

Deep Dive into Neutron

by Yong Sheng Gong



UnitedStack

caveats

- developers oriented
 - many codes and UML diagrams
- the snapshot of current neutron code
 - evolution of neutron codes will obsolete some contents of this presentation

Coming sessions about Neutron

- Load balancing in neutron

Thursday November 7, 2013 4:30pm - 5:10pm, SkyCity Grand Ballroom C (SkyCity Marriott Hotel)

- How to Write a Neutron Plugin, If You Really Need to

Thursday November 7, 2013 5:20pm - 6:00pm ,SkyCity Grand Ballroom C (SkyCity Marriott Hotel)

- OpenStack Neutron Modular Layer 2 Plugin Deep Dive

Friday November 8, 2013 11:00am - 11:40am, Expo Breakout Room 2 (AsiaWorld-Expo)

- Neutron Hybrid Deployment and Performance Analysis

Friday November 8, 2013 1:30pm - 2:10pm, Expo Breakout Room 2 (AsiaWorld-Expo)

- Neutron Network Namespaces and IPtables: Technical Deep Dive

Friday November 8, 2013 4:10pm - 4:50pm, Expo Breakout Room 2 (AsiaWorld-Expo)

Contents

- the process of neutron start
- the normal steps to process a request
- Start ML2 plugin
- message queues in Neutron
- interaction with nova compute
- To debug the Neutron

related skills

- **WSGI**

WSGI is the Web Server Gateway Interface. It is a specification for web servers and application servers to communicate with web applications.

- **paste deploy**

Paste Deployment is a system for finding and configuring WSGI applications and servers. The primary interaction with Paste Deploy is through its configuration files.

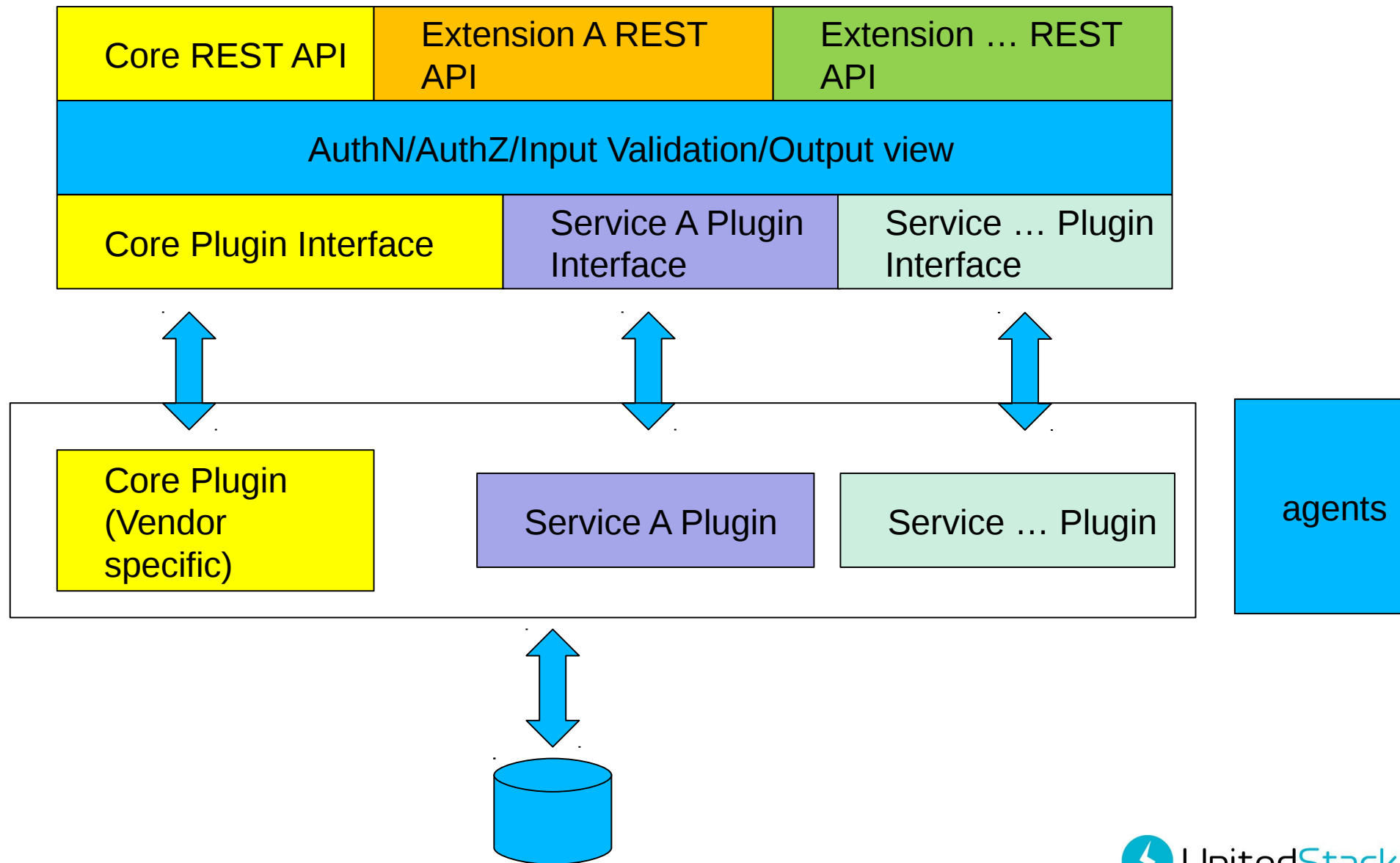
- **Python Routes**

Routes is a Python re-implementation of the Rails routes system for mapping URLs to application actions, and conversely to generate URLs. Routes makes it easy to create pretty and concise URLs that are RESTful with little effort.

- **peCan**

Will we change to pecan? see design summit session [Neutron API Framework Replacement](#)

Layer diagram of Neutron server



paste application and filters

```
[composite:neutron]  
use = egg:Paste#urlmap  
/: neutronversions  
/v2.0: neutronapi_v2_0
```

```
[composite:neutronapi_v2_0]  
use = call:neutron.auth:pipeline_factory  
keystone = authtoken keystonecontext extensions neutronapiapp_v2_0
```

```
[filter:keystonecontext]  
paste.filter_factory = neutron.auth:NeutronKeystoneContext.factory
```

```
[filter:authtoken]  
paste.filter_factory = keystoneclient.middleware.auth_token:filter_factory
```

```
[filter:extensions]  
paste.filter_factory =  
neutron.api.extensions:plugin_aware_extension_middleware_factory
```

```
[app:neutronversions]  
paste.app_factory = neutron.api.versions:Versions.factory
```

```
[app:neutronapiapp_v2_0]  
paste.app_factory = neutron.api.v2.router:APIRouter.factory
```

main entry point

neutron/server/__init__.py: main()

1.config.parse(sys.argv[1:]) ← --config-file neutron.conf --config-file xxx.ini

2.neutron/common/config.py:load_paste_app("neutron")

2.1 neutron/auth.py:pipeline_factory()

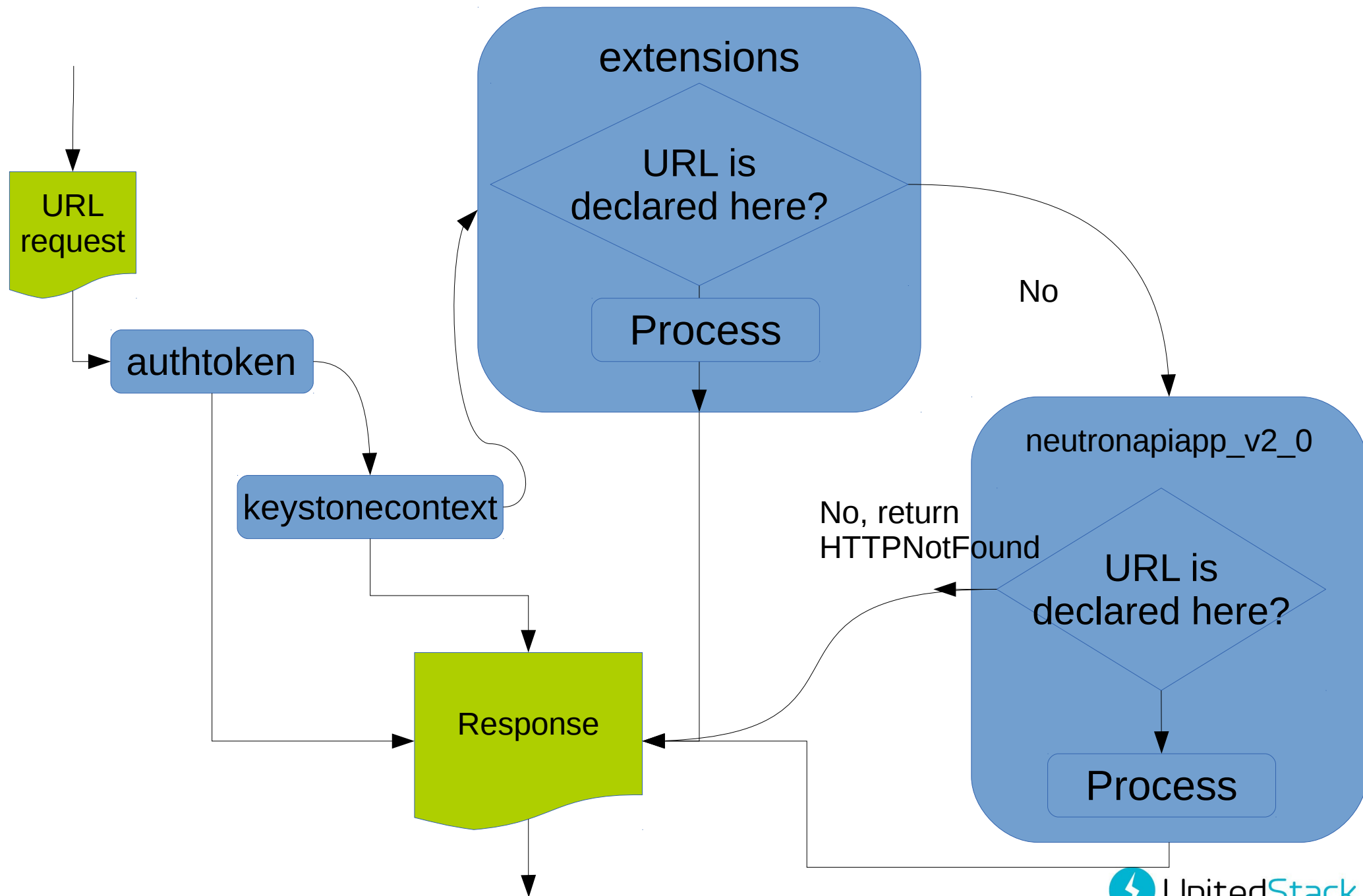
2.1.1 neutron/api/v2/router.py:APIRouter.factory()

2.1.2 neutron/api/extensions.py:
plugin_aware_extension_middleware_factory()

2.1.3 neutron.auth:NeutronKeystoneContext.factory()

2.1.4 keystoneclient.middleware.auth_token:filter_factory()

filters and application pipeline



neutronapiapp_v2_0: load plugins

neutron/api/v2/router.py:APIRouter.factory()

1. `__init__()`

1.1 `plugin = manager.NeutronManager.get_plugin()`

1.1.1 `neutron/manager.py:__init__()`

A 1.1.1.1 create core plugin instance

B 1.1.1.2

`neutron/manager.py:_load_service_plugins()`

neutron.conf:

`service_plugins = ...`

`core_plugin = neutron.plugins.ml2.plugin.Ml2Plugin`

```
NeutronManager
:service_plugins =
{"CORE": ml2_plugin,
 "LOADBALANCER": xxx,
 ...}
```

what are plugins and extensions

- extensions are about resources and the actions on them

```
@classmethod
def get_resources(cls):
    for resource_name in ['router', 'floatingip']:
        ...
        controller = base.create_resource(
            collection_name, resource_name, plugin...)

    ex = ResourceExtension(collection_name, controller,
member_actions...)
```

- plugins are used to support the resources

```
supported_extension_aliases = ["router", "ext-gw-mode",
                               "extraroute",
                               "l3_agent_scheduler"]
def update_router(self, context, id, router):
def get_router(self, context, id, fields=None):
```

neutronapiapp_v2_0: load extensions

```
neutron/api/v2/router.py:APIRouter.factory()
```

```
1. __init__()
```

```
1.1 plugin = manager.NeutronManager.get_plugin()
```

```
1.2 extensions.PluginAwareExtensionManager.get_instance()
```

```
1.2.1 extensions.py:get_extensions_path()
```

```
1.2.2 PluginAwareExtensionManager.__init__(paths, plugins)
```

```
1.2.2.1 _load_all_extensions()
```

```
for each path in paths
```

```
    _load_all_extensions_from_path(path
```

```
    )
    add_extension(ext)
```

```
    _check_extension(ext)
```

neutron standard
extension plus ones
specified by
`api_extensions_path=` in
neutron.conf

1. check if the potential extension has implemented the needed functions
2. check if one of plugins supports it. plugin's `supported_extension_aliases` attribute defines what extensions it supports.

check each python module name
under the path, and capitalize the
first letter of the module name to
find the class in it, excluding the
modules starting with "_".

neutronapiapp_v2_0: install core resources

```
neutron/api/v2/router.py:APIRouter.factory()
```

```
1. __init__()
```

```
1.1 plugin = manager.NeutronManager.get_plugin()
```

```
1.2 PluginAwareExtensionManager.get_instance()
```

```
1.3 install core resources
```



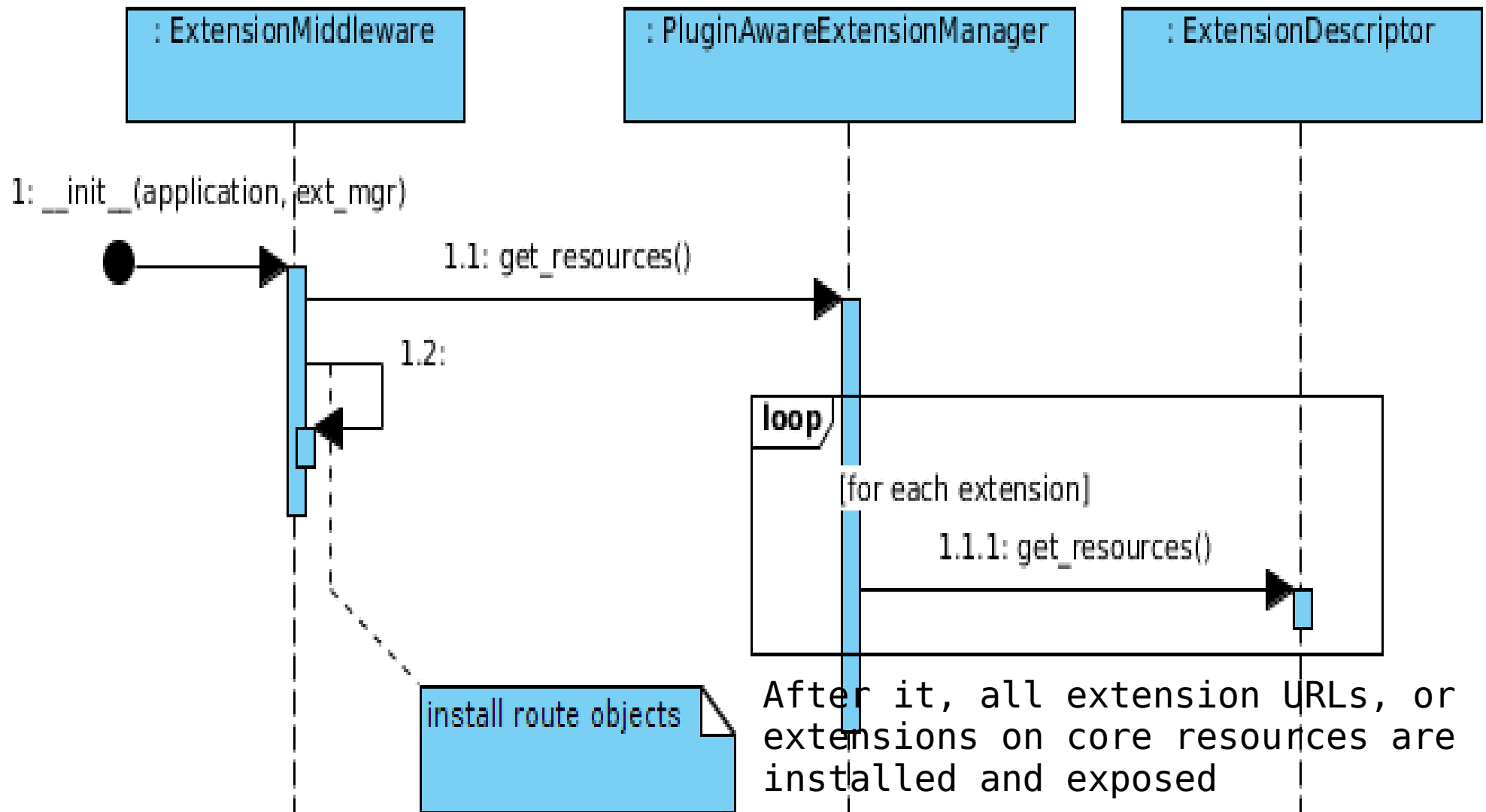
```
neutron/api/v2/router.py:
```

```
RESOURCES = {'network': 'networks',  
             'subnet': 'subnets',  
             'port': 'ports'}
```

After it, core resources URLs, i.e. Core Resource API, are installed and exposed.

extension filter: assemble extensions

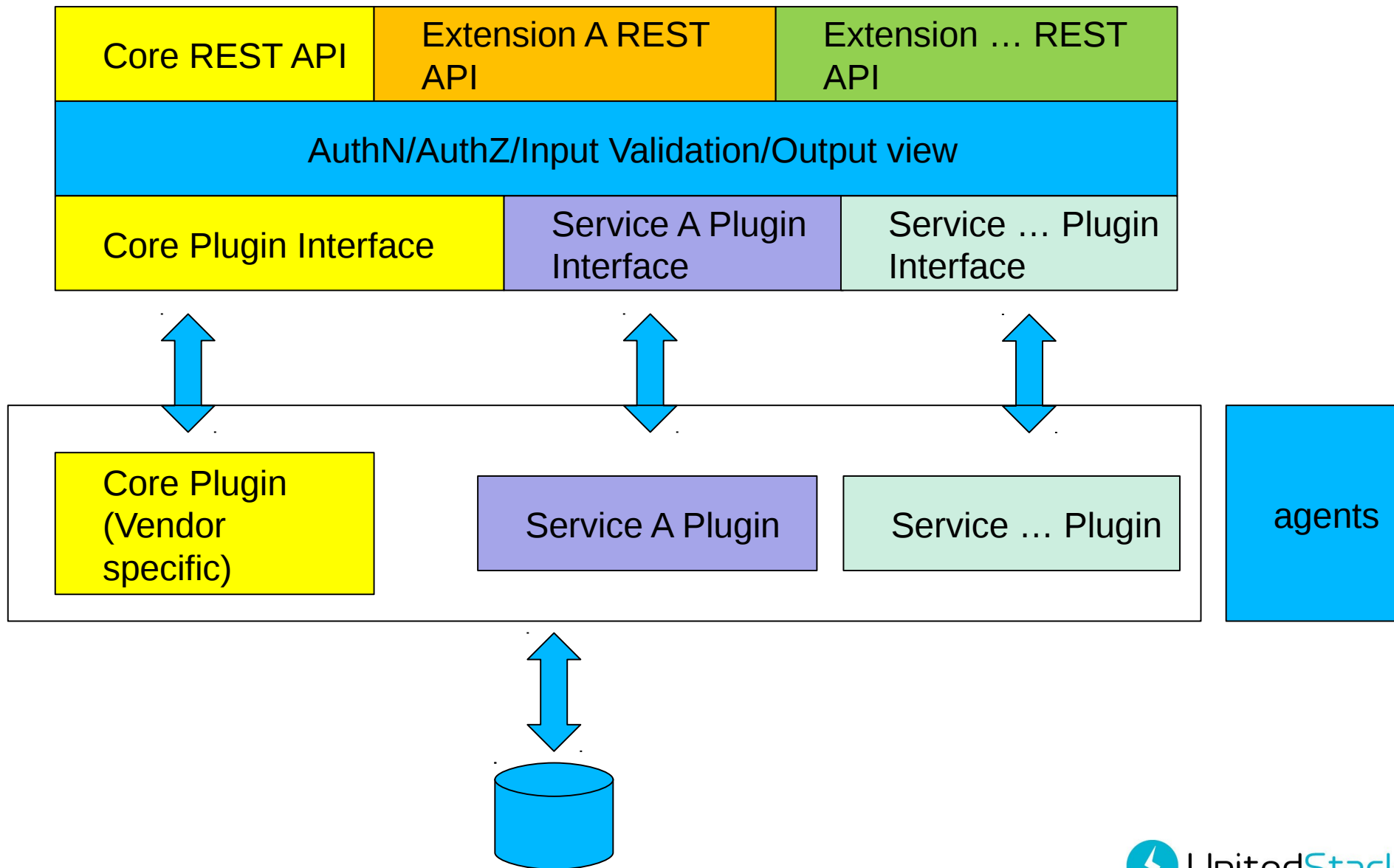
```
2.1.2 neutron/api/extensions.py:plugin_aware_extension_middleware_factory()  
    ext_mgr = PluginAwareExtensionManager.get_instance()  
    return ExtensionMiddleware(app, ext_mgr=ext_mgr)
```



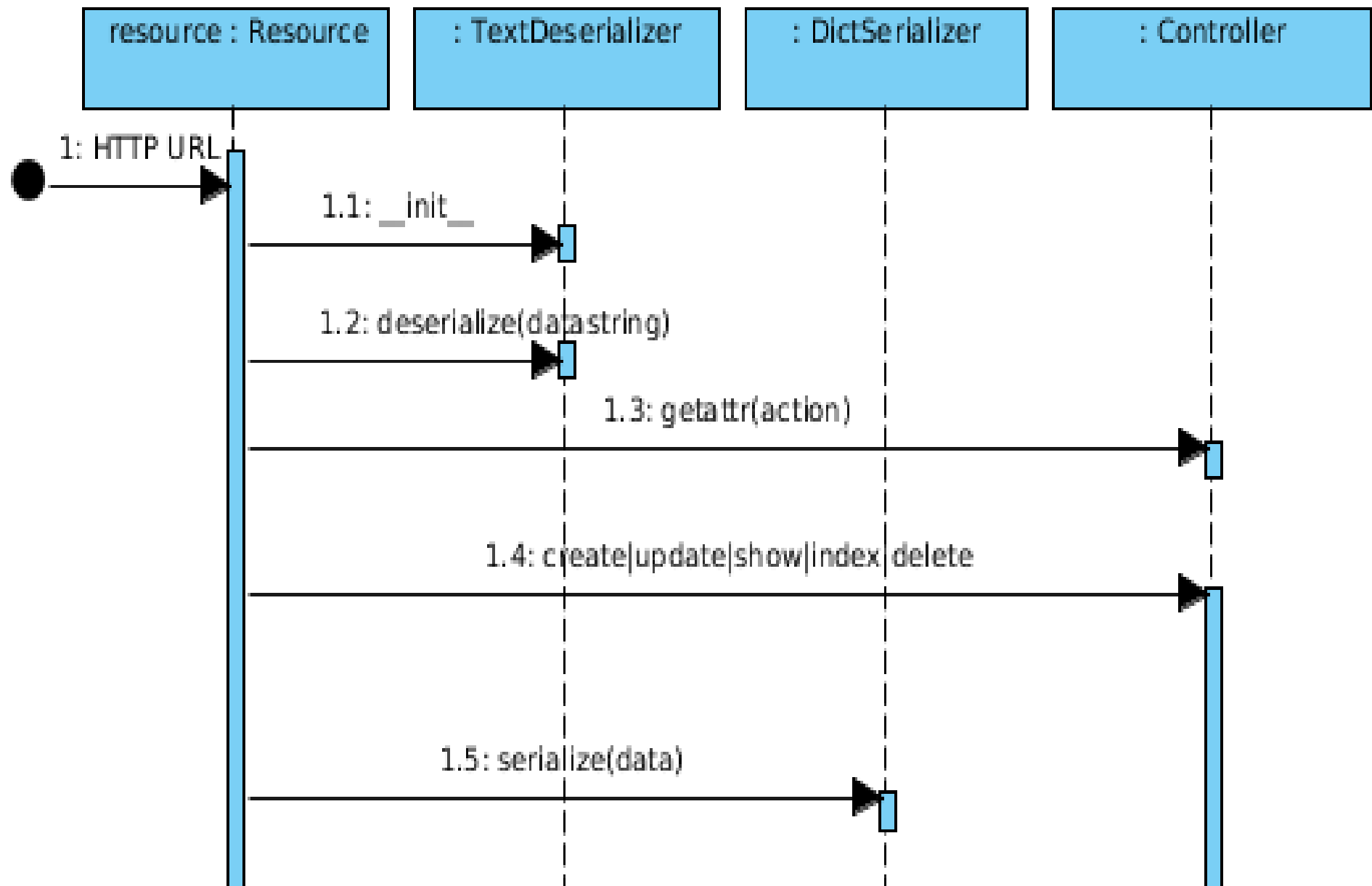
Contents

- the process of neutron start
- the normal steps to process a request
- Start ML2 plugin
- message queues in Neutron
- interaction with nova compute
- To debug the Neutron

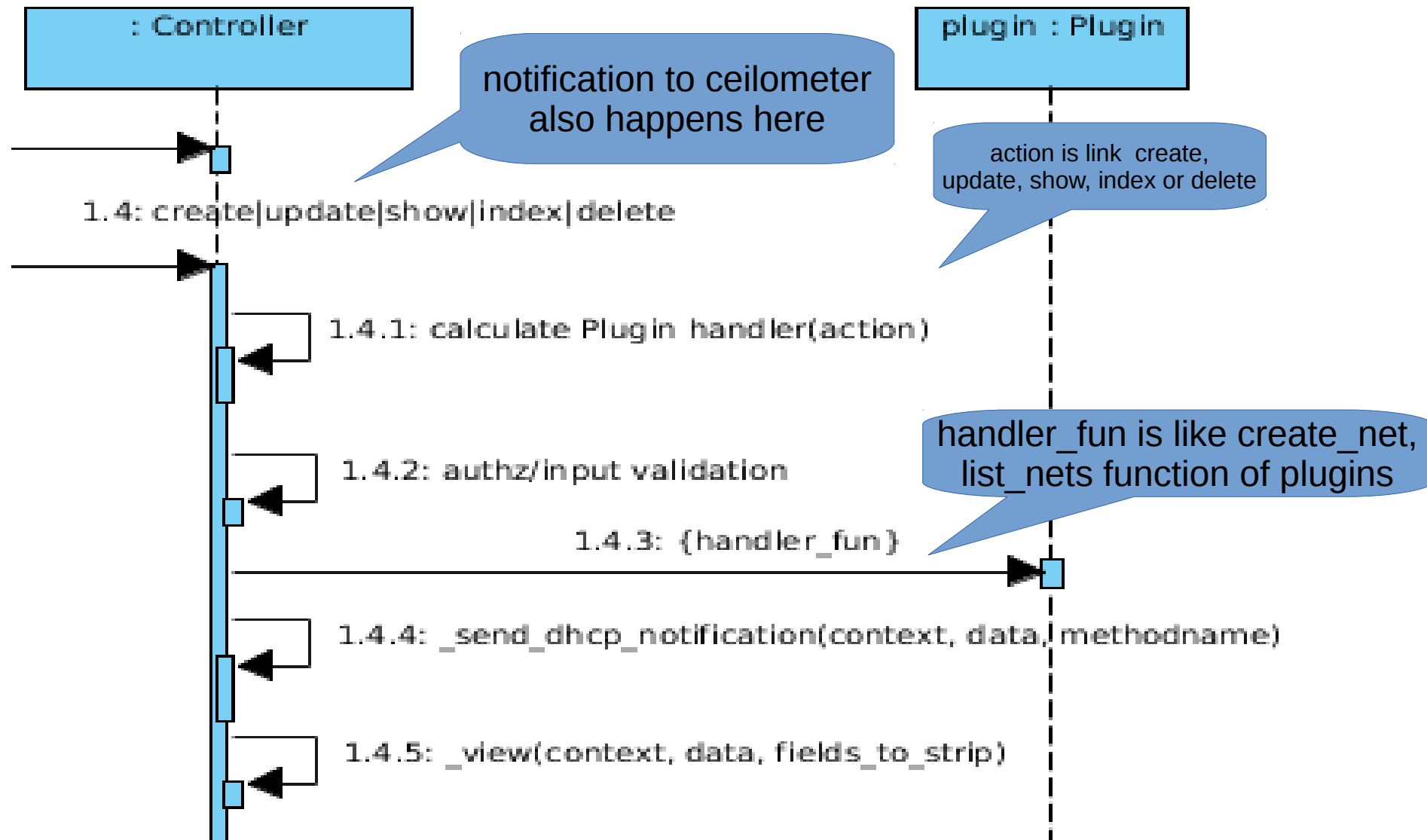
Layer diagram



URL processing (major steps)



URL processing continued



Contents

- the process of neutron start
- the normal steps to process a request
- **Start ML2 plugin**
- message queues in Neutron
- interaction with nova compute
- To debug the Neutron

ML2 Plugin

- simultaneously utilize the variety of layer 2 networking technologies found in complex real-world data centers
- It currently works with the existing openvswitch, linuxbridge, and hyperv L2 agents
- The ml2 framework is also intended to greatly simplify adding support for new L2 networking technologies
- consists of network types and mechanisms

Type and mechanism drivers in setup.cfg

```
neutron.ml2.type_drivers =
```

```
flat = neutron.plugins.ml2.drivers.type_flat:FlatTypeDriver
```

```
local = neutron.plugins.ml2.drivers.type_local:LocalTypeDriver
```

```
vlan = neutron.plugins.ml2.drivers.type_vlan:VlanTypeDriver
```

```
gre = neutron.plugins.ml2.drivers.type_gre:GreTypeDriver
```

```
vxlan = neutron.plugins.ml2.drivers.type_vxlan:VxlanTypeDriver
```

```
neutron.ml2.mechanism_drivers =
```

```
linuxbridge = neutron.plugins.ml2.drivers.mech_linuxbridge:LinuxbridgeMechanismDriver
```

```
openvswitch = neutron.plugins.ml2.drivers.mech_openvswitch:OpenvswitchMechanismDriver
```

```
hyperv = neutron.plugins.ml2.drivers.mech_hyperv:HypervMechanismDriver
```

```
ncs = neutron.plugins.ml2.drivers.mechanism_ncs:NCSMechanismDriver
```

```
arista = neutron.plugins.ml2.drivers.mech_arista.mechanism_arista:AristaDriver
```

```
cisco_nexus = neutron.plugins.ml2.drivers.cisco.mech_cisco_nexus:CiscoNexusMechanismDriver
```

```
l2population = neutron.plugins.ml2.drivers.l2pop.mech_driver:L2populationMechanismDriver
```

Configuration for types in ml2.ini

```
neutron-server --config-file /etc/neutron/neutron.conf --config-file  
/etc/neutron/ml2.ini
```

```
[ml2]  
type_drivers = local,flat,vlan,gre,vxlan  
mechanism_drivers = openvswitch,linuxbridge  
tenant_network_types = vlan,gre,vxlan
```

```
[ml2_type_flat]  
flat_networks = physnet1,physnet2
```

```
[ml2_type_vlan]  
network_vlan_ranges = physnet1:1000:2999,physnet2
```

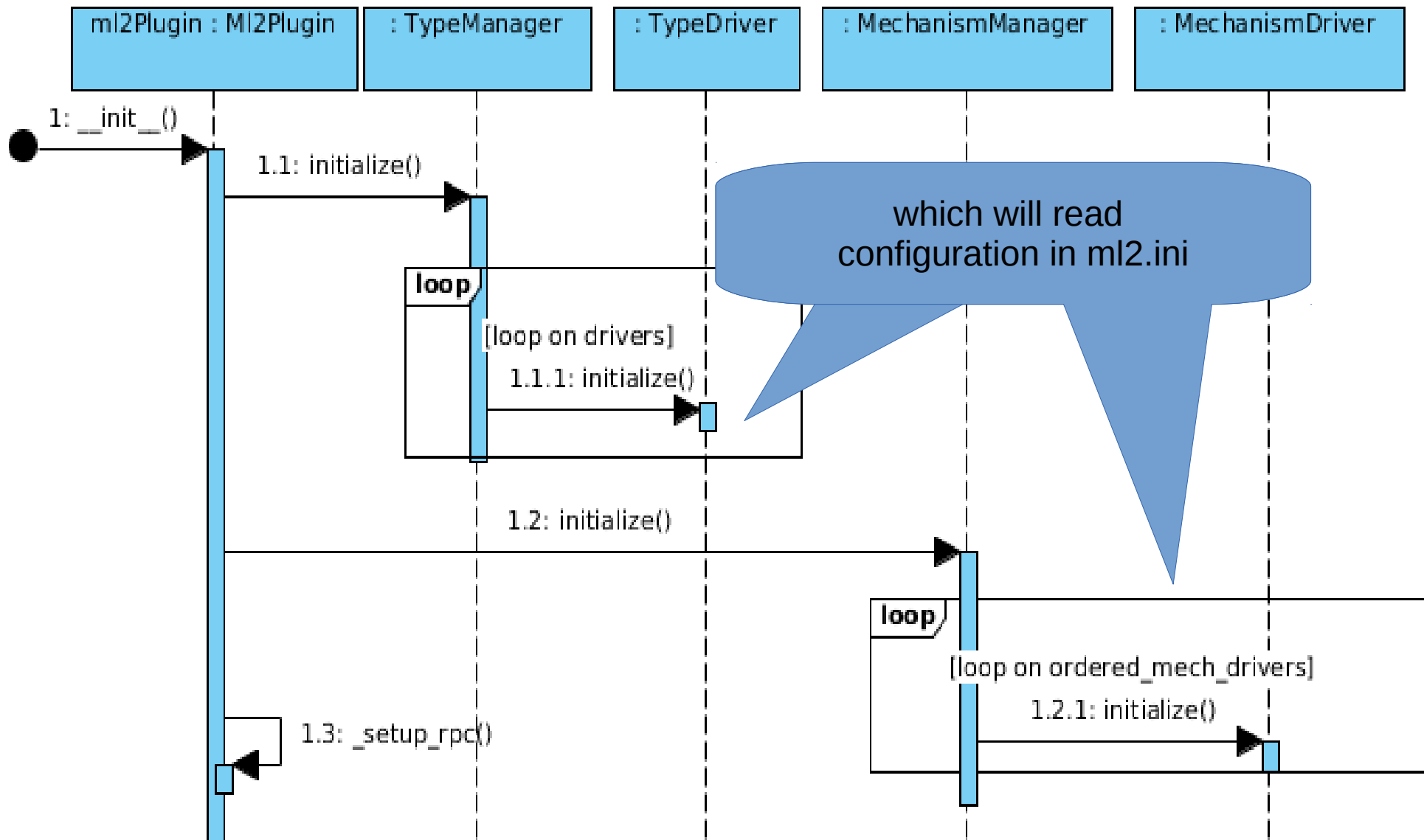
```
[ml2_type_gre]  
tunnel_id_ranges = 1:1000
```

```
[ml2_type_vxlan]  
vni_ranges = 1001:2000
```

__init__ of ML2

neutron/manager.py: __init__()

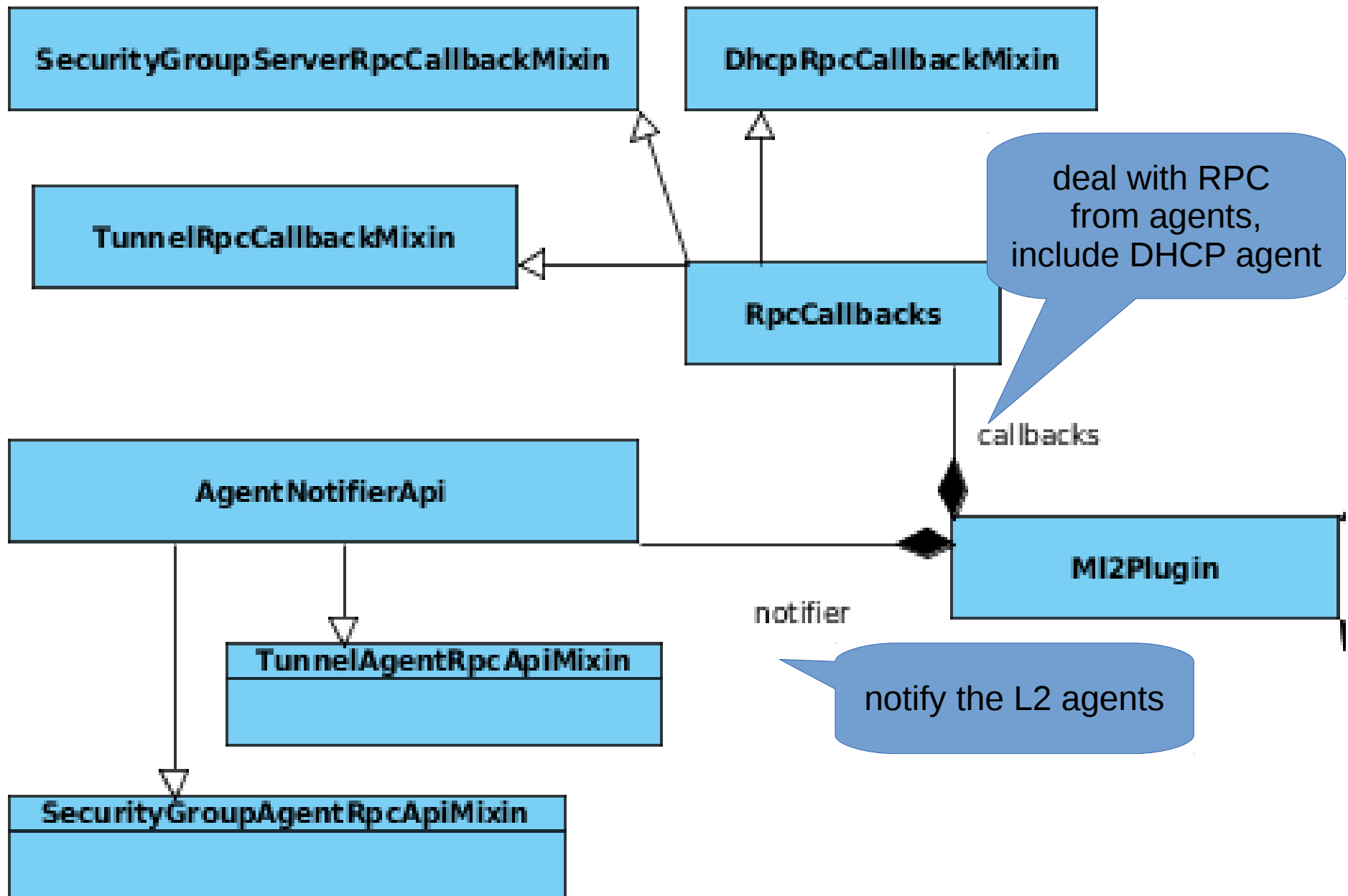
create core plugin instance [core_plugin=]

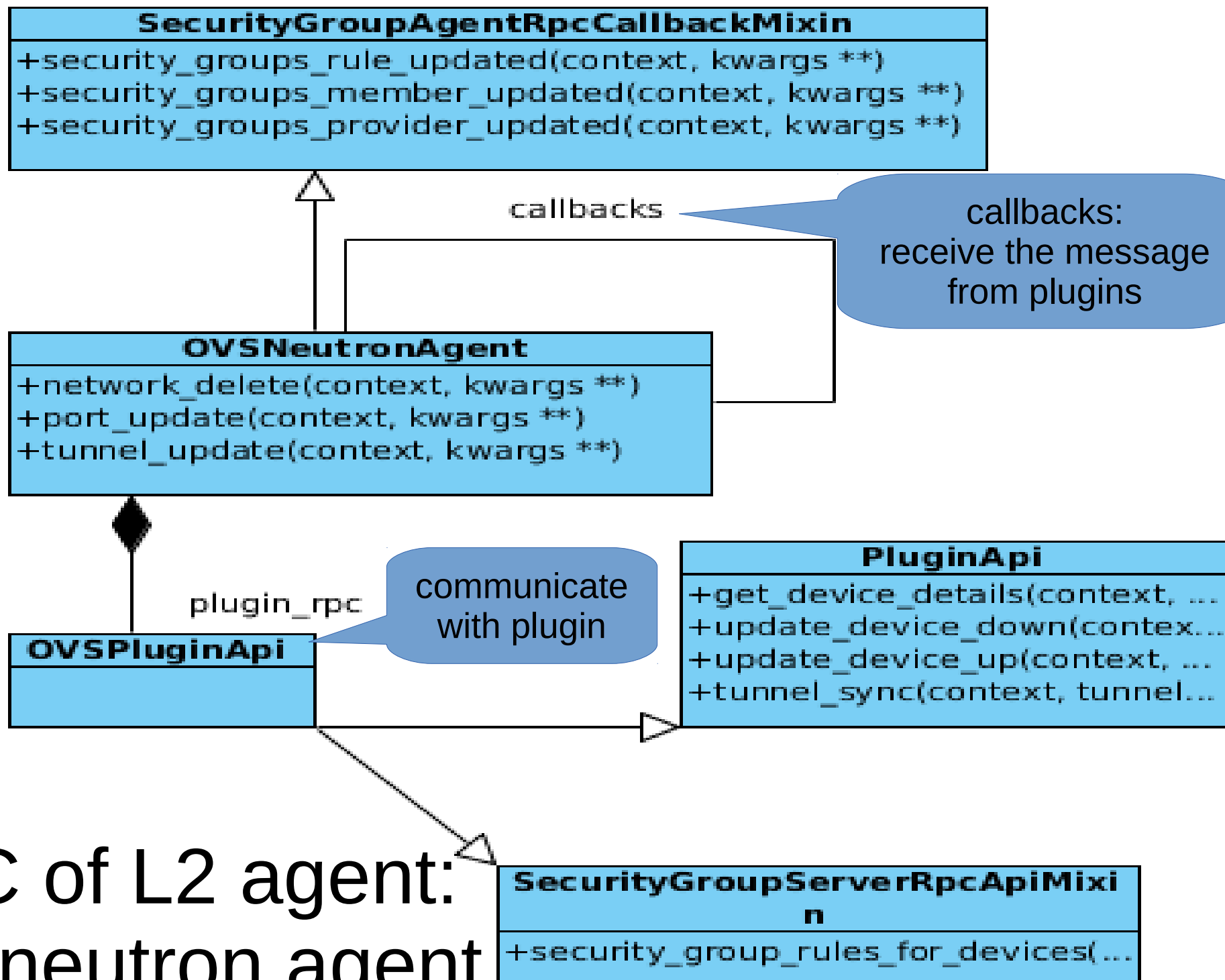


Contents

- the process of neutron start
- the normal steps to process a request
- Start ML2 plugin
- message queues in Neutron
- interaction with nova compute
- To debug the Neutron

RPC structure of ML2

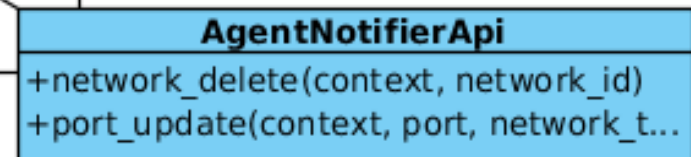
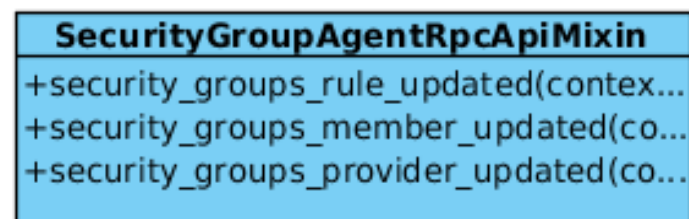
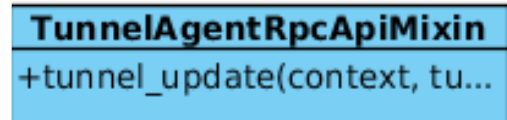




RPC of L2 agent:
ovs neutron agent

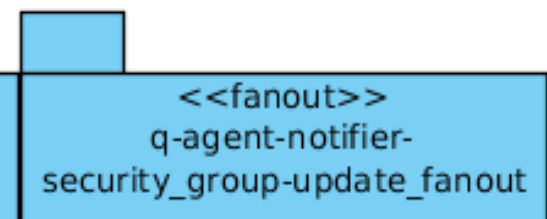
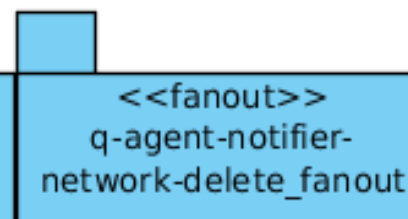
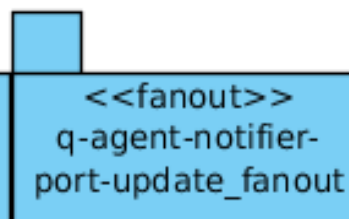
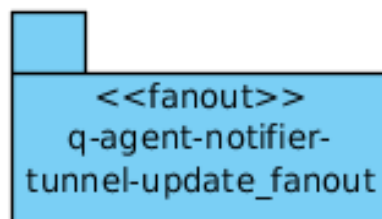
messages: Plugin to agent

Plugins



notifier

Exchanges



Queues

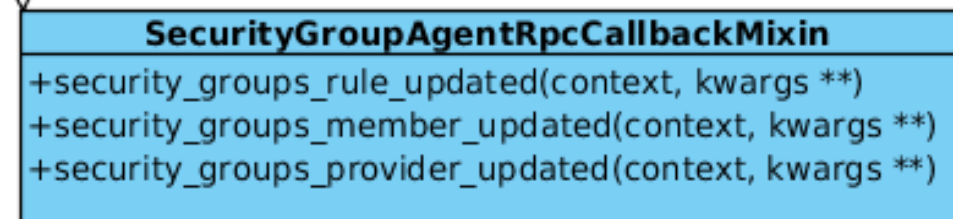
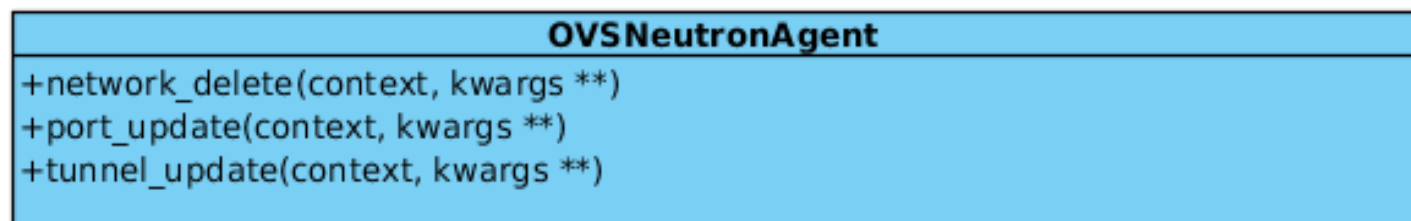
q-agent-notifier-
tunnel-update_fanout
_<uuid>

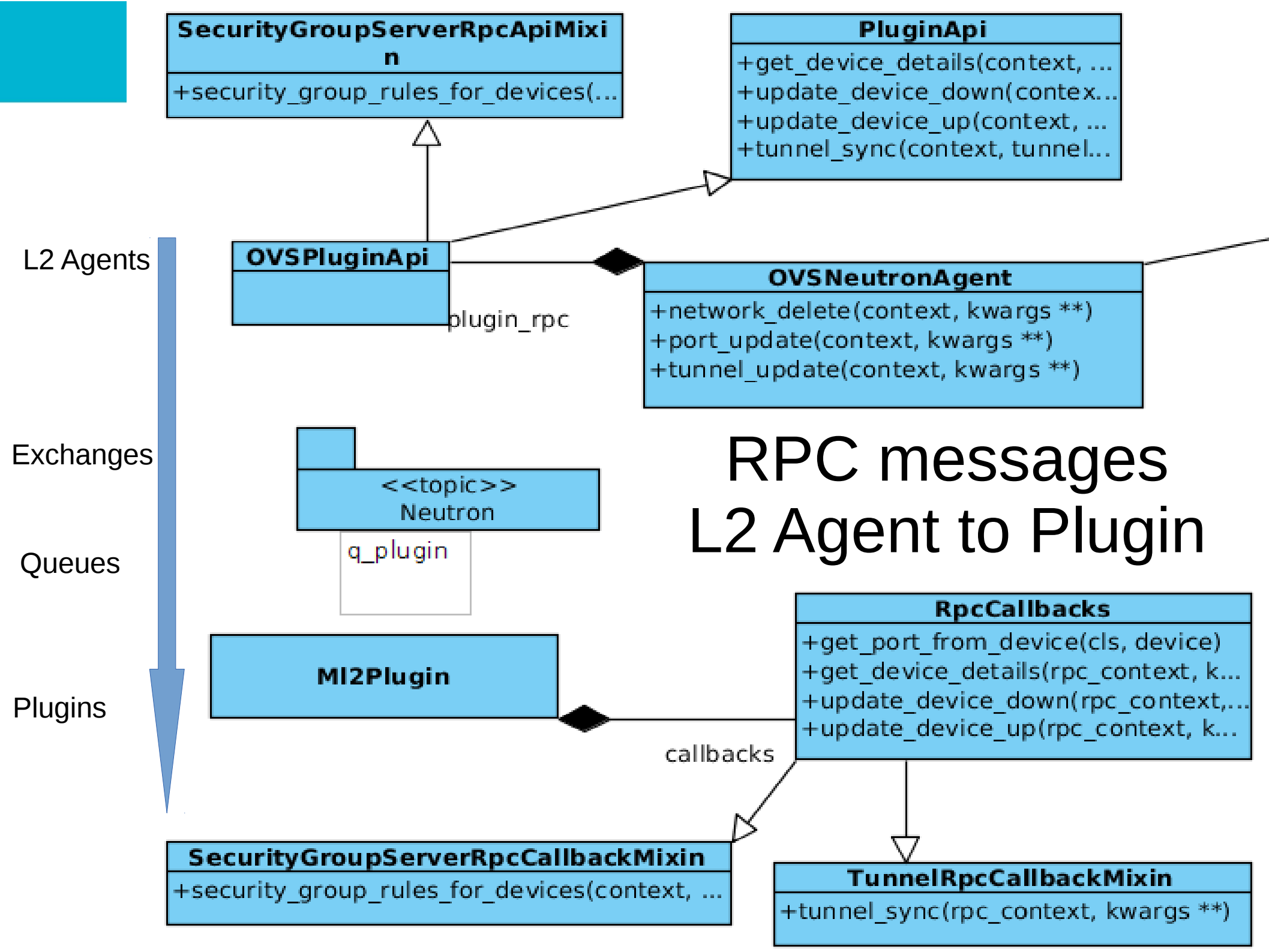
q-agent-notifier-
port-update_fanout
_<uuid>

q-agent-notifier-
network-delete_fanout
_<uuid>

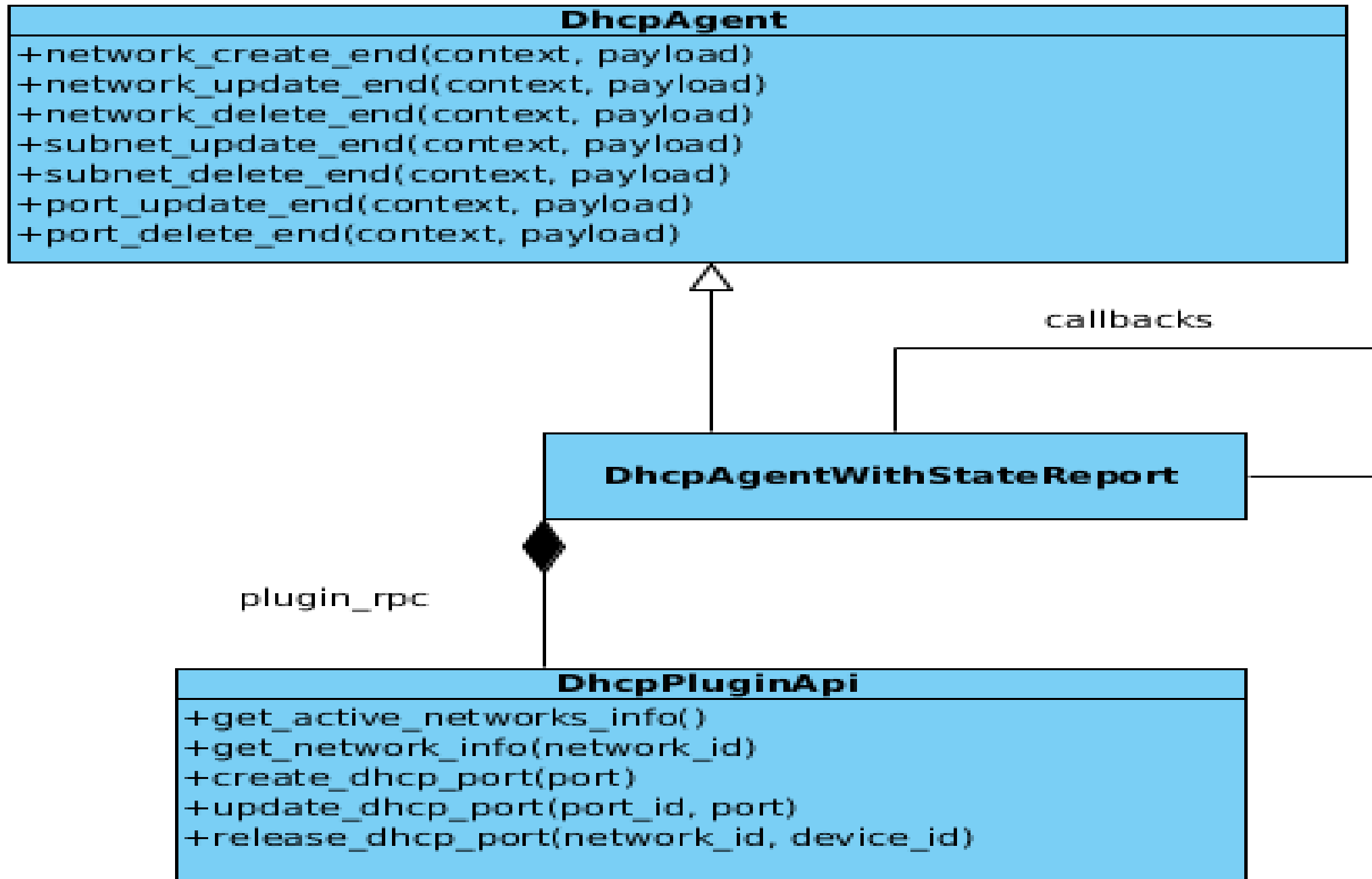
q-agent-notifier-
security_group-update_fanout
_<uuid>

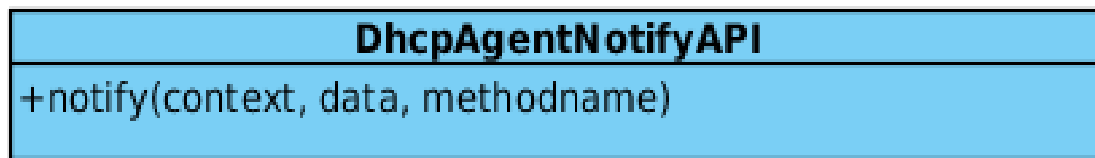
L2 Agents



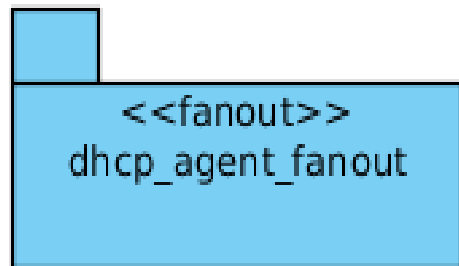


RPC structure of DHCP agent



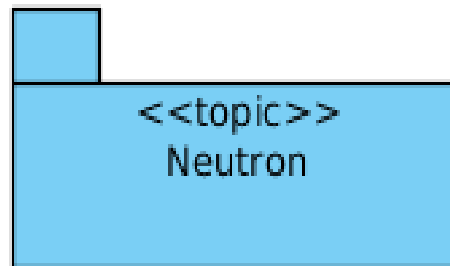


Neutron
Server



Exchanges

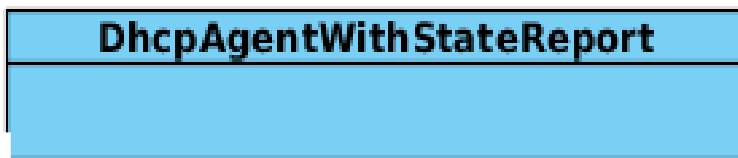
`dhcp_agent_fanout
_<uuid>`



`dhcp_agent.
<host>`

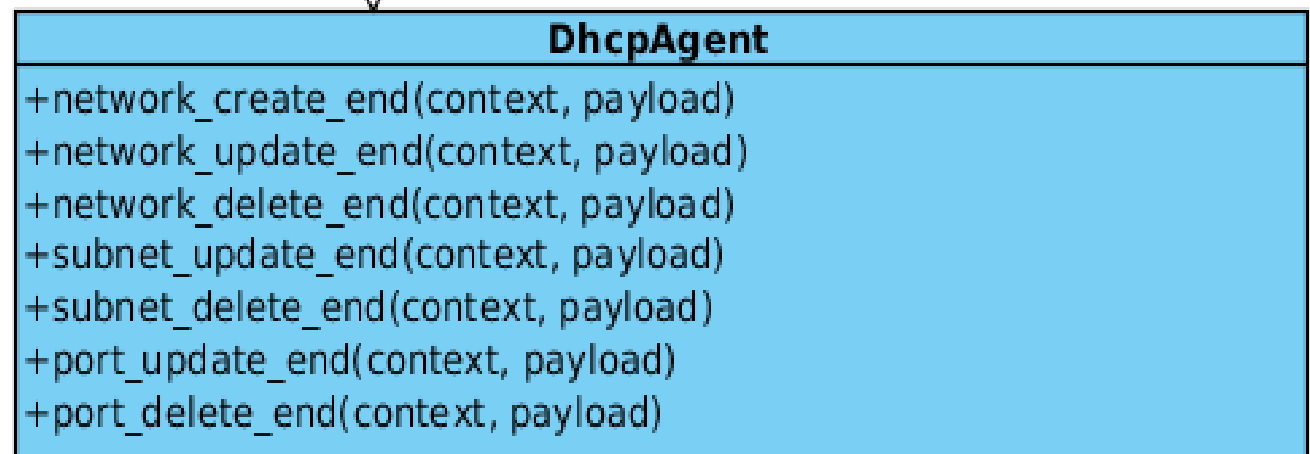
`'network.create.end',
'network.update.end',
'network.delete.end',
'subnet.create.end', 'subnet.
update.end', 'subnet.delete.
end', 'port.create.end',
'port.update.end', 'port.
delete.end'`

Queues



Messages from Neutron
server to DHCP agent

DHCP
Agents



RPC messages

DHCP Agent to Plugin

DHCP
Agents

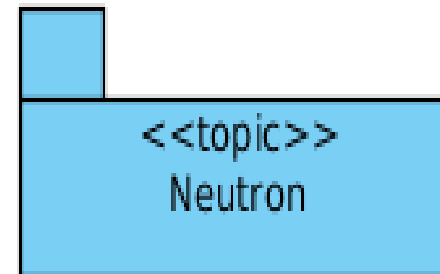
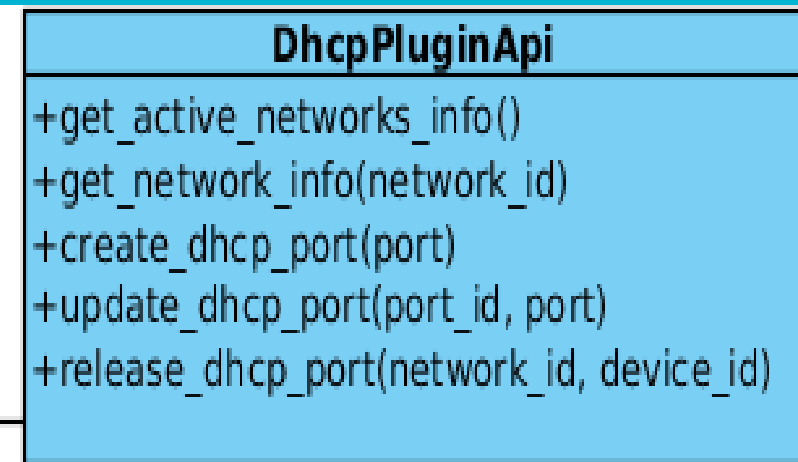
Exchanges

Queues

Plugin



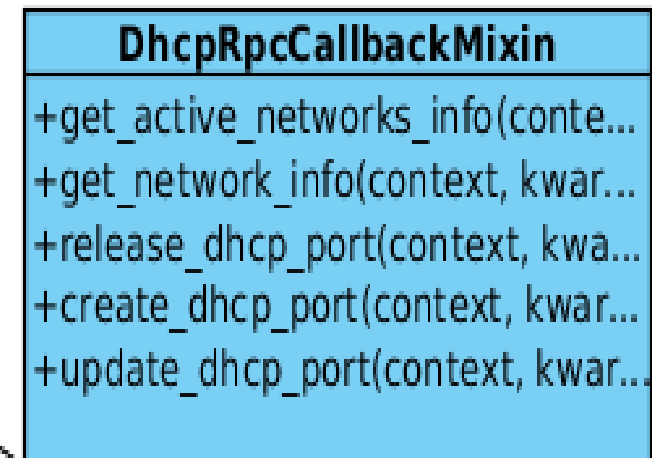
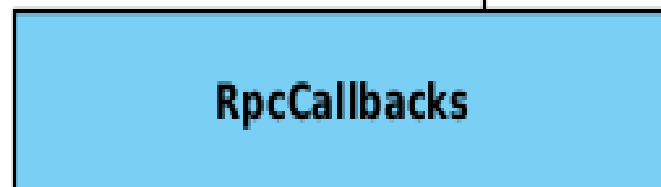
plugin_rpc



q_plugin



callbacks



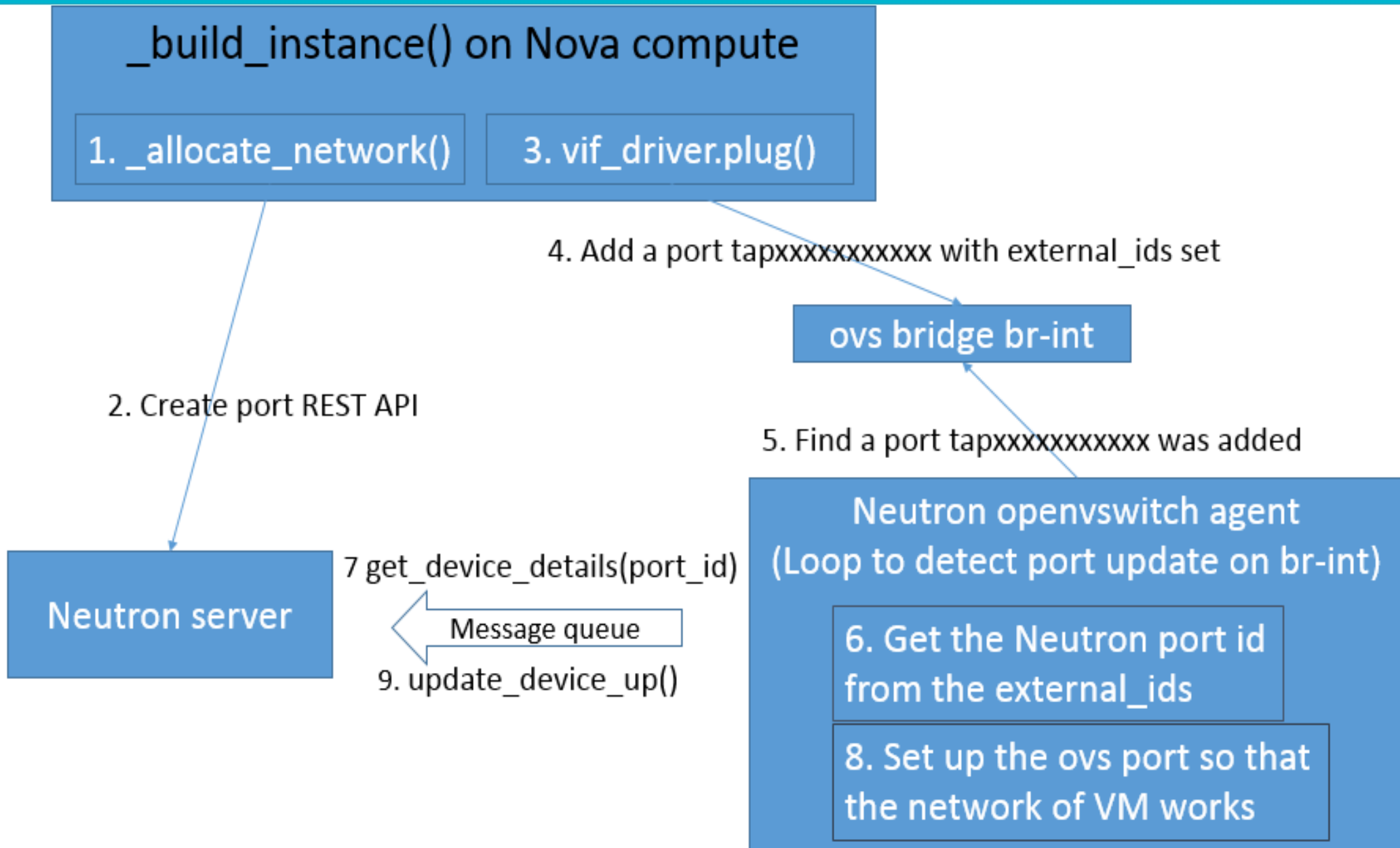
Contents

- the process of neutron start
- the normal steps to process a request
- Start ML2 plugin
- message queues in Neutron
- **interaction with nova compute**
- To debug the Neutron

Some Neutron options in Nova.conf

- `network_api_class = nova.network.neutronv2.api.API`
- `neutron_url = http://172.16.108.1:9696`
- `neutron_region_name = RegionOne`
- `neutron_admin_tenant_name = service`
- `neutron_auth_strategy = keystone`
- `neutron_admin_auth_url = http://172.16.108.1:35357/v2.0`
- `neutron_admin_password = password`
- `neutron_admin_username = neutron`
- `libvirt_vif_driver = nova.virt.libvirt.vif.LibvirtGenericVIFDriver`

interaction to boot VM (OVS bridge)

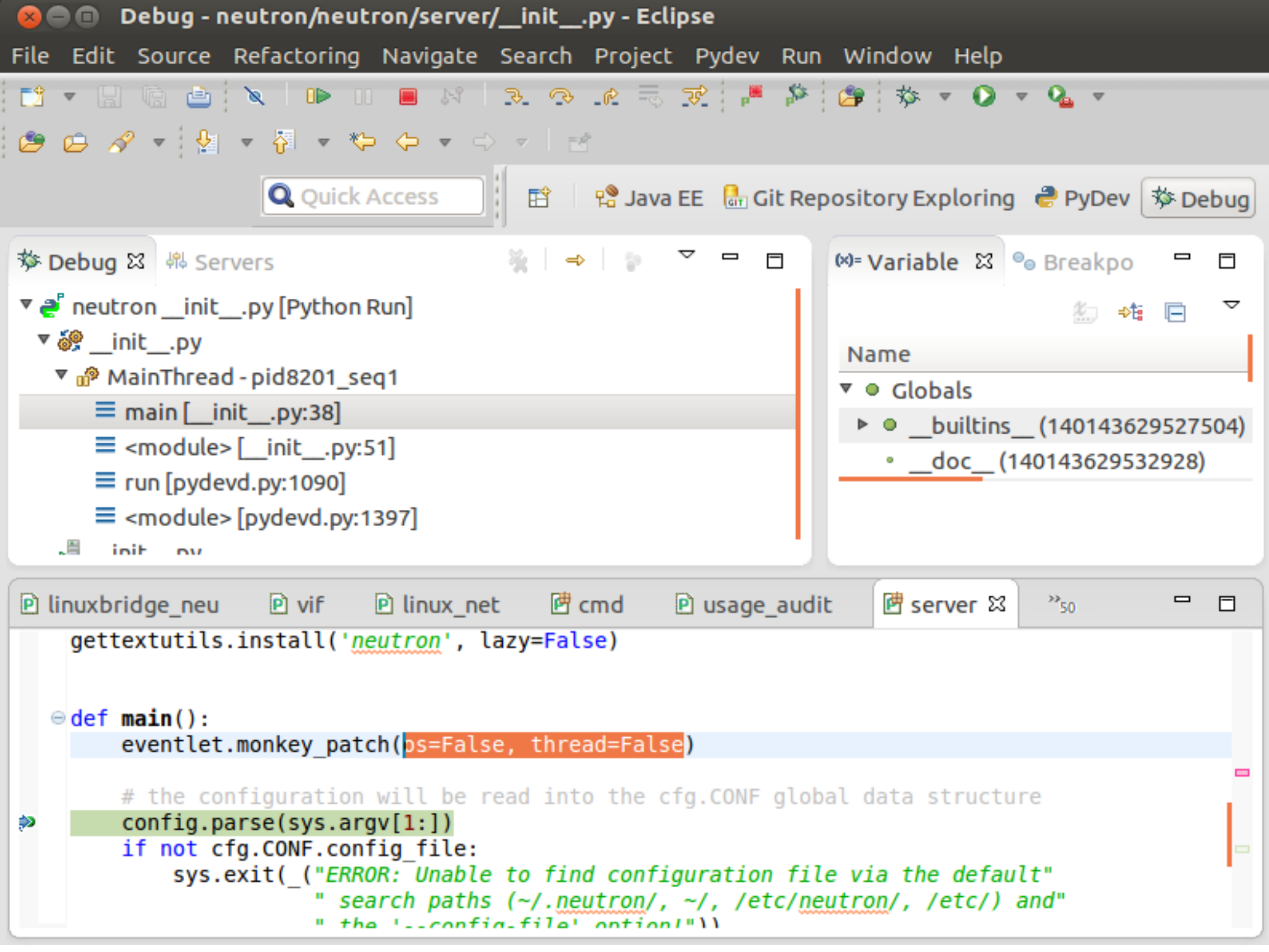


Contents

- the process of neutron start
- the normal steps to process a request
- Start ML2 plugin
- message queues in Neutron
- interaction with nova compute
- To debug the Neutron

debug Neutron

- <https://wiki.openstack.org/wiki/NeutronDevelopment>
- Eclipse pydev to debug neutron server
 - neutron/server/__init__.py:
 - change eventlet.monkey_patch() To:
eventlet.monkey_patch(os=False, thread=False)
 - and then create a python run/debug configuration with the correct parameter such as "--config-file /etc/neutron/neutron.conf --config-file /etc/neutron/plugins/ml2/ml2_conf.ini"



ipdb

- add the following line to the `neutron/server/__init__.py`:
`import ipdb; ipdb.set_trace()`
- start the neutron server

ipdb debug

gongysh@gongysh-ThinkPad-T530: ~

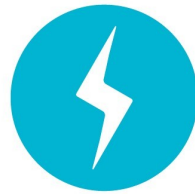
```
> /mnt/data/opt/stack/neutron/neutron/server/__init__.py(36)main()
    35     import ipdb; ipdb.set_trace()
--> 36     eventlet.monkey_patch()
    37

ipdb> n
> /mnt/data/opt/stack/neutron/neutron/server/__init__.py(39)main()
    38     # the configuration will be read into the cfg.CONF global
e
--> 39     config.parse(sys.argv[1:])
    40     if not cfg.CONF.config_file:

ipdb> n
> /mnt/data/opt/stack/neutron/neutron/server/__init__.py(40)main()
    39     config.parse(sys.argv[1:])
--> 40     if not cfg.CONF.config_file:
    41         sys.exit(_("ERROR: Unable to find configuration file v
t"

ipdb> p cfg.CONF.config_file
['/etc/neutron/neutron.conf', '/etc/neutron/plugins/ml2/ml2_conf.ini']
ipdb>
```

Thanks



UnitedStack