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1 使用 pdb 跟踪 openstack 代码

这部分内容比较适合调试使用 devstack 进行安装的 openstack。

1.1 devstack screen 使用技巧

devstack 环境中，openstack 运行在一个 screen 中，每个 service 运行在一个窗口中，如下图所示：

```

| host_status | 37dcdbe-b0b0-4603-b774-5d16d65e9da8 |
| id | cirros-0.3.5-x86_64-disk (e9ab61d0-a408-4db5-b347-723923c74f49) |
| image |
| key_name | False |
| locked | {} |
| metadata | machine1 |
| name | [] |
| os-extended-volumes:volumes_attached | 0 |
| progress | default |
| security_groups | BUILD |
| status |
| tags | [] |
| tenant_id | dc164f34ed594af880a20ee51aa38692 |
| updated | 2017-02-18T04:42:18Z |
| user_id | 92351abfc3e54ffc907af8685d0688d4 |
+-----+-----+
pengsida@scholcs:~/devstack$ nova delete machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
Request to delete server machine1 has been accepted.
pengsida@scholcs:~/devstack$ screen -ls
There is a screen on:
  22549.stack      (02/18/17 09:47:06)      (Attached)
1 Socket in /var/run/screen/S-pengsida.
pengsida@scholcs:~/devstack$ screen -x 22549
Attaching from inside of screen?
pengsida@scholcs:~/devstack$ 0$
0$: command not found
pengsida@scholcs:~/devstack$ $$$$$$$$
2271722717227172271722717: command not found
pengsida@scholcs:~/devstack$ nova boot --flavor m1.tiny --image cirros-0.3.5-x86_64-disk machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
ERROR (ConnectTimeout): Request to http://10.180.165.243:8774/v2.1/servers timed out
pengsida@scholcs:~/devstack$ nova boot --flavor m1.tiny --image cirros-0.3.5-x86_64-disk machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
ERROR (ConnectTimeout): Request to http://10.180.165.243:8774/v2.1/servers timed out
pengsida@scholcs:~/devstack$
15$(L) n-sch 16$(L) n-novnc 17$(L) n-cauth 18$(L) n-cpu 19$(L) placement-api 20$(L) c-api 21$(L) c-sch 22$(L) c-vol 23$(L) horizon*

```

可以看到图中底下一排窗口：

```

pengsida@scholcs:~/devstack$
d 15$(L) n-sch 16$(L) n-novnc 17$(L) n-cauth 18$(L) n-cpu 19$(L) placement-api 20$(L) c-api 21$(L) c-sch 22$(L) c-vol 23$(L) horizon*

```

1.1.1 screen -list

这个命令可以查看 devstack 中有哪些 screen，如下图所示：

```

pengsida@scholcs:~/devstack$ screen -list
There is a screen on:
  22549.stack      (2017年02月18日 09时47分06秒)      (Attached)
1 Socket in /var/run/screen/S-pengsida.

```

1.1.2 screen -d <screen-id>

这个命令用于断开与 screen 的连接。

1.1.3 screen -r <screen-id>

这个命令用于断开并重新进入 screen。

1.1.4 screen -x <screen-id>

这个命令相当于在新的终端中查看这个 screen。

1.1.5 screen -h

通过这个命令可以查看关于 screen 的更多信息。

1.1.6 进入 screen 以后的操作

使用 screen -x <screen-id> 进入某个 screen 以后，界面如下：

```

| host_status      | 37dccbde-b0b0-4603-b774-5d16d65e9da8 |
| id              | 37dccbde-b0b0-4603-b774-5d16d65e9da8 |
| image          | cirros-0.3.5-x86_64-disk (e9ab61d0-a408-4db5-b347-723923c74f49) |
| key_name       | - |
| locked        | False |
| metadata      | {} |
| name           | machine1 |
| os-extended-volumes:volumes_attached | [] |
| progress       | 0 |
| security_groups | default |
| status         | BUILD |
| tags           | [] |
| tenant_id      | dc164f34ed594af880a20ee51aa38692 |
| updated        | 2017-02-18T04:42:18Z |
| user_id        | 92351abfc3e54ffc907af8685d0688d4 |
+-----+-----+
pengsida@scholes:~/devstack$ nova delete machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
Request to delete server machine1 has been accepted.
pengsida@scholes:~/devstack$ screen -ls
There is a screen on:
  22549.stack      (02/18/17 09:47:06)      (Attached)
1 Socket in /var/run/screen/S-pengsida.
pengsida@scholes:~/devstack$ screen -x 22549
Attaching from inside of screen?
pengsida@scholes:~/devstack$ 0$
0$: command not found
pengsida@scholes:~/devstack$ $$$$$$$$$$
2271722717227172271722717: command not found
pengsida@scholes:~/devstack$ nova boot --flavor m1.tiny --image cirros-0.3.5-x86_64-disk machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
ERROR (ConnectTimeout): Request to http://10.180.165.243:8774/v2.1/servers timed out
pengsida@scholes:~/devstack$ nova boot --flavor m1.tiny --image cirros-0.3.5-x86_64-disk machine1
/usr/local/lib/python2.7/dist-packages/novaclient/client.py:278: UserWarning: The 'tenant_id' argument is deprecated in Ocata and its use may r
result in errors in future releases. As 'project_id' is provided, the 'tenant_id' argument will be ignored.
  warnings.warn(msg)
ERROR (ConnectTimeout): Request to http://10.180.165.243:8774/v2.1/servers timed out
pengsida@scholes:~/devstack$ █
15$(L) n-sch 16$(L) n-novnc 17$(L) n-cauth 18$(L) n-cpu 19$(L) placement-api 20$(L) c-api 21$(L) c-sch 22$(L) c-vol 23$(L) horizon*
```

图中带 * 号的是当前窗口。

可以使用“ctrl+a+n”移动到下一个窗口，可以使用“ctrl+a+p”移动到上一个窗口。可以使用“ctrl+a+”进入选择窗口的模式。

选择窗口还有一个更快的方式，使用使用 “ctrl+a+shift+””，就可以进入如下界面：

```

Num Name                               Flags
0 shell                                S(L)
1 dstat                                S(L)
2 key                                  S(L)
3 key-access                           S(L)
4 g-reg                                S(L)
5 g-api                                S(L)
6 n-api                                S(L)
7 q-svc                                S(L)
8 q-agt                                S(L)
9 q-dhcp                                S(L)
10 q-l3                                 S(L)
11 q-meta                              S(L)
12 n-cond                              S(L)
13 n-cell-region                       S(L)
14 n-cell-child                        S(L)
15 n-sch                               S(L)
16 n-novnc                              S(L)
17 n-cauth                             S(L)
18 n-cpu                               S(L)
19 placement-api                       S(L)
20 c-api                               S(L)
21 c-sch                               S(L)
22 c-vol                               S(L)
23 horizon                             S(L)

- * 0$ shell 1$(L) dstat 2$(L) key 3$(L) key-access 4$(L) g-reg 5-$(L) g-api 6$(L) n-api 7$(L) q-svc 8$(L) q-agt 9$(L) q-dhcp 10$(L)

```

使用 “ctrl+a+[” 以后就可以滚动窗口了，使用 “ctrl+|” 重新固定窗口。

1.1.7 借助 screen 重启 openstack 服务

首先进入想重启的服务的窗口，比如 “nova-api”，如下图所示：

```

2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions return func(*args, **kwargs)
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/opt/stack/nova/nova/api/validation/__init__.py", line 108, in wrapper
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions return func(*args, **kwargs)
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/opt/stack/nova/nova/api/validation/__init__.py", line 108, in wrapper
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions return func(*args, **kwargs)
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/opt/stack/nova/nova/api/validation/__init__.py", line 108, in wrapper
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions return func(*args, **kwargs)
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/opt/stack/nova/nova/api/openstack/compute/servers.py", line 535, in create
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions server_dict = body['server']
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/opt/stack/nova/nova/api/openstack/compute/servers.py", line 535, in create
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions server_dict = body['server']
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/usr/lib/python2.7/bdb.py", line 49, in trace_dispatch
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions return self.dispatch_line(frame)
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions File "/usr/lib/python2.7/bdb.py", line 68, in dispatch_line
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions if self.quitting: raise BdbQuit
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions BdbQuit
2017-02-18 22:03:57.533 TRACE nova.api.openstack.extensions
2017-02-18 22:03:57.539 INFO nova.api.openstack.wsgi [req-0ef39d7e-8128-4332-9a06-45213bbb4809 admin admin] HTTP exception thrown: Unexpected A
PI Error. Please report this at http://bugs.launchpad.net/nova/ and attach the Nova API log if possible.
<class 'bdb.BdbQuit'>
2017-02-18 22:03:57.540 DEBUG nova.api.openstack.wsgi [req-0ef39d7e-8128-4332-9a06-45213bbb4809 admin admin] Returning 500 to user: Unexpected
API Error. Please report this at http://bugs.launchpad.net/nova/ and attach the Nova API log if possible.
<class 'bdb.BdbQuit'> from (pid=11507) __call__ /opt/stack/nova/nova/api/openstack/wsgi.py:1839
2017-02-18 22:03:57.547 INFO nova.osapi_compute.wsgi.server [req-0ef39d7e-8128-4332-9a06-45213bbb4809 admin admin] Traceback (most recent call
last):
  File "/usr/local/lib/python2.7/dist-packages/eventlet/wsgi.py", line 481, in handle_one_response
    result = self.application(self.environ, start_response)
  File "/usr/local/lib/python2.7/dist-packages/eventlet/wsgi.py", line 453, in write
    wfile.flush()
  File "/usr/lib/python2.7/socket.py", line 307, in flush
    self._sock.sendall(view[write_offset:write_offset+buffer_size])
  File "/usr/local/lib/python2.7/dist-packages/eventlet/greenio/base.py", line 385, in sendall
    tail = self.send(data, flags)
  File "/usr/local/lib/python2.7/dist-packages/eventlet/greenio/base.py", line 379, in send
    return self._send_loop(self.fd.send, data, flags)
  File "/usr/local/lib/python2.7/dist-packages/eventlet/greenio/base.py", line 366, in _send_loop
    return send_method(data, *args)
  error: [Errno 32] Broken pipe
2017-02-18 22:03:57.548 INFO nova.osapi_compute.wsgi.server [req-0ef39d7e-8128-4332-9a06-45213bbb4809 admin admin] 10.180.165.243 "POST /v2.1/s
ervers HTTP/1.1" status: 500 len: 0 time: 31349.8615620
6$(L) n-api* 7$(L) q-svc 8$(L) q-agt 9$(L) q-dhcp 10$(L) q-l3 11$(L) q-meta 12$(L) n-cond 13$(L) n-cell-region 14$(L) n-cell-child 15

```

然后按“ctrl+c”，杀死进程。随后按向上键，出现启动进程的命令，输入即重启“nova-api”服务。

1.2 使用 pdb

python 中有一个 pdb 模块，使 python 代码也可以像 gdb 一样调试。

只要在需要开始调试的地方加上以下语句即可：

```
1 import pdb; pdb.set_trace()
```

如下图所示：

```
529 @validation.schema(schema_server_create_v237, '2.37', '2.41')
530 @validation.schema(schema_server_create_v242, '2.42')
531 def create(self, req, body):
532     """Creates a new server for a given user."""
533     import pdb; pdb.set_trace()
534     -> context = req.environ['nova.context']
535     server_dict = body['server']
536     password = self._get_server_admin_password(server_dict)
537     name = common.normalize_name(server_dict['name'])
538
539     if api_version_request.is_supported(req, min_version='2.19'):
```

随后重启代码处相应的服务，比如这里想调试的是“nova-api”，就借助 screen 重启“nova-api”服务。

随后使用相应的命令触发这个断电，进入“nova-api”的窗口，就可以开始调试了，如下图所示：

```
orsController.show of <nova.api.openstack.compute.Flavors.FlavorsController object at 0x7f8e50ed0cd0> from (pid=27315) _process_stack /opt/stack/nova/nova/api/openstack/wsgi.py:626
2017-02-18 23:22:25.262 DEBUG oslo.db.sqlalchemy.engines [req-1657d564-3e7d-4f02-a77e-36a569569216 admin admin] MySQL server mode set to STRICT_TRANS_TABLES,STRICT_ALL_TABLES,NO_ZERO_IN_DATE,NO_ZERO_DATE,ERROR_FOR_DIVISION_BY_ZERO,TRADITIONAL,NO_AUTO_CREATE_USER,NO_ENGINE_SUBSTITUTION
From (pid=27315) check_effective_sql_node /usr/local/lib/python2.7/dist-packages/oslo_db/sqlalchemy/engines.py:261
2017-02-18 23:22:25.297 INFO nova.api.openstack.wsgi [req-1657d564-3e7d-4f02-a77e-36a569569216 admin admin] HTTP exception thrown: Flavor m1.tiny could not be found.
2017-02-18 23:22:25.297 DEBUG nova.api.openstack.wsgi [req-1657d564-3e7d-4f02-a77e-36a569569216 admin admin] Returning 404 to user: Flavor m1.tiny could not be found. from (pid=27315) call _ /opt/stack/nova/nova/api/openstack/wsgi.py:1039
2017-02-18 23:22:25.298 INFO nova.osapi_compute.wsgi.server [req-1657d564-3e7d-4f02-a77e-36a569569216 admin admin] 10.180.165.243 "GET /v2.1/flavors/m1.tiny HTTP/1.1" status: 404 len: 436 time: 0.1086760
2017-02-18 23:22:25.346 DEBUG nova.api.openstack.wsgi [req-ec979ea4-e9f7-4fa1-9788-b58ef43f212e admin admin] Calling method 'cbound method FlavorsController.index of <nova.api.openstack.compute.Flavors.FlavorsController object at 0x7f8e50ed0cd0>' from (pid=27315) _process_stack /opt/stack/nova/nova/api/openstack/wsgi.py:626
2017-02-18 23:22:25.374 INFO nova.osapi_compute.wsgi.server [req-ec979ea4-e9f7-4fa1-9788-b58ef43f212e admin admin] 10.180.165.243 "GET /v2.1/flavors/m1.tiny HTTP/1.1" status: 200 len: 2553 time: 0.6726519
2017-02-18 23:22:25.403 DEBUG nova.api.openstack.wsgi [req-c0eca745-56b4-473e-a440-391f15895235 admin admin] Calling method 'cbound method FlavorsController.show of <nova.api.openstack.compute.Flavors.FlavorsController object at 0x7f8e50ed0cd0>' from (pid=27315) _process_stack /opt/stack/nova/nova/api/openstack/wsgi.py:626
2017-02-18 23:22:25.416 INFO nova.osapi_compute.wsgi.server [req-c0eca745-56b4-473e-a440-391f15895235 admin admin] 10.180.165.243 "GET /v2.1/flavors/m1.tiny HTTP/1.1" status: 200 len: 697 time: 0.0404420
2017-02-18 23:22:25.449 DEBUG nova.api.openstack.wsgi [req-2a6dc8c5-a904-4117-9b7b-96b605f508c6 admin admin] Action: 'create', calling method: 'cbound method ServersController.create of <nova.api.openstack.compute.servers.ServersController object at 0x7f8e50bb2db0>', body: {'server': {'name': 'machinel1', "imageRef": "e9ab61d0-a408-4db5-b347-723923c74f49", "flavorRef": "1", "max_count": 1, "min_count": 1, "networks": "auto"}} from (pid=27315) _process_stack /opt/stack/nova/nova/api/openstack/wsgi.py:623
> /opt/stack/nova/nova/api/openstack/compute/servers.py(534)create()
-> context = req.environ['nova.context']
(Pdb)
*** SyntaxError: EOL while scanning string literal (<stdin>, line 1)
(Pdb) l
529 @validation.schema(schema_server_create_v237, '2.37', '2.41')
530 @validation.schema(schema_server_create_v242, '2.42')
531 def create(self, req, body):
532     """Creates a new server for a given user."""
533     import pdb; pdb.set_trace()
534     -> context = req.environ['nova.context']
535     server_dict = body['server']
536     password = self._get_server_admin_password(server_dict)
537     name = common.normalize_name(server_dict['name'])
538
539     if api_version_request.is_supported(req, min_version='2.19'):
```

1.2.1 pdb 常用调试命令

pdb 常用调试命令如下所示:

```
1      q  退出debug
2      h  打印可用的调试命令
3      b  设置断点, b 5 在第五行设置断点
4      h command 打印command的命令含义
5      disable codenum 使某一行断点失效
6      enable codenum 使某一行的断点有效
7      condition codenum xxx 针对断点设置条件
8      c  继续执行程序,直到下一个断点
9      n  执行下一行代码,如果当前语句有函数调用,则不会进入函数体中
10     s  执行下一行代码,但是s会进入函数
11     w  打印当前执行点的位置
12     j  codenum 让程序跳转到指定的行
13     l  列出附近的源码
14     p  打印一个参数的值
15     a  打印当前函数及参数的值
16     u  跳到上一层代码,也就是调用当前函数的函数
17     d  跳到下一层代码,也就是进入当前所处的函数中
18     回车 重复执行上一行的命令
```

pdb 下有一点非常好用,就是它相当于 python shell,支持 python 中的各种语句。