irreversible - all of the data from the workflow will be permanently deleted.

**export()**
Export a re-importable representation of the workflow.

**Return type** dict
**Returns** a JSON-serializable dump of the workflow

**property input_labels**
Return the labels of this workflow’s input steps.

**invoke(inputs=None, params=None, history=None, import_inputs_to_history=None, replacement_params=None, allow_tool_state_corrections=True, inputs_by=None, parameters_normalized=False)**
Invoke the workflow. This will cause a workflow to be scheduled and return an object describing the workflow invocation.

**Parameters**

- **inputs (dict)** – A mapping of workflow inputs to datasets and dataset collections. The datasets source can be a LibraryDatasetDatasetAssociation (1dda), LibraryDataset (1d), HistoryDatasetAssociation (hda), or HistoryDatasetCollectionAssociation (hdca).

  The map must be in the following format: {'<input_index>': {'id': <encoded dataset ID>, 'src': '1dda, 1d, hda, hdca'}} (e.g. {'2': {'id': '29beef4fadeed09f', 'src': 'hda'}})

  This map may also be indexed by the UUIDs of the workflow steps, as indicated by the uuid property of steps returned from the Galaxy API. Alternatively workflow steps may be addressed by the label that can be set in the workflow editor. If using uuid or label you need to also set the inputs_by parameter to step_uuid or name.

- **params (dict)** – A mapping of non-datasets tool parameters (see below)

- **history (str)** – The history in which to store the workflow output.

- **import_inputs_to_history (bool)** – If True, used workflow inputs will be imported into the history. If False, only workflow outputs will be visible in the given history.

- **allow_tool_state_corrections (bool)** – If True, allow Galaxy to fill in missing tool state when running workflows. This may be useful for workflows using tools that have changed over time or for workflows built outside of Galaxy with only a subset of inputs defined.

- **replacement_params (dict)** – pattern-based replacements for post-job actions (see below)
• **inputs_by** *(str)* – Determines how inputs are referenced. Can be “step_index|step_uuid” (default), “step_index”, “step_id”, “step_uuid”, or “name”.

• **parameters_normalized** *(bool)* – Whether Galaxy should normalize params to ensure everything is referenced by a numeric step ID. Default is False, but when setting params for a subworkflow, True is required.

**Return type** Invocation

**Returns** the workflow invocation

The params dict should be specified as follows:

```
{STEP_ID: PARAM_DICT, ...}
```

where PARAM_DICT is:

```
{PARAM_NAME: VALUE, ...}
```

For backwards compatibility, the following (deprecated) format is also supported for params:

```
{TOOL_ID: PARAM_DICT, ...}
```

in which case PARAM_DICT affects all steps with the given tool id. If both by-tool-id and by-step-id specifications are used, the latter takes precedence.

Finally (again, for backwards compatibility), PARAM_DICT can also be specified as:

```
{param: PARAM_NAME, 'value': VALUE}
```

Note that this format allows only one parameter to be set per step.

For a repeat parameter, the names of the contained parameters needs to be specified as `<repeat name>_|<repeat index>_|<param name>`, with the repeat index starting at 0. For example, if the tool XML contains:

```xml
<repeat name="cutoff" title="Parameters used to filter cells" min="1">
  <param name="name" type="text" value="n_genes" label="Name of param...">
    <option value="n_genes">n_genes</option>
    <option value="n_counts">n_counts</option>
  </param>
  <param name="min" type="float" min="0" value="0" label="Min value"/>
</repeat>
```

then the PARAM_DICT should be something like:

```
{
  "cutoff_0|name": "n_genes",
  "cutoff_0|min": "2",
  "cutoff_1|name": "n_counts",
  "cutoff_1|min": "4",
  ...
}
```

At the time of this writing, it is not possible to change the number of times the contained parameters are repeated. Therefore, the parameter indexes can go from 0 to n-1, where n is the number of times the repeated element was added when the workflow was saved in the Galaxy UI.

The replacement_params dict should map parameter names in post-job actions (PJAs) to their runtime values. For instance, if the final step has a PJA like the following:

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then the following renames the output dataset to ‘foo’:

```python
textPreferredCopy
replacement_params = {'output': 'foo'}
```

see also this email thread.

**Warning:** Historically, the run_workflow method consumed a dataset_map data structure that was indexed by unencoded workflow step IDs. These IDs would not be stable across Galaxy instances. The new inputs property is instead indexed by either the order_index property (which is stable across workflow imports) or the step UUID which is also stable.

**property is_runnable**

Return True if the workflow can be run on Galaxy.

A workflow is considered runnable on a Galaxy instance if all of the tools it uses are installed in that instance.

**property parameter_input_ids**

Return the ids of parameter input steps for this workflow.

**preview()**

```python
dict(zip(workflow.input_labels, library.get_datasets()))
```

**wait (bool)** – whether to wait while the returned datasets are in a pending state

**polling_interval (float)** – polling interval in seconds

**break_on_error (bool)** – whether to break as soon as at least one of the returned datasets is in the ‘error’ state

**Returns**

list of output datasets, output history

The params dict should be specified as follows:
where PARAM_DICT is:

```python
{PARAM_NAME: VALUE, ...}
```

For backwards compatibility, the following (deprecated) format is also supported for params:

```python
{TOOL_ID: PARAM_DICT, ...}
```

in which case PARAM_DICT affects all steps with the given tool id. If both by-tool-id and by-step-id specifications are used, the latter takes precedence.

Finally (again, for backwards compatibility), PARAM_DICT can also be specified as:

```python
{'param': PARAM_NAME, 'value': VALUE}
```

Note that this format allows only one parameter to be set per step.

Example: set ‘a’ to 1 for the third workflow step:

```python
params = {workflow.steps[2].id: {'a': 1}}
```

**Warning:** This is a blocking operation that can take a very long time. If `wait` is set to `False`, the method will return as soon as the workflow has been *scheduled*, otherwise it will wait until the workflow has been *run*. With a large number of steps, however, the delay may not be negligible even in the former case (e.g. minutes for 100 steps).

sorted_step_ids()  
Return a topological sort of the workflow’s DAG.

**property tool_ids**  
Return the ids of tool steps for this workflow.

```python
class bioblend.galaxy.objects.wrappers.WorkflowPreview(*args, **kwargs)
Models Galaxy workflow ‘previews’.

Instances of this class wrap dictionaries obtained by getting /api/workflows from Galaxy.

Parameters
- `wrapped` (dict) – JSON-serializable dictionary
- `parent` (#Wrapper) – the parent of this wrapper
- `gi` (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id', 'deleted', 'latest_workflow_uuid', 'name', 'number_of_steps', 'owner', 'published', 'show_in_tool_panel', 'tags')
```

```python
class bioblend.galaxy.objects.wrappers_WRAPPER(*args, **kwargs)
Abstract base class for Galaxy entity wrappers.

Wrapper instances wrap deserialized JSON dictionaries such as the ones obtained by the Galaxy web API, converting key-based access to attribute-based access (e.g., library['name'] -> library.name).

Dict keys that are converted to attributes are listed in the BASE_ATTRS class variable: this is the ‘stable’ interface. Note that the wrapped dictionary is accessible via the `wrapped` attribute.

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Parameters

- wrapped (dict) – JSON-serializable dictionary
- parent (Wrapper) – the parent of this wrapper
- gi (GalaxyInstance) – the GalaxyInstance through which we can access this wrapper

BASE_ATTRS: Tuple[str, ...] = ('id',)

clone()

Return an independent copy of this wrapper.

classmethod from_json(jdef)

Build a new wrapper from a JSON dump.

property is_mapped

True if this wrapper is mapped to an actual Galaxy entity.

property parent

The parent of this wrapper.

to_json()

Return a JSON dump of this wrapper.

touch()

Mark this wrapper as having been modified since its creation.

unmap()

Disconnect this wrapper from Galaxy.

5.1.3 Usage documentation

This page describes some sample use cases for the Galaxy API and provides examples for these API calls. In addition to this page, there are functional examples of complete scripts in the docs/examples directory of the BioBlend source code repository.

Connect to a Galaxy server

To connect to a running Galaxy server, you will need an account on that Galaxy instance and an API key for the account. Instructions on getting an API key can be found at https://galaxyproject.org/develop/api/.

To open a connection call:

```python
from bioblend.galaxy import GalaxyInstance

gi = GalaxyInstance(url='http://example.galaxy.url', key='your-API-key')
```

We now have a GalaxyInstance object which allows us to interact with the Galaxy server under our account, and access our data. If the account is a Galaxy admin account we also will be able to use this connection to carry out admin actions.
## View Histories and Datasets

Methods for accessing histories and datasets are grouped under `GalaxyInstance.histories.*` and `GalaxyInstance.datasets.*` respectively.

To get information on the Histories currently in your account, call:

```python
>>> gi.histories.get_histories()
[{'id': 'f3c2b0f3ecac9f02',
   'name': 'RNAseq_DGE_BASIC_PreP',
   'url': '/api/histories/f3c2b0f3ecac9f02'},
  {'id': '8a91dcf1866a80c2',
   'name': 'June demo',
   'url': '/api/histories/8a91dcf1866a80c2'}]
```

This returns a list of dictionaries containing basic metadata, including the id and name of each History. In this case, we have two existing Histories in our account, 'RNAseq_DGE_BASIC_PreP' and 'June demo'. To get more detailed information about a History we can pass its id to the `show_history` method:

```python
>>> gi.histories.show_history('f3c2b0f3ecac9f02', contents=False)
{'annotation': '',
 'contents_url': '/api/histories/f3c2b0f3ecac9f02/contents',
 'id': 'f3c2b0f3ecac9f02',
 'name': 'RNAseq_DGE_BASIC_PreP',
 'nice_size': '93.5 MB',
 'state': 'ok',
 'state_details': {'discarded': 0,
   'empty': 0,
   'error': 0,
   'failed_metadata': 0,
   'new': 0,
   'ok': 7,
   'paused': 0,
   'queued': 0,
   'running': 0,
   'setting_metadata': 0,
   'upload': 0},
 'state_ids': {'discarded': [],
   'empty': [],
   'error': [],
   'failed_metadata': [],
   'new': [],
   'ok': ['d6842fb08a76e351',
   '10a4b652da44e82a',
   '81c601a2549966a0',
   'a154f05e3bcee26b',
   '1352fe19ddce0400',
   '06d549c52d753e53',
   '9ec54455d6279cc7'],
   'paused': [],
   'queued': [],
   'running': [],
   'setting_metadata': [],
   'upload': []}}
```
This gives us a dictionary containing the History’s metadata. With contents=False (the default), we only get a list of ids of the datasets contained within the History; with contents=True we would get metadata on each dataset. We can also directly access more detailed information on a particular dataset by passing its id to the show_dataset method:

```python
>>> gi.datasets.show_dataset('10a4b652da44e82a')
{'data_type': 'fastqsanger',
 'deleted': False,
 'file_size': 16527060,
 'genome_build': 'dm3',
 'id': 17499,
 'metadata_data_lines': None,
 'metadata_dbkey': 'dm3',
 'metadata_sequences': None,
 'misc_blurb': '15.8 MB',
 'misc_info': 'None uploaded fastqsanger file',
 'model_class': 'HistoryDatasetAssociation',
 'name': 'C1_R2_1.chr4.fq',
 'purged': False,
 'state': 'ok',
 'visible': True}
```

### Uploading Datasets to a History

To upload a local file to a Galaxy server, you can run the `upload_file` method, supplying the path to a local file:

```python
>>> gi.tools.upload_file('test.txt', 'f3c2b0f3ecac9f02')
{'implicit_collections': [],
 'jobs': [{
 'create_time': '2015-07-28T17:52:39.756488',
 'exit_code': None,
 'id': '9752b387803d3e1e',
 'model_class': 'Job',
 'state': 'new',
 'tool_id': 'upload1',
 'update_time': '2015-07-28T17:52:39.987509'}],
 'output_collections': [],
 'outputs': [{
 'create_time': '2015-07-28T17:52:39.331176',
 'data_type': 'galaxy.datatypes.data.Text',
 'deleted': False,
 'file_ext': 'auto',
 'file_size': 0,
 'genome_build': '?',
 'hda_ldda': 'hda',
 'hid': 16,
 'history_content_type': 'dataset',
 'history_id': 'f3c2b0f3ecac9f02',
 'id': '59c76a119581e190',
 'metadata_data_lines': None,
 'metadata_dbkey': '?',
 'misc_blurb': None,
 'misc_info': None,
 'model_class': 'HistoryDatasetAssociation',
 'name': 'test.txt',
 'state': 'ok',
 'visible': True}
```

(continues on next page)
If files are greater than 2GB in size, they will need to be uploaded via FTP. Importing files from the user’s FTP folder can be done via running the upload tool again:

```python
>>> gi.tools.upload_from_ftp('test.txt', 'f3c2b0f3ecac9f02')
{'implicit_collections': [],
 'jobs': [{'create_time': '2015-07-28T17:54:43.704394',
          'exit_code': None,
          'id': '82b264d83d11790',
          'model_class': 'Job',
          'state': 'new',
          'tool_id': 'upload1',
          'update_time': '2015-07-28T17:54:43.910958'}],
 'output_collections': [],
 'outputs': [{'create_time': '2015-07-28T17:54:43.209041',
              'data_type': 'galaxy.datatypes.data.Text',
              'deleted': False,
              'file_ext': 'auto',
              'file_size': 0,
              'genome_build': '?',
              'hda_ldda': 'hda',
              'hid': 17,
              'history_content_type': 'dataset',
              'history_id': 'f3c2b0f3ecac9f02',
              'id': 'a676e8f07209a3be',
              'metadata_data_lines': None,
              'metadata_dbkey': '?',
              'misc_blurb': None,
              'misc_info': None,
              'model_class': 'HistoryDatasetAssociation',
              'name': 'test.txt',
              'output_name': 'output0',
              'peek': '<table cellspacing="0" cellpadding="3">
              ,
              'purged': False,
              'state': 'queued',
              'tags': [],
              'update_time': '2015-07-28T17:54:44.07',
              'uuid': '2cbe8f0a-4019-47e4-87e2-005ce35b8449',
              'visible': True}]
```
View Data Libraries

Methods for accessing Data Libraries are grouped under `GalaxyInstance.libraries.*`. Most Data Library methods are available to all users, but as only administrators can create new Data Libraries within Galaxy, the `create_folder` and `create_library` methods can only be called using an API key belonging to an admin account.

We can view the Data Libraries available to our account using:

```python
>>> gi.libraries.get_libraries()
[{
    'id': '8e6f930d00d123ea',
    'name': 'RNA-seq workshop data',
    'url': '/api/libraries/8e6f930d00d123ea'},
   {
    'id': 'f740ab636b360a70',
    'name': '1000 genomes',
    'url': '/api/libraries/f740ab636b360a70'}]
```

This gives a list of metadata dictionaries with basic information on each library. We can get more information on a particular Data Library by passing its id to the `show_library` method:

```python
>>> gi.libraries.show_library('8e6f930d00d123ea')
{'contents_url': '/api/libraries/8e6f930d00d123ea/contents',
 'description': 'RNA-Seq workshop data',
 'name': 'RNA-Seq',
 'synopsis': 'Data for the RNA-Seq tutorial'}
```

Upload files to a Data Library

We can get files into Data Libraries in several ways: by uploading from our local machine, by retrieving from a URL, by passing the new file content directly into the method, or by importing a file from the filesystem on the Galaxy server.

For instance, to upload a file from our machine we might call:

```python
>>> gi.libraries.upload_file_from_local_path('8e6f930d00d123ea', '/local/path/to/mydata.fastq', file_type='fastqsanger')
```

Note that we have provided the id of the destination Data Library, and in this case we have specified the type that Galaxy should assign to the new dataset. The default value for `file_type` is ‘auto’, in which case Galaxy will attempt to guess the dataset type.

View Workflows

Methods for accessing workflows are grouped under `GalaxyInstance.workflows.*`.

To get information on the Workflows currently in your account, use:

```python
>>> gi.workflows.get_workflows()
[{
    'id': 'e8b85ad72aefca86',
    'name': 'TopHat + cufflinks part 1',
    'url': '/api/workflows/e8b85ad72aefca86'},
   {
    'id': 'b0631c44aa74526d',
    'name': 'CuffDiff',
    'url': '/api/workflows/b0631c44aa74526d'}]
```

This returns a list of metadata dictionaries. We can get the details of a particular Workflow, including its steps, by passing its id to the `show_workflow` method:
Export or import a workflow

Workflows can be exported from or imported into Galaxy. This makes it possible to archive workflows, or to move them between Galaxy instances.

To export a workflow, we can call:

```python
>>> workflow_dict = gi.workflows.export_workflow_dict('e8b85ad72aefca86')
```

This gives us a complex dictionary representing the workflow. We can import this dictionary as a new workflow with:

```python
>>> gi.workflows.import_workflow_dict(workflow_dict)
```

This call returns a dictionary containing basic metadata on the new workflow. Since in this case we have imported the dictionary into the original Galaxy instance, we now have a duplicate of the original workflow in our account:

```python
>>> gi.workflows.get_workflows()
[{'id': 'c0bacafdfe211f9a', 'name': 'TopHat + cufflinks part 1 (imported from API)', 'url': '/api/workflows/c0bacafdfe211f9a'},
 {'id': 'e8b85ad72aefca86', 'name': 'TopHat + cufflinks part 1', 'url': '/api/workflows/e8b85ad72aefca86'},
 {'id': 'b0631c44aa74526d', 'name': 'CuffDiff', 'url': '/api/workflows/b0631c44aa74526d'}]
```

Instead of using dictionaries directly, workflows can be exported to or imported from files on the local disk using the `export_workflow_to_local_path` and `import_workflow_from_local_path` methods. See the API reference for details.
Note: If we export a workflow from one Galaxy instance and import it into another, Galaxy will only run it without modification if it has the same versions of the tool wrappers installed. This is to ensure reproducibility. Otherwise, we will need to manually update the workflow to use the new tool versions.

Run a Workflow

To run a Workflow, we need to tell Galaxy which datasets to use for which workflow inputs. We can use datasets from Histories or Data Libraries.

Examine the Workflow above. We can see that it takes only one input file. That is:

```
>>> wf = gi.workflows.show_workflow('e8b85ad72aefca86')
>>> wf['inputs']
{'252': {'label': 'Input RNA-seq fastq', 'value': ''}}
```

There is one input, labelled 'Input RNA-seq fastq'. This input is passed to the Tophat tool and should be a fastq file. We will use the dataset we examined above, under View Histories and Datasets, which had name ‘C1_R2_1.chr4.fq’ and id ‘10a4b652da44e82a’.

To specify the inputs, we build a data map and pass this to the run_workflow method. This data map is a nested dictionary object which maps inputs to datasets. We call:

```
>>> datamap = {'252': {'src': 'hda', 'id': '10a4b652da44e82a'}}
>>> gi.workflows.run_workflow('e8b85ad72aefca86', datamap, history_name='New output history')
```

In this case the only input id is ‘252’ and the corresponding dataset id is ‘10a4b652da44e82a’. We have specified the dataset source to be ‘hda’ (HistoryDatasetAssociation) since the dataset is stored in a History. See the API reference for allowed dataset specifications. We have also requested that a new History be created and used to store the results of the run, by setting history_name='New output history'.

The run_workflow call submits all the jobs which need to be run to the Galaxy workflow engine, with the appropriate dependencies so that they will run in order. The call returns immediately, so we can continue to submit new jobs while waiting for this workflow to execute. run_workflow returns the id of the output History and of the datasets that will be created as a result of this run. Note that these dataset ids are valid immediately, so we can specify these datasets as inputs to new jobs even before the files have been created, and the new jobs will be added to the queue with the appropriate dependencies.

If we view the output History immediately after calling run_workflow, we will see something like:

```
>>> gi.histories.show_history('0a7b7992a7cabaec')
{'annotation': '', 'contents_url': '/api/histories/0a7b7992a7cabaec/contents', 'id': '0a7b7992a7cabaec',
(continues on next page)
In this case, because the submitted jobs have not had time to run, the output History contains 8 datasets in the ‘queued’ state and has a total size of 0 bytes. If we make this call again later we should instead see completed output files.

View Users

Methods for managing users are grouped under GalaxyInstance.users.*. User management is only available to Galaxy administrators, that is, the API key used to connect to Galaxy must be that of an admin account.

To get a list of users, call:

```python
>>> gi.users.get_users()
[{'email': 'userA@unimelb.edu.au',
'key': '975a9ce09b49502a',
'quota_percent': None,
'url': '/api/users/975a9ce09b49502a'},
{'email': 'userB@student.unimelb.edu.au',
'key': '0193a95acfc427d2c',
'quota_percent': None,
'url': '/api/users/0193a95acfc427d2c'}]
```
Using BioBlend for raw API calls

BioBlend can be used to make HTTP requests to the Galaxy API in a more convenient way than using e.g. the requests Python library. There are 5 available methods corresponding to the most common HTTP methods: `make_get_request`, `make_post_request`, `make_put_request`, `make_delete_request` and `make_patch_request`. One advantage of using these methods is that the API keys stored in the `GalaxyInstance` object is automatically added to the request.

To make a GET request to the Galaxy API with BioBlend, call:

```python
>>> gi.make_get_request(gi.base_url + '/api/version').json()
{'version_major': '19.05',
 'extra': {}}
```

To make a POST request to the Galaxy API with BioBlend, call:

```python
>>> gi.make_post_request(gi.base_url + '/api/histories', payload={'name': 'test history'})
{'importable': False,
 'create_time': '2019-07-05T20:10:04.823716',
 'contents_url': '/api/histories/a77b3f95070d689a/contents',
 'id': 'a77b3f95070d689a',
 'size': 0, 'user_id': '5b732999121d4593',
 'username_and_slug': None,
 'annotation': None,
 'state_details': {'discarded': 0,
 'ok': 0,
 'failed_metadata': 0,
 'upload': 0,
 'paused': 0,
 'running': 0,
 'setting_metadata': 0,
 'error': 0,
 'new': 0,
 'queued': 0,
 'empty': 0},
 'state': 'new',
 'empty': True,
 'update_time': '2019-07-05T20:10:04.823742',
 'tags': [],
 'deleted': False,
 'genome_build': None,
 'slug': None,
 'name': 'test history',
 'url': '/api/histories/a77b3f95070d689a',
 'state_ids': {'discarded': [],
 'ok': [],
 'failed_metadata': [],
 'upload': [],
 'paused': [],
 'running': [],
 'setting_metadata': [],
 'error': [],
 'new': []},
```
'queued': [],
'empty': [],
'published': False,
'model_class': 'History',
'purged': False

5.2 Toolshed API

API used to interact with the Galaxy Toolshed, including repository management.

5.2.1 API documentation for interacting with the Galaxy Toolshed

**ToolShedInstance**

class bioblend.toolshed.ToolShedInstance(url, key=None, email=None, password=None, verify=True)

A base representation of a connection to a ToolShed instance, identified by the ToolShed URL and user credentials.

After you have created a **ToolShedInstance** object, access various modules via the class fields. For example, to work with repositories and get a list of all public repositories, the following should be done:

```python
from bioblend import toolshed

ts = toolshed.ToolShedInstance(url='https://testtoolshed.g2.bx.psu.edu')

rl = ts.repositories.get_repositories()

tools = ts.tools.search_tools('fastq')
```

**Parameters**

- **url** (str) – A FQDN or IP for a given instance of ToolShed. For example: https://testtoolshed.g2.bx.psu.edu. If a ToolShed instance is served under a prefix (e.g. http://127.0.0.1:8080/toolshed/), supply the entire URL including the prefix (note that the prefix must end with a slash).

- **key** (str) – If required, user’s API key for the given instance of ToolShed, obtained from the user preferences.

- **email** (str) – ToolShed e-mail address corresponding to the user. Ignored if key is supplied directly.

- **password** (str) – Password of ToolShed account corresponding to the above e-mail address. Ignored if key is supplied directly.

- **verify** (bool) – Whether to verify the server’s TLS certificate

**__init__**(url, key=None, email=None, password=None, verify=True)

A base representation of a connection to a ToolShed instance, identified by the ToolShed URL and user credentials.

After you have created a **ToolShedInstance** object, access various modules via the class fields. For example, to work with repositories and get a list of all public repositories, the following should be done:
```python
from bioblend import toolshed

ts = toolshed.ToolShedInstance(url='https://testtoolshed.g2.bx.psu.edu')
rl = ts.repositories.get_repositories()
tools = ts.tools.search_tools('fastq')
```

### Parameters

- **url** (*str*) – A FQDN or IP for a given instance of ToolShed. For example: `https://testtoolshed.g2.bx.psu.edu`. If a ToolShed instance is served under a prefix (e.g. `http://127.0.0.1:8080/toolshed/`), supply the entire URL including the prefix (note that the prefix must end with a slash).
- **key** (*str*) – If required, user’s API key for the given instance of ToolShed, obtained from the user preferences.
- **email** (*str*) – ToolShed e-mail address corresponding to the user. Ignored if key is supplied directly.
- **password** (*str*) – Password of ToolShed account corresponding to the above e-mail address. Ignored if key is supplied directly.
- **verify** (*bool*) – Whether to verify the server’s TLS certificate.

### Categories

Interaction with a Tool Shed instance categories

```python
class bioblend.toolshed.categories.ToolShedCategoryClient(toolshed_instance)
```

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., `http://<galaxy_instance>/api/libraries`): `self.module = 'workflows' | 'libraries' | 'histories' | ...

```python
def get_categories(deleted=False)
    Returns a list of dictionaries that contain descriptions of the repository categories found on the given Tool Shed instance.

Parameters **deleted** (*bool*) – whether to show deleted categories

Return type list

Returns

A list of dictionaries containing information about repository categories present in the Tool Shed. For example:

```json
[{
    'deleted': False,
    'description': 'Tools for manipulating data',
    'id': '175812cd7caaf439',
    'model_class': 'Category',
    'name': 'Text Manipulation',
    'url': '/api/categories/175812cd7caaf439'
}]
```

New in version 0.5.2.
module = 'categories'

show_category(category_id)

Get details of a given category.

Parameters

category_id (str) -- Encoded category ID

 Return type  dict

 Returns  details of the given category

Repositories

Interaction with a Tool Shed instance repositories

class bioblend.toolshed.repositories.ToolShedRepositoryClient(toolshed_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition
(e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

create_repository(name, synopsis, description=None, type='unrestricted', remote_repository_url=None,
 homepage_url=None, category_ids=None)

Create a new repository in a Tool Shed.

Parameters

• name (str) -- Name of the repository
• synopsis (str) -- Synopsis of the repository
• description (str) -- Optional description of the repository
• type (str) -- type of the repository. One of “unrestricted”, “repository_suite_definition”,
or “tool_dependency_definition”
• remote_repository_url (str) -- Remote URL (e.g. GitHub/Bitbucket repository)
• homepage_url (str) -- Upstream’s homepage for the project
• category_ids (list) -- List of encoded category IDs

Return type  dict

Returns

a dictionary containing information about the new repository. For example:

```py
{"deleted": false,
 "deprecated": false,
 "description": "new_synopsis",
 "homepage_url": "https://github.com/galaxyproject/",
 "id": "8cf91205f2f737f4",
 "long_description": "this is some repository",
 "model_class": "Repository",
 "name": "new_repo_17",
 "owner": "qqqqqq",
 "private": false,
 "remote_repository_url": "https://github.com/galaxyproject/tools-devteam",
 "times_downloaded": 0,
```
"type": "unrestricted",
"user_id": "adb5f5c93f827949"}

get_ordered_installable_revisions(name, owner)
Returns the ordered list of changelog revision hash strings that are associated with installable revisions. As in the changelog, the list is ordered oldest to newest.

Parameters
• name (str) – the name of the repository
• owner (str) – the owner of the repository

Return type list
Returns List of changelog revision hash strings from oldest to newest

get_repositories()
Get a list of all the repositories in a Galaxy Tool Shed.

Return type list
Returns

Returns a list of dictionaries containing information about repositories present in the Tool Shed. For example:

```
[[
    'category_ids': ['c1df3132f6334b0e', 'f6d7b0037d901d9b'],
    'deleted': False,
    'deprecated': False,
    'description': 'Order Contigs',
    'homepage_url': '',
    'id': '287bd69f724b99ce',
    'name': 'best_tool_ever',
    'owner': 'billybob',
    'private': False,
    'remote_repository_url': '',
    'times_downloaded': 0,
    'type': 'unrestricted',
    'url': '/api/repositories/287bd69f724b99ce',
    'user_id': '5cefd48bc04af6d4']]
```

Changed in version 0.4.1: Changed method name from get_tools to get_repositories to better align with the Tool Shed concepts.

get_repository_revision_install_info(name, owner, changeset_revision)
Return a list of dictionaries of metadata about a certain changeset revision for a single tool.

Parameters
• name (str) – the name of the repository
• owner (str) – the owner of the repository
• changeset_revision (str) – the changeset_revision of the RepositoryMetadata object associated with the repository

Return type List of dictionaries
Returns
Returns a list of the following dictionaries:

1. a dictionary defining the repository
2. a dictionary defining the repository revision (RepositoryMetadata)
3. a dictionary including the additional information required to install the repository

For example:

```json
[{
    'deleted': False,
    'deprecated': False,
    'description': 'Galaxy Freebayes Bayesian genetic variant detector tool',
    'homepage_url': '',
    'id': '491b7a3fdddf9366f',
    'long_description': 'Galaxy Freebayes Bayesian genetic variant detector tool originally included in the Galaxy code distribution but migrated to the tool shed.',
    'name': 'freebayes',
    'owner': 'devteam',
    'private': False,
    'remote_repository_url': '',
    'times_downloaded': 269,
    'type': 'unrestricted',
    'url': '/api/repositories/491b7a3fdddf9366f',
    'user_id': '1de29d50c3c44272'},
{
    'changeset_revision': 'd291dc763c4c',
    'do_not_test': False,
    'downloadable': True,
    'has_repository_dependencies': False,
    'id': '504be8aa652c154',
    'includes_datatypes': False,
    'includes_tool_dependencies': True,
    'includes_tools': True,
    'includes_tools_for_display_in_tool_panel': True,
    'includes_workflows': False,
    'malicious': False,
    'repository_id': '491b7a3fdddf9366f',
    'url': '/api/repository_revisions/504be8aa652c154'},
{
    'freebayes': [
        'http://testtoolshed.g2.bx.psu.edu/repos/devteam/
        freebayes',
        'd291dc763c4c',
        '9',
        'devteam',
    {}},
{
    'freebayes/0.9.6':
        '608597d12e127c847ae03440ab63992fedf': {'changeset_revision':
        'd291dc763c4c'},
    'name': 'freebayes',
    'repository_name': 'freebayes',
}
```

(continues on next page)
module = 'repositories'

repository_revisions(downloadable=None, malicious=None, tools_functionally_correct=None, missing_test_components=None, do_not_test=None, includes_tools=None, test_install_error=None, skip_tool_test=None)

Returns a (possibly filtered) list of dictionaries that include information about all repository revisions. The following parameters can be used to filter the list.

Parameters

- **downloadable** (bool) – Can the tool be downloaded
- **malicious** (bool) –
- **tools_functionally_correct** (bool) –
- **missing_test_components** (bool) –
- **do_not_test** (bool) –
- **includes_tools** (bool) –
- **test_install_error** (bool) –
- **skip_tool_test** (bool) –

Return type  List of dictionaries

Returns

Returns a (possibly filtered) list of dictionaries that include information about all repository revisions. For example:

```
[{
    'changeset_revision': '6e26c5a48e9a',
    'do_not_test': False,
    'downloadable': True,
    'has_repository_dependencies': False,
    'id': '92250aaff777a169',
    'includes_datatypes': False,
    'includes_tool_dependencies': False,
    'includes_tools': True,
    'includes_tools_for_display_in_tool_panel': True,
    'includes_workflows': False,
    'malicious': False,
}]```
'missing_test_components': False,
'repository_id': '78f2604ff5e65707',
'test_install_error': False,
'time_last_tested': None,
'tools_functionally_correct': False,
'url': '/api/repository_revisions/92250afff777a169'},
{'changeset_revision': '15a54f11ad7',
'do_not_test': False,
'downloadable': True,
'has_repository_dependencies': False,
'id': 'd3823c748ae2205d',
'includes_datatypes': False,
'includes_tool_dependencies': False,
'includes_tools': True,
'includes_tools_for_display_in_tool_panel': True,
'includes_workflows': False,
'malicious': False,
'missing_test_components': False,
'repository_id': 'f966200d9a7bfc9e',
'test_install_error': False,
'time_last_tested': None,
'tools_functionally_correct': False,
'url': '/api/repository_revisions/d3823c748ae2205d'}]

search_repositories(q, page=1, page_size=10)
Search for repositories in a Galaxy Tool Shed.

Parameters

• q (str) – query string for searching purposes
• page (int) – page requested
• page_size (int) – page size requested

Return type dict

Returns
dictionary containing search hits as well as metadata for the search. For example:

{"hits": [{"matched_terms": [],
  "repository": {'approved': 'no',
    'description': 'Convert export file to fastq
    →',
    'full_last_updated': '2015-01-18 09:48 AM',
    'homepage_url': '',
    'id': 'bdfa208f0cfc6504e',
    'last_updated': 'less than a year',
    'long_description': 'This is a simple too→ to convert Solexas Export files to FASTQ files.',
    'name': 'export_to_fastq',
    'remote_repository_url': '',
    'repo_owner_username': 'louise',
    'times_downloaded': 164},
  'score': 4.92},

(continues on next page)
show_repository(\texttt{toolShed\_id})

Display information of a repository from Tool Shed

\textbf{Parameters} \texttt{toolShed\_id} (str) – Encoded Tool Shed ID

\textbf{Return type} dict

\textbf{Returns}

Information about the tool. For example:

\begin{verbatim}
{'category_ids': ['c1df3132f6334b0e', 'f6d7b0037d901d9b'],
 'deleted': False,
 'deprecated': False,
 'description': 'Order Contigs',
 'homepage_url': '',
 'id': '287bd69f724b99ce',
 'long_description': '',
 'name': 'best_tool\_ever',
 'owner': 'billybob',
 'private': False,
 'remote\_repository\_url': '',
 'times\_downloaded': 0,
 'type': 'unrestricted',
 'url': '/api/repositories/287bd69f724b99ce',
 'user\_id': '5c6fd48bc04af6d4'}
\end{verbatim}

Changed in version 0.4.1: Changed method name from \texttt{show\_tool} to \texttt{show\_repository} to better align with the Tool Shed concepts.

\textbf{show\_repository\_revision(\texttt{metadata\_id})}

Returns a dictionary that includes information about a specified repository revision.

\textbf{Parameters} \texttt{metadata\_id} (str) – Encoded repository metadata ID

\textbf{Return type} dict
Returns

Returns a dictionary that includes information about a specified repository revision. For example:

```json
{
    'changeset_revision': '7602de1e7f32',
    'do_not_test': False,
    'downloadable': True,
    'has_repository_dependencies': False,
    'id': '504be8aaa652c154',
    'includes_datatypes': False,
    'includes_tool_dependencies': False,
    'includes_tools': True,
    'includes_tools_for_display_in_tool_panel': True,
    'includes_workflows': False,
    'malicious': False,
    'missing_test_components': True,
    'repository_id': '491b7a3fddf9366f',
    'test_install_error': False,
    'time_last_tested': None,
    'tool_test_results': {'missing_test_components': []},
    'tools_functionally_correct': False,
    'url': '/api/repository_revisions/504be8aaa652c154'
}
```

`update_repository(id, tar_ball_path, commit_message=None)`

Update the contents of a Tool Shed repository with specified tar ball.

**Parameters**

- **id** (*str*) – Encoded repository ID
- **tar_ball_path** (*str*) – Path to file containing tar ball to upload.
- **commit_message** (*str*) – Commit message used for the underlying Mercurial repository backing Tool Shed repository.

**Return type**  *dict*

**Returns**

Returns a dictionary that includes repository content warnings. Most valid uploads will result in no such warning and an exception will be raised generally if there are problems. For example a successful upload will look like:

```json
{
    'content_alert': '',
    'message': ''
}
```

New in version 0.5.2.
Tools

Interaction with a Tool Shed instance tools

class bioblend.toolshed.tools.ToolShedToolClient(toolshed_instance)

A generic Client interface defining the common fields.

All clients must define the following field (which will be used as part of the URL composition (e.g., http://<galaxy_instance>/api/libraries): self.module = 'workflows' | 'libraries' | 'histories' | ...

module = 'tools'

search_tools(q, page=1, page_size=10)

Search for tools in a Galaxy Tool Shed.

Parameters

- **q** (str) – query string for searching purposes
- **page** (int) – page requested
- **page_size** (int) – page size requested

Return type dict

Returns

dictionary containing search hits as well as metadata for the search. For example:

```python
{'hits': [{
    'matched_terms': [],
    'score': 3.0,
    'tool': {'description': 'convert between various FASTQ => quality formats',
             'id': '69819b84d55f521efda001e0926e7233',
             'name': 'FASTQ Groomer',
             'repo_name': None,
             'repo_owner_username': 'devteam'},
  },
  {'matched_terms': [],
    'score': 3.0,
    'tool': {'description': 'converts a bam file to fastq => files.',
             'id': '521e282770fd94537dafff87adad2551b',
             'name': 'Defuse BamFastq',
             'repo_name': None,
             'repo_owner_username': 'jjohnson'},
  }],
'hostname': 'https://testtoolshed.g2.bx.psu.edu/',
'page': '1',
'page_size': '2',
'total_results': '118'}
```
5.3 CloudMan API

API used to manipulate the instantiated infrastructure. For example, scale the size of the compute cluster, get infrastructure status, get service status.

5.3.1 API documentation for interacting with CloudMan

CloudManLauncher

class bioblend.cloudman.launch.CloudManLauncher(access_key, secret_key, cloud=None)

Define the environment in which this instance of CloudMan will be launched.

Besides providing the credentials, optionally provide the cloud object. This object must define the properties required to establish a boto connection to that cloud. See this method’s implementation for an example of the required fields. Note that as long the as provided object defines the required fields, it can really be implemented as anything (e.g., a Bunch, a database object, a custom class). If no value for the cloud argument is provided, the default is to use the Amazon cloud.

assign_floating_ip(ec2_conn, instance)

connect_ec2(a_key, s_key, cloud=None)

Create and return an EC2-compatible connection object for the given cloud.

See _get_cloud_info method for more details on the requirements for the cloud parameter. If no value is provided, the class field is used.

connect_s3(a_key, s_key, cloud=None)

Create and return an S3-compatible connection object for the given cloud.

See _get_cloud_info method for more details on the requirements for the cloud parameter. If no value is provided, the class field is used.

connect_vpc(a_key, s_key, cloud=None)

Establish a connection to the VPC service.

TODO: Make this work with non-default clouds as well.

create_cm_security_group(sg_name='CloudMan', vpc_id=None)

Create a security group with all authorizations required to run CloudMan.

If the group already exists, check its rules and add the missing ones.

Parameters

• sg_name (str) – A name for the security group to be created.

• vpc_id (str) – VPC ID under which to create the security group.

Return type  dict

Returns A dictionary containing keys name (with the value being the name of the security group that was created), error (with the value being the error message if there was an error or None if no error was encountered), and ports (containing the list of tuples with port ranges that were opened or attempted to be opened).

Changed in version 0.6.1: The return value changed from a string to a dict

create_key_pair(key_name='cloudman_key_pair')

If a key pair with the provided key_name does not exist, create it.

Parameters sg_name (str) – A name for the key pair to be created.
Return type  dict

Returns  A dictionary containing keys name (with the value being the name of the key pair that
was created), error (with the value being the error message if there was an error or None if
no error was encountered), and material (containing the unencrypted PEM encoded RSA
private key if the key was created or None if the key already existed).

Changed in version 0.6.1: The return value changed from a tuple to a dict

**find_placements** *(ec2_conn, instance_type, cloud_type, cluster_name=None)*
Find a list of placement zones that support the specified instance type.

If cluster_name is given and a cluster with the given name exist, return a list with only one entry where
the given cluster lives.

Searching for available zones for a given instance type is done by checking the spot prices in the
potential availability zones for support before deciding on a region: http://blog.piefox.com/2011/07/
ec2-availability-zones-and-instance.html

Note that, currently, instance-type based zone selection applies only to AWS. For other clouds, all the
available zones are returned (unless a cluster is being recreated, in which case the cluster’s placement zone
is returned as stored in its persistent data.

Return type  dict

Returns  A dictionary with zones and error keywords.

Changed in version 0.3: Changed method name from _find_placements to find_placements. Also
added cluster_name parameter.

Changed in version 0.7.0: The return value changed from a list to a dictionary.

**get_cluster_pd**(cluster_name)
Return persistent data (as a dict) associated with a cluster with the given cluster_name. If a cluster with
the given name is not found, return an empty dict.

New in version 0.3.

**get_clusters_pd**(include_placement=True)
Return persistent data of all existing clusters for this account.

Parameters include_placement (bool) – Whether or not to include region placement for the
clusters. Setting this option will lead to a longer function runtime.

Return type  dict

Returns  A dictionary containing keys clusters and error. The value of clusters will be a
dictionary with the following keys cluster_name, persistent_data, bucket_name and
optionally placement or an empty list if no clusters were found or an error was encountered.
persistent_data key value is yet another dictionary containing given cluster’s persistent
data. The value for the error key will contain a string with the error message.

New in version 0.3.

Changed in version 0.7.0: The return value changed from a list to a dictionary.

**get_status**(instance_id)
Check on the status of an instance. instance_id needs to be a boto-library copatible instance ID (e.g.,
i-8fehrdss). If instance_id is not provided, the ID obtained when launching the most recent instance
is used. Note that this assumes the instance being checked on was launched using this class. Also note that
the same class may be used to launch multiple instances but only the most recent instance_id is kept
while any others will to be explicitly specified.
This method also allows the required `ec2_conn` connection object to be provided at invocation time. If the object is not provided, credentials defined for the class are used (ability to specify a custom `ec2_conn` helps in case of stateless method invocations).

Return a `state` dict containing the following keys: `instance_state`, `public_ip`, `placement`, and `error`, which capture CloudMan's current state. For `instance_state`, expected values are: `pending`, `booting`, `running`, or `error` and represent the state of the underlying instance. Other keys will return an empty value until the `instance_state` enters `running` state.

```python
launch(cluster_name, image_id, instance_type, password, kernel_id=None, ramdisk_id=None, key_name='cloudman_key_pair', security_groups=None, placement='.', subnet_id=None, ebs_optimized=False, **kwargs)
```

Check all the prerequisites (key pair and security groups) for launching a CloudMan instance, compose the user data based on the parameters specified in the arguments and the cloud properties as defined in the object’s `cloud` field.

For the current list of user data fields that can be provided via `kwargs`, see https://galaxyproject.org/cloudman/userdata/

Return a dict containing the properties and info with which an instance was launched, namely: `sg_names` containing the names of the security groups, `kp_name` containing the name of the key pair, `kp_material` containing the private portion of the key pair (note that this portion of the key is available and can be retrieved only at the time the key is created, which will happen only if no key with the name provided in the `key_name` argument exists), `rs` containing the boto `ResultSet` object, `instance_id` containing the ID of a started instance, and `error` containing an error message if there was one.

```python
rule_exists(rules, from_port, to_port, ip_protocol='tcp', cidr_ip='0.0.0.0/0')
```

A convenience method to check if an authorization rule in a security group already exists.

### CloudManInstance

API for interacting with a CloudMan instance.

```python
class bioblend.cloudman.CloudManConfig(access_key=None, secret_key=None, cluster_name=None, image_id=None, instance_type='m1.medium', password=None, cloud_metadata=None, cluster_type=None, galaxy_data_option='", initial_storage_size=10, key_name='cloudman_key_pair', security_groups=None, placement='.', kernel_id=None, ramdisk_id=None, block_until_ready=False, **kwargs)
```

Initializes a CloudMan launch configuration object.

**Parameters**

- `access_key` (str) – Access credentials.
- `secret_key` (str) – Access credentials.
- `cluster_name` (str) – Name used to identify this CloudMan cluster.
- `image_id` (str) – Machine image ID to use when launching this CloudMan instance.
- `instance_type` (str) – Machine image ID to use when launching this CloudMan instance.
- `password` (str) – The administrative password for this CloudMan instance.
- `cloud_metadata` (Bunch) – This object must define the properties required to establish a boto connection to that cloud. See this method’s implementation for an example of the required fields. Note that as long as provided object defines the required fields, it can
really by implemented as anything (e.g., a Bunch, a database object, a custom class). If no
value for the cloud argument is provided, the default is to use the Amazon cloud.

- **kernel_id** (str) – The ID of the kernel with which to launch the instances
- **ramdisk_id** (str) – The ID of the RAM disk with which to launch the instances
- **key_name** (str) – The name of the key pair with which to launch instances
- **security_groups** (list of str) – The IDs of the security groups with which to associate instances
- **placement** (str) – The availability zone in which to launch the instances
- **cluster_type** (str) – The type, either ‘Galaxy’, ‘Data’, or ‘Test’, defines the type of cluster platform to initialize.
- **galaxy_data_option** (str) – The storage type to use for this instance. May be ‘transient’, ‘custom_size’ or ‘’. The default is ‘’, which will result in ignoring the bioblend specified initial_storage_size. ‘custom_size’ must be used for initial_storage_size to come into effect.
- **initial_storage_size** (int) – The initial storage to allocate for the instance. This only applies if cluster_type is set to either Galaxy or Data and galaxy_data_option is set to custom_size
- **block_until_ready** (bool) – Specifies whether the launch method will block until the instance is ready and only return once all initialization is complete. The default is False. If False, the launch method will return immediately without blocking. However, any subsequent calls made will automatically block if the instance is not ready and initialized. The blocking timeout and polling interval can be configured by providing extra parameters to the CloudManInstance.launch_instance method.

```python
static CustomTypeDecoder(dct)
```

```python
class CustomTypeEncoder(*, skipkeys=False, ensure_ascii=True, check_circular=True, allow_nan=True, sort_keys=False, indent=None, separators=None, default=None)
```

Constructor for JSONEncoder, with sensible defaults.

If skipkeys is false, then it is a TypeError to attempt encoding of keys that are not str, int, float or None. If skipkeys is True, such items are simply skipped.

If ensure_ascii is true, the output is guaranteed to be str objects with all incoming non-ASCII characters escaped. If ensure_ascii is false, the output can contain non-ASCII characters.

If check_circular is true, then lists, dicts, and custom encoded objects will be checked for circular references during encoding to prevent an infinite recursion (which would cause an OverflowError). Otherwise, no such check takes place.

If allow_nan is true, then NaN, Infinity, and -Infinity will be encoded as such. This behavior is not JSON specification compliant, but is consistent with most JavaScript based encoders and decoders. Otherwise, it will be a ValueError to encode such floats.

If sort_keys is true, then the output of dictionaries will be sorted by key; this is useful for regression tests to ensure that JSON serializations can be compared on a day-to-day basis.

If indent is a non-negative integer, then JSON array elements and object members will be pretty-printed with that indent level. An indent level of 0 will only insert newlines. None is the most compact representation.

If specified, separators should be an (item_separator, key_separator) tuple. The default is (’,’, ‘:’) if indent is None and (‘’, ‘: ’) otherwise. To get the most compact JSON representation, you should specify (‘’, ‘:’) to eliminate whitespace.
If specified, default is a function that gets called for objects that can’t otherwise be serialized. It should return a JSON encodable version of the object or raise a TypeError.

```
def default(obj):
    try:
        iterable = iter(obj)
    except TypeError:
        pass
    else:
        return list(iterable)
    # Let the base class default method raise the TypeError
    return JSONEncoder.default(self, o)
```

---

**static load_config(fp)**

**save_config(fp)**

**set_connection_parameters**(*access_key*, *secret_key*, *cloud_metadata=None*)

**set_extra_parameters**(**kwargs)**

**set_post_launch_parameters**(cluster_type=None, galaxy_data_option=None, initial_storage_size=10)

**set_pre_launch_parameters**(cluster_name, image_id, instance_type, password, kernel_id=None, ramdisk_id=None, key_name='cloudman_key_pair', security_groups=None, placement=None, block_until_ready=False)

**validate()**

---

**class bioblend.cloudman.CloudManInstance(url, password, **kwargs)**

Create an instance of the CloudMan API class, which is to be used when manipulating that given CloudMan instance.

The url is a string defining the address of CloudMan, for example “http://115.146.92.174”. The password is CloudMan’s password, as defined in the user data sent to CloudMan on instance creation.

**add_nodes**(num_nodes, instance_type=None, spot_price=None)

Add a number of worker nodes to the cluster, optionally specifying the type for new instances. If instance_type is not specified, instance(s) of the same type as the master instance will be started. Note that the instance_type must match the type of instance available on the given cloud.

spot_price applies only to AWS and, if set, defines the maximum price for Spot instances, thus turning this request for more instances into a Spot request.

**adjust_autoscaling**(minimum_nodes=None, maximum_nodes=None)

Adjust the autoscaling configuration parameters.

The number of worker nodes in the cluster is bounded by the optional minimum_nodes and maximum_nodes parameters. If a parameter is not provided then its configuration value does not change.

**autoscaling_enabled()**

Returns a boolean indicating whether autoscaling is enabled.

**property cloudman_url**

Returns the URL for accessing this instance of CloudMan.
disable_autoscaling()
Disable autoscaling, meaning that worker nodes will need to be manually added and removed.

enable_autoscaling(minimum_nodes=0, maximum_nodes=19)
Enable cluster autoscaling, allowing the cluster to automatically add, or remove, worker nodes, as needed.

The number of worker nodes in the cluster is bounded by the minimum_nodes (default is 0) and maximum_nodes (default is 19) parameters.

property galaxy_url
Returns the base URL for this instance, which by default happens to be the URL for Galaxy application.

get_cloudman_version()
Returns the cloudman version from the server. Versions prior to Cloudman 2 does not support this call, and therefore, the default is to return 1

get_cluster_size()
Get the size of the cluster in terms of the number of nodes; this count includes the master node.

get_cluster_type()
Get the cluster type for this CloudMan instance. See the CloudMan docs about the available types.
Returns a dictionary, for example: {'cluster_type': 'Test'}.

get_galaxy_state()
Get the current status of Galaxy running on the cluster.

get_master_id()
Returns the instance ID of the master node in this CloudMan cluster

get_master_ip()
Returns the public IP of the master node in this CloudMan cluster

get_nodes()
Get a list of nodes currently running in this CloudMan cluster.

get_static_state()
Get static information on this CloudMan instance. i.e. state that doesn’t change over the lifetime of the cluster

get_status()
Get status information on this CloudMan instance.

initialize(cluster_type, galaxy_data_option=", initial_storage_size=None, shared_bucket=None)
Initialize CloudMan platform. This needs to be done before the cluster can be used.
The cluster_type, either ‘Galaxy’, ‘Data’, or ‘Test’, defines the type of cluster platform to initialize.

is_master_execution_host()
Checks whether the master node has job execution enabled.

static launch_instance(cfg, **kwargs)
Launches a new instance of CloudMan on the specified cloud infrastructure.

Parameters

    cfg (CloudManConfig) -- A CloudManConfig object containing the initial parameters for this launch.

reboot_node(instance_id)
Reboot a specific worker node.
The instance_id parameter defines the ID, as a string, of a worker node to reboot.

remove_node(instance_id, force=False)
Remove a specific worker node from the cluster.
The `instance_id` parameter defines the ID, as a string, of a worker node to remove from the cluster. The `force` parameter (defaulting to False), is a boolean indicating whether the node should be forcibly removed rather than gracefully removed.

**remove_nodes(num_nodes, force=False)**

Remove worker nodes from the cluster.

The `num_nodes` parameter defines the number of worker nodes to remove. The `force` parameter (defaulting to False), is a boolean indicating whether the nodes should be forcibly removed rather than gracefully removed.

**set_master_as_execution_host(enable)**

Enables/disables master as execution host.

**terminate(terminate_master_instance=True, delete_cluster=False)**

Terminate this CloudMan cluster. There is an option to also terminate the master instance (all worker instances will be terminated in the process of cluster termination), and delete the whole cluster.

**Warning:** Deleting a cluster is irreversible - all of the data will be permanently deleted.

**update()**

Update the local object's fields to be in sync with the actual state of the CloudMan instance the object points to. This method should be called periodically to ensure you are looking at the current data.

New in version 0.2.2.

**class bioblend.cloudman.GenericVMInstance(launcher, launch_result)**

Create an instance of the CloudMan API class, which is to be used when manipulating that given CloudMan instance.

The `url` is a string defining the address of CloudMan, for example “http://115.146.92.174”. The `password` is CloudMan's password, as defined in the user data sent to CloudMan on instance creation.

**get_machine_status()**

Check on the underlying VM status of an instance. This can be used to determine whether the VM has finished booting up and if CloudMan is up and running.

Return a `state` dict with the current `instance_state`, `public_ip`, `placement`, and `error` keys, which capture the current state (the values for those keys default to empty string if no data is available from the cloud).

**property instance_id**

Returns the ID of this instance (e.g., i-87ey32dd) if launch was successful or `None` otherwise.

**property key_pair_material**

Returns the private portion of the generated key pair. It does so only if the instance was properly launched and key pair generated; `None` otherwise.

**property key_pair_name**

Returns the name of the key pair used by this instance. If instance was not launched properly, returns `None`.

**wait_until_instance_ready(vm_ready_timeout=300, vm_ready_check_interval=10)**

Wait until the VM state changes to ready/error or timeout elapses. Updates the host name once ready.

**exception bioblend.cloudmanVMLaunchException(value)**

**bioblend.cloudman.block_until_vm_ready(func)**

This decorator exists to make sure that a launched VM is ready and has received a public IP before allowing the wrapped function call to continue. If the VM is not ready, the function will block until the VM is ready.

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If the VM does not become ready until the \texttt{vm\_ready\_timeout} elapses or the VM status returns an error, a \texttt{VMLaunchException} will be thrown.

This decorator relies on the \texttt{wait\_until\_instance\_ready} method defined in class \texttt{GenericVMInstance}. All methods to which this decorator is applied must be members of a class which inherit from \texttt{GenericVMInstance}.

The following two optional keyword arguments are recognized by this decorator:

\begin{itemize}
  \item \texttt{vm\_ready\_timeout (int)} – Maximum length of time to block before timing out. Once the timeout is reached, a \texttt{VMLaunchException} will be thrown.
  \item \texttt{vm\_ready\_check\_interval (int)} – The number of seconds to pause between consecutive calls when polling the VM’s ready status.
\end{itemize}

### 5.3.2 Usage documentation

This page describes some sample use cases for CloudMan API and provides examples for these API calls. In addition to this page, there are functional examples of complete scripts in \texttt{docs/examples} directory of the BioBlend source code repository.

**Setting up custom cloud properties**

CloudMan supports Amazon, OpenStack, OpenNebula, and Eucalyptus based clouds and BioBlend can be used to programatically manipulate CloudMan on any of those clouds. Once launched, the API calls to CloudMan are the same irrespective of the cloud. In order to launch an instance on a given cloud, cloud properties need to be provided to \texttt{CloudManLauncher}. If cloud properties are not specified, \texttt{CloudManLauncher} will default to Amazon cloud properties.

If we want to use a different cloud provider, we need to specify additional cloud properties when creating an instance of the \texttt{CloudManLauncher} class. For example, if we wanted to create a connection to NeCTAR, Australia’s national research cloud, we would use the following properties:

```python
from bioblend.util import Bunch
nectar = Bunch(
    name='NeCTAR',
    cloud_type='openstack',
    bucket_default='cloudman-os',
    region_name='NeCTAR',
    region_endpoint='nova.rc.nectar.org.au',
    ec2_port=8773,
    ec2_conn_path='/services/Cloud',
    cidr_range='115.146.92.0/22',
    is_secure=True,
    s3_host='swift.rc.nectar.org.au',
    s3_port=8888,
    s3_conn_path='/')
```

**Note:** These properties are cloud-specific and need to be obtained from a given cloud provider.
Launching a new cluster instance

In order to launch a CloudMan cluster on a chosen cloud, we do the following (continuing from the previous example):

```python
from bioblend.cloudman import CloudManConfig
from bioblend.cloudman import CloudManInstance
cmc = CloudManConfig('your AWS access key', 'your AWS secret key', 'Cluster name', 'ami-<ID>', 'm1.medium', 'choose_a_password_here', nectar)
cmi = CloudManInstance.launch_instance(cmc)
```

**Note:** If you already have an existing instance of CloudMan, just create an instance of the `CloudManInstance` object directly by calling its constructor and connecting to it (the password you provide must match the password you provided as part of user data when launching this instance). For example:

```python
cmi = CloudManInstance('http://115.146.92.174', 'your_UD_password')
```

We now have a `CloudManInstance` object that allows us to manage created CloudMan instance via the API. Once launched, it will take a few minutes for the instance to boot and CloudMan start. To check on the status of the machine, (repeatedly) run the following command:

```python
>>> cmi.get_machine_status()
{'error': '', 'instance_state': 'pending', 'placement': '', 'public_ip': ''}
>>> cmi.get_machine_status()
{'error': '', 'instance_state': 'running', 'placement': 'melbourne-qh2', 'public_ip': '115.146.86.29'}
```

Once the instance is ready, although it may still take a few moments for CloudMan to start, it is possible to start interacting with the application.

**Note:** The `CloudManInstance` object (e.g., cmi) is a local representation of the actual CloudMan instance. As a result, the local object can get out of sync with the remote instance. To update the state of the local object, call the `update` method on the `cmi` object:

```python
>>> cmi.update()
```

Manipulating an existing cluster

Having a reference to a `CloudManInstance` object, we can manage it via the available `CloudManInstance` API:

```python
>>> cmi.initialized
False
>>> cmi.initialize('SGE')
>>> cmi.get_status()
{'all_fs': []}
```

(continues on next page)
'app_status': 'yellow',
'autoscaling': {'as_max': 'N/A',
    'as_min': 'N/A',
    'use_autoscaling': False},
'cluster_status': 'STARTING',
'data_status': 'green',
'disk_usage': {'pct': '0%', 'total': '0', 'used': '0'},
'dns': '#',
'instance_status': {'available': '0', 'idle': '0', 'requested': '0'},
'snapshot': {'progress': 'None', 'status': 'None'}}

```python
>>> cmi.get_cluster_size()
1

>>> cmi.get_nodes()
[{
    'id': 'i-00006016',
    'instance_type': 'm1.medium',
    'id': '0.0 0.025 0.065',
    'public_ip': '115.146.86.29',
    'time_in_state': '2268'}]

>>> cmi.add_nodes(2)

{'all_fs': [],
'app_status': 'green',
'autoscaling': {'as_max': 'N/A',
    'as_min': 'N/A',
    'use_autoscaling': False},
'cluster_status': 'READY',
'data_status': 'green',
'disk_usage': {'pct': '0%', 'total': '0', 'used': '0'},
'dns': '#',
'instance_status': {'available': '0', 'idle': '0', 'requested': '2'},
'snapshot': {'progress': 'None', 'status': 'None'}}

>>> cmi.get_cluster_size()
3
```
BioBlend allows library-wide configuration to be set in external files. These configuration files can be used to specify access keys, for example.

### 6.1 Configuration documents for BioBlend

#### 6.1.1 BioBlend

**exception bioblend.ConnectionError**(message, body=None, status_code=None)
An exception class that is raised when unexpected HTTP responses come back.

Should make it easier to debug when strange HTTP things happen such as a proxy server getting in the way of the request etc. @see: body attribute to see the content of the http response

**class bioblend.NullHandler**(level=0)
Initializes the instance - basically setting the formatter to None and the filter list to empty.

**emit**(record)
Do whatever it takes to actually log the specified logging record.

This version is intended to be implemented by subclasses and so raises a NotImplementedError.

**exception bioblend.TimeoutException**

**bioblend.get_version**()
Returns a string with the current version of the library (e.g., “0.2.0”)

**bioblend.init_logging**()
Initialize BioBlend’s logging from a configuration file.

**bioblend.set_file_logger**(name, filepath, level=20, format_string=None)

**bioblend.set_stream_logger**(name, level=10, format_string=None)
6.1.2 Config

class bioblend.config.Config(path=None, fp=None, do_load=True)

BioBlend allows library-wide configuration to be set in external files. These configuration files can be used to
specify access keys, for example. By default we use two locations for the BioBlend configurations:

- System wide: /etc/bioblend.cfg
- Individual user: ~/.bioblend (which works on both Windows and Unix)

get(section, name, default=None)

get_value(section, name, default=None)

getbool(section, name, default=False)

getfloat(section, name, default=0.0)

getint(section, name, default=0)
If you would like to do more than just a mock test, you need to point BioBlend to an instance of Galaxy. Do so by exporting the following two variables:

```bash
$ export BIOBLEND_GALAXY_URL=http://127.0.0.1:8080
$ export BIOBLEND_GALAXY_API_KEY=<API key>
```

The unit tests, stored in the `tests` folder, can be run using `pytest`. From the project root:

```
$ pytest
```
CHAPTER
EIGHT

GETTING HELP

If you have run into issues, found a bug, or can’t seem to find an answer to your question regarding the use and functionality of BioBlend, please use the Github Issues page to ask your question.
Links to other documentation and libraries relevant to this library:

- Galaxy API documentation
- Blend4j: Galaxy API wrapper for Java
- clj-blend: Galaxy API wrapper for Clojure
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