Cyborg Documentation

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OpenStack Foundation

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Cyborg is a general management framework for accelerators

CHAPTER

ONE

OVERVIEW

1.1 Introduction

1.1.1 Background Story

OpenStack Acceleration Discussion Started from Telco Requirements:

- High level requirements first drafted in the standard organization ETSI NFV ISG
- High level requirements transformed into detailed requirements in OPNFV DPACC project.
- New project called Nomad established to address the requirements.
- BoF discussions back in OpenStack Austin Summit.

Transition to Cyborg Project:

- From a long period of conversation and discussion within the OpenStack community, we found that the initial goal of Nomad project to address acceleration management in Telco is too limited. From design summit session in Barcelona Summit, we have developers from Scientific WG help us understanding the need for acceleration management in HPC cloud, and we also had a lot of discussion on the Public Cloud support of accelerated instances.
- We decide to formally establish a project that will work on the management framework for dedicated devices in OpenStack, and there comes the Cyborg Project.

1.1.2 Definition Breakdown

General Management Framework:

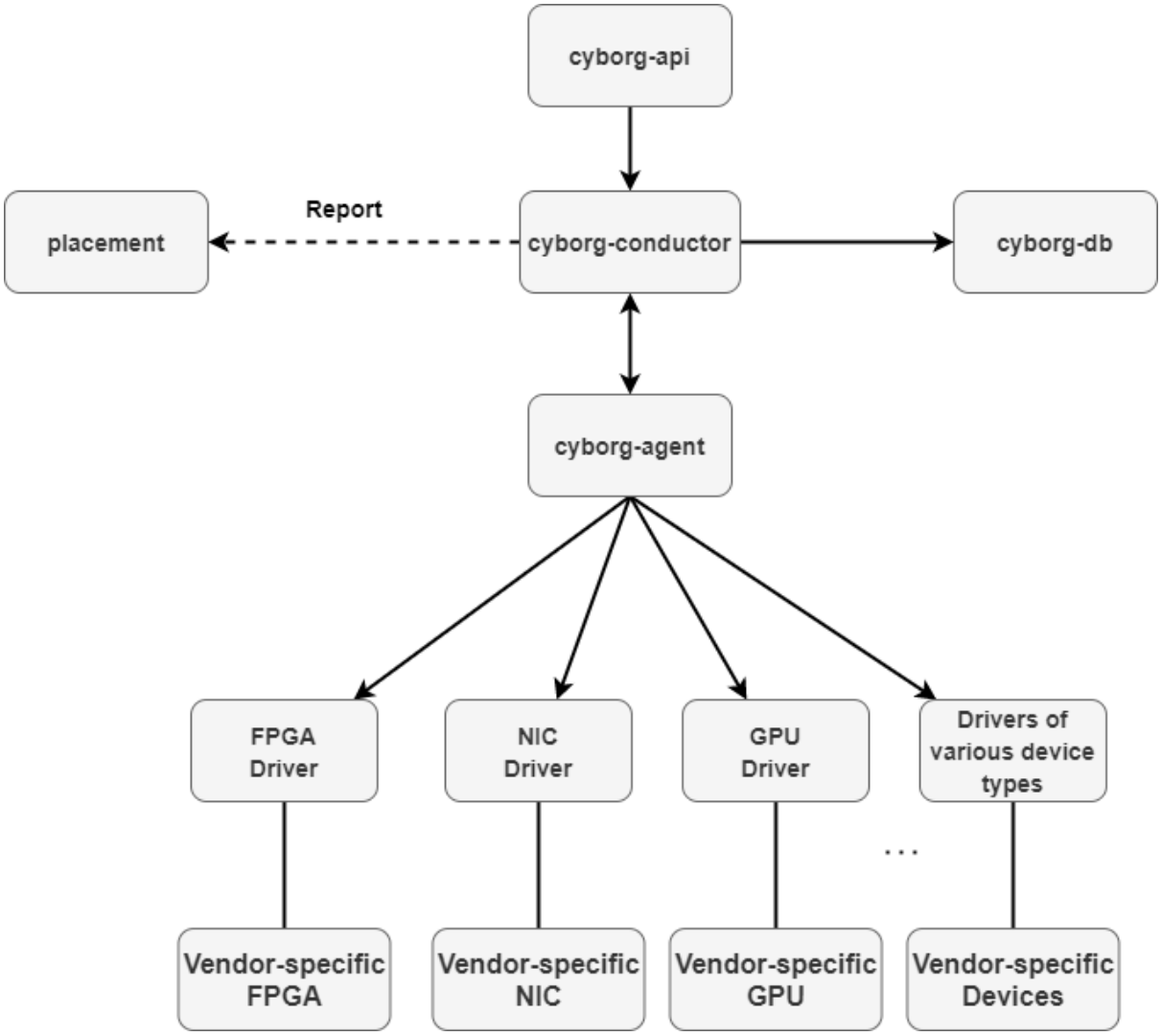
- Acceleration Resource Discovery
- Life Cycle Management

Accelerators:

- Software: dpdk/spdk, pmem,
- Hardware: FPGA, GPU, ARM SoC, NVMe SSD, CCIX based Caches,

1.2 Cyborg architecture

Cyborg design can be described by following diagram:



cyborg-api - cyborg-api is a cyborg service that provides **REST API** interface for the Cyborg project. It supports POST/PUT/DELETE/GET operations and interacts with cyborg-agent and cyborg-db via cyborg-conductor.

cyborg-conductor - cyborg-conductor is a cyborg service that coordinates interaction, DB access between cyborg-api and cyborg-agent.

cyborg-agent - cyborg-agent is a cyborg service that is responsible for interaction with accelerator backends via the Cyborg Driver. For now the only implementation in play is the Cyborg generic Driver. It will also handle the communication with the Nova placement service. Cyborg-Agent will also write to a local cache for local accelerator events.

Vendor drivers - Cyborg can be integrated with drivers for various accelerator device types, such as FPGA, GPU, NIC, and so forth. You are welcome to extend your own driver for a new type of accelerator device.

1.3 Usage

To use cyborg in a project:

```
import cyborg
```

CHAPTER

TWO

DOCUMENTATION FOR OPERATORS

The documentation in this section is aimed at Cloud Operators needing to install or configure Cyborg.

2.1 Installation

The detailed install guide for Cyborg.

2.1.1 Compute service

Common Configuration

Regardless of the package or code source you must do the following to properly setup the Accelerator Life Cycle Management service. A database, service credentials, and API endpoints must be created.

1. To create the database, complete these steps:

   - Use the database access client to connect to the database server as the `root` user:

     ```
     $ mysql -u root -p
     ```

   - Create the `cyborg` database:

     ```
     CREATE DATABASE cyborg;
     ```

   - Grant proper access to the `cyborg` database:

     ```
     GRANT ALL PRIVILEGES ON cyborg.* TO 'cyborg'@'localhost' IDENTIFIED␣
     ↪BY 'CYBORG_DBPASS';
     ```

     Replace `CYBORG_DBPASS` with a suitable password.

   - Exit the database access client.

     ```
     exit;
     ```

2. Source the `admin` credentials to gain access to admin-only CLI commands:

   ```
   $ . admin-openrc
   ```

3. To create the service credentials, complete these steps:

   - Create the `cyborg` user:

```
$ openstack user create --domain default --password-prompt cyborg
```

- Add the `admin` role to the `cyborg` user:

```
$ openstack role add --project service --user cyborg admin
```

- Create the cyborg service entities:

```
$ openstack service create --name cyborg --description "Acceleration␣
↪Service" accelerator
```

4. Create the Acceleration service API endpoints:

   - If cyborg-api service is deployed using uwsgi, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>/accelerator/v2
```

   - Otherwise, if cyborg-api service is running as a python process, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>:6666/v2
```

> **Note**
>
> URLs (publicurl, internalurl and adminurl) may be different depending on your environment.

Configure Cyborg

1. Edit `cyborg.conf` with your favorite editor. Below is an example which contains basic settings you likely need to configure.

```
[DEFAULT]
transport_url = rabbit://%RABBITMQ_USER%:%RABBITMQ_PASSWORD%@%OPENSTACK_
↪HOST_IP%:5672/
use_syslog = False
state_path = /var/lib/cyborg
debug = True

...

[api]
```

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```
host_ip = 0.0.0.0

...

[database]
connection = mysql+pymysql://%DATABASE_USER%:%DATABASE_PASSWORD%@
↪%OPENSTACK_HOST_IP%/cyborg

...

[service_catalog]
cafile = /opt/stack/data/ca-bundle.pem
project_domain_id = default
user_domain_id = default
project_name = service
password = cyborg
username = cyborg
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password

...

[placement]
project_domain_name = Default
project_name = service
user_domain_name = Default
password = password
username = placement
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[nova]
project_domain_name = Default
project_name = service
user_domain_name = Default
password = password
username = nova
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[keystone_authtoken]
memcached_servers = localhost:11211
signing_dir = /var/cache/cyborg/api
```

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```
cafile = /opt/stack/data/ca-bundle.pem
project_domain_name = Default
project_name = service
user_domain_name = Default
password = cyborg
username = cyborg
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
```

2. Create database tables for Cyborg.

```
cyborg-dbsync --config-file /etc/cyborg/cyborg.conf upgrade
```

3. Install Cyborg API via WSGI *api-uwsgi*

Note

Cyborg-api service can also be run as a Python command that runs a web serve, which can be launched as follows with different Acceleration service API endpoints as mentioned in Prerequisites part. However, we would like to recommend you the uwsgi way since when a project provides a WSGI application the API service gains flexibility in terms of deployment, performance, configuration and scaling. BYW, if you choose devstack to deploy your acceleration service, uwsgi is a default choice.

cyborg-api config-file=/etc/cyborg/cyborg.conf

1. Launch Cyborg Conductor, Cyborg Agent services. Open a separate terminal for each service since the console will be locked by a running process.

```
cyborg-conductor --config-file=/etc/cyborg/cyborg.conf
cyborg-agent --config-file=/etc/cyborg/cyborg.conf
```

Install Cyborg from Source

This section describes how to install and configure the Acceleration Service for Ubuntu 18.04.1 LTS from source code.

Install from git repository

1. Create a folder which will hold all Cyborg components.

```
mkdir ~/cyborg
```

2. Clone the cyborg git repository to the management server.

```
cd ~/cyborg
git clone https://opendev.org/openstack/cyborg
```

3. Set up the cyborg config file

   First, generate a sample configuration file, using tox

```
cd ~/cyborg/cyborg
tox -e genconfig
```

And make a copy of it for further modifications

```
cp -r ~/cyborg/cyborg/etc/cyborg /etc
cd /etc/cyborg
ln -s cyborg.conf.sample cyborg.conf
```

4. Install Cyborg packages.

```
cd ~/cyborg/cyborg
sudo python setup.py install
```

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   - Use the database access client to connect to the database server as the `root` user:

     ```
     $ mysql -u root -p
     ```

   - Create the `cyborg` database:

     ```
     CREATE DATABASE cyborg;
     ```

   - Grant proper access to the `cyborg` database:

     ```
     GRANT ALL PRIVILEGES ON cyborg.* TO 'cyborg'@'localhost' IDENTIFIED␣
     ↪BY 'CYBORG_DBPASS';
     ```

     Replace `CYBORG_DBPASS` with a suitable password.

   - Exit the database access client.

     ```
     exit;
     ```

2. Source the `admin` credentials to gain access to admin-only CLI commands:

   ```
   $ . admin-openrc
   ```

3. To create the service credentials, complete these steps:
   - Create the `cyborg` user:

     ```
     $ openstack user create --domain default --password-prompt cyborg
     ```

   - Add the `admin` role to the `cyborg` user:

     ```
     $ openstack role add --project service --user cyborg admin
     ```

   - Create the cyborg service entities:

```
$ openstack service create --name cyborg --description "Acceleration␣
↪Service" accelerator
```

4. Create the Acceleration service API endpoints:

   - If cyborg-api service is deployed using uwsgi, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>/accelerator/v2
```

   - Otherwise, if cyborg-api service is running as a python process, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>:6666/v2
```

Note

URLs (publicurl, internalurl and adminurl) may be different depending on your environment.

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1. Edit `cyborg.conf` with your favorite editor. Below is an example which contains basic settings you likely need to configure.

```
[DEFAULT]
transport_url = rabbit://%RABBITMQ_USER%:%RABBITMQ_PASSWORD%@%OPENSTACK_
↪HOST_IP%:5672/
use_syslog = False
state_path = /var/lib/cyborg
debug = True

...

[api]
host_ip = 0.0.0.0

...

[database]
connection = mysql+pymysql://%DATABASE_USER%:%DATABASE_PASSWORD%@
↪%OPENSTACK_HOST_IP%/cyborg
```

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```
...

[service_catalog]
cafile = /opt/stack/data/ca-bundle.pem
project_domain_id = default
user_domain_id = default
project_name = service
password = cyborg
username = cyborg
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password

...

[placement]
project_domain_name = Default
project_name = service
user_domain_name = Default
password = password
username = placement
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[nova]
project_domain_name = Default
project_name = service
user_domain_name = Default
password = password
username = nova
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[keystone_authtoken]
memcached_servers = localhost:11211
signing_dir = /var/cache/cyborg/api
cafile = /opt/stack/data/ca-bundle.pem
project_domain_name = Default
project_name = service
user_domain_name = Default
password = cyborg
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```

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```
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Note

Cyborg-api service can also be run as a Python command that runs a web serve, which can be launched as follows with different Acceleration service API endpoints as mentioned in Prerequisites part. However, we would like to recommend you the uwsgi way since when a project provides a WSGI application the API service gains flexibility in terms of deployment, performance, configuration and scaling. BYW, if you choose devstack to deploy your acceleration service, uwsgi is a default choice.

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1. Launch Cyborg Conductor, Cyborg Agent services. Open a separate terminal for each service since the console will be locked by a running process.

```
cyborg-conductor --config-file=/etc/cyborg/cyborg.conf
cyborg-agent --config-file=/etc/cyborg/cyborg.conf
```

Installation with pip

At the command line:

```
$ pip install openstack-cyborg
```

Or, if you have virtualenvwrapper installed:

```
$ mkvirtualenv cyborg
$ pip install openstack-cyborg
```

Common Configuration

Regardless of the package or code source you must do the following to properly setup the Accelerator Life Cycle Management service. A database, service credentials, and API endpoints must be created.

1. To create the database, complete these steps:

   - Use the database access client to connect to the database server as the `root` user:

     ```
     $ mysql -u root -p
     ```

   - Create the `cyborg` database:

     ```
     CREATE DATABASE cyborg;
     ```

   - Grant proper access to the `cyborg` database:

     ```
     GRANT ALL PRIVILEGES ON cyborg.* TO 'cyborg'@'localhost' IDENTIFIED␣
     ↪BY 'CYBORG_DBPASS';
     ```

     Replace `CYBORG_DBPASS` with a suitable password.

- Exit the database access client.

```
exit;
```

2. Source the `admin` credentials to gain access to admin-only CLI commands:

```
$ . admin-openrc
```

3. To create the service credentials, complete these steps:

   - Create the `cyborg` user:

```
$ openstack user create --domain default --password-prompt cyborg
```

   - Add the `admin` role to the `cyborg` user:

```
$ openstack role add --project service --user cyborg admin
```

   - Create the cyborg service entities:

```
$ openstack service create --name cyborg --description "Acceleration␣
↪Service" accelerator
```

4. Create the Acceleration service API endpoints:

   - If cyborg-api service is deployed using uwsgi, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>/accelerator/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>/accelerator/v2
```

   - Otherwise, if cyborg-api service is running as a python process, create the following endpoints:

```
$ openstack endpoint create --region RegionOne \
  accelerator public http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator internal http://<cyborg-ip>:6666/v2
$ openstack endpoint create --region RegionOne \
  accelerator admin http://<cyborg-ip>:6666/v2
```

> **Note**
>
> URLs (publicurl, internalurl and adminurl) may be different depending on your environment.

Configure Cyborg

1. Edit `cyborg.conf` with your favorite editor. Below is an example which contains basic settings you likely need to configure.

```
[DEFAULT]
transport_url = rabbit://%RABBITMQ_USER%:%RABBITMQ_PASSWORD%@%OPENSTACK_
↪HOST_IP%:5672/
use_syslog = False
state_path = /var/lib/cyborg
debug = True

...

[api]
host_ip = 0.0.0.0

...

[database]
connection = mysql+pymysql://%DATABASE_USER%:%DATABASE_PASSWORD%@
↪%OPENSTACK_HOST_IP%/cyborg

...

[service_catalog]
cafile = /opt/stack/data/ca-bundle.pem
project_domain_id = default
user_domain_id = default
project_name = service
password = cyborg
username = cyborg
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password

...

[placement]
project_domain_name = Default
project_name = service
user_domain_name = Default
password = password
username = placement
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[nova]
project_domain_name = Default
```

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```
project_name = service
user_domain_name = Default
password = password
username = nova
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
auth_section = keystone_authtoken

...

[keystone_authtoken]
memcached_servers = localhost:11211
signing_dir = /var/cache/cyborg/api
cafile = /opt/stack/data/ca-bundle.pem
project_domain_name = Default
project_name = service
user_domain_name = Default
password = cyborg
username = cyborg
auth_url = http://%OPENSTACK_HOST_IP%/identity
auth_type = password
```

2. Create database tables for Cyborg.

```
cyborg-dbsync --config-file /etc/cyborg/cyborg.conf upgrade
```

3. Install Cyborg API via WSGI *api-uwsgi*

Note

Cyborg-api service can also be run as a Python command that runs a web serve, which can be launched as follows with different Acceleration service API endpoints as mentioned in Prerequisites part. However, we would like to recommend you the uwsgi way since when a project provides a WSGI application the API service gains flexibility in terms of deployment, performance, configuration and scaling. BYW, if you choose devstack to deploy your acceleration service, uwsgi is a default choice.

cyborg-api config-file=/etc/cyborg/cyborg.conf

1. Launch Cyborg Conductor, Cyborg Agent services. Open a separate terminal for each service since the console will be locked by a running process.

```
cyborg-conductor --config-file=/etc/cyborg/cyborg.conf
cyborg-agent --config-file=/etc/cyborg/cyborg.conf
```

2.1.2 Installing Cyborg API via WSGI

Cyborg-api service can be run either as a Python command that runs a web serve or As a WSGI application hosted by uwsgi. This document is a guide to deploy cyborg-api using uwsgi. In devstack, uwsgi is used by default for development.

WSGI Application

The function `cyborg.api.wsgi_app.init_application` will setup a WSGI application to run behind uwsgi.

Cyborg API behind uwsgi

Create a `cyborg-api-uwsgi` file with content below:

```
[uwsgi]
chmod-socket = 666
socket = /var/run/uwsgi/cyborg-wsgi-api.socket
lazy-apps = true
add-header = Connection: close
buffer-size = 65535
hook-master-start = unix_signal:15 gracefully_kill_them_all
thunder-lock = true
plugins = python
enable-threads = true
worker-reload-mercy = 90
exit-on-reload = false
die-on-term = true
master = true
processes = 2
wsgi-file = /usr/local/bin/cyborg-wsgi-api
```

Start cyborg-api:

```
# uwsgi --ini /etc/cyborg/cyborg-api-uwsgi.ini
```

2.2 Configuration Reference

2.2.1 Configuration Guide

Configuration options for the Acceleration service

The following options can be set in the `/etc/cyborg/cyborg.conf` config file A *sample configuration file* is also available.

DEFAULT

`fatal_exception_format_errors`

Type
boolean

Default
`False`

Used if there is a formatting error when generating an exception message (a programming error). If True, raise an exception; if False, use the unformatted message.

`host`

Type
host address

Default
`localhost`

This option has a sample default set, which means that its actual default value may vary from the one documented above.

Name of this node. This can be an opaque identifier. It is not necessarily a hostname, FQDN, or IP address. However, the node name must be valid within an AMQP key.

`periodic_interval`

Type
integer

Default
`60`

Default interval (in seconds) for running periodic tasks.

`thread_pool_size`

Type
integer

Default
`10`

This option specifies the size of the pool of threads used by API to do async jobs.It is possible to limit the number of concurrent connections using this option.

`bind_timeout`

Type
integer

Default
`60`

This option specifies the timeout of async job for ARQ bind.

`pybasedir`

Type
string

Default
`/usr/lib/python/site-packages/cyborg/cyborg`

This option has a sample default set, which means that its actual default value may vary from the one documented above.

Directory where the cyborg python module is installed.

`bindir`

Type
string

Default
`$pybasedir/bin`

Directory where cyborg binaries are installed.

`state_path`

Type
string

Default
`$pybasedir`

Top-level directory for maintaining cyborgs state.

`debug`

Type
boolean

Default
`False`

Mutable
This option can be changed without restarting.

If set to true, the logging level will be set to DEBUG instead of the default INFO level.

`log_config_append`

Type
string

Default
<None>

Mutable
This option can be changed without restarting.

The name of a logging configuration file. This file is appended to any existing logging configuration files. For details about logging configuration files, see the Python logging module documentation. Note that when logging configuration files are used then all logging configuration is set in the configuration file and other logging configuration options are ignored (for example, log-date-format).

Table 1: Deprecated Variations

Group	Name
DEFAULT	log-config
DEFAULT	log_config

`log_date_format`

Type
string

Default
`%Y-%m-%d %H:%M:%S`

Defines the format string for %(asctime)s in log records. Default: the value above . This option is ignored if log_config_append is set.

`log_file`

Type
string

Default
<None>

(Optional) Name of log file to send logging output to. If no default is set, logging will go to stderr as defined by use_stderr. This option is ignored if log_config_append is set.

Table 2: Deprecated Variations

Group	Name
DEFAULT	logfile

`log_dir`

Type
string

Default
<None>

(Optional) The base directory used for relative log_file paths. This option is ignored if log_config_append is set.

Table 3: Deprecated Variations

Group	Name
DEFAULT	logdir

`use_syslog`

Type
boolean

Default
`False`

Use syslog for logging. Existing syslog format is DEPRECATED and will be changed later to honor RFC5424. This option is ignored if log_config_append is set.

`use_journal`

Type
boolean

Default
`False`

Enable journald for logging. If running in a systemd environment you may wish to enable journal support. Doing so will use the journal native protocol which includes structured metadata in addition to log messages.This option is ignored if log_config_append is set.

`syslog_log_facility`

Type
string

Default
`LOG_USER`

Syslog facility to receive log lines. This option is ignored if log_config_append is set.

`use_json`

Type
boolean

Default
`False`

Use JSON formatting for logging. This option is ignored if log_config_append is set.

`use_stderr`

Type
boolean

Default
`False`

Log output to standard error. This option is ignored if log_config_append is set.

`log_color`

Type
boolean

Default
`False`

(Optional) Set the color key according to log levels. This option takes effect only when logging to stderr or stdout is used. This option is ignored if log_config_append is set.

`log_rotate_interval`

Type
integer

Default
1

The amount of time before the log files are rotated. This option is ignored unless log_rotation_type is set to interval.

`log_rotate_interval_type`

Type
string

Default
`days`

Valid Values
Seconds, Minutes, Hours, Days, Weekday, Midnight

Rotation interval type. The time of the last file change (or the time when the service was started) is used when scheduling the next rotation.

`max_logfile_count`

Type
integer

Default
`30`

Maximum number of rotated log files.

`max_logfile_size_mb`

Type
integer

Default
`200`

Log file maximum size in MB. This option is ignored if log_rotation_type is not set to size.

`log_rotation_type`

Type
string

Default
`none`

Valid Values
interval, size, none

Log rotation type.

Possible values

interval
Rotate logs at predefined time intervals.

size
Rotate logs once they reach a predefined size.

none
Do not rotate log files.

`logging_context_format_string`

Type
string

Default
```
%(asctime)s.%(msecs)03d %(process)d %(levelname)s %(name)s
[%(global_request_id)s %(request_id)s %(user_identity)s]
%(instance)s%(message)s
```

Format string to use for log messages with context. Used by oslo_log.formatters.ContextFormatter

`logging_default_format_string`

Type
string

Default
`%(asctime)s.%(msecs)03d %(process)d %(levelname)s %(name)s [-] %(instance)s%(message)s`

Format string to use for log messages when context is undefined. Used by oslo_log.formatters.ContextFormatter

`logging_debug_format_suffix`

Type
string

Default
`%(funcName)s %(pathname)s:%(lineno)d`

Additional data to append to log message when logging level for the message is DEBUG. Used by oslo_log.formatters.ContextFormatter

`logging_exception_prefix`

Type
string

Default
`%(asctime)s.%(msecs)03d %(process)d ERROR %(name)s %(instance)s`

Prefix each line of exception output with this format. Used by oslo_log.formatters.ContextFormatter

`logging_user_identity_format`

Type
string

Default
`%(user)s %(project)s %(domain)s %(system_scope)s %(user_domain)s %(project_domain)s`

Defines the format string for %(user_identity)s that is used in logging_context_format_string. Used by oslo_log.formatters.ContextFormatter

`default_log_levels`

Type
list

Default
`['amqp=WARN', 'boto=WARN', 'sqlalchemy=WARN', 'suds=INFO', 'oslo.messaging=INFO', 'oslo_messaging=INFO', 'iso8601=WARN', 'requests.packages.urllib3.connectionpool=WARN', 'urllib3.connectionpool=WARN', 'websocket=WARN', 'requests.packages.urllib3.util.retry=WARN', 'urllib3.util.retry=WARN', 'keystonemiddleware=WARN', 'routes.middleware=WARN',`

```
'stevedore=WARN', 'taskflow=WARN', 'keystoneauth=WARN', 'oslo.
cache=INFO', 'oslo_policy=INFO', 'dogpile.core.dogpile=INFO']
```

List of package logging levels in logger=LEVEL pairs. This option is ignored if log_config_append is set.

`publish_errors`

Type
boolean

Default
`False`

Enables or disables publication of error events.

`instance_format`

Type
string

Default
`"[instance: %(uuid)s] "`

The format for an instance that is passed with the log message.

`instance_uuid_format`

Type
string

Default
`"[instance: %(uuid)s] "`

The format for an instance UUID that is passed with the log message.

`rate_limit_interval`

Type
integer

Default
`0`

Interval, number of seconds, of log rate limiting.

`rate_limit_burst`

Type
integer

Default
`0`

Maximum number of logged messages per rate_limit_interval.

`rate_limit_except_level`

Type
string

Default
`CRITICAL`

Valid Values
CRITICAL, ERROR, INFO, WARNING, DEBUG,

Log level name used by rate limiting. Logs with level greater or equal to rate_limit_except_level are not filtered. An empty string means that all levels are filtered.

`fatal_deprecations`

Type
boolean

Default
`False`

Enables or disables fatal status of deprecations.

`run_external_periodic_tasks`

Type
boolean

Default
`True`

Some periodic tasks can be run in a separate process. Should we run them here?

`backdoor_port`

Type
string

Default
<None>

Enable eventlet backdoor. Acceptable values are 0, <port>, and <start>:<end>, where 0 results in listening on a random tcp port number; <port> results in listening on the specified port number (and not enabling backdoor if that port is in use); and <start>:<end> results in listening on the smallest unused port number within the specified range of port numbers. The chosen port is displayed in the services log file.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The backdoor_port option is deprecated and will be removed in a future release.

`backdoor_socket`

Type
string

Default
<None>

Enable eventlet backdoor, using the provided path as a unix socket that can receive connections. This option is mutually exclusive with backdoor_port in that only one should be provided. If both are provided then the existence of this option overrides the usage of that option. Inside the path {pid} will be replaced with the PID of the current process.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The backdoor_socket option is deprecated and will be removed in a future release.

`log_options`

Type
boolean

Default
`True`

Enables or disables logging values of all registered options when starting a service (at DEBUG level).

`graceful_shutdown_timeout`

Type
integer

Default
`60`

Specify a timeout after which a gracefully shutdown server will exit. Zero value means endless wait.

`executor_thread_pool_size`

Type
integer

Default
`64`

Size of executor thread pool when executor is threading or eventlet.

Table 4: Deprecated Variations

Group	Name
DEFAULT	rpc_thread_pool_size

`rpc_response_timeout`

Type
integer

Default
`60`

Seconds to wait for a response from a call.

`transport_url`

Type
string

Default
`rabbit://`

The network address and optional user credentials for connecting to the messaging backend, in URL format. The expected format is:

driver://[user:pass@]host:port[,[userN:passN@]hostN:portN]/virtual_host?query

Example: rabbit://rabbitmq:password@127.0.0.1:5672//

For full details on the fields in the URL see the documentation of oslo_messaging.TransportURL at https://docs.openstack.org/oslo.messaging/latest/reference/transport.html

`control_exchange`

Type
string

Default
`openstack`

The default exchange under which topics are scoped. May be overridden by an exchange name specified in the transport_url option.

`rpc_ping_enabled`

Type
boolean

Default
`False`

Add an endpoint to answer to ping calls. Endpoint is named oslo_rpc_server_ping

agent

`enabled_drivers`

Type
list

Default
`['fake_driver']`

The accelerator drivers enabled on this agent. Such as intel_fpga_driver, inspur_fpga_driver,nvidia_gpu_driver, intel_qat_driver,inspur_nvme_ssd_driver, xilinx_fpga_driver, etc.

api

host_ip

Type
host address

Default
`127.0.0.1`

The IP address on which cyborg-api listens.

port

Type
port number

Default
`6666`

Minimum Value
0

Maximum Value
65535

The TCP port on which cyborg-api listens.

api_workers

Type
integer

Default
<None>

Number of workers for OpenStack Cyborg API service. The default is equal to the number of CPUs available if that can be determined, else a default worker count of 1 is returned.

enable_ssl_api

Type
boolean

Default
`False`

Enable the integrated stand-alone API to service requests via HTTPS instead of HTTP. If there is a front-end service performing HTTPS offloading from the service, this option should be False; note, you will want to change public API endpoint to represent SSL termination URL with public_endpoint option.

public_endpoint

Type
string

Default
<None>

Public URL to use when building the links to the API resources (for example, https://cyborg.rocks:6666). If None the links will be built using the requests host URL. If the API is operating behind a proxy, you will want to change this to represent the proxys URL. Defaults to None.

`api_paste_config`

Type
string

Default
`api-paste.ini`

Configuration file for WSGI definition of API.

database

`mysql_engine`

Type
string

Default
`InnoDB`

MySQL engine to use.

`sqlite_synchronous`

Type
boolean

Default
`True`

If True, SQLite uses synchronous mode.

`backend`

Type
string

Default
`sqlalchemy`

The back end to use for the database.

`connection`

Type
string

Default
`<None>`

The SQLAlchemy connection string to use to connect to the database.

`slave_connection`

Type
string

Default
<None>

The SQLAlchemy connection string to use to connect to the slave database.

`asyncio_connection`

Type
string

Default
<None>

The SQLAlchemy asyncio connection string to use to connect to the database.

`asyncio_slave_connection`

Type
string

Default
<None>

The SQLAlchemy asyncio connection string to use to connect to the slave database.

`synchronous_reader`

Type
boolean

Default
`True`

Whether or not to assume a reader context needs to guarantee it can read data committed by a writer assuming replication lag is present; defaults to True. When False, a reader context works the same as async_reader and will select the slave database if present. When using a galera cluster, this can be set to False only if you set mysql_wsrep_sync_wait to 1 (this will guarantee that the reader will wait until writesets are committed).Note that this may incur a performance degradation within the galera cluster. Note also that this parameter has no effect if you do not set any slave_connection.

`mysql_sql_mode`

Type
string

Default
`TRADITIONAL`

The SQL mode to be used for MySQL sessions. This option, including the default, overrides any server-set SQL mode. To use whatever SQL mode is set by the server configuration, set this to no value. Example: mysql_sql_mode=

`mysql_wsrep_sync_wait`

Type
integer

Default
<None>

For Galera only, configure wsrep_sync_wait causality checks on new connections. Default is None, meaning dont configure any setting.

`connection_recycle_time`

Type
integer

Default
`3600`

Connections which have been present in the connection pool longer than this number of seconds will be replaced with a new one the next time they are checked out from the pool.

`max_pool_size`

Type
integer

Default
`5`

Maximum number of SQL connections to keep open in a pool. Setting a value of 0 indicates no limit.

`max_retries`

Type
integer

Default
`10`

Maximum number of database connection retries during startup. Set to -1 to specify an infinite retry count.

`retry_interval`

Type
integer

Default
`10`

Interval between retries of opening a SQL connection.

`max_overflow`

Type
integer

Default
`50`

If set, use this value for max_overflow with SQLAlchemy.

`connection_debug`

Type
integer

Default
`0`

Minimum Value
0

Maximum Value
100

Verbosity of SQL debugging information: 0=None, 100=Everything.

`connection_trace`

Type
boolean

Default
`False`

Add Python stack traces to SQL as comment strings.

`pool_timeout`

Type
integer

Default
<None>

If set, use this value for pool_timeout with SQLAlchemy.

`use_db_reconnect`

Type
boolean

Default
`False`

Enable the experimental use of database reconnect on connection lost.

`db_retry_interval`

Type
integer

Default
1

Seconds between retries of a database transaction.

`db_inc_retry_interval`

Type
boolean

Default
`True`

If True, increases the interval between retries of a database operation up to db_max_retry_interval.

`db_max_retry_interval`

Type
integer

Default
`10`

If db_inc_retry_interval is set, the maximum seconds between retries of a database operation.

`db_max_retries`

Type
integer

Default
`20`

Maximum retries in case of connection error or deadlock error before error is raised. Set to -1 to specify an infinite retry count.

`connection_parameters`

Type
string

Default
`''`

Optional URL parameters to append onto the connection URL at connect time; specify as param1=value1&param2=value2&

glance

Configuration options for the Image service

`num_retries`

Type
integer

Default
`0`

Minimum Value
0

Enable glance operation retries.

Specifies the number of retries when uploading / downloading an image to / from glance. 0 means no retries.

`verify_glance_signatures`

Type
boolean

Default
`False`

Enable image signature verification.

cyborg uses the image signature metadata from glance and verifies the signature of a signed image while downloading that image. If the image signature cannot be verified or if the image signature metadata is either incomplete or unavailable, then cyborg will not boot the image and instead will place the instance into an error state. This provides end users with stronger assurances of the integrity of the image data they are using to create servers.

Related options:

- The options in the *key_manager* group, as the key_manager is used for the signature validation.
- Both enable_certificate_validation and default_trusted_certificate_ids below depend on this option being enabled.

`enable_certificate_validation`

Type
boolean

Default
`False`

Enable certificate validation for image signature verification.

During image signature verification cyborg will first verify the validity of the images signing certificate using the set of trusted certificates associated with the instance. If certificate validation fails, signature verification will not be performed and the instance will be placed into an error state. This provides end users with stronger assurances that the image data is unmodified and trustworthy. If left disabled, image signature verification can still occur but the end user will not have any assurance that the signing certificate used to generate the image signature is still trustworthy.

Related options:

- This option only takes effect if verify_glance_signatures is enabled.
- The value of default_trusted_certificate_ids may be used when this option is enabled.

Warning

This option is deprecated for removal since 16.0.0. Its value may be silently ignored in the future.

Reason
This option is intended to ease the transition for deployments leveraging image signature verification. The intended state long-term is for signature verification and certificate validation to always happen together.

`default_trusted_certificate_ids`

Type
list

Default
`[]`

List of certificate IDs for certificates that should be trusted.

May be used as a default list of trusted certificate IDs for certificate validation. The value of this option will be ignored if the user provides a list of trusted certificate IDs with an instance API request. The value of this option will be persisted with the instance data if signature verification and certificate validation are enabled and if the user did not provide an alternative list. If left empty when certificate validation is enabled the user must provide a list of trusted certificate IDs otherwise certificate validation will fail.

Related options:

- The value of this option may be used if both verify_glance_signatures and enable_certificate_validation are enabled.

debug

Type
boolean

Default
`False`

Enable or disable debug logging with glanceclient.

cafile

Type
string

Default
<None>

PEM encoded Certificate Authority to use when verifying HTTPs connections.

certfile

Type
string

Default
<None>

PEM encoded client certificate cert file

keyfile

Type
string

Default
<None>

PEM encoded client certificate key file

insecure

Type
boolean

Default
`False`

Verify HTTPS connections.

`timeout`

Type
integer

Default
<None>

Timeout value for http requests

`collect_timing`

Type
boolean

Default
`False`

Collect per-API call timing information.

`split_loggers`

Type
boolean

Default
`False`

Log requests to multiple loggers.

`service_type`

Type
string

Default
`image`

The default service_type for endpoint URL discovery.

`service_name`

Type
string

Default
<None>

The default service_name for endpoint URL discovery.

`valid_interfaces`

Type
list

Default
`['internal', 'public']`

List of interfaces, in order of preference, for endpoint URL.

`region_name`

Type
string

Default
<None>

The default region_name for endpoint URL discovery.

`endpoint_override`

Type
string

Default
<None>

Always use this endpoint URL for requests for this client. NOTE: The unversioned endpoint should be specified here; to request a particular API version, use the *version*, *min-version*, and/or *max-version* options.

`connect_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for connection errors.

`connect_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for connection errors. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`status_code_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for retriable HTTP status codes.

`status_code_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for retriable status codes. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

retriable_status_codes

Type
list

Default
<None>

List of retriable HTTP status codes that should be retried. If not set default to [503]

gpu_devices

This is used to config vGPU types for nvidia GPU devices.

enabled_vgpu_types

Type
list

Default
[]

The vGPU types enabled in the compute node.

Cyborg supports multiple vGPU types in one host. Usually, a single physical GPU can only set one vgpu type. Some pGPUs (e.g. NVIDIA GRID K1) support multiple vGPU types.

If more than one single vGPU type are provided, then for each *vGPU type*, you must add an additional section `[vgpu_$(VGPU_TYPE)]` with a single configuration option `device_addresses` to assign this type to the target physical GPU(s). PGPUs should be configured explictly now, we will improve this after we implement the enable/disable interface.

If the same PCI address is provided for two different types, cyborg-agent will return an InvalidGPUConfig exception at restart.

An example is as the following:

```
[gpu_devices]
enabled_vgpu_types = nvidia-35, nvidia-36

[vgpu_nvidia-35]
device_addresses = 0000:84:00.0,0000:85:00.0

[vgpu_nvidia-36]
device_addresses = 0000:86:00.0
```

keystone

Configuration options for the identity service

cafile

Type
string

Default
<None>

PEM encoded Certificate Authority to use when verifying HTTPs connections.

`certfile`

Type
string

Default
<None>

PEM encoded client certificate cert file

`keyfile`

Type
string

Default
<None>

PEM encoded client certificate key file

`insecure`

Type
boolean

Default
`False`

Verify HTTPS connections.

`timeout`

Type
integer

Default
<None>

Timeout value for http requests

`collect_timing`

Type
boolean

Default
`False`

Collect per-API call timing information.

`split_loggers`

Type
boolean

Default
`False`

Log requests to multiple loggers.

`service_type`

Type
string

Default
`identity`

The default service_type for endpoint URL discovery.

`service_name`

Type
string

Default
<None>

The default service_name for endpoint URL discovery.

`valid_interfaces`

Type
list

Default
`['internal', 'public']`

List of interfaces, in order of preference, for endpoint URL.

`region_name`

Type
string

Default
<None>

The default region_name for endpoint URL discovery.

`endpoint_override`

Type
string

Default
<None>

Always use this endpoint URL for requests for this client. NOTE: The unversioned endpoint should be specified here; to request a particular API version, use the *version*, *min-version*, and/or *max-version* options.

`connect_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for connection errors.

`connect_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for connection errors. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`status_code_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for retriable HTTP status codes.

`status_code_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for retriable status codes. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`retriable_status_codes`

Type
list

Default
<None>

List of retriable HTTP status codes that should be retried. If not set default to [503]

keystone_authtoken

`www_authenticate_uri`

Type
string

Default
<None>

Complete public Identity API endpoint. This endpoint should not be an admin endpoint, as it should be accessible by all end users. Unauthenticated clients are redirected to this endpoint to authenticate. Although this endpoint should ideally be unversioned, client support in the wild varies. If youre using a versioned v2 endpoint here, then this should *not* be the same endpoint the service user utilizes for validating tokens, because normal end users may not be able to reach that endpoint.

Table 5: Deprecated Variations

Group	Name
keystone_authtoken	auth_uri

auth_uri

Type
string

Default
<None>

Complete public Identity API endpoint. This endpoint should not be an admin endpoint, as it should be accessible by all end users. Unauthenticated clients are redirected to this endpoint to authenticate. Although this endpoint should ideally be unversioned, client support in the wild varies. If youre using a versioned v2 endpoint here, then this should *not* be the same endpoint the service user utilizes for validating tokens, because normal end users may not be able to reach that endpoint. This option is deprecated in favor of www_authenticate_uri and will be removed in the S release.

Warning

This option is deprecated for removal since Queens. Its value may be silently ignored in the future.

Reason
The auth_uri option is deprecated in favor of www_authenticate_uri and will be removed in the S release.

auth_version

Type
string

Default
<None>

API version of the Identity API endpoint.

interface

Type
string

Default
internal

Interface to use for the Identity API endpoint. Valid values are public, internal (default) or admin.

delay_auth_decision

Type
boolean

Default
`False`

Do not handle authorization requests within the middleware, but delegate the authorization decision to downstream WSGI components.

`http_connect_timeout`

Type
integer

Default
<None>

Request timeout value for communicating with Identity API server.

`http_request_max_retries`

Type
integer

Default
3

How many times are we trying to reconnect when communicating with Identity API Server.

`cache`

Type
string

Default
<None>

Request environment key where the Swift cache object is stored. When auth_token middleware is deployed with a Swift cache, use this option to have the middleware share a caching backend with swift. Otherwise, use the `memcached_servers` option instead.

`certfile`

Type
string

Default
<None>

Required if identity server requires client certificate

`keyfile`

Type
string

Default
<None>

Required if identity server requires client certificate

`cafile`

Type
string

Default
<None>

A PEM encoded Certificate Authority to use when verifying HTTPs connections. Defaults to system CAs.

`insecure`

Type
boolean

Default
`False`

Verify HTTPS connections.

`region_name`

Type
string

Default
<None>

The region in which the identity server can be found.

`memcached_servers`

Type
list

Default
<None>

Optionally specify a list of memcached server(s) to use for caching. If left undefined, tokens will instead be cached in-process.

Table 6: Deprecated Variations

Group	Name
keystone_authtoken	memcache_servers

`token_cache_time`

Type
integer

Default
`300`

In order to prevent excessive effort spent validating tokens, the middleware caches previously-seen tokens for a configurable duration (in seconds). Set to -1 to disable caching completely.

`memcache_security_strategy`

Type
string

Default
`None`

Valid Values
None, MAC, ENCRYPT

(Optional) If defined, indicate whether token data should be authenticated or authenticated and encrypted. If MAC, token data is authenticated (with HMAC) in the cache. If ENCRYPT, token data is encrypted and authenticated in the cache. If the value is not one of these options or empty, auth_token will raise an exception on initialization.

`memcache_secret_key`

Type
string

Default
<None>

(Optional, mandatory if memcache_security_strategy is defined) This string is used for key derivation.

`memcache_tls_enabled`

Type
boolean

Default
`False`

(Optional) Global toggle for TLS usage when comunicating with the caching servers.

`memcache_tls_cafile`

Type
string

Default
<None>

(Optional) Path to a file of concatenated CA certificates in PEM format necessary to establish the caching servers authenticity. If tls_enabled is False, this option is ignored.

`memcache_tls_certfile`

Type
string

Default
<None>

(Optional) Path to a single file in PEM format containing the clients certificate as well as any number of CA certificates needed to establish the certificates authenticity. This file is only required when client side authentication is necessary. If tls_enabled is False, this option is ignored.

`memcache_tls_keyfile`

Type
string

Default
<None>

(Optional) Path to a single file containing the clients private key in. Otherwhise the private key will be taken from the file specified in tls_certfile. If tls_enabled is False, this option is ignored.

`memcache_tls_allowed_ciphers`

Type
string

Default
<None>

(Optional) Set the available ciphers for sockets created with the TLS context. It should be a string in the OpenSSL cipher list format. If not specified, all OpenSSL enabled ciphers will be available.

`memcache_pool_dead_retry`

Type
integer

Default
300

(Optional) Number of seconds memcached server is considered dead before it is tried again.

`memcache_pool_maxsize`

Type
integer

Default
10

(Optional) Maximum total number of open connections to every memcached server.

`memcache_pool_socket_timeout`

Type
integer

Default
3

(Optional) Socket timeout in seconds for communicating with a memcached server.

`memcache_pool_unused_timeout`

Type
integer

Default
60

(Optional) Number of seconds a connection to memcached is held unused in the pool before it is closed.

`memcache_pool_conn_get_timeout`

Type
integer

Default
`10`

(Optional) Number of seconds that an operation will wait to get a memcached client connection from the pool.

`memcache_use_advanced_pool`

Type
boolean

Default
`True`

(Optional) Use the advanced (eventlet safe) memcached client pool.

`include_service_catalog`

Type
boolean

Default
`True`

(Optional) Indicate whether to set the X-Service-Catalog header. If False, middleware will not ask for service catalog on token validation and will not set the X-Service-Catalog header.

`enforce_token_bind`

Type
string

Default
`permissive`

Used to control the use and type of token binding. Can be set to: disabled to not check token binding. permissive (default) to validate binding information if the bind type is of a form known to the server and ignore it if not. strict like permissive but if the bind type is unknown the token will be rejected. required any form of token binding is needed to be allowed. Finally the name of a binding method that must be present in tokens.

`service_token_roles`

Type
list

Default
`['service']`

A choice of roles that must be present in a service token. Service tokens are allowed to request that an expired token can be used and so this check should tightly control that only actual services should be sending this token. Roles here are applied as an ANY check so any role in this list must be present. For backwards compatibility reasons this currently only affects the allow_expired check.

`service_token_roles_required`

Type
boolean

Default
`False`

For backwards compatibility reasons we must let valid service tokens pass that dont pass the service_token_roles check as valid. Setting this true will become the default in a future release and should be enabled if possible.

`service_type`

Type
string

Default
<None>

The name or type of the service as it appears in the service catalog. This is used to validate tokens that have restricted access rules.

`memcache_sasl_enabled`

Type
boolean

Default
`False`

Enable the SASL(Simple Authentication and Security Layer) if the SASL_enable is true, else disable.

`memcache_username`

Type
string

Default
`''`

the user name for the SASL

`memcache_password`

Type
string

Default
`''`

the username password for SASL

`auth_type`

Type
unknown type

Default
<None>

Authentication type to load

Table 7: Deprecated Variations

Group	Name
keystone_authtoken	auth_plugin

auth_section

Type
unknown type

Default
<None>

Config Section from which to load plugin specific options

nic_devices

This is used to config specific nic devices.

enabled_nic_types

Type
list

Default
[]

nova

cafile

Type
string

Default
<None>

PEM encoded Certificate Authority to use when verifying HTTPs connections.

certfile

Type
string

Default
<None>

PEM encoded client certificate cert file

keyfile

Type
string

Default
<None>

PEM encoded client certificate key file

`insecure`

Type
boolean

Default
`False`

Verify HTTPS connections.

`timeout`

Type
integer

Default
<None>

Timeout value for http requests

`collect_timing`

Type
boolean

Default
`False`

Collect per-API call timing information.

`split_loggers`

Type
boolean

Default
`False`

Log requests to multiple loggers.

`auth_type`

Type
unknown type

Default
<None>

Authentication type to load

Table 8: Deprecated Variations

Group	Name
nova	auth_plugin

`auth_section`

Type
unknown type

Default
<None>

Config Section from which to load plugin specific options

`auth_url`

Type
unknown type

Default
<None>

Authentication URL

`system_scope`

Type
unknown type

Default
<None>

Scope for system operations

`domain_id`

Type
unknown type

Default
<None>

Domain ID to scope to

`domain_name`

Type
unknown type

Default
<None>

Domain name to scope to

`project_id`

Type
unknown type

Default
<None>

Project ID to scope to

`project_name`

Type
unknown type

Default
<None>

Project name to scope to

`project_domain_id`

Type
unknown type

Default
<None>

Domain ID containing project

`project_domain_name`

Type
unknown type

Default
<None>

Domain name containing project

`trust_id`

Type
unknown type

Default
<None>

ID of the trust to use as a trustee use

`default_domain_id`

Type
unknown type

Default
<None>

Optional domain ID to use with v3 and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`default_domain_name`

Type
unknown type

Default
<None>

Optional domain name to use with v3 API and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`user_id`

Type
unknown type

Default
<None>

Users user ID

username

Type
unknown type

Default
<None>

Users username

Table 9: Deprecated Variations

Group	Name
nova	user-name
nova	user_name

user_domain_id

Type
unknown type

Default
<None>

Users domain ID

user_domain_name

Type
unknown type

Default
<None>

Users domain name

password

Type
unknown type

Default
<None>

Users password

tenant_id

Type
unknown type

Default
<None>

Tenant ID

`tenant_name`

Type
unknown type

Default
<None>

Tenant Name

`service_type`

Type
string

Default
`compute`

The default service_type for endpoint URL discovery.

`service_name`

Type
string

Default
<None>

The default service_name for endpoint URL discovery.

`valid_interfaces`

Type
list

Default
`['internal', 'public']`

List of interfaces, in order of preference, for endpoint URL.

`region_name`

Type
string

Default
<None>

The default region_name for endpoint URL discovery.

`endpoint_override`

Type
string

Default
<None>

Always use this endpoint URL for requests for this client. NOTE: The unversioned endpoint should be specified here; to request a particular API version, use the *version*, *min-version*, and/or *max-version* options.

`connect_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for connection errors.

`connect_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for connection errors. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`status_code_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for retriable HTTP status codes.

`status_code_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for retriable status codes. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`retriable_status_codes`

Type
list

Default
<None>

List of retriable HTTP status codes that should be retried. If not set default to [503]

oslo_messaging_kafka

`kafka_max_fetch_bytes`

Type
integer

Default
1048576

Max fetch bytes of Kafka consumer

`kafka_consumer_timeout`

Type
floating point

Default
`1.0`

Default timeout(s) for Kafka consumers

`consumer_group`

Type
string

Default
`oslo_messaging_consumer`

Group id for Kafka consumer. Consumers in one group will coordinate message consumption

`producer_batch_timeout`

Type
floating point

Default
`0.0`

Upper bound on the delay for KafkaProducer batching in seconds

`producer_batch_size`

Type
integer

Default
`16384`

Size of batch for the producer async send

`compression_codec`

Type
string

Default
`none`

Valid Values
none, gzip, snappy, lz4, zstd

The compression codec for all data generated by the producer. If not set, compression will not be used. Note that the allowed values of this depend on the kafka version

`enable_auto_commit`

Type
boolean

Default
`False`

Enable asynchronous consumer commits

`max_poll_records`

Type
integer

Default
`500`

The maximum number of records returned in a poll call

`security_protocol`

Type
string

Default
`PLAINTEXT`

Valid Values
PLAINTEXT, SASL_PLAINTEXT, SSL, SASL_SSL

Protocol used to communicate with brokers

`sasl_mechanism`

Type
string

Default
`PLAIN`

Mechanism when security protocol is SASL

`ssl_cafile`

Type
string

Default
`''`

CA certificate PEM file used to verify the server certificate

`ssl_client_cert_file`

Type
string

Default
`''`

Client certificate PEM file used for authentication.

`ssl_client_key_file`

Type
string

Default
''

Client key PEM file used for authentication.

`ssl_client_key_password`

Type
string

Default
''

Client key password file used for authentication.

oslo_messaging_notifications

`driver`

Type
multi-valued

Default
''

The Drivers(s) to handle sending notifications. Possible values are messaging, messagingv2, routing, log, test, noop

`transport_url`

Type
string

Default
<None>

A URL representing the messaging driver to use for notifications. If not set, we fall back to the same configuration used for RPC.

`topics`

Type
list

Default
['notifications']

AMQP topic used for OpenStack notifications.

`retry`

Type
integer

Default
-1

The maximum number of attempts to re-send a notification message which failed to be delivered due to a recoverable error. 0 - No retry, -1 - indefinite

oslo_messaging_rabbit

amqp_durable_queues

Type
boolean

Default
`False`

Use durable queues in AMQP. If rabbit_quorum_queue is enabled, queues will be durable and this value will be ignored.

amqp_auto_delete

Type
boolean

Default
`False`

Auto-delete queues in AMQP.

rpc_conn_pool_size

Type
integer

Default
`30`

Minimum Value
1

Size of RPC connection pool.

conn_pool_min_size

Type
integer

Default
`2`

The pool size limit for connections expiration policy

conn_pool_ttl

Type
integer

Default
`1200`

The time-to-live in sec of idle connections in the pool

ssl

Type
boolean

Default
`False`

Connect over SSL.

`ssl_version`

Type
string

Default
`''`

SSL version to use (valid only if SSL enabled). Valid values are TLSv1 and SSLv23. SSLv2, SSLv3, TLSv1_1, and TLSv1_2 may be available on some distributions.

`ssl_key_file`

Type
string

Default
`''`

SSL key file (valid only if SSL enabled).

`ssl_cert_file`

Type
string

Default
`''`

SSL cert file (valid only if SSL enabled).

`ssl_ca_file`

Type
string

Default
`''`

SSL certification authority file (valid only if SSL enabled).

`ssl_enforce_fips_mode`

Type
boolean

Default
`False`

Global toggle for enforcing the OpenSSL FIPS mode. This feature requires Python support. This is available in Python 3.9 in all environments and may have been backported to older Python versions on select environments. If the Python executable used does not support OpenSSL FIPS mode, an exception will be raised.

heartbeat_in_pthread

Type
boolean

Default
`False`

(DEPRECATED) It is recommend not to use this option anymore. Run the health check heartbeat thread through a native python thread by default. If this option is equal to False then the health check heartbeat will inherit the execution model from the parent process. For example if the parent process has monkey patched the stdlib by using eventlet/greenlet then the heartbeat will be run through a green thread. This option should be set to True only for the wsgi services.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The option is related to Eventlet which will be removed. In addition this has never worked as expected with services using eventlet for core service framework.

kombu_reconnect_delay

Type
floating point

Default
`1.0`

Minimum Value
0.0

Maximum Value
4.5

How long to wait (in seconds) before reconnecting in response to an AMQP consumer cancel notification.

kombu_reconnect_splay

Type
floating point

Default
`0.0`

Minimum Value
0.0

Random time to wait for when reconnecting in response to an AMQP consumer cancel notification.

kombu_compression

Type
string

Default
<None>

EXPERIMENTAL: Possible values are: gzip, bz2. If not set compression will not be used. This option may not be available in future versions.

`kombu_missing_consumer_retry_timeout`

Type
integer

Default
60

How long to wait a missing client before abandoning to send it its replies. This value should not be longer than rpc_response_timeout.

Table 10: Deprecated Variations

Group	Name
oslo_messaging_rabbit	kombu_reconnect_timeout

`kombu_failover_strategy`

Type
string

Default
round-robin

Valid Values
round-robin, shuffle

Determines how the next RabbitMQ node is chosen in case the one we are currently connected to becomes unavailable. Takes effect only if more than one RabbitMQ node is provided in config.

`rabbit_login_method`

Type
string

Default
AMQPLAIN

Valid Values
PLAIN, AMQPLAIN, EXTERNAL, RABBIT-CR-DEMO

The RabbitMQ login method.

`rabbit_retry_interval`

Type
integer

Default
1

Minimum Value
1

How frequently to retry connecting with RabbitMQ.

`rabbit_retry_backoff`

Type
integer

Default
2

Minimum Value
0

How long to backoff for between retries when connecting to RabbitMQ.

`rabbit_interval_max`

Type
integer

Default
30

Minimum Value
1

Maximum interval of RabbitMQ connection retries.

`rabbit_ha_queues`

Type
boolean

Default
`False`

Try to use HA queues in RabbitMQ (x-ha-policy: all). If you change this option, you must wipe the RabbitMQ database. In RabbitMQ 3.0, queue mirroring is no longer controlled by the x-ha-policy argument when declaring a queue. If you just want to make sure that all queues (except those with auto-generated names) are mirrored across all nodes, run: rabbitmqctl set_policy HA ^(?!amq.).* {ha-mode: all}

`rabbit_quorum_queue`

Type
boolean

Default
`False`

Use quorum queues in RabbitMQ (x-queue-type: quorum). The quorum queue is a modern queue type for RabbitMQ implementing a durable, replicated FIFO queue based on the Raft consensus algorithm. It is available as of RabbitMQ 3.8.0. If set this option will conflict with the HA queues (`rabbit_ha_queues`) aka mirrored queues, in other words the HA queues should be disabled. Quorum queues are also durable by default so the amqp_durable_queues option is ignored when this option is enabled.

`rabbit_transient_quorum_queue`

Type
boolean

Default
`False`

Use quorum queues for transients queues in RabbitMQ. Enabling this option will then make sure those queues are also using quorum kind of rabbit queues, which are HA by default.

`rabbit_quorum_delivery_limit`

Type
integer

Default
`0`

Each time a message is redelivered to a consumer, a counter is incremented. Once the redelivery count exceeds the delivery limit the message gets dropped or dead-lettered (if a DLX exchange has been configured) Used only when rabbit_quorum_queue is enabled, Default 0 which means dont set a limit.

`rabbit_quorum_max_memory_length`

Type
integer

Default
`0`

By default all messages are maintained in memory if a quorum queue grows in length it can put memory pressure on a cluster. This option can limit the number of messages in the quorum queue. Used only when rabbit_quorum_queue is enabled, Default 0 which means dont set a limit.

`rabbit_quorum_max_memory_bytes`

Type
integer

Default
`0`

By default all messages are maintained in memory if a quorum queue grows in length it can put memory pressure on a cluster. This option can limit the number of memory bytes used by the quorum queue. Used only when rabbit_quorum_queue is enabled, Default 0 which means dont set a limit.

`rabbit_transient_queues_ttl`

Type
integer

Default
`1800`

Minimum Value
0

Positive integer representing duration in seconds for queue TTL (x-expires). Queues which are unused for the duration of the TTL are automatically deleted. The parameter affects only reply

and fanout queues. Setting 0 as value will disable the x-expires. If doing so, make sure you have a rabbitmq policy to delete the queues or you deployment will create an infinite number of queue over time.In case rabbit_stream_fanout is set to True, this option will control data retention policy (x-max-age) for messages in the fanout queue rather then the queue duration itself. So the oldest data in the stream queue will be discarded from it once reaching TTL Setting to 0 will disable x-max-age for stream which make stream grow indefinitely filling up the diskspace

`rabbit_qos_prefetch_count`

Type
integer

Default
`0`

Specifies the number of messages to prefetch. Setting to zero allows unlimited messages.

`heartbeat_timeout_threshold`

Type
integer

Default
`60`

Number of seconds after which the Rabbit broker is considered down if heartbeats keep-alive fails (0 disables heartbeat).

`heartbeat_rate`

Type
integer

Default
`3`

How often times during the heartbeat_timeout_threshold we check the heartbeat.

`direct_mandatory_flag`

Type
boolean

Default
`True`

(DEPRECATED) Enable/Disable the RabbitMQ mandatory flag for direct send. The direct send is used as reply, so the MessageUndeliverable exception is raised in case the client queue does not exist.MessageUndeliverable exception will be used to loop for a timeout to lets a chance to sender to recover.This flag is deprecated and it will not be possible to deactivate this functionality anymore

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
Mandatory flag no longer deactivable.

`enable_cancel_on_failover`

Type
boolean

Default
`False`

Enable x-cancel-on-ha-failover flag so that rabbitmq server will cancel and notify consumerswhen queue is down

`use_queue_manager`

Type
boolean

Default
`False`

Should we use consistant queue names or random ones

`hostname`

Type
string

Default
`node1.example.com`

This option has a sample default set, which means that its actual default value may vary from the one documented above.

Hostname used by queue manager. Defaults to the value returned by socket.gethostname().

`processname`

Type
string

Default
`nova-api`

This option has a sample default set, which means that its actual default value may vary from the one documented above.

Process name used by queue manager

`rabbit_stream_fanout`

Type
boolean

Default
`False`

Use stream queues in RabbitMQ (x-queue-type: stream). Streams are a new persistent and replicated data structure (queue type) in RabbitMQ which models an append-only log with non-destructive consumer semantics. It is available as of RabbitMQ 3.9.0. If set this option will replace all fanout queues with only one stream queue.

oslo_policy

enforce_scope

Type
boolean

Default
`True`

This option controls whether or not to enforce scope when evaluating policies. If `True`, the scope of the token used in the request is compared to the `scope_types` of the policy being enforced. If the scopes do not match, an `InvalidScope` exception will be raised. If `False`, a message will be logged informing operators that policies are being invoked with mismatching scope.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
This configuration was added temporarily to facilitate a smooth transition to the new RBAC. OpenStack will always enforce scope checks. This configuration option is deprecated and will be removed in the 2025.2 cycle.

enforce_new_defaults

Type
boolean

Default
`True`

This option controls whether or not to use old deprecated defaults when evaluating policies. If `True`, the old deprecated defaults are not going to be evaluated. This means if any existing token is allowed for old defaults but is disallowed for new defaults, it will be disallowed. It is encouraged to enable this flag along with the `enforce_scope` flag so that you can get the benefits of new defaults and `scope_type` together. If `False`, the deprecated policy check string is logically ORd with the new policy check string, allowing for a graceful upgrade experience between releases with new policies, which is the default behavior.

policy_file

Type
string

Default
`policy.yaml`

The relative or absolute path of a file that maps roles to permissions for a given service. Relative paths must be specified in relation to the configuration file setting this option.

policy_default_rule

Type
string

Default
`default`

Default rule. Enforced when a requested rule is not found.

`policy_dirs`

Type
multi-valued

Default
`policy.d`

Directories where policy configuration files are stored. They can be relative to any directory in the search path defined by the config_dir option, or absolute paths. The file defined by policy_file must exist for these directories to be searched. Missing or empty directories are ignored.

`remote_content_type`

Type
string

Default
`application/x-www-form-urlencoded`

Valid Values
application/x-www-form-urlencoded, application/json

Content Type to send and receive data for REST based policy check

`remote_ssl_verify_server_crt`

Type
boolean

Default
`False`

server identity verification for REST based policy check

`remote_ssl_ca_crt_file`

Type
string

Default
<None>

Absolute path to ca cert file for REST based policy check

`remote_ssl_client_crt_file`

Type
string

Default
<None>

Absolute path to client cert for REST based policy check

`remote_ssl_client_key_file`

Type
string

Default
<None>

Absolute path client key file REST based policy check

`remote_timeout`

Type
floating point

Default
60

Minimum Value
0

Timeout in seconds for REST based policy check

placement

`cafile`

Type
string

Default
<None>

PEM encoded Certificate Authority to use when verifying HTTPs connections.

`certfile`

Type
string

Default
<None>

PEM encoded client certificate cert file

`keyfile`

Type
string

Default
<None>

PEM encoded client certificate key file

`insecure`

Type
boolean

Default
`False`

Verify HTTPS connections.

`timeout`

Type
integer

Default
<None>

Timeout value for http requests

`collect_timing`

Type
boolean

Default
`False`

Collect per-API call timing information.

`split_loggers`

Type
boolean

Default
`False`

Log requests to multiple loggers.

`auth_type`

Type
unknown type

Default
<None>

Authentication type to load

Table 11: Deprecated Variations

Group	Name
placement	auth_plugin

`auth_section`

Type
unknown type

Default
<None>

Config Section from which to load plugin specific options

`auth_url`

Type
unknown type

Default
<None>

Authentication URL

`system_scope`

Type
unknown type

Default
<None>

Scope for system operations

`domain_id`

Type
unknown type

Default
<None>

Domain ID to scope to

`domain_name`

Type
unknown type

Default
<None>

Domain name to scope to

`project_id`

Type
unknown type

Default
<None>

Project ID to scope to

`project_name`

Type
unknown type

Default
<None>

Project name to scope to

`project_domain_id`

Type
unknown type

Default
<None>

Domain ID containing project

`project_domain_name`

Type
unknown type

Default
<None>

Domain name containing project

`trust_id`

Type
unknown type

Default
<None>

ID of the trust to use as a trustee use

`default_domain_id`

Type
unknown type

Default
<None>

Optional domain ID to use with v3 and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`default_domain_name`

Type
unknown type

Default
<None>

Optional domain name to use with v3 API and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`user_id`

Type
unknown type

Default
<None>

Users user ID

`username`

Type
unknown type

Default
<None>

Users username

Table 12: Deprecated Variations

Group	Name
placement	user-name
placement	user_name

`user_domain_id`

Type
unknown type

Default
<None>

Users domain ID

`user_domain_name`

Type
unknown type

Default
<None>

Users domain name

`password`

Type
unknown type

Default
<None>

Users password

`tenant_id`

Type
unknown type

Default
<None>

Tenant ID

`tenant_name`

Type
unknown type

Default
<None>

Tenant Name

`service_type`

Type
string

Default
`placement`

The default service_type for endpoint URL discovery.

`service_name`

Type
string

Default
<None>

The default service_name for endpoint URL discovery.

`valid_interfaces`

Type
list

Default
`['internal', 'public']`

List of interfaces, in order of preference, for endpoint URL.

`region_name`

Type
string

Default
<None>

The default region_name for endpoint URL discovery.

`endpoint_override`

Type
string

Default
<None>

Always use this endpoint URL for requests for this client. NOTE: The unversioned endpoint should be specified here; to request a particular API version, use the *version*, *min-version*, and/or *max-version* options.

`connect_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for connection errors.

`connect_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for connection errors. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`status_code_retries`

Type
integer

Default
<None>

The maximum number of retries that should be attempted for retriable HTTP status codes.

`status_code_retry_delay`

Type
floating point

Default
<None>

Delay (in seconds) between two retries for retriable status codes. If not set, exponential retry starting with 0.5 seconds up to a maximum of 60 seconds is used.

`retriable_status_codes`

Type
list

Default
<None>

List of retriable HTTP status codes that should be retried. If not set default to [503]

service_user

Configuration options for service to service authentication using a service token. These options allow sending a service token along with the users token when contacting external REST APIs.

`send_service_user_token`

Type
boolean

Default
`False`

When True, if sending a user token to a REST API, also send a service token.

`cafile`

Type
string

Default
<None>

PEM encoded Certificate Authority to use when verifying HTTPs connections.

`certfile`

Type
string

Default
<None>

PEM encoded client certificate cert file

`keyfile`

Type
string

Default
<None>

PEM encoded client certificate key file

`insecure`

Type
boolean

Default
`False`

Verify HTTPS connections.

`timeout`

Type
integer

Default
<None>

Timeout value for http requests

`collect_timing`

Type
boolean

Default
`False`

Collect per-API call timing information.

`split_loggers`

Type
boolean

Default
`False`

Log requests to multiple loggers.

`auth_type`

Type
unknown type

Default
<None>

Authentication type to load

Table 13: Deprecated Variations

Group	Name
service_user	auth_plugin

`auth_section`

Type
unknown type

Default
<None>

Config Section from which to load plugin specific options

`auth_url`

Type
unknown type

Default
<None>

Authentication URL

`system_scope`

Type
unknown type

Default
<None>

Scope for system operations

`domain_id`

Type
unknown type

Default
<None>

Domain ID to scope to

`domain_name`

Type
unknown type

Default
<None>

Domain name to scope to

`project_id`

Type
unknown type

Default
<None>

Project ID to scope to

`project_name`

Type
unknown type

Default
<None>

Project name to scope to

`project_domain_id`

Type
unknown type

Default
<None>

Domain ID containing project

`project_domain_name`

Type
unknown type

Default
<None>

Domain name containing project

`trust_id`

Type
unknown type

Default
<None>

ID of the trust to use as a trustee use

`default_domain_id`

Type
unknown type

Default
<None>

Optional domain ID to use with v3 and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`default_domain_name`

Type
unknown type

Default
<None>

Optional domain name to use with v3 API and v2 parameters. It will be used for both the user and project domain in v3 and ignored in v2 authentication.

`user_id`

Type
unknown type

Default
<None>

Users user ID

`username`

Type
unknown type

Default
<None>

Users username

Table 14: Deprecated Variations

Group	Name
service_user	user-name
service_user	user_name

`user_domain_id`

Type
unknown type

Default
<None>

Users domain ID

`user_domain_name`

Type
unknown type

Default
<None>

Users domain name

`password`

Type
unknown type

Default
<None>

Users password

`tenant_id`

Type
unknown type

Default
<None>

Tenant ID

`tenant_name`

Type
unknown type

Default
<None>

Tenant Name

ssl

`ca_file`

Type
string

Default
<None>

CA certificate file to use to verify connecting clients.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The ca_file option is deprecated and will be removed in a future release.

`cert_file`

Type
string

Default
<None>

Certificate file to use when starting the server securely.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The cert_file option is deprecated and will be removed in a future release.

`key_file`

Type
string

Default
<None>

Private key file to use when starting the server securely.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The key_file option is deprecated and will be removed in a future release.

`version`

Type
string

Default
<None>

SSL version to use (valid only if SSL enabled). Valid values are TLSv1 and SSLv23. SSLv2, SSLv3, TLSv1_1, and TLSv1_2 may be available on some distributions.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The version option is deprecated and will be removed in a future release.

`ciphers`

Type
string

Default
<None>

Sets the list of available ciphers. value should be a string in the OpenSSL cipher list format.

Warning

This option is deprecated for removal. Its value may be silently ignored in the future.

Reason
The ciphers option is deprecated and will be removed in a future release.

Cyborg Configuration Sample

Sample configuration files for all Cyborg services are found in the online version of this documentation.

Cyborg Sample Policy

Warning

JSON formatted policy file is deprecated since Cyborg 5.0.0(Victoria). Use YAML formatted file. Use oslopolicy-convert-json-to-yaml tool to convert the existing JSON to YAML formatted policy file in backward compatible way.

The following is a sample cyborg policy file that has been auto-generated from default policy values in code. If youre using the default policies, then the maintenance of this file is not necessary, and it should not be copied into a deployment. Doing so will result in duplicate policy definitions. It is here to help explain which policy operations protect specific cyborg APIs, but it is not suggested to copy and paste into a deployment unless youre planning on providing a different policy for an operation that is not the default.

If you wish build a policy file, you can also use `tox -e genpolicy` to generate it.

The sample policy file can also be downloaded in file form.

```
# Legacy rule for cloud admin access
#"admin_api": "role:admin or role:administrator"

# Default rule for Project level admin APIs.
#"project_admin_api": "role:admin and project_id:%(project_id)s"

# Default rule for Project level non admin APIs.
#"project_member_api": "role:member and project_id:%(project_id)s"

# Default rule for Project level read only APIs.
#"project_reader_api": "role:reader and project_id:%(project_id)s"

# Default rule for Project Member or admin APIs.
#"project_member_or_admin": "rule:project_member_api or rule:admin_api"
```

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```
# DEPRECATED
# "rule:admin_or_owner":"is_admin:True or project_id:%(project_id)s"
# has been deprecated since W in favor of
# "project_member_or_admin":"rule:project_member_api or
# rule:admin_api".
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# WARNING: A rule name change has been identified.
#          This may be an artifact of new rules being
#          included which require legacy fallback
#          rules to ensure proper policy behavior.
#          Alternatively, this may just be an alias.
#          Please evaluate on a case by case basis
#          keeping in mind the format for aliased
#          rules is:
#          "old_rule_name": "new_rule_name".
# "rule:admin_or_owner": "rule:project_member_or_admin"

# Default rule for Project reader or admin APIs.
#"project_reader_or_admin": "rule:project_reader_api or rule:admin_api"

# DEPRECATED
# "rule:admin_or_owner":"is_admin:True or project_id:%(project_id)s"
# has been deprecated since W in favor of
# "project_reader_or_admin":"rule:project_reader_api or
# rule:admin_api".
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# WARNING: A rule name change has been identified.
#          This may be an artifact of new rules being
#          included which require legacy fallback
#          rules to ensure proper policy behavior.
#          Alternatively, this may just be an alias.
#          Please evaluate on a case by case basis
#          keeping in mind the format for aliased
#          rules is:
#          "old_rule_name": "new_rule_name".
# "rule:admin_or_owner": "rule:project_reader_or_admin"

# DEPRECATED
```

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```
# "public_api" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# legacy rule of Internal flag for public API routes
#"public_api": "is_public_api:True"

# DEPRECATED
# "allow" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# legacy rule: any access will be passed
#"allow": "@"

# DEPRECATED
# "deny" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# legacy rule: all access will be forbidden
#"deny": "!"

# DEPRECATED
# "default" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# Legacy rule for default rule
#"default": "rule:admin_or_owner"

# DEPRECATED
# "is_admin" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
```

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```
# consideration if you are relying on overrides in your deployment for
# the policy API.
# Full read/write API access
#"is_admin": "rule:admin_api"

# DEPRECATED
# "admin_or_owner" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# Admin or owner API access
#"admin_or_owner": "is_admin:True or project_id:%(project_id)s"

# DEPRECATED
# "admin_or_user" has been deprecated since W.
# Cyborg API policies are introducing new default roles with
# scope_type capabilities. We will start to deprecate old policies
# from WALLABY release, and are going to ignore all the old policies
# silently from X release. Be sure to take these new defaults into
# consideration if you are relying on overrides in your deployment for
# the policy API.
# Admin or user API access
#"admin_or_user": "is_admin:True or user_id:%(user_id)s"

# Retrieve all device_profiles
# GET  /v2/device_profiles
# Intended scope(s): project
#"cyborg:device_profile:get_all": "rule:project_reader_or_admin"

# DEPRECATED
# "cyborg:device_profile:get_all":"rule:admin_or_owner" has been
# deprecated since W in favor of
# "cyborg:device_profile:get_all":"rule:project_reader_or_admin".
# request admin_or_owmer rule is too strict for listing device_profile

# Retrieve a specific device_profile
# GET  /v2/device_profiles/{device_profiles_uuid}
# Intended scope(s): project
#"cyborg:device_profile:get_one": "rule:project_reader_or_admin"

# DEPRECATED
# "cyborg:device_profile:get_one":"rule:admin_or_owner" has been
# deprecated since W in favor of
# "cyborg:device_profile:get_one":"rule:project_reader_or_admin".
# request admin_or_owmer rule is too strict for retrieving a
# device_profile
```

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```
# Create a device_profile
# POST  /v2/device_profiles
# Intended scope(s): project
#"cyborg:device_profile:create": "rule:admin_api"

# DEPRECATED
# "cyborg:device_profile:create":"rule:is_admin" has been deprecated
# since W in favor of "cyborg:device_profile:create":"rule:admin_api".
# project_admin_or_owner is too permissive, introduce admin for
# creation

# Delete device_profile(s)
# DELETE  /v2/device_profiles/{device_profiles_uuid}
# DELETE  /v2/device_profiles?value={device_profile_name1}
# Intended scope(s): project
#"cyborg:device_profile:delete": "rule:admin_api"

# DEPRECATED
# "cyborg:device_profile:delete":"rule:admin_or_owner" has been
# deprecated since W in favor of
# "cyborg:device_profile:delete":"rule:admin_api".
# project_admin_or_owner is too permissive, introduce admin for
# deletion

# Show device detail
#"cyborg:device:get_one": "rule:allow"

# Retrieve all device records
#"cyborg:device:get_all": "rule:allow"

# Disable a device
#"cyborg:device:disable": "rule:admin_api"

# Enable a device
#"cyborg:device:enable": "rule:admin_api"

# Show deployable detail
#"cyborg:deployable:get_one": "rule:allow"

# Retrieve all deployable records
#"cyborg:deployable:get_all": "rule:allow"

# FPGA programming.
#"cyborg:deployable:program": "rule:allow"

# Show attribute detail
#"cyborg:attribute:get_one": "rule:allow"
```

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```
# Retrieve all attribute records
#"cyborg:attribute:get_all": "rule:allow"

# Create an attribute record
#"cyborg:attribute:create": "rule:allow"

# Delete attribute records.
#"cyborg:attribute:delete": "rule:allow"

# Retrieve accelerator request records.
#"cyborg:arq:get_all": "rule:default"

# Get an accelerator request record.
#"cyborg:arq:get_one": "rule:default"

# Create accelerator request records.
#"cyborg:arq:create": "rule:allow"

# Delete accelerator request records.
#"cyborg:arq:delete": "rule:default"

# Update accelerator request records.
#"cyborg:arq:update": "rule:default"

# Show fpga detail
#"cyborg:fpga:get_one": "rule:allow"

# Retrieve all fpga records
#"cyborg:fpga:get_all": "rule:allow"

# Update fpga records
#"cyborg:fpga:update": "rule:allow"
```

Cyborg Policy Configuration Guide

Cyborg, like most OpenStack projects, uses a policy language to restrict permissions on REST API actions.

- *Policy Concepts*: In the Victoria release, Cyborg API policy defines new default roles with system scope capabilities. These new changes improve the security level and manageability of Cyborg API as they are richer in terms of handling access at system and project level token with Read and Write roles.

Understanding Cyborg Policies

Warning

JSON formatted policy file is deprecated since Cyborg (Victoria). Use YAML formatted file. Use

oslopolicy-convert-json-to-yaml tool to convert the existing JSON to YAML formatted policy file in backward compatible way.

Cyborg supports a rich policy system that has evolved significantly over its lifetime. Initially, cyborg policy defaults have been defined in the codebase, requiring the `policy.json` file only to override these defaults. Starting in the Victoria release, policy file has been changed from `policy.json` to `policy.yaml`.

The old default policy in Cyborg is incomplete and not good enough. Since Cyborg V2 API is newly implemented in Train, RBAC check for V2 API still remains incomplete. So in the Ussuri release, the specification of policy refresh was approved. In the Victoria release, Cyborg landed the new default roles to improve some issues that had been identified:

1. No `allow`. Old policy `allow` means any access will be passed. `allow` rule was used by cyborg:arq:create, which is too slack.
2. No global vs project admin. The old role `is_admin` is used for the global admin that is able to make almost any change to Cyborg, and see all details of the Cyborg system. The rule passes for any user with an admin role, it doesnt matter which project is used.
3. No `admin_or_owner`. Old role `admin_or_owner` sounds like it checks if the user is a member of a project. However, for most APIs we use the default target which means this rule will pass for any authenticated user.
4. Introduce `scope_type` and `reader` role. There still some cases which are not well covered. For example, it is impossible to allow a user to retrieve/update devices which are shared by multiple projects from a system level without being given the global admin role. In addition, cyborg now doesnt have a `reader` role.

Keystone comes with `admin`, `member` and `reader` roles by default. Please refer to keystone document for more information about these new defaults. In addition, keystone supports a new system scope concept that makes it easier to protect deployment level resources from project or system level resources. Please refer to token scopes and system scope specification to understand the scope concept.

In the Cyborg (Victoria) release, Cyborg policies implemented the scope concept and default roles provided by keystone (admin, member, and reader). Using common roles from keystone reduces the likelihood of similar, but different, roles implemented across projects or deployments. With the help of the new defaults it is easier to understand who can do what across projects, reduces divergence, and increases interoperability.

The below sections explain how these new defaults in the Cyborg can solve the issues mentioned above and extend more functionality to end users in a safe and secure way.

More information is provided in the cyborg specification

Scope

OpenStack Keystone supports different scopes in tokens. These are described here. Token scopes represent the layer of authorization. Policy `scope_types` represent the layer of authorization required to access an API.

Note

The `scope_type` of each policy is hardcoded and is not overridable via the policy file.

Cyborg policies have implemented the scope concept by defining the `scope_type` in policies. To know each policys `scope_type`, please refer to the *Policy Reference* and look for `Scope Types` or `Intended scope(s)` in *Policy Sample File* as shown in below examples.

`system` scope

Policies with a `scope_type` of `system` means a user with a `system-scoped` token has permission to access the resource. This can be seen as a global role. All the system-level operations policies have defaulted to `scope_type` of `['system']`.

For example, consider the `POST /v2/device_profiles` API.

```
# Create a device_profile
# POST  /v2/device_profiles
# Intended scope(s): system
#"cyborg:device_profile:create": "rule:system_admin_api"
```

`project` scope

Policies with a `scope_type` of `project` means a user with a `project-scoped` token has permission to access the resource. This can be seen as a project role. All the project-level operations policies should be set to `scope_type` of `['project']` by default.

`system and project` scope

Policies with a `scope_type` of `system and project` means a user with a `system-scoped` or `project-scoped` token has permission to access the resource. All the system and project level operations policies have defaulted to `scope_type` of `['system', 'project']`.

For example, consider the `GET /v2/device_profiles/{device_profiles_uuid}` API.

```
# Retrieve a specific device_profile
# GET  /v2/device_profiles/{device_profiles_uuid}
# Intended scope(s): system, project
#"cyborg:device_profile:get_one": "rule:system_or_project_reader"
```

These scope types provide a way to differentiate between system-level and project-level access roles. You can control the information with scope of the users.

Policy scope is disabled by default to allow operators to migrate from the old policy enforcement system in a graceful way. This can be enabled by configuring the *`oslo_policy.enforce_scope`* option to `True`.

Note

[oslo_policy] enforce_scope=True

Roles

You can refer to this document to know about all available defaults from Keystone.

Along with the `scope_type` feature, Cyborg policy defines new defaults for each policy.

reader

This provides read-only access to the resources within the `system` or `project`. Cyborg policies are defaulted to below rules:

```
system_reader_api
   Default
      role:reader and system_scope:all

project_reader_api
   Default
      role:reader and project_id:%(project_id)s

system_or_project_reader
   Default
      rule:system_reader_api or rule:project_reader_api
```

member

This role is to perform the project level write operation with combination to the system admin. Cyborg policies are defaulted to below rules:

```
project_member_api
   Default
      role:member and project_id:%(project_id)s

system_admin_or_owner
   Default
      rule:system_admin_api or rule:project_member_api
```

admin

This role is to perform the admin level write operation at system as well as at project-level operations. Cyborg policies are defaulted to below rules:

```
system_admin_api
   Default
      role:admin and system_scope:all

project_admin_api
   Default
      role:admin and project_id:%(project_id)s

system_admin_or_owner
   Default
      rule:system_admin_api or rule:project_member_api
```

With these new defaults, you can solve the problem of:

1. Providing the read-only access to the user. Polices are made more granular and defaulted to reader rules. For exmaple: If you need to let someone audit your deployment for security purposes.

2. Customize the policy in better way. For example, you will be able to provide access to project level member to perform arq patch/post for instance boot with the projects token.

Backward Compatibility

During the development period (Victoria and Wallaby releases), the new and old policy will both work for backward compatibility by supporting the old defaults and disabling the `scope_type` feature by default. This means the old defaults and deployments that use them will keep working as-is. However, we encourage every deployment to switch to new policy. `scope_type` will be enabled by default and the old defaults will be removed starting in the X release.

To implement the new default reader roles, some policies needed to become granular. They have been renamed, with the old names still supported for backwards compatibility.

Migration Plan

To have a graceful migration, Cyborg provides two flags to switch to the new policy completely. You do not need to overwrite the policy file to adopt the new policy defaults.

Here is step wise guide for migration:

1. Create scoped token:

   You need to create the new token with scope knowledge via below CLI:

   - Create System Scoped Token.
   - Create Project Scoped Token.

2. Create new default roles in keystone if not done:

   If you do not have new defaults in Keystone then you can create and re-run the Keystone Bootstrap. Keystone added this support in 14.0.0 (Rocky) release.

3. Enable Scope Checks

   The *oslo_policy.enforce_scope* flag is to enable the `scope_type` features. The scope of the token used in the request is always compared to the `scope_type` of the policy. If the scopes do not match, one of two things can happen. If *oslo_policy.enforce_scope* is True, the request will be rejected. If *oslo_policy.enforce_scope* is False, an warning will be logged, but the request will be accepted (assuming the rest of the policy passes). The default value of this flag is False.

   Note

   Before you enable this flag, you need to audit your users and make sure everyone who needs system-level access has a system role assignment in keystone.

4. Enable new defaults

   The *oslo_policy.enforce_new_defaults* flag switches the policy to new defaults-only. This flag controls whether or not to use old deprecated defaults when evaluating policies. If True, the old deprecated defaults are not evaluated. This means if any existing token is allowed for old defaults but is disallowed for new defaults, it will be rejected. The default value of this flag is False.

> **Note**
>
> Before you enable this flag, you need to educate users about the different roles they need to use to continue using Cyborg APIs.

5. Check for deprecated policies

   A few policies were made more granular to implement the reader roles. New policy names are available to use. If old policy names which are renamed are overwritten in policy file, then warning will be logged. Please migrate those policies to new policy names.

We expect all deployments to migrate to new policy by X release so that we can remove the support of old policies.

- *Policy Reference*: A complete reference of all policy points in cyborg and what they impact.

Cyborg Policies

The following is an overview of all available policies in Cyborg.

> **Warning**
>
> JSON formatted policy file is deprecated since Cyborg (Victoria). Use YAML formatted file. Use oslopolicy-convert-json-to-yaml tool to convert the existing JSON to YAML formatted policy file in backward compatible way.

cyborg.api

admin_api

Default
`role:admin or role:administrator`

Legacy rule for cloud admin access

project_admin_api

Default
`role:admin and project_id:%(project_id)s`

Default rule for Project level admin APIs.

project_member_api

Default
`role:member and project_id:%(project_id)s`

Default rule for Project level non admin APIs.

project_reader_api

Default
`role:reader and project_id:%(project_id)s`

Default rule for Project level read only APIs.

project_member_or_admin

Default

`rule:project_member_api or rule:admin_api`

Default rule for Project Member or admin APIs.

`project_reader_or_admin`

Default

`rule:project_reader_api or rule:admin_api`

Default rule for Project reader or admin APIs.

`public_api`

Default

`is_public_api:True`

legacy rule of Internal flag for public API routes

`allow`

Default

`@`

legacy rule: any access will be passed

`deny`

Default

`!`

legacy rule: all access will be forbidden

`default`

Default

`rule:admin_or_owner`

Legacy rule for default rule

`is_admin`

Default

`rule:admin_api`

Full read/write API access

`admin_or_owner`

Default

`is_admin:True or project_id:%(project_id)s`

Admin or owner API access

`admin_or_user`

Default

`is_admin:True or user_id:%(user_id)s`

Admin or user API access

`cyborg:device_profile:get_all`

Default

`rule:project_reader_or_admin`

Operations

- **GET** /v2/device_profiles

Scope Types

- **project**

Retrieve all device_profiles

`cyborg:device_profile:get_one`

Default
rule:project_reader_or_admin

Operations

- **GET** /v2/device_profiles/{device_profiles_uuid}

Scope Types

- **project**

Retrieve a specific device_profile

`cyborg:device_profile:create`

Default
rule:admin_api

Operations

- **POST** /v2/device_profiles

Scope Types

- **project**

Create a device_profile

`cyborg:device_profile:delete`

Default
rule:admin_api

Operations

- **DELETE** /v2/device_profiles/{device_profiles_uuid}
- **DELETE** /v2/device_profiles?value={device_profile_name1}

Scope Types

- **project**

Delete device_profile(s)

`cyborg:device:get_one`

Default
rule:allow

Show device detail

`cyborg:device:get_all`

Default
`rule:allow`

Retrieve all device records

`cyborg:device:disable`

Default
`rule:admin_api`

Disable a device

`cyborg:device:enable`

Default
`rule:admin_api`

Enable a device

`cyborg:deployable:get_one`

Default
`rule:allow`

Show deployable detail

`cyborg:deployable:get_all`

Default
`rule:allow`

Retrieve all deployable records

`cyborg:deployable:program`

Default
`rule:allow`

FPGA programming.

`cyborg:attribute:get_one`

Default
`rule:allow`

Show attribute detail

`cyborg:attribute:get_all`

Default
`rule:allow`

Retrieve all attribute records

`cyborg:attribute:create`

Default
`rule:allow`

Create an attribute record

`cyborg:attribute:delete`

Default
`rule:allow`

Delete attribute records.

`cyborg:arq:get_all`

Default
`rule:default`

Retrieve accelerator request records.

`cyborg:arq:get_one`

Default
`rule:default`

Get an accelerator request record.

`cyborg:arq:create`

Default
`rule:allow`

Create accelerator request records.

`cyborg:arq:delete`

Default
`rule:default`

Delete accelerator request records.

`cyborg:arq:update`

Default
`rule:default`

Update accelerator request records.

`cyborg:fpga:get_one`

Default
`rule:allow`

Show fpga detail

`cyborg:fpga:get_all`

Default
`rule:allow`

Retrieve all fpga records

`cyborg:fpga:update`

Default
`rule:allow`

Update fpga records

2.2.2 Cyborg Support Matrix

Cyborg supports specific operations on VMs with attached accelerator resources, which are generally a subset of the full set of VM operations supported by Nova (nova-vm-ops).

In this release, these operations have a dependency on specific Nova patches (nova-patches). They can be expected to work in Cyborg only if and when these Nova patches get merged without significant changes. These operations are not supported in this release since the dependencies are not met.

Table 15: VM Operations Expected to Work With Nova Dependencies

VM Operation	Command
VM creation	`openstack server create`
VM deletion	`openstack server delete`
Reboot within VM	`ssh to VM and reboot in OS`
Soft reboot	`openstack server reboot --soft`
Pause/Unpause	`openstack server pause`, `openstack server unpause`
Backup	`openstack server backup create`
Take a snapshot	`openstack server image create`
Lock/Unlock	`openstack server lock`, `openstack server unlock`
Rebuild/Evacuate	`openstack server rebuild`
Shelve/Unshelve	`openstack server shelve`, `openstack server unshelve`

Operations not listed here may or may not work.

Driver Support

The list of drivers available as part of the Cyborg distribution at the time of release can be found in: `cyborg.accelerator.driver` section of Cyborgs setup.cfg

The following table provides additional information for individual drivers.

Table 16: Driver Support

Driver Name	Supported Products	Description	Notes	Temporary Test Report
Fake Driver	None	A driver that creates a fake device with accelerator resources of type FPGA. Useful for exploring Cyborg without hardware and for Continuous Integration testing.	None	None
Intel FPGA OPAE Driver	Intel PAC	The driver for Intel FPGA devices with OPAE software stack.	Supports programming of FPGA bitstreams of type `gbs`.	None
Nvidia GPU driver	None	The driver for Nvidia GPUs.	None	None
Ascend AI Chip driver	None	The driver for Huaweis Ascend AI chips.	None	None
Intel QAT Driver	Intel QuickAssist Technology Card	The driver for Intel QAT Cards.	None	Test results reported at Aug 2020. Please reference: Intel QAT Driver Test Report
Inspur FPGA Driver	None	The driver for Inspur FPGA Cards.	None	Test results reported at Aug 2020. Please reference: Inspur FPGA Driver Test Report
Intel NIC Driver	None	The driver for Intel NIC Cards.	None	Test results reported at Feb 2021. Please reference: Intel NIC Driver Test Report
Inspur NVMe SSD Driver	None	The driver for Inspur NVMe SSD DISK.	None	Test results reported at Feb 2021. Please reference: Inspur NVMe SSD Driver Test Report
Xilinx FPGA Driver	None	The driver for Xilinx FPGA Cards.	None	None

Note

Temporary Test Report: This is a temporary test report, it is only valid for a short time, if you encounter problems, please contact the Cyborg team.

2.3 Maintenance

Once you are running cyborg, the following information is extremely useful.

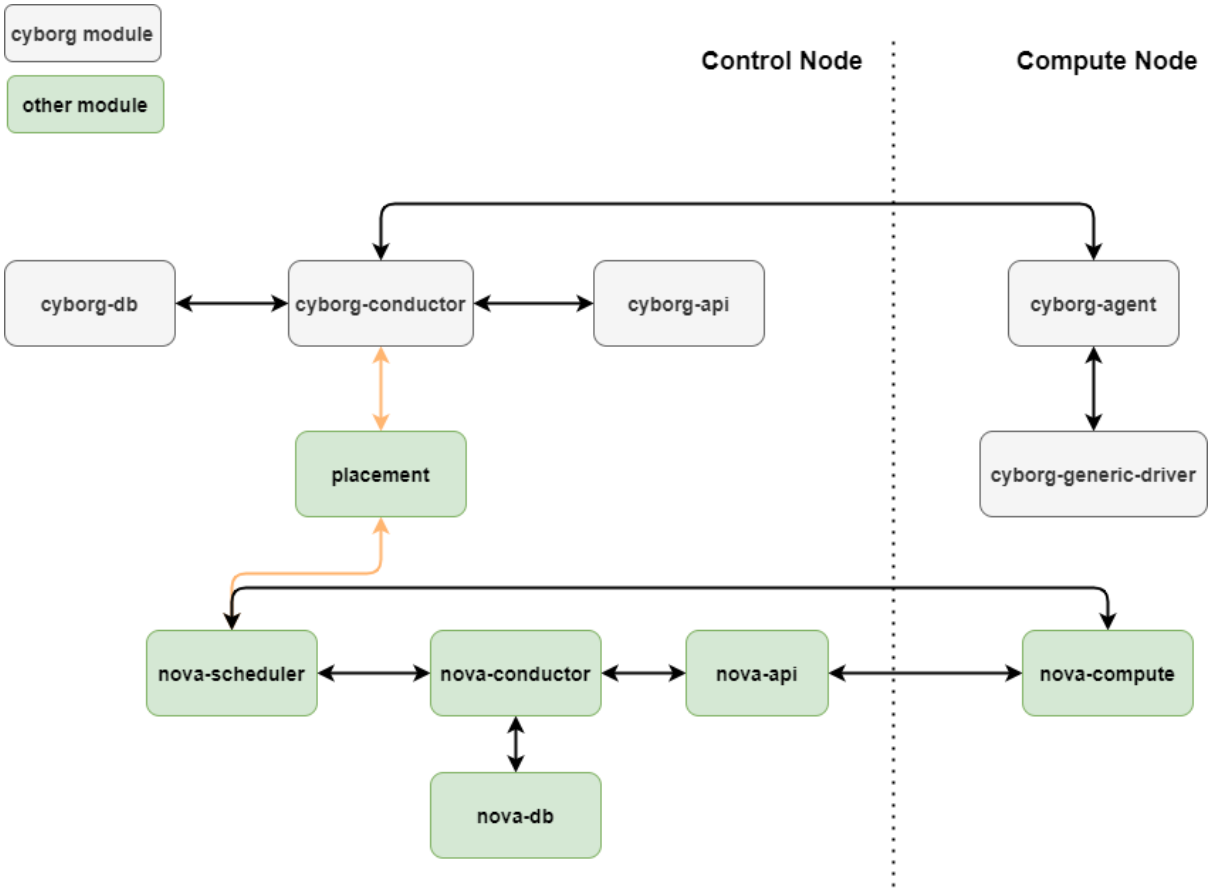
- *Admin Guide*: A collection of guides for administrating cyborg.

2.3.1 Acceleration Service

The OpenStack Cyborg is running as an acceleration service that allows you to manage the lifecycle of accelerating for an instance in cloud computing platform. It gives you control over accelerators attached to instances easily.

Overview

A good understand on how Cyborg interacts with Nova and Placement help operators manage the acceleration service more effectively.



Coexistence with PCI whitelists

The operator tells Nova which PCI devices to claim and to be used by configuring the PCI Whitelists mechanism. In addition, the operator installs Cyborg drivers in compute nodes and configures/enables them. Those drivers may then discover and report some PCI devices. The operator must ensure that both configurations are compatible.

Ideally, there is a single way for the operator to identify which PCI devices should be claimed by Nova and which by Cyborg. Until that is figured out, the operator shall use Cyborgs configuration file to specify which Cyborg drivers are enabled. Since each driver claims specific PCI IDs, the operator can and must ensure that none of these PCI IDs are included in Novas PCI whitelist.

Placement update

Cyborg conductor calls Placement API directly to represent devices and accelerators. Some of the intended use cases for the API invocation are:

- Create or delete child RPs under the compute node RP.
- Create or delete custom RCs and custom traits.
- Associate traits with RPs or remove such association.
- Update RP inventory.

Cyborg shall not modify the RPs created by any other component, such as Nova virt drivers.

User Requests

The user request for accelerators is encapsulated in a device profile, which is created and managed by the admin via the Cyborg API.

The structure overview of a *device_profile* is like this:

```
{
    "device_profiles":[
      {
          "name":"fpga-dp1",
          "uuid":"5518a925-1c2c-49a2-a8bf-0927d9456f3e",
          "description": "",
          "groups":[
            {
              "trait:CUSTOM_FPGA_TRAITS":"required",
              "resources:FPGA":"1",
              "accel:bitstream_id":"d5ca2f11-3108-4426-a11c-a959987565df"
            }
          ],
          "created_at": "2020-03-10 03:52:15+00:00",
          "updated_at": null,
          "links":[
            {
              "href":"http://192.168.32.217/accelerator/v2/device_profiles/
↪5518a925-1c2c-49a2-a8bf-0927d9456f3e",
              "rel":"self"
            }
          ]
      }
    ]
}
```

The device profile is folded into the flavor as an extra spec by the operator, as below:

```
openstack flavor set --property 'accel:device_profile=<profile_name>' flavor
```

Thus the standard Nova API can be used to create an instance with only the flavor (without device profiles), like this:

```
openstack server create --flavor f ....  # instance creation
```

In the future, device profile may be used by itself to specify accelerator resources for the instance creation API.

Updating the Request Spec

When the user submits a request to create an instance, as described in Section User Requests, Nova needs to call a Cyborg API, to get back the resource request groups in the device profile and merge them into the request spec.

This call, like all the others that Nova would make to Cyborg APIs, is done through a Keystone-based adapter that would locate the Cyborg service, similar to the way Nova calls Placement. A Cyborg client module added to Nova, will encapsulate such calls.

VM images in Glance may be associated with image properties (other than image traits), such as bit-stream/function IDs needed for that image. So, Nova should pass the VM image UUID from the request spec to Cyborg.

The groups in the device profile are numbered by Cyborg. The request groups that are merged into the request spec are numbered by Nova. These numberings would not be the same in general, i.e., the N-th device profile group may not correspond to the N-th request group in the request spec.

When the device profile request groups are added to other request groups in the flavor, the group_policy of the flavor shall govern the overall semantics of all request groups.

Accelerator Requests

An accelerator request (ARQ) is an object that represents the state of the request for an accelerator to be assigned to an instance. The creation and management of ARQs are handled by Cyborg, and ARQs are persisted in Cyborg database.

An ARQ represents a request for a single accelerator by definition. The device profile in the user request may have N request groups, each asking for M accelerators, then N * M ARQs will be created for that device profile.

When an ARQ is initially created by Cyborg, it is not yet associated with a specific host name or a device resource provider. So it is said to be in an unbound state. Subsequently, Nova calls Cyborg to bind the ARQ to a host name, a device RP UUID and an instance UUID. If the instance fails to spawn, Nova would unbind the ARQ with deleting it. On instance termination, Nova would delete the ARQs after unbinding them.

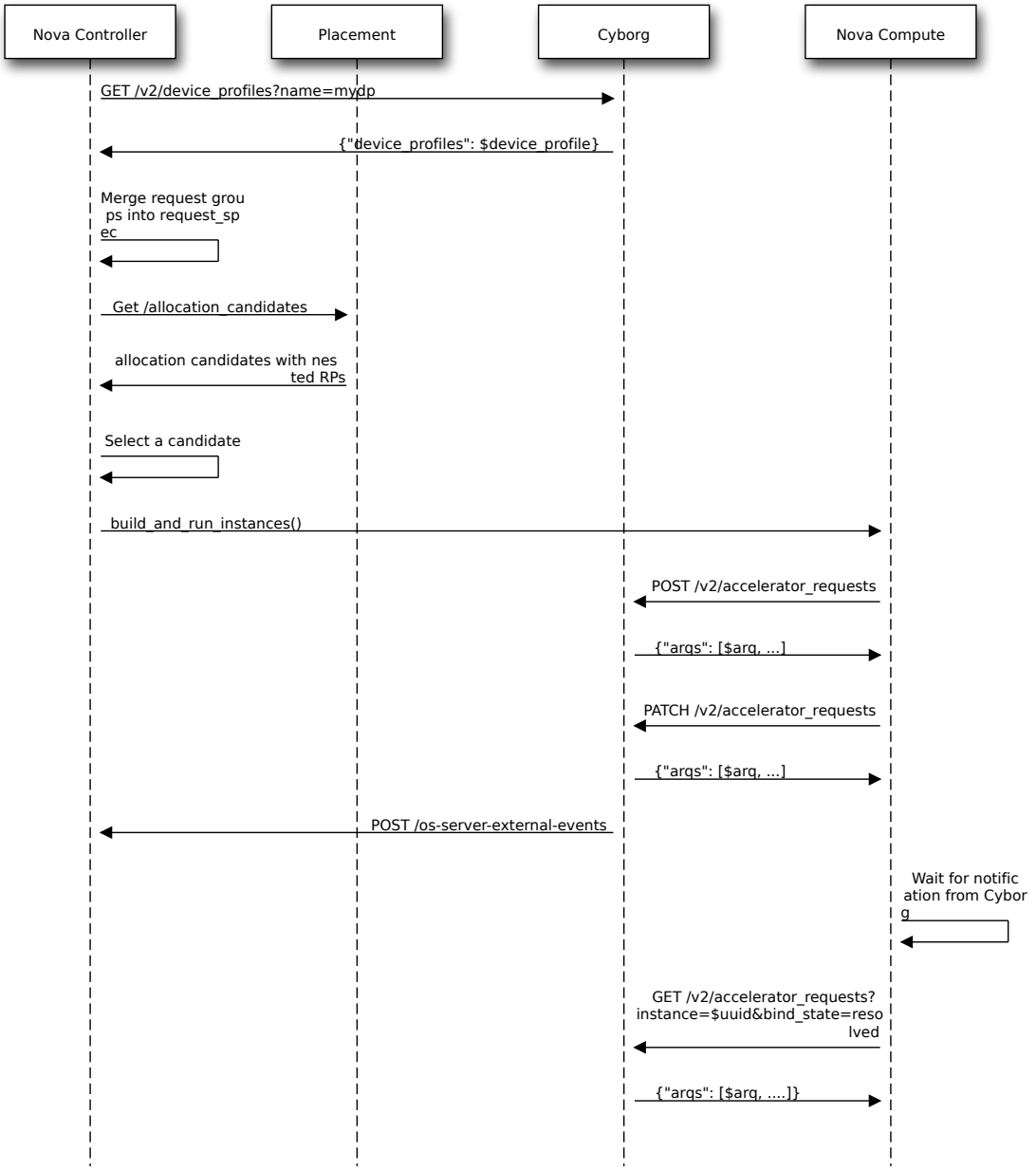
Each ARQ needs to be matched to the specific RP in the allocation candidate that Nova has chosen, before the ARQ is bound. The current Nova code maps request groups to RPs, while the Cyborg client module in Nova (cyborg-client-module) matches ARQs to request groups. The matching is done using the request_id field in the RequestGroup object as below:

- The order of request groups in a device profile is not significant, but it is preserved by Cyborg. Thus, each device profile request group has a unique index.
- When the device profile request groups returned by Cyborg are added to the request spec, the request_id field is set to device_profile_<N> for the N-th device profile request group (starting from zero). The device profile name need not be included here because there is only one device profile per request spec.

- When Cyborg creates an ARQ for a device profile, it embeds the device profile request group index in the ARQ before returning it to Nova.
- The matching is done in two steps:
  - Each ARQ is mapped to a specific request group in the request spec using the request_id field.
  - Each request group is mapped to a specific RP using the same logic as the Neutron bandwidth provider.

Cyborg and Nova interaction workflow

This flow is captured by the following sequence diagram, in which the Nova conductor and scheduler are together represented as the Nova controller.



A Cyborg client module is added to nova (cyborg-client-module). All Cyborg API calls are routed through that.

1. The Nova API server receives a *POST /servers* API request with a flavor that includes a device

profile name.

2. The Nova API server calls the Cyborg API *GET /v2/device_profiles?name=$device_profile_name* and gets back the device profile. The request groups in that device profile are added to the request spec.

3. The Nova scheduler invokes Placement and gets a list of allocation candidates. It selects one of those candidates and makes claim(s) in Placement. The Nova conductor then sends a RPC message build_and_run_instances to the Nova compute manager.

4. Nova conductor manager calls the Cyborg API *POST /v2/accelerator_requests* with the device profile name. Cyborg creates a set of unbound ARQs for that device profile and returns them to Nova.

5. The Cyborg client in Nova matches each ARQ to the resource provider picked for that accelerator.

6. The Nova compute manager calls the Cyborg API *PATCH /v2/accelerator_requests* to bind the ARQ with the host name, devices RP UUID and instance UUID. This is an asynchronous call which prepares or reconfigures the device in the background.

7. Cyborg, on completion of the bindings (successfully or otherwise), calls Novas *POST /os-server-external-events* API with:

```
{
    "events": [
        { "name": "accelerator-request-bound",
            "tag": $arq_uuid,
            "server_uuid": $instance_uuid,
            "status": "completed" # or "failed"
        },
        ...
    ]
}
```

8. The Nova compute manager waits for the notification, subject to the timeout mentioned in Section Other deployer impact. It then calls the Cyborg REST API *GET /v2/accelerator_requests?instance=<uuid>&bind_state=resolved* to get the arqs in status [Bound, BindFailed, Deleting].

9. The Nova virt driver uses the bound arqs returned from the Cyborg call to compose PCI passthrough devices into the VMs definition.

10. If there is any error after binding has been initiated, Nova must unbind the relevant ARQs by calling Cyborg API. It may then retry on another host or delete the (unbound) ARQs for the instance.

CHAPTER

THREE

FOR END USERS

As an end user of Cyborg, youll use Cyborg to create and manage accelerators with either tools or the API directly.

3.1 Tools for using Cyborg

Information on the commands available through Cyborgs Command Line Interface (CLI) can be found in this section of documentation.

3.1.1 Command-Line Interface Reference

cyborg-status

Synopsis

```
cyborg-status <category> <command> [<args>]
```

Description

`cyborg-status` is a tool that provides routines for checking the status of a Cyborg deployment.

Options

The standard pattern for executing a **`cyborg-status`** command is:

```
cyborg-status <category> <command> [<args>]
```

Run without arguments to see a list of available command categories:

```
cyborg-status
```

Categories are:

- `upgrade`

Detailed descriptions are below.

You can also run with a category argument such as `upgrade` to see a list of all commands in that category:

```
cyborg-status upgrade
```

These sections describe the available categories and arguments for **`cyborg-status`**.

Upgrade

cyborg-status upgrade check

Performs a release-specific readiness check before restarting services with new code. This command expects to have complete configuration and access to databases and services.

Return Codes

Return code	Description
0	All upgrade readiness checks passed successfully and there is nothing to do.
1	At least one check encountered an issue and requires further investigation. This is considered a warning but the upgrade may be OK.
2	There was an upgrade status check failure that needs to be investigated. This should be considered something that stops an upgrade.
255	An unexpected error occurred.

History of Checks

2.0.0 (Stein)

- Placeholder to be filled in with checks as they are added in Stein.

3.2 Using the API

Following the Ussuri release, every Cyborg deployment should have the following endpoints:

/ - list of available versions

/v2 - the version 2 of the Acceleration API, it uses microversions

/v2.0 - same API as v2, except uses microversions

The follwoing guide concentrates on documenting the v2 API, please note that the v2.0 is the first microversion of the v2 API and are also covered by this guide.

- Cyborg API Reference: The complete reference for the accelerator API, including all methods and request / response parameters and their meaning.
- *REST API Version History*: The Cyborg API evolves over time through Microversions. This provides the history of all those changes. Consider it a whats new in the Cyborg API.

CHAPTER

FOUR

DOCUMENTATION FOR DEVELOPERS

4.1 Contributor Documentation

Contributing to Cybrog gives you the power to help add features, fix bugs, enhance documentation, and increase testing. Contributions of any type are valuable, and part of what keeps the project going. Here are a list of resources to get your started.

4.1.1 Basic Information

So You Want to Contribute

For general information on contributing to OpenStack, please check out the contributor guide to get started. It covers all the basics that are common to all OpenStack projects: the accounts you need, the basics of interacting with our Gerrit review system, how we communicate as a community, etc.

Below will cover the more project specific information you need to get started with Cyborg.

Communication

We use the #openstack-cyborg channel on the OFTC IRC network.

The weekly meetings happen in this channel. You can find the meeting times, previous meeting logs and proposed meeting agendas at Cyborg Team Meeting Page.

The openstack-discuss mailing list is another way we make announcement and discuss some topics in public. Cyborg related discussions usually start with tag:{[}cyborg]. Theopenstack-discussArchiveshttp://lists.openstack.org/pipermail/openstack-discuss/

Contacting the Core Team

The core reviewers of Cyborg and their emails are listed in Cyborg core team.

New Feature Planning

To propose or plan new features, we add a new story in the Cyborg Launchpad and/or propose a specification in the cyborg-specs repository.

Task Tracking

We track our tasks in the Launchpad.

We also have our planed goals and schedule for each OpenStack official release. If you are a new contributor who are looking for tasks, please take a look. we have tasks from low-hanging-fruit to middle, and

advanced levels. Development_Release_Schedule If youre looking for some smaller, easier work item to pick up and get started on, ask in the IRC meeting.

Reporting a Bug

You found an issue and want to make sure we are aware of it? You can do so on Launchpad. More info about Launchpad usage can be found on OpenStack docs page. But before you report a bug or register a new feature, we recommend you to check if it is already registered there. Otherwise, it might be a duplicated patch and will be abandoned. If youre still confused, as a more efficient way, we encourage you to go and ask PTL and cores in the IRC channel directly. Or mail PTL if IRC is not convenient for you.

Getting Your Patch Merged

To merge a patch, it must pass all voting Zuul checks and get two +2s from core reviewers. We strive to avoid scenarios where one person from a company or organization proposes a patch, and two other core reviewers from the same organization approve it to get it merged. In other words, at least one among the patch author and the two approving reviwers must be from another organization.

We are constantly striving to improve quality. Proposed patches must generally have unit tests and/or functional tests that cover the changes, and strive to improve code coverage.

Project Team Lead Duties

All common PTL duties are enumerated in the PTL guide.

4.1.2 Reviewing

- *API Microversions*: How the API is (micro)versioned and what you need to do when adding an API exposed feature that needs a new microversion.
- *Release Notes*: When we need a release note for a contribution.
- *DevStack Quick Start*: Guidelines for handling setup devstack
- *Driver Development Guide*: Get your driver development guide to contribute

API Microversions

Background

Cyborg uses a framework we call API Microversions for allowing changes to the API while preserving backward compatibility. The basic idea is that a user has to explicitly ask for their request to be treated with a particular version of the API. So breaking changes can be added to the API without breaking users who dont specifically ask for it. This is done with an HTTP header `OpenStack-API-Version` which has as its value a string containing the name of the service, `accelerator`, and a monotonically increasing semantic version number starting from `2.0`. The full form of the header takes the form:

```
OpenStack-API-Version: accelerator 2.0
```

If a user makes a request without specifying a version, they will get the `_MIN_VERSION_STRING``(defined in ``cyborg/api/controllers/v2/versions.py)` as the default version. This value is currently `2.0` and is expected to remain so for quite a long time.

There is a special value `latest` which can be specified, which will allow a client to always receive the most recent version (`_MAX_VERSION_STRING` defined in `cyborg/api/controllers/v2/versions.py`) of API responses from the server.

Warning

The `latest` value is mostly meant for integration testing and would be dangerous to rely on in client code since Cyborg microversions are not following sever and therefore backward compatibility is not guaranteed. Clients, like python-cyborgclient, should always require a specific microversion but limit what is acceptable to the version range that it understands at the time.

For full details please read the Ussuri spec for microversions and Microversion Specification.

When do I need a new Microversion?

A microversion is needed when the contract to the user is changed. The user contract covers many kinds of information such as:

- the Request
  - the list of resource urls which exist on the accelerator

    Example: adding a new accelerator_requests/{ID}/foo which didnt exist in a previous version of the code
  - the list of query parameters that are valid on urls

    Example: adding a new parameter `is_yellow` accelerator_requests/{ID}?is_yellow=True
  - the list of query parameter values for non free form fields

    Example: parameter filter_by takes a small set of constants/enums A, B, C. Adding support for new enum D.
  - new headers accepted on a request
  - the list of attributes and data structures accepted.

    Example: adding a new attribute description to the accelerator request body
- the Response
  - the list of attributes and data structures returned

    Example: adding a new attribute description to the output of accelerator_requests/{ID}
  - the allowed values of non free form fields

    Example: adding a new allowed `state` to accelerator_requests/{ID}
  - the list of status codes allowed for a particular request

    Example: an API previously could return 200, 400, 403, 404 and the change would make the API now also be allowed to return 409.

    See[2] for the 400, 403, 404 and 415 cases.

[2] The exception to not needing a microversion when returning a previously unspecified error code is the 400, 403, 404 and 415 cases. This is considered OK to return even if previously unspecified in the code since its implied given keystone authentication can fail with a 403 and API validation can fail with a 400 for invalid json request body. Request to url/resource that does not exist always fails with 404. Invalid content types are handled before API methods are called which results in a

- new headers returned on a response.
- changing a status code on a particular response.

  Example: changing the return code of an API from 501 to 400.

> **Note**
>
> Fixing a bug so that a 400+ code is returned rather than a 500 or 503 does not require a microversion change. Its assumed that clients are not expected to handle a 500 or 503 response and therefore should not need to opt-in to microversion changes that fixes a 500 or 503 response from happening. According to the OpenStack API Working Group, a **500 Internal Server Error** should **not** be returned to the user for failures due to user error that can be fixed by changing the request on the client side. See[1].

The following flow chart attempts to walk through the process of do we need a microversion.

415.

> **Note**
>
> When in doubt about whether or not a microversion is required for changing an error response code, consult the Cyborg team.

[1] When fixing 500 errors that previously caused stack traces, try to map the new error into the existing set of errors that API call could previously return (400 if nothing else is appropriate). Changing the set of allowed status codes from a request is changing the contract, and should be part of a microversion (except inPage 106, 2).

The reason why we are so strict on contract is that wed like application writers to be able to know, for sure, what the contract is at every microversion in Cyborg. If they do not, they will need to write conditional code in their application to handle ambiguities.

When in doubt, consider application authors. If it would work with no client side changes on both Cyborg versions, you probably dont need a microversion. If, on the other hand, there is any ambiguity, a microversion is probably needed.

Footnotes

When a microversion is not needed

A microversion is not needed in the following situation:

- the response
  - Changing the error message without changing the response code does not require a new microversion.
  - Removing an inapplicable HTTP header, for example, suppose the Retry-After HTTP header is being returned with a 4xx code. This header should only be returned with a 503 or 3xx response, so it may be removed without bumping the microversion.
  - An obvious regression bug in an admin-only API where the bug can still be fixed upstream on active stable branches. Admin-only APIs are less of a concern for interoperability and generally a regression in behavior can be dealt with as a bug fix when the documentation clearly shows the API behavior was unexpectedly regressed.

In Code

In `cyborg/api/controllers/v2/versions.py` we define some constants below:

- `BASE_VERSION`: value is `2` which is intended to be used as the Cyborg API version.
- `MINOR_0_INITIAL_VERSION`: value is `0` to be used as the initial value of microversion.
- `MINOR_X_Y`: `Y` is the change you want to make, `X` is the min version to support `Y`. For example, `MINOR_1_PROJECT_ID` means that the request `project_id` is supported from microversion `2.1`.
- `MINOR_MAX_VERSION`: the max version, which equals to latest.
- `_MIN_VERSION_STRING`: the combination of `BASE_VERSION` and `MINOR_0_INITIAL_VERSION`, which means the min version of Cyborg API.
- `_MAX_VERSION_STRING` with the combination of `BASE_VERSION` and `MINOR_MAX_VERSION`, which means the max version of Cyborg API.

In `cyborg/api/controllers/v2/utils.py`, we define the check function of microversion.

> For the example of *allow_project_id()* function, we compare the request version and the defined `MINOR_1_PROJECT_ID` to check whether the request is allowed. If the users request with the version which is lower than `MINOR_1_PROJECT_ID`, we will raise Request not acceptable. exception to the user.

```
def allow_project_id():
    # v2.1 added project_id for arq patch
    return api.request.version.minor >= versions.MINOR_1_PROJECT_ID
```

Adding a new API method

In the controller class:

```
def my_api_method(self, req, id):
    if not utils.allow_project_id():
        raise exception.NotAcceptable(_(
            "Request not acceptable. The minimal required API "
            "version should be %(base)s.%(opr)s") %
            {'base': versions.BASE_VERSION,
            'opr': versions.MINOR_1_PROJECT_ID})
```

This method would only be available if the caller had specified an `OpenStack-API-Version` of `>= accelerator 2.1`. If they had specified a lower version (or not specified it and received the default of `accelerator 2.0`) the server would respond with `HTTP/406`.

Other necessary changes

If you are adding a patch which adds a new microversion, it is necessary to add changes to other places which describe your change:

- Define `MINOR_*{int}_**` in `cyborg/api/controllers/v2/versions.py`
- Update `MINOR_MAX_VERSION` to the defined `MINOR_*{int}_**` in `cyborg/api/controllers/v2/versions.py`

- Add a verbose description of what changed in the new version to `cyborg/api/rest_api_version_history.rst`.
- Add a *release note* with a `features` section announcing the new or changed feature and the microversion.
- Update the expected versions in affected tests, for example in `cyborg.tests.unit.api.controllers.v2.test_arqs.TestARQsController#test_apply_patch_allow_project_id`.
- Make a new commit to python-cyborgclient and update corresponding files to enable the newly added microversion API.
- Update the API Reference documentation as appropriate. The source is located under *api-ref/source/*.

If applicable, add functional sample tests under `cyborg_tempest_plugin/tests/api/`

Allocating a microversion

If you are adding a patch which adds a new microversion, it is necessary to allocate the next microversion number. The minor number of `_MAX_API_VERSION` will be incremented. This will also be the new microversion number for the API change. Developers may need over time to rebase their patch calculating a new version number as above based on the updated value of `_MAX_API_VERSION`.

Testing Microversioned API Methods

Testing a microversioned API method is very similar to a normal controller method test, you just need to add the `OpenStack-API-Version` header, for example:

```
req = fakes.HTTPRequest.blank('/testable/url/endpoint')
req.headers = {'OpenStack-API-Version': 'accelerator 2.1'}
req.api_version_request = api_version.APIVersionRequest('2.1')

controller = controller.TestableController()

res = controller.index(req)
... assertions about the response ...
```

For many examples of testing, the canonical examples are in `cyborg.tests.unit.api.controllers.v2.test_arqs.TestARQsController#test_apply_patch_allow_project_id`.

Release Notes

What is reno ?

Cyborg uses reno for providing release notes in-tree. That means that a patch can include a *reno file* or a series can have a follow-on change containing that file explaining what the impact is.

A *reno file* is a YAML file written in the `releasenotes/notes` tree which is generated using the *reno* tool this way:

```
$ tox -e venv -- reno new <name-your-file>
```

where usually `<name-your-file>` can be `bp-<blueprint_name>` for a blueprint or `bug-XXXXXX` for a bugfix.

Refer to the reno documentation for more information.

When a release note is needed

A release note is required anytime a reno section is needed. Below are some examples for each section. Any sections that would be blank should be left out of the note file entirely. If no section is needed, then you know you dont need to provide a release note :-)

- **`upgrade`**
  - The patch has an UpgradeImpact tag
  - A DB change needs some deployer modification (like a migration)
  - A configuration option change (deprecation, removal or modified default)
  - some specific changes that have a DocImpact tag but require further action from an deployer perspective
  - any patch that requires an action from the deployer in general
- **`security`**
  - If the patch fixes a known vulnerability
- **`features`**
  - If the patch has an APIImpact tag
  - For Cyborg api and python-cyborgclient changes, if it adds or changes a new command, including adding new options to existing commands
  - a new accelerator driver is provided or an existing driver impacts the *DriversSupport-Matrix*
- **`critical`**
  - Bugfixes categorized as Critical in launchpad *impacting users*
- **`fixes`**
  - No clear definition of such bugfixes. Hairy long-standing bugs with high importance that have been fixed are good candidates though.

Three sections are left intentionally unexplained (`prelude`, `issues` and `other`). Those are targeted to be filled in close to the release time for providing details about the soon-ish release. Dont use them unless you know exactly what you are doing.

DevStack Quick Start

Create stack user (optional)

Devstack should be run as a non-root user with sudo enabled (standard logins to cloud images such as ubuntu or cloud-user are usually fine).

You can quickly create a separate stack user to run DevStack with.

```
$ sudo useradd -s /bin/bash -d /opt/stack -m stack
```

Since this user will be making many changes to your system, it should have sudo privileges:

```
$ echo "stack ALL=(ALL) NOPASSWD: ALL" | sudo tee /etc/sudoers.d/stack
```

```
$ sudo su - stack
```

Download DevStack

```
$ git clone https://opendev.org/openstack/devstack
```

```
$ cd devstack
```

The *devstack* repo contains a script that installs OpenStack.

Create local.conf file

Create a *local.conf* file at the root of the devstack git repo.

Host settings

```
[[local|localrc]]
HOST_IP=YOUR_IP_CONFIG
SERVICE_HOST=$HOST_IP
DATABASE_TYPE=mysql
MYSQL_HOST=$HOST_IP
RABBIT_HOST=$HOST_IP
```

- Replace YOUR_IP_CONFIG with your host IP (e.g. 10.0.0.72 or localhost).

Password settings

```
# Passwords
DATABASE_PASSWORD=123
ADMIN_PASSWORD=123
MYSQL_PASSWORD=123
RABBIT_PASSWORD=123
SERVICE_PASSWORD=123
SERVICE_TOKEN=ADMIN
```

- Pre-set the passwords to prevent interactive prompts.

Enable services

```
#FIXED_RANGE=192.168.128.0/24
#IPV4_ADDRS_SAFE_TO_USE=192.168.128.0/24
#GIT_BASE=/opt/git
disable_service n-net
disable_service tempest
disable_service heat
enable_service q-svc
```

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```
enable_service q-agt
enable_service q-dhcp
enable_service q-l3
enable_service q-meta
enable_service neutron
enable_service n-novnc
enable_plugin cyborg https://opendev.org/openstack/cyborg
NOVA_VNC_ENABLED=True
NOVNCPROXY_URL="http://$SERVICE_HOST:6080/vnc_auto.html"
VNCSERVER_LISTEN=0.0.0.0
VNCSERVER_PROXYCLIENT_ADDRESS=$SERVICE_HOST
RECLONE=False
#enable Logging
LOGFILE=/opt/stack/logs/stack.sh.log
VERBOSE=True
LOG_COLOR=True
LOGDIR=/opt/stack/logs
```

- Uncomment GIT_BASE configuration if you have a local git repo
- enable_plugin cyborg will execute cyborg/devstack/plugin.sh and start cyborg service
- The devstack logs will appear in $LOGDIR

Note

If you got version conflicts, please set *PIP_UPGRADE* to *True* in local.conf

Multi-Node Lab

If you want to setup an OpenStack with cyborg in a realistic test configuration with multiple physical servers. Please ref[1].

Cluster Controller

```
disable_service cyborg-agent
```

Compute Nodes

```
enable_service cyborg-agent
disable_service cyborg-api
disable_service cyborg-cond
```

- If you do not want to setup cyborg-agent on controller, you can disable it.
- You do not need to enable cyborg-api and cyborg-cond on compute nodes.

[1] Openstack Multi-Node Lab Setup

Testing with unmerged changes

To test with changes that have not been merged, the enable_plugin line can be modifed to specify the branch/reference to be cloned.

```
enable_plugin cyborg https://review.opendev.org/openstack/cyborg refs/changes/
↪28/708728/1
```

the format is

```
enable_plugin <directory name> <git repo url> <change/revision>
```

Cell V2 Deployment

Compute node services must be mapped to a cell before they can be used. Cell V2 deployment, please ref[2].

Run DevStack

```
$ ./stack.sh
```

This will take a 30-40 minutes, largely depending on the speed of your internet connection. Many git trees and packages will be installed during this process.

It will speed up your installation if you have a local GIT_BASE.

Use OpenStack

Command line

You can *source openrc YOUR_USER YOUR_USER (e.g. source openrc admin admin)* in your shell, and then use the *openstack* command line tool to manage your devstack.

Horizon

You can access horizon to experience the web interface to OpenStack, and manage vms, networks, volumes, and images from there.

References

Driver Development Guide

The goal of this document is to explain how to develop a new kind of Cyborg accelerator driver.

Note

Make sure you have installed Openstack environment using devstack before development.

[2] Openstack Cell V2 Deployment Guide

Derive a new driver class

Imply the necessary interface, the list of interfaces is as follows:

```
class NewCyborgDriver(object):
    """Cyborg new accelerator driver.
    """

    def discover(self):
        """Discover specific accelerator
        :return: list of cyborg.objects.driver_objects.driver_device.
                 DriverDevice
        """
        pass
```

Modify setup.cfg

Add the new driver map into file `cyborg/setup.cfg`:

```
[entry_points]
cyborg.accelerator.driver =
    intel_fpga_driver = cyborg.accelerator.drivers.fpga.intel.
↪driver:IntelFPGADriver
    new_driver_name = cyborg.accelerator.drivers.example.
↪driver:NewCyborgDriver
```

Reinstall and Test

Reinstall cyborg:

```
$ python setup.py develop
```

Restart cyborg-agent:

```
$ sudo systemctl restart devstack@cyborg-agent
```

4.2 REST API Version History

This documents the changes made to the REST API with every microversion change. The description for each version should be a verbose one which has enough information to be suitable for use in user documentation.

A user can specify a header in the API request:

```
OpenStack-API-Version: accelerator <microversion>
```

where `<microversion>` is any valid api microversion for this API.

If no version is specified then the API will behave as if a version request of v2.0 was requested.

4.2.1 2.0

This is the initial version of the v2 API which supports microversions.

4.2.2 2.1 (Maximum in Victoria)

Add `project_id` for Accelerator Requests PATCH API. `project_id` is used to control the operation of arq with different roles.

4.2.3 2.2

Changed `device_profile_uuid` to `device_profile_name_or_uuid` in *Get One Device Profile* API path, so support getting device profile by name (newly introduced) and uuid.

- GET /v2/device_profiles/{device_profile_name_or_uuid}

4.2.4 2.3

Add new status info for list Device and get device API.

- GET: /devices
- GET: /devices/{uuid}

CHAPTER

FIVE

INDICES AND TABLES

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