

# Placement, Present and Future, in Nova and Beyond

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# Who We Are

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*Find us in #openstack-placement*

# Overview

- A brief overview of Placement
- An even briefer introduction to Gabbi
- A walk through a refrigerator managed by Placement
- What got accomplished in Queens
- What we're working on in Rocky
- Future direction

# Placement

- Service to manage resources
- Main Concepts
  - ResourceProvider
  - ResourceClass
  - Inventory
  - Allocation

# Gabbi

- Tool for running HTTP tests
- Uses human-readable YAML files
- Used by Placement for end-to-end functional testing

# A brief overview of Placement ...in your fridge

– courtesy of Chris Dent

<https://github.com/cdent/placecat>

**“Placecat is a source of experiments with the OpenStack Placement service, a standalone docker container, and some gabbi tests.”**

<https://github.com/cdent/gabbi>

<https://gabbi.readthedocs.io/en/latest/>

<https://github.com/cdent/placecat/blob/master/gabbits/fridge.yaml>

# Gabbi - Setup

## defaults:

**verbose: True**

**request\_headers:**

**accept: application/json**

**content-type: application/json**

**x-auth-token: admin**

**openstack-api-version: placement latest**

# Create a Fridge

```
# First we create the fridge resource provider. We use an explicit  
# uuid because that makes subsequent tests easier to deal with. It's  
# not required: the service will set a uuid if you do not provide one.
```

```
- name: create fridge
```

```
  POST: /resource_providers
```

```
  data:
```

```
    name: fridge
```

```
    uuid: 3ebdcf8d-8089-41f9-8491-f6b8618a0cf1
```

```
> POST http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_providers
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
{  
  "name": "fridge",  
  "uuid": "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1"  
}
```



# Create Fridge - Response

```
< 200 OK
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1
< Content-Length: 769
< Content-Type: application/json
< Last-Modified: Thu, 03 May 2018 17:43:48 GMT
< Cache-Control: no-cache
< openstack-api-version: placement 1.24
< vary: openstack-api-version
< x-openstack-request-id: req-158a1863-f162-42a6-8d6c-dc8633abccfc

{ "uuid": "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
  "links": [
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
      "rel": "self" },
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/inventories",
      "rel": "inventories" },
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/usages",
      "rel": "usages" },
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/aggregates",
      "rel": "aggregates" },
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/traits",
      "rel": "traits" },
    { "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/allocations",
      "rel": "allocations" } ],
  "generation": 0,
  "name": "fridge",
  "root_provider_uuid": "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
  "parent_provider_uuid": null }
```

# Create a Lettuce Leaf Custom Resource Class

```
#### create lettuce ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_LETTUCE_LEAF
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 201 Created
```

```
< Content-Length: 0
```

```
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_LETTUCE_LEAF
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-534d68ba-0e5a-417c-b43c-f50b491d1e70
```

# Create a Mustard Custom Resource Class

```
#### create mustard ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_classes/  
CUSTOM_MUSTARD_ML
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 201 Created
```

```
< Content-Length: 0
```

```
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_MUSTARD_ML
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-a7496472-f9c8-43a2-97fc-fd8583d88b7d
```

# Create a Ham Slice Custom Resource Class

```
#### create ham ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_classes/  
CUSTOM_HAM_SLICE
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 201 Created
```

```
< Content-Length: 0
```

```
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_HAM_SLICE
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-edcb0064-1778-4b27-a214-a90ce2c0b05b
```

# Create a Bread Slice Custom Resource Class

```
#### create bread ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_classes/  
CUSTOM_BREAD_SLICE
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 201 Created
```

```
< Content-Length: 0
```

```
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_BREAD_SLICE
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-130a0aa4-8329-4674-9105-de0a7b73ac7e
```

# Create a Pickle Spear Custom Resource Class

```
#### create pickle ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_classes/  
CUSTOM_PICKLE_SPEAR
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 201 Created
```

```
< Content-Length: 0
```

```
< Location: http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
resource_classes/CUSTOM_PICKLE_SPEAR
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-9f207596-d9b8-488e-ac3f-d11f0516d566
```

# Put the Groceries in the Fridge

```
#### set inventory ####
```

```
> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/inventories
```

```
> openstack-api-version: placement latest  
> user-agent: gabbi/1.40.0 (Python urllib3)  
> content-type: application/json  
> accept: application/json  
> x-auth-token: admin
```

```
{ "resource_provider_generation": 0,  
  "inventories": {  
    "CUSTOM_HAM_SLICE": {  
      "total": 75 },  
    "CUSTOM_PICKLE_SPEAR": {  
      "total": 25 },  
    "CUSTOM_MUSTARD_ML": {  
      "total": 900 },  
    "CUSTOM_LETTUCE_LEAF": {  
      "max_unit": 3,  
      "total": 25 },  
    "CUSTOM_BREAD_SLICE": {  
      "min_unit": 2,  
      "total": 50 }  
  }  
}
```

# PUT Inventory Response

< **200 OK**

< Content-Length: 703

< Content-Type: application/json

< Last-Modified: Thu, 03 May 2018 17:43:49 GMT

< Cache-Control: no-cache

< openstack-api-version: placement 1.24

< vary: openstack-api-version

< x-openstack-request-id: req-eb932508-0bbc-4e28-9c7a-61af9db30463

```
{ "resource_provider_generation": 1,
```

```
  "inventories": {
```

```
    "CUSTOM_HAM_SLICE": {
```

```
      "allocation_ratio": 1.0,
```

```
      "total": 75,
```

```
      "reserved": 0,
```

```
      "step_size": 1,
```

```
      "min_unit": 1,
```

```
      "max_unit": 2147483647 },
```

```
    <snip/>
```

```
    "CUSTOM_LETTUCE_LEAF": {
```

```
      "allocation_ratio": 1.0,
```

```
      "total": 25,
```

```
      "reserved": 0,
```

```
      "step_size": 1,
```

```
      "min_unit": 1,
```

```
      "max_unit": 3 },
```

```
    <snip/>
```

```
  }
```



# GET Usage and Response

#### get usage ####

> **GET** http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource\_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/usages

> openstack-api-version: placement latest

> user-agent: gabbi/1.40.0 (Python urllib3)

> content-type: application/json

> accept: application/json

> x-auth-token: admin

< 200 OK

< Content-Length: 171

< Content-Type: application/json

< Cache-Control: no-cache

< Last-Modified: Thu, 03 May 2018 17:43:49 GMT

< openstack-api-version: placement 1.24

< vary: openstack-api-version

< x-openstack-request-id: req-afb4dc07-c4b7-4d9f-bd32-e17aee9560c9

```
{
  "resource_provider_generation": 1,
  "usages": {
    "CUSTOM_HAM_SLICE": 0,
    "CUSTOM_MUSTARD_ML": 0,
    "CUSTOM_BREAD_SLICE": 0,
    "CUSTOM_LETTUCE_LEAF": 0,
    "CUSTOM_PICKLE_SPEAR": 0
  }
}
```

# Request Some Food

#### request food ####

```
> GET http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/  
allocation_candidates?resources=CUSTOM_LETTUCE_LEAF:2,  
CUSTOM_HAM_SLICE:1,  
CUSTOM_BREAD_SLICE:2,  
CUSTOM_PICKLE_SPEAR:3  
> openstack-api-version: placement latest  
> user-agent: gabbi/1.40.0 (Python urllib3)  
> content-type: application/json  
> accept: application/json  
> x-auth-token: admin
```

# Response - Fridge Resource Provider Returned

```
< 200 OK
< Content-Length: 500
< Content-Type: application/json
< Cache-Control: no-cache
< Last-Modified: Thu, 03 May 2018 17:43:49 GMT
< openstack-api-version: placement 1.24
< vary: openstack-api-version
< x-openstack-request-id: req-16eff37c-9199-4ca2-bc7d-7c5328dbefe9
```

```
{
  "allocation_requests": [
    {
      "allocations": {
        "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1": {
          "resources": {
            "CUSTOM_HAM_SLICE": 1,
            "CUSTOM_BREAD_SLICE": 2,
            "CUSTOM_LETTUCE_LEAF": 2,
            "CUSTOM_PICKLE_SPEAR": 3
          }
        }
      }
    }
  ],
  ...
}
```

# Response (continued)

```
...
"provider_summaries": {
  "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1": {
    "traits": [],
    "resources": {
      "CUSTOM_HAM_SLICE": {
        "used": 0,
        "capacity": 75
      },
      "CUSTOM_PICKLE_SPEAR": {
        "used": 0,
        "capacity": 25
      },
      "CUSTOM_LETTUCE_LEAF": {
        "used": 0,
        "capacity": 25
      },
      "CUSTOM_BREAD_SLICE": {
        "used": 0,
        "capacity": 50
      }
    }
  }
}
```

# Claim the Food

#### claim food ####

> PUT http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/allocations/sandwich1

> openstack-api-version: placement latest

> user-agent: gabbi/1.40.0 (Python urllib3)

> content-type: application/json

> accept: application/json

> x-auth-token: admin

```
{
  "project_id": "8d2e1420-019c-41dd-8798-2094d2cc1e52",
  "user_id": "24384094-9b91-467d-b69a-ccfacaabfbe7",
  "allocations": {
    "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1": {
      "resources": {
        "CUSTOM_HAM_SLICE": 1,
        "CUSTOM_BREAD_SLICE": 2,
        "CUSTOM_LETTUCE_LEAF": 2,
        "CUSTOM_PICKLE_SPEAR": 3
      }
    }
  }
}
```

< **204 No Content**

< Content-Length: 0

< openstack-api-version: placement 1.24

< vary: openstack-api-version

< x-openstack-request-id: req-881c56aa-8cf4-4632-a2d4-f9c1da2c1442

# GET the Fridge's Current State

```
#### get fridge again ####
```

```
> GET http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_providers/  
3ebdcf8d-8089-41f9-8491-f6b8618a0cf1
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

# Response

```
< 200 OK
< Content-Length: 769
< Content-Type: application/json
< Last-Modified: Thu, 03 May 2018 17:43:49 GMT
< Cache-Control: no-cache
< openstack-api-version: placement 1.24
< vary: openstack-api-version
< x-openstack-request-id: req-f2c58d14-f5d5-465a-946f-d272e355443a
```

```
{
  "uuid": "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
  "links": [
    {
      "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
      "rel": "self"
    },
    <snip/>
    {
      "href": "/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/allocations",
      "rel": "allocations"
    }
  ],
  "generation": 2,
  "name": "fridge",
  "root_provider_uuid": "3ebdcf8d-8089-41f9-8491-f6b8618a0cf1",
  "parent_provider_uuid": null
}
```

# GET Current Usages

```
#### get usages ####
```

```
> GET http://2c7287ab-4c00-40a4-a2e0-f5c91919516a:8001/resource_providers/3ebdcf8d-8089-41f9-8491-f6b8618a0cf1/usages
```

```
> openstack-api-version: placement latest
```

```
> user-agent: gabbi/1.40.0 (Python urllib3)
```

```
> content-type: application/json
```

```
> accept: application/json
```

```
> x-auth-token: admin
```

```
< 200 OK
```

```
< Content-Length: 171
```

```
< Content-Type: application/json
```

```
< Cache-Control: no-cache
```

```
< Last-Modified: Thu, 03 May 2018 17:43:49 GMT
```

```
< openstack-api-version: placement 1.24
```

```
< vary: openstack-api-version
```

```
< x-openstack-request-id: req-1404b02b-87a8-4163-8546-6e7770f5e81d
```

```
{  
  "resource_provider_generation": 2,  
  "usages": {  
    "CUSTOM_HAM_SLICE": 1,  
    "CUSTOM_MUSTARD_ML": 0,  
    "CUSTOM_BREAD_SLICE": 2,  
    "CUSTOM_LETTUCE_LEAF": 2,  
    "CUSTOM_PICKLE_SPEAR": 3  
  }  
}
```



# What We Accomplished in Queens

- Made `project_id` and `user_id` usage consistent for GET and PUT `/allocations/{consumer_uuid}`.
- Added a POST `/allocations` for multiple consumers to better handle migrations.
- Added `parent_` and `root_provider_uuid` to represent nested resource providers.
- Add last-modified and cache-control headers.
- Added a 'limit' query parameter to GET `/allocation_candidates`.
- Added support for filtering by Traits in GET `/allocation_candidates`

<https://docs.openstack.org/nova/queens/user/placement.html>

# What We Have Completed in Rocky

- Added filtering by Traits to GET /resource\_providers. [\[1\]](#)
- Added generation and conflict detection for Resource Provider aggregates. [\[2\]](#)
- POST /resource\_providers now returns a copy of the new ResourceProvider. [\[3\]](#)
- Added filtering by aggregate membership to GET /allocation\_candidates and GET /resource\_providers. [\[4\]](#)
- Added support for excluded (forbidden) traits. [\[5\]](#)
- Added support for error codes in the error response JSON. [\[6\]](#)
- Added support for “granular” resource requests. [\[7\]](#)

# What We Are Working On in Rocky

- Nested Resource Providers [\[8\]](#)
- Consumer Generations [\[9\]](#)
- Mirror Nova host aggregates to Placement [\[10\]](#)

# Future Plans

- Extracting Placement into its own repo/service [\[11\]](#)
- Full support for accelerators with Cyborg [\[12\]](#)
- Better support for NUMA configurations [\[13\]](#)
- Using Placement for Quota Management [\[14\]](#)

Q & A

# Links

[1] <https://review.openstack.org/546837>

[2] <https://review.openstack.org/548249/>

[3] <https://review.openstack.org/548934>

[4] <https://review.openstack.org/552098>

[5] <https://review.openstack.org/556820>

[6] <https://review.openstack.org/546177>

[7] <https://review.openstack.org/517757>

# More Links

[8] <https://review.openstack.org/505209/>

[9] <https://review.openstack.org/556971>

[10] <https://review.openstack.org/545057>

[11] <https://blueprints.launchpad.net/nova/+spec/placement-extract>

[12] <https://review.openstack.org/554717>

[13] <https://review.openstack.org/552924>

[14] <https://review.openstack.org/509042>

# Even More Links

Latest Placement API Reference: [https://  
developer.openstack.org/api-ref/placement/](https://developer.openstack.org/api-ref/placement/)

Placement Microversion History: [https://  
docs.openstack.org/nova/latest/user/  
placement.html#placement-api-microversion-history](https://docs.openstack.org/nova/latest/user/placement.html#placement-api-microversion-history)