
pylxd Documentation

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Contents

1	Installation	3
2	Getting started	5
2.1	Client	5
3	Client Authentication	7
3.1	Generate a certificate	7
3.2	Authenticate a new keypair	7
4	Events	9
5	Certificates	11
5.1	Manager methods	11
5.2	Certificate attributes	11
6	Containers	13
6.1	Manager methods	13
6.2	Container attributes	13
6.3	Container methods	14
6.4	Examples	14
6.5	Container Snapshots	15
6.6	Container files	15
7	Images	17
7.1	Manager methods	17
7.2	Image attributes	17
7.3	Image methods	18
7.4	Examples	18
8	Networks	19
8.1	Manager methods	19
8.2	Network attributes	19
9	Profiles	21
9.1	Manager methods	21
9.2	Profile attributes	21
9.3	Profile methods	21
9.4	Examples	21

10 Contributing	23
10.1 Code standards	23
10.2 Testing	23
11 API documentation	25
11.1 Client	25
11.2 Certificate	26
11.3 Container	26
11.4 Image	27
11.5 Network	28
11.6 Operation	28
11.7 Profile	28
12 Indices and tables	31

Contents:

CHAPTER 1

Installation

If you're running on Ubuntu Xenial or greater:

```
sudo apt-get install python-pylxd lxd
```

Otherwise you can track LXD development on other Ubuntu releases:

```
sudo add-apt-repository ppa:ubuntu-lxc/lxd-git-master && sudo apt-get update  
sudo apt-get install lxd
```

Or install pylxd using pip:

```
pip install pylxd
```


2.1 Client

Once you have *installed*, you're ready to instantiate an API client to start interacting with the LXD daemon on local-host:

```
>>> from pylxd import Client
>>> client = Client()
```

If your LXD instance is listening on HTTPS, you can pass a two part tuple of (cert, key) as the *cert* argument.

```
>>> from pylxd import Client
>>> client = Client(
...     endpoint='http://10.0.0.1:8443',
...     cert=('/path/to/client.crt', '/path/to/client.key'))
```

Note: in the case where the certificate is self signed (LXD default), you may need to pass *verify=False*.

2.1.1 Querying LXD

LXD exposes a number of objects via its REST API that are used to orchestrate containers. Those objects are all accessed via manager attributes on the client itself. This includes *certificates*, *containers*, *images*, *networks*, *operations*, and *profiles*. Each manager has methods for querying the LXD instance. For example, to get all containers in a LXD instance

For specific manager methods, please see the documentation for each object.

2.1.2 pylxd Objects

Each LXD object has an analogous pylxd object. Returning to the previous *client.containers.all* example, a *Container* object is manipulated as such:

Each pylxd object has a lifecycle which includes support for transactional changes. This lifecycle includes the following methods and attributes:

- *sync()* - Synchronize the object with the server. This method is called implicitly when accessing attributes that have not yet been populated, but may also be called explicitly. Why would attributes not yet be populated? When retrieving objects via *all*, LXD's API does not return a full representation.
- *dirty* - After setting attributes on the object, the object is considered "dirty".
- *rollback()* - Discard all local changes to the object, opting for a representation taken from the server.
- *save()* - Save the object, writing changes to the server.

Returning again to the *Container* example

2.1.3 A note about asynchronous operations

Some changes to LXD will return immediately, but actually occur in the background after the http response returns. All operations that happen this way will also take an optional *wait* parameter that, when *True*, will not return until the operation is completed.

Client Authentication

When using LXD over https, LXD uses an asymmetric keypair for authentication. The keypairs are added to the authentication database after entering the LXD instance’s “trust password”.

3.1 Generate a certificate

To generate a keypair, you should use the *openssl* command. As an example:

```
openssl req -newkey rsa:2048 -nodes -keyout lxd.key -out lxd.csr
openssl x509 -signkey lxd.key -in lxd.csr -req -days 365 -out lxd.crt
```

For more detail on the commands, or to customize the keys, please see the documentation for the *openssl* command.

3.2 Authenticate a new keypair

If a client is created using this keypair, it would originally be “untrusted”, essentially meaning that the authentication has not yet occurred.

```
>>> from pylxd import Client
>>> client = Client(
...     endpoint='http://10.0.0.1:8443',
...     cert=('lxd.crt', 'lxd.key'))
>>> client.trusted
False
```

In order to authenticate the client, pass the lxd instance’s trust password to *Client.authenticate*

```
>>> client.authenticate('a-secret-trust-password')
>>> client.trusted
>>> True
```


CHAPTER 4

Events

LXD provides an */events* endpoint that is upgraded to a streaming websocket for getting LXD events in real-time. The Client's *events* method will return a websocket client that can interact with the web socket messages.

```
>>> ws_client = client.events()
>>> ws_client.connect()
>>> ws_client.run()
```

A default client class is provided, which will block indefinitely, and collect all json messages in a *messages* attribute. An optional *websocket_client* parameter can be provided when more functionality is needed. The *ws4py* library is used to establish the connection; please see the *ws4py* documentation for more information.

Certificates are used to manage authentications in LXD. Certificates are not editable. They may only be created or deleted. None of the certificate operations in LXD are asynchronous.

5.1 Manager methods

Certificates can be queried through the following client manager methods:

- *all()* - Retrieve all certificates.
- *get()* - Get a specific certificate, by its fingerprint.
- *create()* - Create a new certificate. This method requires a first argument that is the LXD trust password, and the cert data, in binary format.

5.2 Certificate attributes

Certificates have the following attributes:

- *fingerprint* - The fingerprint of the certificate. Certificates are keyed off this attribute.
- *certificate* - The certificate itself, in PEM format.
- *type* - The certificate type (currently only “client”)

Container objects are the core of LXD. Containers can be created, updated, and deleted. Most of the methods for operating on the container itself are asynchronous, but many of the methods for getting information about the container are synchronous.

6.1 Manager methods

Containers can be queried through the following client manager methods:

- *all()* - Retrieve all containers.
- *get()* - Get a specific container, by its name.
- *create(wait=False)* - Create a new container. This method requires a first argument that is the container name, followed by a config. The config itself is beyond the scope of this documentation. Please refer to the LXD documentation for more information. This method will also return immediately, unless *wait* is *True*.

6.2 Container attributes

For more information about the specifics of these attributes, please see the LXD documentation.

- *architecture* - The container architecture.
- *config* - The container config
- *created_at* - The time the container was created
- *devices* - The devices for the container
- *ephemeral* - Whether the container is ephemeral
- *expanded_config* - An expanded version of the config
- *expanded_devices* - An expanded version of devices

- *name* - The name of the container. This attribute serves as the primary identifier of a container.
- *profiles* - A list of profiles applied to the container
- *status* - A string representing the status of the container
- *status_code* - A LXD status code of the container
- *stateful* - Whether the container is stateful

6.3 Container methods

- *rename* - Rename a container. Because *name* is the key, it cannot be renamed by simply changing the name of the container as an attribute and calling *save*. The new name is the first argument and, as the method is asynchronous, you may pass *wait=True* as well.
- *state* - Get the expanded state of the container.
- *start* - Start the container
- *stop* - Stop the container
- *restart* - Restart the container
- *freeze* - Suspend the container
- *unfreeze* - Resume the container
- *execute* - Execute a command on the container. The first argument is a list, in the form of *subprocess.Popen* with each item of the command as a separate item in the list. Returns a two part tuple of (*stdout*, *stderr*). This method will block while the command is executed.
- *migrate* - Migrate the container. The first argument is a client connection to the destination server. This call is asynchronous, so *wait=True* is optional. The container on the new client is returned.

6.4 Examples

If you'd only like to fetch a single container by its name...

```
>>> client.containers.get('my-container')
<container.Container at 0x7f95d8af72b0>
```

If you're looking to operate on all containers of a LXD instance, you can get a list of all LXD containers with *all*.

```
>>> client.containers.all()
[<container.Container at 0x7f95d8af72b0>]
```

In order to create a new *Container*, a container config dictionary is needed, containing a name and the source. A create operation is asynchronous, so the operation will take some time. If you'd like to wait for the container to be created before the command returns, you'll pass *wait=True* as well.

```
>>> config = {'name': 'my-container', 'source': {'type': 'none'}}
>>> container = client.containers.create(config, wait=False)
>>> container
<container.Container at 0x7f95d8af72b0>
```

If you were to use an actual image source, you would be able to operate on the container, starting, stopping, snapshotting, and deleting the container.

```
>>> container.start()
>>> container.freeze()
>>> container.delete()
```

6.5 Container Snapshots

Each container carries its own manager for managing `Snapshot` functionality. It has *get*, *all*, and *create* functionality.

Snapshots are keyed by their name (and only their name, in pylxd; LXD keys them by `<container-name>/<snapshot-name>`, but the manager allows us to use our own namespacing).

To create a new snapshot, use *create* with a *name* argument. If you want to capture the contents of RAM in the snapshot, you can use *stateful=True*. **Note: Your LXD requires a relatively recent version of CRIU for this.**

6.6 Container files

Containers also have a *files* manager for getting and putting files on the container.

Image objects are the base for which containers are built. Many of the methods of images are asynchronous, as they required reading and writing large files.

7.1 Manager methods

Images can be queried through the following client manager methods:

- *all()* - Retrieve all images.
- *get()* - Get a specific image, by its fingerprint.

And create through the following methods, theres also a copy method on an image:

- *create(data, public=False, wait=False)* - Create a new image. The first argument is the binary data of the image itself. If the image is public, set *public* to *True*.
- *create_from_simplestreams(server, alias, public=False, auto_update=False, wait=False)* - Create an image from simplestreams.
- *create_from_url(url, public=False, auto_update=False, wait=False)* - Create an image from a url.

7.2 Image attributes

For more information about the specifics of these attributes, please see the [LXD documentation](#).

- *aliases* - A list of aliases for this image
- *auto_update* - Whether the image should auto-update
- *architecture* - The target architecture for the image
- *cached* - Whether the image is cached
- *created_at* - The date and time the image was created

- *expires_at* - The date and time the image expires
- *filename* - The name of the image file
- *fingerprint* - The image fingerprint, a sha2 hash of the image data itself. This unique key identifies the image.
- *last_used_at* - The last time the image was used
- *properties* - The configuration of image itself
- *public* - Whether the image is public or not
- *size* - The size of the image
- *uploaded_at* - The date and time the image was uploaded
- *update_source* - A dict of update informations

7.3 Image methods

- *export* - Export the image. Returns binary data that is the image itself.
- *add_alias* - Add an alias to the image.
- *delete_alias* - Remove an alias.
- *copy* - Copy the image to another LXD client.

7.4 Examples

Image operations follow the same protocol from the client's *images* manager (i.e. *get*, *all*, and *create*). Images are keyed on a sha-1 fingerprint of the image itself. To get an image...

```
>>> image = client.images.get(
...     'e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855')
>>> image
<image.Image at 0x7f95d8af72b0>
```

Once you have an image, you can operate on it as before:

```
>>> image.public
False
>>> image.public = True
>>> image.update()
```

To create a new Image, you'll open an image file, and pass that to *create*. If the image is to be public, *public=True*. As this is an asynchronous operation, you may also want to *wait=True*.

```
>>> image_data = open('an_image.tar.gz').read()
>>> image = client.images.create(image_data, public=True, wait=True)
>>> image.fingerprint
'e3b0c44298fc1c149afbf4c8996fb92427ae41e4649b934ca495991b7852b855'
```

Network objects show the current networks available to lxd. They are read-only via the REST API.

8.1 Manager methods

Networks can be queried through the following client manager methods:

- *all()* - Retrieve all networks
- *get()* - Get a specific network, by its name.

8.2 Network attributes

- *name* - The name of the network
- *type* - The type of the network
- *used_by* - A list of containers using this network

Profile describe configuration options for containers in a re-usable way.

9.1 Manager methods

Profiles can be queried through the following client manager methods:

- *all()* - Retrieve all networks
- *get()* - Get a specific network, by its name.
- *create(name, config, devices)* - Create a new profile. The name of the profile is required. *config* and *devices* dictionaries are optional, and the scope of their contents is documented in the LXD documentation.

9.2 Profile attributes

- *name* - The name of the network
- *type* - The type of the network
- *used_by* - A list of containers using this network

9.3 Profile methods

- *rename* - Rename the profile.

9.4 Examples

`Profile` operations follow the same manager-style as `Containers` and `Images`. Profiles are keyed on a unique name.

```
>>> profile = client.profiles.get('my-profile')
>>> profile
<profile.Profile at 0x7f95d8af72b0>
```

The profile can then be modified and saved.

```
>>> profile.config = profile.config.update({'security.nesting': 'true'})
>>> profile.update()
```

To create a new profile, use *create* with a name, and optional *config* and *devices* config dictionaries.

```
>>> profile = client.profiles.create(
...     'an-profile', config={'security.nesting': 'true'},
...     devices={'root': {'path': '/', 'size': '10GB', 'type': 'disk'}})
```

CHAPTER 10

Contributing

pyLXD development is done [on Github](#). Pull Requests and Issues should be filed there. We try and respond to PRs and Issues within a few days.

If you would like to contribute large features or have big ideas, it's best to post on to [the lxc-users list](#) to discuss your ideas before submitting PRs.

10.1 Code standards

pyLXD follows [PEP 8](#) as closely as practical. To check your compliance, use the *pep8* tox target:

```
tox -epep8
```

10.2 Testing

pyLXD tries to follow best practices when it comes to testing. PRs are gated by [Travis CI](#) and [CodeCov](#). It's best to submit tests with new changes, as your patch is unlikely to be accepted without them.

To run the tests, you can use nose:

```
nosetests pylxd
```

...or, alternatively, you can use *tox* (with the added bonus that it will test python 2.7, python 3, and pypy, as well as run pep8). This is the way that Travis will test, so it's recommended that you run this at least once before submitting a Pull Request.

11.1 Client

class pylxd.client.**Client** (*endpoint=None, version='1.0', cert=None, verify=True*)

Client class for LXD REST API.

This client wraps all the functionality required to interact with LXD, and is meant to be the sole entry point.

containers

Instance of `Client.Containers`:

images

Instance of `Client.Images`.

operations

Instance of `Client.Operations`.

profiles

Instance of `Client.Profiles`.

api

This attribute provides tree traversal syntax to LXD's REST API for lower-level interaction.

Use the name of the url part as attribute or item of an api object to create another api object appended with the new url part name, ie:

```
>>> api = Client().api
# /
>>> response = api.get()
# Check status code and response
>>> print response.status_code, response.json()
# /containers/test/
>>> print api.containers['test'].get().json()
```

events (*websocket_client=None*)

Get a websocket client for getting events.

/events is a websocket url, and so must be handled differently than most other LXD API endpoints. This method returns a client that can be interacted with like any regular python socket.

An optional *websocket_client* parameter can be specified for implementation-specific handling of events as they occur.

11.2 Certificate

class pylxd.certificate.Certificate(*client*, ****kwargs**)

A LXD certificate.

classmethod all(*client*)

Get all certificates.

classmethod create(*client*, *password*, *cert_data*)

Create a new certificate.

classmethod get(*client*, *fingerprint*)

Get a certificate by fingerprint.

11.3 Container

class pylxd.container.Container(***args**, ****kwargs**)

An LXD Container.

This class is not intended to be used directly, but rather to be used via *Client.containers.create*.

class FileManager(*client*, *container*)

A pseudo-manager for namespacing file operations.

classmethod all(*client*)

Get all containers.

Containers returned from this method will only have the name set, as that is the only property returned from LXD. If more information is needed, *Container.sync* is the method call that should be used.

classmethod create(*client*, *config*, *wait=False*)

Create a new container config.

execute(*commands*, *environment={}*)

Execute a command on the container.

freeze(*timeout=30*, *force=True*, *wait=False*)

Freeze the container.

classmethod get(*client*, *name*)

Get a container by name.

migrate(*new_client*, *wait=False*)

Migrate a container.

Destination host information is contained in the client connection passed in.

If the container is running, it either must be shut down first or criu must be installed on the source and destination machines.

publish(*public=False*, *wait=False*)

Publish a container as an image.

The container must be stopped in order publish it as an image. This method does not enforce that constraint, so a `LXDAPISException` may be raised if this method is called on a running container.

If `wait=True`, an `Image` is returned.

rename (*name*, *wait=False*)

Rename a container.

restart (*timeout=30*, *force=True*, *wait=False*)

Restart the container.

start (*timeout=30*, *force=True*, *wait=False*)

Start the container.

stop (*timeout=30*, *force=True*, *wait=False*)

Stop the container.

unfreeze (*timeout=30*, *force=True*, *wait=False*)

Unfreeze the container.

class `pylxd.container.Snapshot` (*client*, ***kwargs*)

A container snapshot.

publish (*public=False*, *wait=False*)

Publish a snapshot as an image.

If `wait=True`, an `Image` is returned.

This functionality is currently broken in LXD. Please see <https://github.com/lxc/lxd/issues/2201> - The implementation here is mostly a guess. Once that bug is fixed, we can verify that this works, or file a bug to fix it appropriately.

rename (*new_name*, *wait=False*)

Rename a snapshot.

11.4 Image

class `pylxd.image.Image` (*client*, ***kwargs*)

A LXD Image.

add_alias (*name*, *description*)

Add an alias to the image.

classmethod **all** (*client*)

Get all images.

copy (*new_client*, *public=None*, *auto_update=None*, *wait=False*)

Copy an image to a another LXD.

Destination host information is contained in the client connection passed in.

classmethod **create** (*client*, *image_data*, *public=False*, *wait=False*)

Create an image.

classmethod **create_from_simplestreams** (*client*, *server*, *alias*, *public=False*, *auto_update=False*)

Copy an image from simplestreams.

classmethod **create_from_url** (*client*, *url*, *public=False*, *auto_update=False*)

Copy an image from an url.

delete_alias (*name*)
Delete an alias from the image.

export ()
Export the image.

classmethod get (*client, fingerprint*)
Get an image.

classmethod get_by_alias (*client, alias*)
Get an image by its alias.

11.5 Network

class pylxd.network.**Network** (*client, **kwargs*)
A LXD network.

classmethod all (*client*)
Get all networks.

delete ()
Delete is not available for networks.

classmethod get (*client, name*)
Get a network by name.

save (*wait=False*)
Save is not available for networks.

11.6 Operation

class pylxd.operation.**Operation** (***kwargs*)
A LXD operation.

classmethod get (*client, operation_id*)
Get an operation.

wait ()
Wait for the operation to complete and return.

classmethod wait_for_operation (*client, operation_id*)
Get an operation and wait for it to complete.

11.7 Profile

class pylxd.profile.**Profile** (*client, **kwargs*)
A LXD profile.

classmethod all (*client*)
Get all profiles.

classmethod create (*client, name, config=None, devices=None*)
Create a profile.

classmethod **get** (*client, name*)
Get a profile.

rename (*new_name*)
Rename the profile.

CHAPTER 12

Indices and tables

- `genindex`
- `modindex`
- `search`

A

add_alias() (pylxd.image.Image method), 27
all() (pylxd.certificate.Certificate class method), 26
all() (pylxd.container.Container class method), 26
all() (pylxd.image.Image class method), 27
all() (pylxd.network.Network class method), 28
all() (pylxd.profile.Profile class method), 28
api (pylxd.client.Client attribute), 25

C

Certificate (class in pylxd.certificate), 26
Client (class in pylxd.client), 25
Container (class in pylxd.container), 26
Container.FileManager (class in pylxd.container), 26
containers (pylxd.client.Client attribute), 25
copy() (pylxd.image.Image method), 27
create() (pylxd.certificate.Certificate class method), 26
create() (pylxd.container.Container class method), 26
create() (pylxd.image.Image class method), 27
create() (pylxd.profile.Profile class method), 28
create_from_simplestreams() (pylxd.image.Image class method), 27
create_from_url() (pylxd.image.Image class method), 27

D

delete() (pylxd.network.Network method), 28
delete_alias() (pylxd.image.Image method), 27

E

events() (pylxd.client.Client method), 25
execute() (pylxd.container.Container method), 26
export() (pylxd.image.Image method), 28

F

freeze() (pylxd.container.Container method), 26

G

get() (pylxd.certificate.Certificate class method), 26
get() (pylxd.container.Container class method), 26

get() (pylxd.image.Image class method), 28
get() (pylxd.network.Network class method), 28
get() (pylxd.operation.Operation class method), 28
get() (pylxd.profile.Profile class method), 28
get_by_alias() (pylxd.image.Image class method), 28

I

Image (class in pylxd.image), 27
images (pylxd.client.Client attribute), 25

M

migrate() (pylxd.container.Container method), 26

N

Network (class in pylxd.network), 28

O

Operation (class in pylxd.operation), 28
operations (pylxd.client.Client attribute), 25

P

Profile (class in pylxd.profile), 28
profiles (pylxd.client.Client attribute), 25
publish() (pylxd.container.Container method), 26
publish() (pylxd.container.Snapshot method), 27

R

rename() (pylxd.container.Container method), 27
rename() (pylxd.container.Snapshot method), 27
rename() (pylxd.profile.Profile method), 29
restart() (pylxd.container.Container method), 27

S

save() (pylxd.network.Network method), 28
Snapshot (class in pylxd.container), 27
start() (pylxd.container.Container method), 27
stop() (pylxd.container.Container method), 27

U

`unfreeze()` (`pylxd.container.Container` method), [27](#)

W

`wait()` (`pylxd.operation.Operation` method), [28](#)

`wait_for_operation()` (`pylxd.operation.Operation` class method), [28](#)