# neutron-dynamic-routing Documentation

***Release 17.0.1.dev3***

**OpenStack Foundation**

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# CONTENTS

CHAPTER

ONE

# INSTALLATION

At the command line:

```
$ pip install neutron-dynamic-routing
```

Or, if you have virtualenv wrapper installed:

```
$ mkvirtualenv neutron-dynamic-routing
$ pip install neutron-dynamic-routing
```

CHAPTER

TWO

# ADMINISTRATION GUIDE

## 2.1 System Design

### 2.1.1 Introduction

Neutron dynamic routing enables advertisement of self-service (private) network prefixes to physical network devices that support dynamic routing protocols such as routers, thus removing the conventional dependency on static routes.

It advertises three classes of routes:

- Host routes for floating IP addresses hosted on non-DVR routers, the nexthop is the centralized router.
- Host routes for floating IP addresses hosted on DVR routers, the nexthop is the appropriate compute node.
- Prefix routes for directly routable tenant networks with address scopes, the nexthop is the centralized router, the same for DVR and CVR.

For details refer to Route Advertisement.

Neutron dynamic routing consists of service plug-in and agent. The service plug-in implements the Networking service extension and the agent manages dynamic routing protocol peering sessions. The plug-in communicates with the agent through RPC.

### 2.1.2 Architecture

The following figure shows the architecture of this feature:

```
 Neutron dynamic Routing System Architecture
+-------------------------------------------------------------+
|                  Dynamic Routing plug-in                    |
|  +-----------------------------------------------------+   |
|  |               Dynamic Routing API/Model             |   |
|  +-----------------------------------------------------+   |
|  |               Dynamic Routing Agent Scheduler       |   |
|  +-----------------------------------------------------+   |
|                                |                            |
+--------------------------------|----------------------------+
                                 |
                                 |
                          +------------+
```

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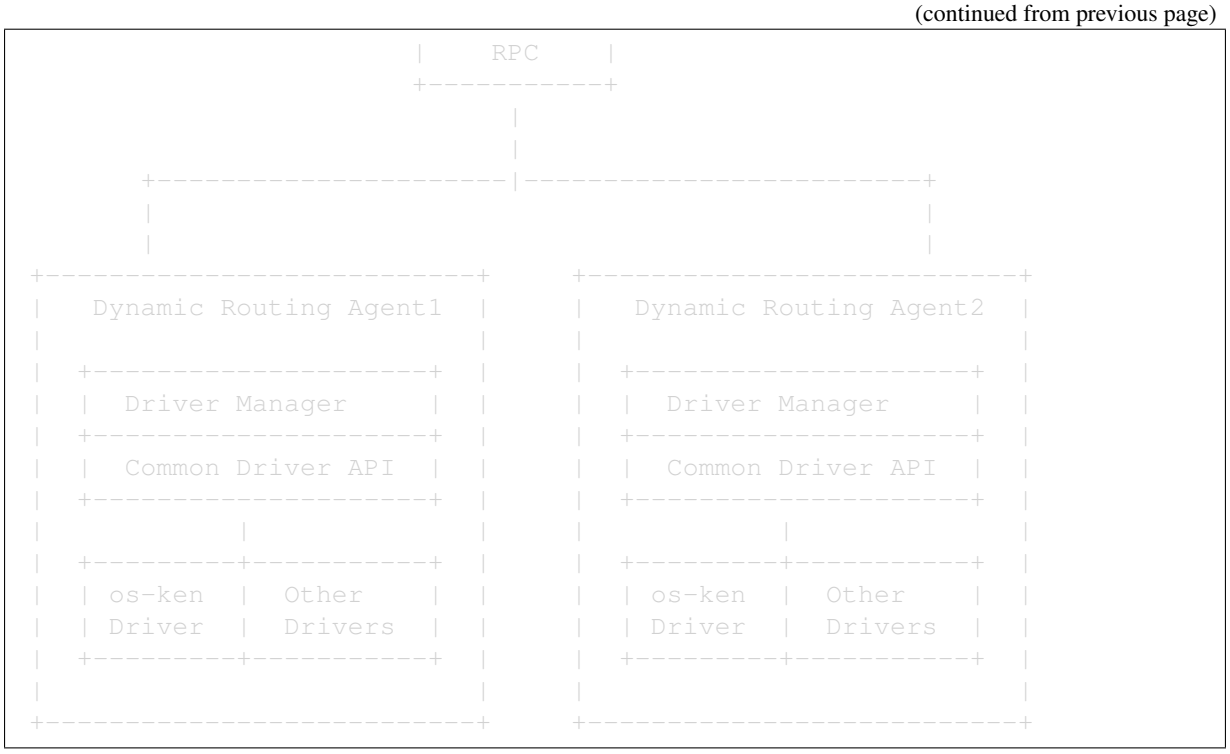


### Dynamic Routing Plug-in

Using dynamic routing plugin one can enable/disable the support of dynamic routing protocols in neutron.

### Dynamic Routing API

Dynamic routing API provides APIs to configure dynamic routing. APIs for below mentioned dynamic protocols are supported.

### BGP

Three kinds of APIs are available for BGP functionality.For details refer to the API document.

- BGP Speaker APIs to advertise Neutron routes outside the Openstack network.
- BGP Peer APIs to form peers with the remote routers.
- BGP DRAgentScheduler APIs to schedule BGP Speaker(s) to one or more hosts running the dynamic routing agent.

---

**Note:** BGP is the only dynamic routing protocol currently supported.

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#### Dynamic Routing Model

Dynamic routing model maintains the database and communicates with the dynamic routing agent.

#### Dynamic Routing Agent Scheduler

Dynamic routing agent scheduler, is responsible for scheduling a routing entity. For details refer to Agent Scheduler.

#### Dynamic Routing Agent (DR Agent)

Dynamic routing can reside on hosts with or without other Networking service agents. It manages and configures different dynamic routing stack through Common Driver API.

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**Note:** Currently, only integration with os-ken is supported. Future releases will add the support for Quagga, Bird, etc.

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## 2.2 BGP Speaker

BGP Speaker acts as a route server using BGP routing protocol. It advertises routes to the BGP peers which are added to the BGP Speaker. Now there is a framework that allows different BGP drivers to be plugged into a dynamic routing agent.

Currently, BGP Speaker only advertises routes for a network to which it is associated. A BGP Speaker requires association with a gateway network to determine eligible routes. In Neutron, a gateway network connects Neutron routers to the upstream routers. An external network is best for being used as a gateway network. The association builds a list of all virtual routers with gateways on provider and self-service networks within the same address scope. Hence, the BGP speaker advertises self-service network prefixes with the corresponding router as the next-hop IP address. For details refer to Route advertisement.

### 2.2.1 Address Scopes

Address scopes provide flexible control as well as decoupling of address overlap from tenancy, so this kind control can provide a routable domain, the domain has itself route and no overlap address, it means an address scope define a L3 routing domain.

BGP Speaker will associate the external networks and advertise the tenants networks routes. Those networks should reside in the same address scope. Neutron can route the tenant network directly without NAT. Then Neutron can host globally routable IPv4 and IPv6 tenant networks. For determining which tenant networks prefixes should be advertised, Neutron will identify all routers with gateway ports on the network which had been bounded with BGP Speaker, check the address scope of the subnets on all connected networks, then begin advertising nexthops for all tenant networks to routers on the bound network.

### 2.2.2 BGP Peer

BGP peer defined in Neutron represents real BGP infrastructure such as routers, route reflectors and route servers. When a BGP peer is defined and associated with a BGP Speaker, Neutron will attempt to open a BGP peering session with the mentioned remote peer. It is this session, using which Neutron announces its routes.

#### How to configure a remote peer

A remote peer can be real or virtual e.g. vRouters or real routers. The remote peer should be configured to handle peering with Neutron in passive mode. The peer needs to waits for the Neutron dynamic routing agent to initiate the peering session. Also, the remote peer can be configured in active mode, but it still can speak BGP until the complete initialization of BGP Speaker running on Neutron dynamic routing agent.

Configuring BGP Speaker: One needs to ensure below points for setting a BGP connection.

- Host running Neutron dynamic agent MUST connect to the external router.
- BGP configuration on the router should be proper.

  **bgp router-id XX.XX.XX.XX** This must be an IP address, the unique identifier of BGP routers actually and can be virtual. If one doesnt configure the router-id, it will be selected automatically as the highest IP address configured for the local interfaces. Just a suggestion, please make sure that it is the same as the `peer_ip` which you configure in Neutron for distinguishing easily.

  **local_as** Autonomous System number can be same or different from the AS_id of external BGP router. AS_id will be same for iBGP and different for eBGP sessions.

Setting BGP peer:

```
neighbor A.B.C.D remote-as AS_ID
A.B.C.D is the host IP which run Neutron dynamic routing agent.
```

A Sample Quagga router configuration file forming BGP peering with Neutron:

```
!
password zebra
log file /var/log/quagga/bgpd.log
!
debug bgp events
debug bgp keepalives
debug bgp updates
debug bgp fsm
debug bgp filters
!
bgp multiple-instance
!
router bgp <BgpPeer remote_as> view test-as
 bgp router-id <quagga router IP address>
 neighbor <dr_agent IP address> remote-as <BgpSpeaker local_as>
 neighbor <dr_agent IP address> passive
!
line vty
!
```

### 2.2.3 BGP Speaker Architecture

Dynamic routing project saves BGP Speaker configuration as per the defined data model. and pass on the configuration request to the dynamic routing agent for further processing. The implementation of a BGP Speaker is driver specific. During the driver interface initialization process, needed configurations are read from the configuration file and BGP Speaker object instance is created. For details refer to BGP drivers.

#### BGP Speaker Life Cycle

Now we support OsKenBgpDriver, BGP Speaker will be processed by Dragent. When associating a BGP Speaker with an active Dragent, the plugin will send an RPC message to the agent for calling driver in order to create a BGP Speaker instance.

In OsKenBgpDriver, the created instance `BGP Speaker` will setup by router-id and ASN, then os-ken will setup new context with speaker configuration and listeners which monitor whether the related peers are alive.

Then the following operation could be done.

- Add peers to BGP Speaker When BGP Speaker is not associated with an active Dragent, there is no real speaker instance, so it will be still the db operation until the speaker is associated with dragent, and all the peers connection before will be setup by `BGP Speaker` creation. If add peers into speaker which is running, Dragent will call driver to add peer dynamically. For OsKenBgpDriver, it will register a new neighbor based on your peer configuration and try to establish a session with the peer.
- Delete peers from BGP Speaker The same logic with below, but it is reverse.

If you dont want use the specific BGP Speaker anymore, you can use CLI: `neutron bgp-speaker-delete <SPEAKER NAME/ID>`

BGP Plugin will find all the associated Dragent and send RPC `bgp_speaker_remove_end` to make the Dragents to clean the `BGP Speaker` instances. This is the same with CLI: `neutron bgp-dragent-speaker-remove <DRAGENT ID> <SPEAKER NAME/ID>` BGP Plugin just send rpc `bgp_speaker_remove_end` to the specific Dragent.

#### Advertisement

For details refer to Route Advertisement.

### 2.2.4 How to work

For details refer to Testing.

## 2.3 Route Advertisement

### 2.3.1 BGP

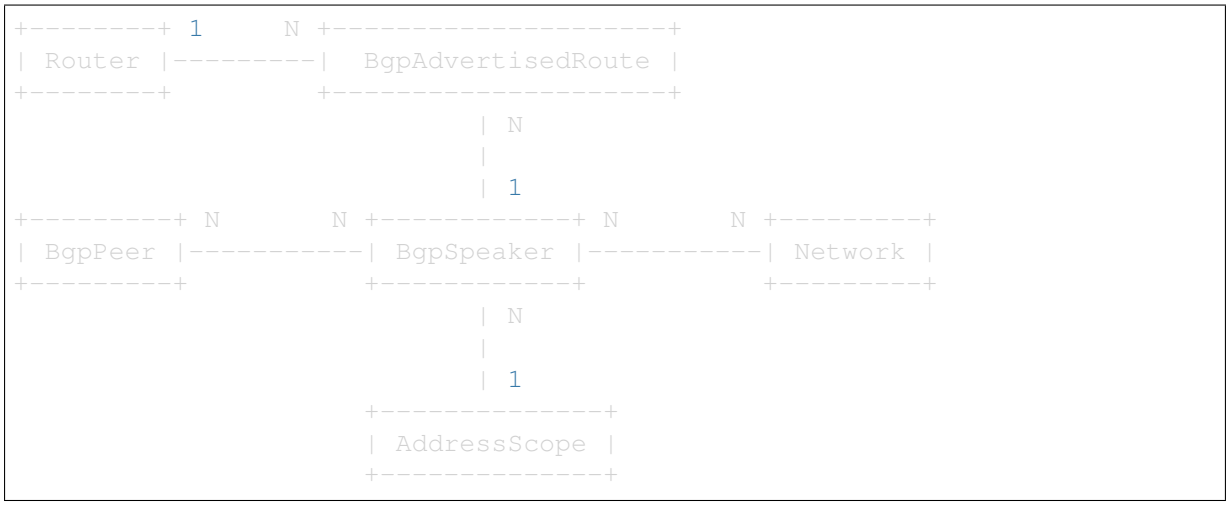
This page discusses the behavior of BGP dynamic routing about how to advertise routes and show the routes details in the project.

BGP dynamic routing could advertise 3 classes of routes:

- Host routes for floating IP addresses hosted on non-DVR routers, as floatingip address set on the router namespace, it knows how to route the message to the correct way, so the next-hop should be the IP address of router gateway port.
- Host routes for floating IP addresses hosted on DVR routers. With DVR-enabled routers, the floating IP can be reached directly on the compute node hosting a given instance. As such, host routes for the floating IP address should advertise the FIP agent gateway on the compute node as the next-hop instead of the centralized router. This will keep inbound floating IP traffic from encountering the bottleneck of the centralized router.
- Prefix routes for directly routable tenant networks with address scopes, the nexthop is the centralized router, the same for DVR and CVR. BGP dynamic routing could advertise tenant network prefixes to physical network devices(routers which support BGP protocol), called this `Prefixes advertisement`.

When distributed virtual routing (DVR) is enabled on a router, next-hops for floating IPs and fixed IPs are not advertised as being at the centralized router. Host routes with the next-hop set to the appropriate compute node are advertised.

#### Logical Model




**Note:** A BGP Speaker only supports one address family to speak BGP. A dual-stack IPv4 and IPv6 network needs two BGP Speakers to advertise the routes with BGP, one for IPv4 and the other for IPv6. So A network can have N number of BGP Speakers bound to it.

BgpAdvertisedRoute represents derived data. As the number of BgpAdvertisedRoutes can be quite large, storing in a database table is not feasible. BgpAdvertisedRoute information can be derived by

joining data already available in the Neutron database. And now BGP dynamic routing project process the Bgpadvertiseroutes which should be advertised to external Router is basing on the exist Neutron DB tables. Neutron looks on each of the gateway network for any routers with a gateway port on that network. For each router identified, Neutron locates each floating IP and tenant network accessible through the router gateway port. Neutron then advertises each floating IP and tenant network with the IP address of the router gateway port as the next hop.

When BGP Plugin is started, it will register callbacks. All callbacks are used for processing Floating IP, Router Interface and Router Gateway creation or update, this functions listen the events of these resources for calling Dragent to change the advertisement routes.

Now we just focus on the resources which may cause route change, the following callbacks does this work.

- floatingip_update_callback This function listens to the Floating IPs AFTER_UPDATE event, it judges whether the associated router is changed, and changes the advertisement routes and nexthop based on that.
- router_interface_callback This function listens to the tenants network routes change, it listens to AFTER_CREATE and AFTER_DELETE events of Router Interface resource. It calls Dragent to advertise or stop the prefix routes after a interface attach into a router.
- router_gateway_callback This function listens to the router gateway port creation or deletion. It also focuses on tenants network routes change.

You could get the advertisement routes of specific BGP Speaker like: `neutron bgp-speaker-advertiseroute-list <created-bgp-speaker>` It does a complicated db query to generate the list of advertised routes. For more details refer to route advertisement db lookup

## 2.4 Agent

Neutron-dynamic-routing implements a new agent named DRAgent. The agent talks to the neutron-dynamic-routing plugin which resides in the neutron server to get routing entity configuration. DRAgent interacts with the back-end driver to realize the required dynamic routing protocol functionality. For details, please refer to the system design document *System Design*

**Note:** One DRAgent can support multiple drivers but currently ONLY os-ken is integrated successfully.

### 2.4.1 Scheduler

Neutron-dynamic-routing scheduler, schedules a routing entity to a proper DRAgent.

### BGP Scheduler

BGP Speaker and DRAgent has 1:N association which means one BGP speaker can be scheduled on multiple DRAgents.

Here is an example to associate/disassociate a BGP Speaker to/from a DRAgent.

```
(neutron) bgp-speaker-list
+--------------------------------------+------+----------+------------+
| id                                   | name | local_as | ip_version |
+--------------------------------------+------+----------+------------+
| 0967eb04-59e5-4ca6-a0b0-d584d8d4a132 | bgp2 |      200 |          4 |
| a73432c3-a3fc-4b1e-9be2-6c32a61df579 | bgp1 |      100 |          4 |
+--------------------------------------+------+----------+------------+

(neutron) agent-list
+--------------------------------------+----------------------------+-------
↪--------------+-------------------+-------+----------------+-------------
↪--------------+
| id                                   | agent_type                 | host ␣
↪              | availability_zone | alive | admin_state_up | binary      ␣
↪              |
+--------------------------------------+----------------------------+-------
↪--------------+-------------------+-------+----------------+-------------
↪--------------+
| 0c21a829-4fd6-4375-8e65-36db4dc434ac | DHCP agent                 | steve-
↪devstack-test | nova              | :-)   | True           | neutron-
↪dhcp-agent        |
| 0f9d6886-910d-4af4-b248-673b22eb9e78 | Metadata agent             | steve-
↪devstack-test |                   | :-)   | True           | neutron-
↪metadata-agent    |
| 5908a304-b9d9-4e8c-a0af-96a066a7c87e | Open vSwitch agent         | steve-
↪devstack-test |                   | :-)   | True           | neutron-
↪openvswitch-agent |
| ae74e375-6a75-4ebe-b85c-6628d2baf02f | L3 agent                   | steve-
↪devstack-test | nova              | :-)   | True           | neutron-l3-
↪agent          |
| dbd9900e-9d16-444d-afc4-8d0035df5ed5 | BGP dynamic routing agent  | steve-
↪devstack-test |                   | :-)   | True           | neutron-bgp-
↪dragent        |
+--------------------------------------+----------------------------+-------
↪--------------+-------------------+-------+----------------+-------------
↪--------------+

(neutron) bgp-dragent-speaker-add dbd9900e-9d16-444d-afc4-8d0035df5ed5 bgp1
Associated BGP speaker bgp1 to the Dynamic Routing agent.

(neutron) bgp-speaker-list-on-dragent dbd9900e-9d16-444d-afc4-8d0035df5ed5
+--------------------------------------+------+----------+------------+
| id                                   | name | local_as | ip_version |
+--------------------------------------+------+----------+------------+
| a73432c3-a3fc-4b1e-9be2-6c32a61df579 | bgp1 |      100 |          4 |
+--------------------------------------+------+----------+------------+

(neutron) bgp-dragent-speaker-remove dbd9900e-9d16-444d-afc4-8d0035df5ed5␣
↪bgp1
Disassociated BGP speaker bgp1 from the Dynamic Routing agent.
```

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```
(neutron) bgp-speaker-list-on-dragent dbd9900e-9d16-444d-afc4-8d0035df5ed5

(neutron)
```

**Note:** Currently, auto-scheduling is not supported.

ReST APIs for neutron-dynamic-routing scheduler is defined in the API document *API*

CHAPTER

THREE

# CONFIGURATION GUIDE

## 3.1 Configuration

This section provides a list of all possible options for each configuration file.

neutron-dynamic-routing uses the following configuration files for its various services.

### 3.1.1 bgp_dragent.ini

#### bgp

**bgp_speaker_driver**

**Type** string

**Default** <None>

BGP speaker driver class to be instantiated.

**bgp_router_id**

**Type** string

**Default** <None>

32-bit BGP identifier, typically an IPv4 address owned by the system running the BGP DrAgent.

The following are sample configuration files for neutron-dynamic-routing. These are generated from code and reflect the current state of code in the neutron-dynamic-routing repository.

### 3.1.2 Sample bgp_dragent.ini

This sample configuration can also be viewed in the raw format.

```
[DEFAULT]


[bgp]

#
# From bgp.agent
#
```

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```
# BGP speaker driver class to be instantiated. (string value)
#bgp_speaker_driver = <None>

# 32-bit BGP identifier, typically an IPv4 address owned by the system␣
↪running
# the BGP DrAgent. (string value)
#bgp_router_id = <None>
```

## 3.2 Policy

neutron-dynamic-routing, like most OpenStack projects, uses a policy language to restrict permissions on REST API actions.

### 3.2.1 neutron-dynamic-routing policies

The following is an overview of all available policies in neutron-dynamic-routing. For a sample configuration file, refer to *Sample neutron-dynamic-routing Policy File*.

#### neutron-dynamic-routing

**create_bgp_speaker**

**Default** `rule:admin_only`

**Operations**

- **POST** `/bgp-speakers`

Create a BGP speaker

**update_bgp_speaker**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-speakers/{id}`

Update a BGP speaker

**delete_bgp_speaker**

**Default** `rule:admin_only`

**Operations**

- **DELETE** `/bgp-speakers/{id}`

Delete a BGP speaker

**get_bgp_speaker**

**Default** `rule:admin_only`

**Operations**

- **GET** `/bgp-speakers`

- **GET** `/bgp-speakers/{id}`

Get BGP speakers

**`add_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-speakers/{id}/add_bgp_peer`

Add a BGP peer to a BGP speaker

**`remove_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-speakers/{id}/remove_bgp_peer`

Remove a BGP peer from a BGP speaker

**`add_gateway_network`**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-speakers/{id}/add_gateway_network`

Add a gateway network to a BGP speaker

**`remove_gateway_network`**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-speakers/{id}/remove_gateway_network`

Remove a gateway network from a BGP speaker

**`get_advertised_routes`**

**Default** `rule:admin_only`

**Operations**

- **GET** `/bgp-speakers/{id}/get_advertised_routes`

Get advertised routes of a BGP speaker

**`create_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **POST** `/bgp-peers`

Create a BGP peer

**`update_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **PUT** `/bgp-peers/{id}`

Update a BGP peer

**`delete_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **DELETE** `/bgp-peers/{id}`

Delete a BGP peer

**`get_bgp_peer`**

**Default** `rule:admin_only`

**Operations**

- **GET** `/bgp-peers`
- **GET** `/bgp-peers/{id}`

Get BGP peers

**`add_bgp_speaker_to_dragent`**

**Default** `rule:admin_only`

**Operations**

- **POST** `/agents/{agent_id}/bgp-drinstances`

Add a BGP speaker to a dynamic routing agent

**`remove_bgp_speaker_from_dragent`**

**Default** `rule:admin_only`

**Operations**

- **DELETE** `/agents/{agent_id}/bgp-drinstances/{bgp_speaker_id}`

Remove a BGP speaker from a dynamic routing agent

**`list_bgp_speaker_on_dragent`**

**Default** `rule:admin_only`

**Operations**

- **GET** `/agents/{agent_id}/bgp-drinstances`

List BGP speakers hosted by a dynamic routing agent

**`list_dragent_hosting_bgp_speaker`**

**Default** `rule:admin_only`

**Operations**

- **GET** `/bgp-speakers/{bgp_speaker_id}/bgp-dragents`

List dynamic routing agents hosting a BGP speaker

### 3.2.2 Sample neutron-dynamic-routing Policy File

The following is a sample neutron-dynamic-routing policy file for adaptation and use.

The sample policy can also be viewed in `file form`.

**Important:** The sample policy file is auto-generated from neutron-dynamic-routing when this documentation is built. You must ensure your version of neutron-dynamic-routing matches the version of this documentation.

```
# Create a BGP speaker
# POST  /bgp-speakers
#"create_bgp_speaker": "rule:admin_only"

# Update a BGP speaker
# PUT  /bgp-speakers/{id}
#"update_bgp_speaker": "rule:admin_only"

# Delete a BGP speaker
# DELETE  /bgp-speakers/{id}
#"delete_bgp_speaker": "rule:admin_only"

# Get BGP speakers
# GET  /bgp-speakers
# GET  /bgp-speakers/{id}
#"get_bgp_speaker": "rule:admin_only"

# Add a BGP peer to a BGP speaker
# PUT  /bgp-speakers/{id}/add_bgp_peer
#"add_bgp_peer": "rule:admin_only"

# Remove a BGP peer from a BGP speaker
# PUT  /bgp-speakers/{id}/remove_bgp_peer
#"remove_bgp_peer": "rule:admin_only"

# Add a gateway network to a BGP speaker
# PUT  /bgp-speakers/{id}/add_gateway_network
#"add_gateway_network": "rule:admin_only"

# Remove a gateway network from a BGP speaker
# PUT  /bgp-speakers/{id}/remove_gateway_network
#"remove_gateway_network": "rule:admin_only"

# Get advertised routes of a BGP speaker
# GET  /bgp-speakers/{id}/get_advertised_routes
#"get_advertised_routes": "rule:admin_only"

# Create a BGP peer
# POST  /bgp-peers
#"create_bgp_peer": "rule:admin_only"

# Update a BGP peer
# PUT  /bgp-peers/{id}
#"update_bgp_peer": "rule:admin_only"
```

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```
# Delete a BGP peer
# DELETE  /bgp-peers/{id}
#"delete_bgp_peer": "rule:admin_only"

# Get BGP peers
# GET  /bgp-peers
# GET  /bgp-peers/{id}
#"get_bgp_peer": "rule:admin_only"

# Add a BGP speaker to a dynamic routing agent
# POST  /agents/{agent_id}/bgp-drinstances
#"add_bgp_speaker_to_dragent": "rule:admin_only"

# Remove a BGP speaker from a dynamic routing agent
# DELETE  /agents/{agent_id}/bgp-drinstances/{bgp_speaker_id}
#"remove_bgp_speaker_from_dragent": "rule:admin_only"

# List BGP speakers hosted by a dynamic routing agent
# GET  /agents/{agent_id}/bgp-drinstances
#"list_bgp_speaker_on_dragent": "rule:admin_only"

# List dynamic routing agents hosting a BGP speaker
# GET  /bgp-speakers/{bgp_speaker_id}/bgp-dragents
#"list_dragent_hosting_bgp_speaker": "rule:admin_only"
```

CHAPTER

FOUR

# API

## 4.1 Introduction

Neutron dynamic routing project adds the support for dynamic routing protocols in neutron. Using the ReST interface, a cloud administrator can define routing peers and advertise neutron routes outside the OpenStack domain.

**Note:** Currently, only the support for BGP dynamic routing protocol is available.

## 4.2 Data Model

New data models are defined for supporting routing protocols. Below models are defined for different protocols.

### 4.2.1 BGP

#### BGP Speaker

- `id` The uuid of BGP Speaker.
- `name` The name of BGP Speaker.
- `local_as` The local AS value, ranges from 1 to 65535.
- `ip_version` The ip address version for BGP Speaker. 4 by default.
- `peers` The remote peer connection which supports BGP.
- `networks` The tenant networks connected to the BGP Speaker.
- `advertise_floating_ip_host_routes` Whether to enable or disable the advertisement of floating ip host routes by the BGP Speaker. True by default.
- `advertise_tenant_networks` Whether to enable or disable the advertisement of tenant network routes by the BGP Speaker. True by default.

#### BGP Peer

- `id` The uuid of BGP peer.
- `name` The name of BGP peer.
- `peer_ip` The IP address of BGP peer.
- `remote_as` The remote AS value, ranges from 1 to 65535.
- `auth_type` The authentication algorithm. Supported algorithms: none and md5, none by default.
- `password` The authentication password for the specified authentication type.

## 4.3 ReST Interface

Different ReST interface are exposed for realizing different dynamic protocol functionality.

**Note:** Only an administrator have the access to the exposed APIs.

### 4.3.1 BGP

#### BGP Speaker

#### Create

Issue a `POST` request to `/v2.0/bgp-speakers` with following JSON-encoded data to create a BGP Speaker:

```
{
   "bgp_speaker":{
      "ip_version":4,
      "local_as":"1000",
      "name":"bgp-speaker"
   }
}

Response body:

{
   "bgp_speaker":{
      "peers":[
      ],
      "name":"bgp-speaker",
      "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
      "local_as":1000,
      "advertise_tenant_networks":true,
      "networks":[
      ],
      "ip_version":4,
      "advertise_floating_ip_host_routes":true,
```

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```
        "id":"5e08db80-db77-4b5c-a56d-dbca0b284f2c"
    }
}

Return code: 201
```

### List

Issue a `GET` request to `/v2.0/bgp-speakers` to retrieve this list of available BGP Speakers.

```
Response body:

{
   "bgp_speakers":[
      {
         "peers":[
         ],
         "name":"bgp-speaker-1",
         "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
         "local_as":1001,
         "advertise_tenant_networks":true,
         "networks":[
         ],
         "ip_version":4,
         "advertise_floating_ip_host_routes":true,
         "id":"5e08db80-db77-4b5c-a56d-dbca0b284f2c"
      },
      {
         "peers":[
         ],
         "name":"bgp-speaker",
         "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
         "local_as":1000,
         "advertise_tenant_networks":true,
         "networks":[
         ],
         "ip_version":4,
         "advertise_floating_ip_host_routes":true,
         "id":"b759b2a1-27f4-4a6b-bb61-f2c9a22c9902"
      }
   ]
}

Return code: 200
```

### Show

Issue a `GET` request to `/v2.0/bgp-speakers/<bgp-speaker-id>` to retrieve the detail about a specific BGP Speaker.

```
Response body:

{
   "bgp_speaker":{
      "peers":[
      ],
      "name":"bgp-speaker",
      "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
      "local_as":1000,
      "advertise_tenant_networks":true,
      "networks":[
      ],
      "ip_version":4,
      "advertise_floating_ip_host_routes":true,
      "id":"b759b2a1-27f4-4a6b-bb61-f2c9a22c9902"
   }
}

Return code: 200
```

### Update

Issue `PUT` request to `/v2.0/bgp-speakers/<bgp-speaker-id>` to update a specific BGP Speaker. Following attributes can be updated.

- `name` The name of BGP Speaker.
- `advertise_floating_ip_host_routes` Whether to enable or disable the advertisement of floating ip host routes by the BGP Speaker. True by default.
- `advertise_tenant_networks` Whether to enable or disable the advertisement of tenant network routes by the BGP Speaker. True by default.

### Delete

Issue `DELETE` request to `/v2.0/bgp-speakers/<bgp-speaker-id>` to delete a specific BGP Speaker.

```
No response body

Return code: 204
```

### BGP Peer

#### Create

Issue a `POST` request to `/v2.0/bgp-peers` with following JSON-encoded data to create a BGP peer:

```
{
   "bgp_peer":{
      "auth_type":"none",
      "remote_as":"1001",
      "name":"bgp-peer",
      "peer_ip":"10.0.0.3"
   }
}

Response body:

{
   "bgp_peer":{
      "auth_type":"none",
      "remote_as":"1001",
      "name":"bgp-peer",
      "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
      "peer_ip":"10.0.0.3",
      "id":"a7193581-a31c-4ea5-8218-b3052758461f"
   }
}

Return code: 201
```

#### List

Issue a `GET` request to `/v2.0/bgp-peers` to retrieve the list of available BGP peers.

```
Response body:

{
   "bgp_peers":[
      {
         "auth_type":"none",
         "remote_as":1001,
         "name":"bgp-peer",
         "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
         "peer_ip":"10.0.0.3",
         "id":"a7193581-a31c-4ea5-8218-b3052758461f"
      }
   ]
}

Return code: 200
```

### Show

Issue a `GET` request to `/v2.0/bgp-peers/<bgp-peer-id>` to retrieve the detail about a specific BGP peer.

```
Response body:

{
   "bgp_peer":{
      "auth_type":"none",
      "remote_as":1001,
      "name":"bgp-peer",
      "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
      "peer_ip":"10.0.0.3",
      "id":"a7193581-a31c-4ea5-8218-b3052758461f"
   }
}

Return code: 200
```

### Update

Issue `PUT` request to `/v2.0/bgp-peers/<bgp-peer-id>` to update a specific BGP peer. Following attributes can be updated.

- `name` The name of BGP peer.
- `password` The authentication password.

### Delete

Issue `DELETE` request to `/v2.0/bgp-peers/<bgp-peer-id>` to delete a specific BGP peer.

```
No response body

Return code: 204
```

### BGP Speaker and Peer binding

### Add BGP Peer to a BGP Speaker

Issue a `PUT` request to `/v2.0/bgp-speakers/<bgp-speaker-id>/add-bgp-peer` to bind the BGP peer to the specified BGP Seaker with following JSON-encoded data:

```
{
   "bgp_peer_id":"a7193581-a31c-4ea5-8218-b3052758461f"
}

Response body: ::

{
```

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```
    "bgp_peer_id":"a7193581-a31c-4ea5-8218-b3052758461f"
}

Return code: 200
```

### Remove BGP Peer from a BGP Speaker

Issue a `DELETE` request with following data to `/v2.0/bgp-speakers/<bgp-speaker-id>/remove-bgp-peer` to unbind the BGP peer:

```
{
    "bgp_peer_id":"a7193581-a31c-4ea5-8218-b3052758461f"
}

No response body

Return code: 200
```

### BGP Speaker and Network binding

### Add Network to a BGP Speaker

Issue a `PUT` request with following data to `/v2.0/bgp-speakers/<bgp-speaker-id>/add_gateway_network` to add a network to the specified BGP speaker:

```
{
    "network_id":"f2269b61-6755-4174-8f64-5e318617b204"
}

Response body:

{
    "network_id":"f2269b61-6755-4174-8f64-5e318617b204"
}

Return code: 200
```

### Delete Network from a BGP Speaker

Issue a `DELETE` request with following data to `/v2.0/bgp-speakers/<bgp-speaker-id>/remove_gateway_network` to delete a network from a specified BGP speaker.

```
No response body

Return code: 200
```

### BGP Speaker Advertised Routes

#### List routes advertised by a BGP Speaker

Issue `GET` request to `/v2.0/bgp-speakers/<bgp-speaker-id>/get_advertised_routes` to list all routes advertised by the specified BGP Speaker.

```
Response body:

{
   "advertised_routes":[
      {
         "cidr":"192.168.10.0/24",
         "nexthop":"10.0.0.1"
      }
   ]
}

Return code: 200
```

### BGP Speaker and Dynamic Routing Agent interaction

#### Add BGP Speaker to a Dynamic Routing Agent

Issue a `POST` request to `/v2.0/agents/<bgp-agent-id>/bgp-drinstances` to add a BGP Speaker to the specified dynamic routing agent. The following is the request body:

```
{
  "bgp_speaker_id": "5639072c-49eb-480a-9f11-953386589bc8"
}

No response body

Return code: 201
```

#### List BGP speakers hosted by a Dynamic Routing Agent

Issue a `GET` request to `/v2.0/agents/<bgp-dragent-id>/bgp-drinstances` to list all BGP Seakers hosted on the specified dynamic routing agent.

```
Response body:

{
   "bgp_speakers":[
      {
         "peers":[
         ],
         "name":"bgp-speaker",
         "tenant_id":"34a6e17a48cf414ebc890367bf42266b",
         "local_as":1000,
         "advertise_tenant_networks":true,
         "networks":[
```

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```
            ],
            "ip_version":4,
            "advertise_floating_ip_host_routes":true,
            "id":"b759b2a1-27f4-4a6b-bb61-f2c9a22c9902"
        }
    ]
}

Return code: 200
```

### List Dynamic Routing Agents hosting a specific BGP Speaker

Issue a `GET` request to `/v2.0/bgp-speakers/<bgp-speaker-id>/bgp-dragents` to list all BGP dynamic agents which are hosting the specified BGP Speaker.

```
Response body:

{
    "agents":[
        {
            "binary":"neutron-bgp-dragent",
            "description":null,
            "admin_state_up":true,
            "heartbeat_timestamp":"2016-05-17 03:05:12",
            "availability_zone":null,
            "alive":true,
            "topic":"bgp_dragent",
            "host":"yangyubj-virtual-machine",
            "agent_type":"BGP dynamic routing agent",
            "resource_versions":{
            },
            "created_at":"2016-05-09 07:38:00",
            "started_at":"2016-05-11 09:06:13",
            "id":"af216618-29d3-4ee7-acab-725bdc90e614",
            "configurations":{
                "advertise_routes":0,
                "bgp_peers":0,
                "bgp_speakers":1
            }
        }
    ]
}

Return code: 200
```

### Delete BGP Speaker from a Dynamic Routing Agent

Issue a `DELETE` request to `/v2.0/agents/<bgp-agent-id>/bgp-drinstances/<bgp-speaker-id>` to delete the BGP Speaker hosted by the specified dynamic routing agent.

```
No response body

Return code: 204
```

## 4.4 Reference

None

CHAPTER

FIVE

# COMMAND-LINE INTERFACE

Neutron client has provided the command-line interfaces (CLI) to realize dynamic routing services supported by neutron-dynamic-routing project.

Current implementation only supports the command line interfaces for BGP functionality. For query on what specific **neutron bgp** commands are supported, enter:

```
$ neutron help | grep bgp
```

## 5.1 BGP Peer

### 5.1.1 BGP Peer Create

```
usage: neutron bgp-peer-create [-h]
                               [-f {html,json,json,shell,table,value,yaml,
↪yaml}]
                               [-c COLUMN] [--max-width <integer>]
                               [--noindent] [--prefix PREFIX]
                               [--request-format {json}]
                               [--tenant-id TENANT_ID] --peer-ip
                               PEER_IP_ADDRESS --remote-as PEER_REMOTE_AS
                               [--auth-type PEER_AUTH_TYPE]
                               [--password AUTH_PASSWORD]
                               NAME
```

Create a BGP Peer.

**Positional arguments:**

**NAME** Name of the BGP peer to create

**--peer-ip PEER_IP_ADDRESS** Peer IP address.

**--remote-as PEER_REMOTE_AS** Peer AS number. (Integer in [1, 65535] is allowed.)

**Optional arguments:**

**-h, --help** show this help message and exit

**--auth-type PEER_AUTH_TYPE** Authentication algorithm. Supported algorithms: none(default), md5

**--password AUTH_PASSWORD** Authentication password.

### 5.1.2 BGP Peer List

```
usage: neutron bgp-peer-list [-h]
                             [-f {csv,html,json,json,table,value,yaml,yaml}
↪]
                             [-c COLUMN] [--max-width <integer>] [--
↪noindent]
                             [--quote {all,minimal,none,nonnumeric}]
                             [--request-format {json}] [-D] [-F FIELD]
                             [-P SIZE] [--sort-key FIELD]
                             [--sort-dir {asc,desc}]
```

List BGP peers.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

### 5.1.3 BGP Peer Show

```
usage: neutron bgp-peer-show [-h]
                             [-f {html,json,json,shell,table,value,yaml,
↪yaml}]
                             [-c COLUMN] [--max-width <integer>] [--
↪noindent]
                             [--prefix PREFIX] [--request-format {json}] [-
↪D]
                             [-F FIELD]
                             BGP_PEER
```

Show information of a given BGP peer.

**Positional arguments:**

**BGP_PEER** ID or name of the BGP peer to look up.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

### 5.1.4 BGP Peer Delete

```
usage: neutron bgp-peer-delete [-h] [--request-format {json}] BGP_PEER
```

Delete a BGP peer.

**Positional arguments:**

**BGP_PEER** ID or name of the BGP peer to delete.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.1.5 BGP Peer Update

```
usage: neutron bgp-peer-update [-h] [--request-format {json}] [--name NAME]
                               [--password AUTH_PASSWORD]
                               BGP_PEER
```

Update BGP Peers information.

**Positional arguments:**

**BGP_PEER** ID or name of the BGP peer to update.

**Optional arguments:**

**-h, --help** show this help message and exit

**--name NAME** Updated name of the BGP peer.

**--password AUTH_PASSWORD** Updated authentication password.

### 5.1.6 Add Peer to BGP Speaker

```
usage: neutron bgp-speaker-peer-add [-h] [--request-format {json}]
                                    BGP_SPEAKER BGP_PEER
```

Add a peer to the BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**BGP_PEER** ID or name of the BGP peer to add.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.1.7 Delete Peer from BGP Speaker

```
usage: neutron bgp-speaker-peer-remove [-h] [--request-format {json}]
                                       BGP_SPEAKER BGP_PEER
```

Remove a peer from the BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**BGP_PEER** ID or name of the BGP peer to remove.

**Optional arguments:**

**-h, --help** show this help message and exit

## 5.2 BGP Speaker

### 5.2.1 BGP Speaker Create

```
usage: neutron bgp-speaker-create [-h]
                                  [-f {html,json,json,shell,table,value,
↪yaml,yaml}]
                                  [-c COLUMN] [--max-width <integer>]
                                  [--noindent] [--prefix PREFIX]
                                  [--request-format {json}]
                                  [--tenant-id TENANT_ID] --local-as LOCAL_
↪AS
                                  [--ip-version {4,6}]
                                  [--advertise-floating-ip-host-routes
↪{True,False}]
                                  [--advertise-tenant-networks {True,False}
↪]
                                  NAME
```

Create a BGP Speaker with a specified NAME.

**Positional arguments:**

**NAME** Name of the BGP speaker to create.

**Optional arguments:**

**-h, --help** show this help message and exit

**--local-as LOCAL_AS** Local AS number. (Integer in [1, 65535] is allowed.)

**--ip-version {4,6}** IP version for the BGP speaker (default is 4)

**--advertise-floating-ip-host-routes {True,False}** Whether to enable or disable the advertisement of floating-ip host routes by the BGP speaker. By default floating ip host routes will be advertised by the BGP speaker.

**--advertise-tenant-networks {True,False}** Whether to enable or disable the advertisement of tenant network routes by the BGP speaker. By default tenant network routes will be advertised by the BGP speaker.

### 5.2.2 BGP Speaker List

```
usage: neutron bgp-speaker-list [-h]
                                [-f {csv,html,json,json,table,value,yaml,
↪yaml}]
                                [-c COLUMN] [--max-width <integer>]
                                [--noindent]
                                [--quote {all,minimal,none,nonnumeric}]
                                [--request-format {json}] [-D] [-F FIELD]
                                [-P SIZE] [--sort-key FIELD]
                                [--sort-dir {asc,desc}]
```

List BGP speakers.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

### 5.2.3 BGP Speaker Show

```
usage: neutron bgp-speaker-show [-h]
                                [-f {html,json,json,shell,table,value,yaml,
↪yaml}]
                                [-c COLUMN] [--max-width <integer>]
                                [--noindent] [--prefix PREFIX]
                                [--request-format {json}] [-D] [-F FIELD]
                                BGP_SPEAKER
```

Show information of a given BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker to look up.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

### 5.2.4 BGP Speaker Delete

```
usage: neutron bgp-speaker-delete [-h] [--request-format {json}] BGP_
↪SPEAKER
```

Delete a BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker to delete.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.2.5 BGP Speaker Update

```
usage: neutron bgp-speaker-update [-h] [--request-format {json}] [--name␣
↪NAME]
                                  [--advertise-floating-ip-host-routes
↪{True,False}]
                                  [--advertise-tenant-networks {True,False}
↪]
                                  BGP_SPEAKER
```

Update BGP Speakers information.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker to update.

**Optional arguments:**

**-h, --help** show this help message and exit

**--name NAME** Name of the BGP speaker to update.

**--advertise-floating-ip-host-routes {True,False}** Whether to enable or disable the advertisement of floating-ip host routes by the BGP speaker. By default floating ip host routes will be advertised by the BGP speaker.

**--advertise-tenant-networks {True,False}** Whether to enable or disable the advertisement of tenant network routes by the BGP speaker. By default tenant network routes will be advertised by the BGP speaker.

### 5.2.6 Add Network to BGP Speaker

```
usage: neutron bgp-speaker-network-add [-h] [--request-format {json}]
                                       BGP_SPEAKER NETWORK
```

Add a network to the BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**NETWORK** ID or name of the network to add.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.2.7 Delete Network from BGP Speaker

```
usage: neutron bgp-speaker-network-remove [-h] [--request-format {json}]
                                          BGP_SPEAKER NETWORK
```

Remove a network from the BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**NETWORK** ID or name of the network to remove.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.2.8 BGP Advertised Routes List

```
usage: neutron bgp-speaker-advertiseroute-list [-h]
                                               [-f {csv,html,json,json,
↪table,value,yaml,yaml}]
                                               [-c COLUMN]
                                               [--max-width <integer>]
                                               [--noindent]
                                               [--quote {all,minimal,none,
↪nonnumeric}]
                                               [--request-format {json}] [-
↪D]
                                               [-F FIELD] [-P SIZE]
                                               [--sort-key FIELD]
                                               [--sort-dir {asc,desc}]
                                               BGP_SPEAKER
```

List routes advertised by a given BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

## 5.3 Dynamic Routing Agent

### 5.3.1 Add BGP Speaker to Dynamic Routing Agent

```
usage: neutron bgp-dragent-speaker-add [-h] [--request-format {json}]
                                       BGP_DRAGENT_ID BGP_SPEAKER
```

Add a BGP speaker to a Dynamic Routing agent.

**Positional arguments:**

**BGP_DRAGENT_ID** ID of the Dynamic Routing agent.

**BGP_SPEAKER** ID or name of the BGP speaker.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.3.2 Delete BGP Speaker from Dynamic Routing Agent

```
usage: neutron bgp-dragent-speaker-remove [-h] [--request-format {json}]
                                          BGP_DRAGENT_ID BGP_SPEAKER
```

Removes a BGP speaker from a Dynamic Routing agent.

**Positional arguments:**

**BGP_DRAGENT_ID** ID of the Dynamic Routing agent.

**BGP_SPEAKER** ID or name of the BGP speaker.

**Optional arguments:**

**-h, --help** show this help message and exit

### 5.3.3 List BGP Speakers hosted by a Dynamic Routing Agent

```
usage: neutron bgp-speaker-list-on-dragent [-h]
                                           [-f {csv,html,json,json,table,
↪value,yaml,yaml}]
                                           [-c COLUMN] [--max-width
↪<integer>]
                                           [--noindent]
                                           [--quote {all,minimal,none,
↪nonnumeric}]
                                           [--request-format {json}] [-D]
                                           [-F FIELD]
                                           BGP_DRAGENT_ID
```

List BGP speakers hosted by a Dynamic Routing agent.

**Positional arguments:**

**BGP_DRAGENT_ID** ID of the Dynamic Routing agent.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

### 5.3.4 List Dynamic Routing Agents Hosting a BGP Speaker

```
usage: neutron bgp-dragent-list-hosting-speaker [-h]
                                                [-f {csv,html,json,json,
↪table,value,yaml,yaml}]
                                                [-c COLUMN]
                                                [--max-width <integer>]
                                                [--noindent]
                                                [--quote {all,minimal,none,
↪nonnumeric}]
                                                [--request-format {json}]␣
↪[-D]
                                                [-F FIELD]
                                                BGP_SPEAKER
```

List Dynamic Routing agents hosting a BGP speaker.

**Positional arguments:**

**BGP_SPEAKER** ID or name of the BGP speaker.

**Optional arguments:**

**-h, --help** show this help message and exit

**-D, --show-details** Show detailed information.

**-F FIELD, --field FIELD** Specify the field(s) to be returned by server. You can repeat this option.

CHAPTER

SIX

# DEVELOPER GUIDE

In the Developer Guide, you will find information on neutron-dynamic-routing lower level programming APIs. There are sections that cover the core pieces of neutron-dynamic-routing, including its API, command-lines, database, system-design, alembic-migration etc. There are also subsections that describe specific drivers inside neutron-dynamic-routing. Finally, the developer guide includes information about testing and supported functionalities as well. This documentation is generated by the Sphinx toolkit and lives in the source tree.

## 6.1 Contributing

Please see the Neutron CONTRIBUTING.rst file for how to contribute to neutron-dynamic-routing:

Neutron CONTRIBUTING.rst

## 6.2 Testing

Dynamic routing enables advertisement of self-service network prefixes to physical network devices that support a dynamic routing protocol, such as routers. The Neutron dynamic routing project consists of a service plugin-in and an agent that can advertise Neutron private network to outside of OpenStack. This document will describe how to test the Dynamic Routing functionalities, introduce what the environment architecture is for dynamic routing test and show how to setup dynamic routing environment using Devstack.

### 6.2.1 Environment Architecture

Use the following example architecture as a test environment to deploy neutron-dynamic-routing in your environment. The example architecture will deploy an all-in-one OpenStack and connect to an Ubuntu VM running Quagga as a router outside of OpenStack. See following:

```
                                                +---------------+
                                  10.156.18.20  |               |
                +-----------------------------------|    Quagga     |
                | BGP Peering Session               |    Router     |
                |                                   |  172.24.4.3   |
                |                                   +---------------+
                |                                           |
                |10.156.18.21                               |
↪External Network(172.24.4.0/24)
```

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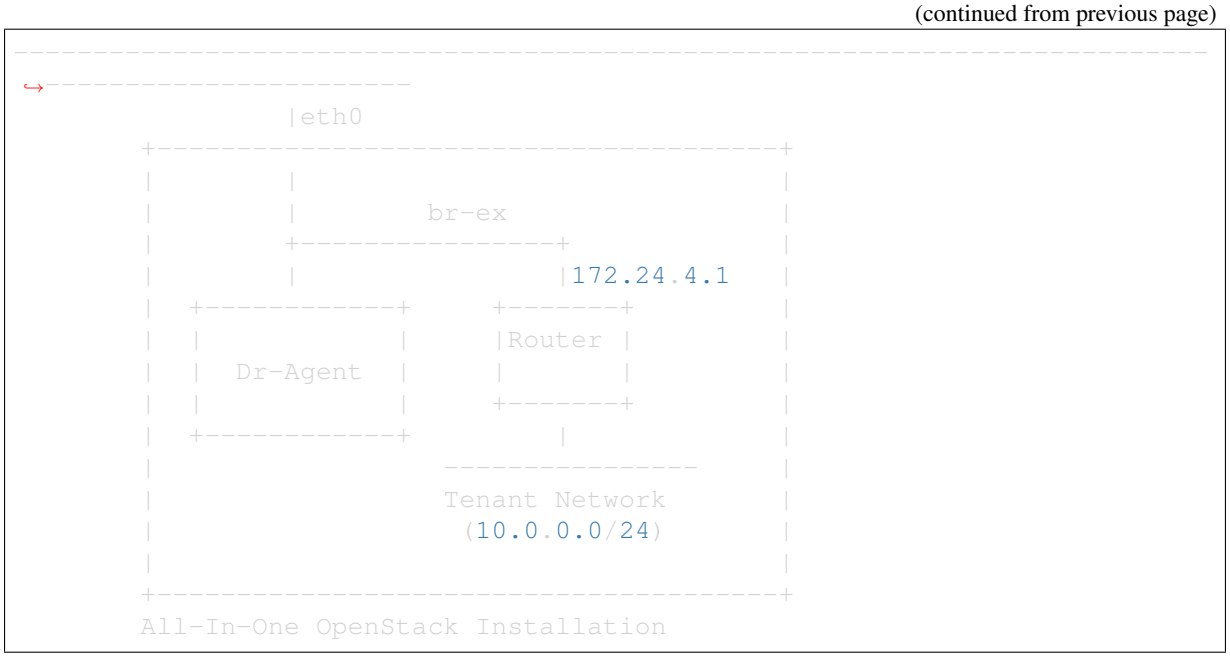


### 6.2.2 Devstack Setup

1. Download devstack:

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

2. Enable neutron-dynamic-routing by including this in your local.conf file:

```
[[local|localrc]]
enable_plugin neutron-dynamic-routing https://opendev.org/openstack/
↪neutron-dynamic-routing
```

3. Run devstack:

```
./stack.sh
```

### 6.2.3 Quagga Configure

Quagga is a network routing software available in most GNU/Linux, Solaris, FreeBSD, and NetBSD. It provides the implementation of OSPF, RIP, BGP and IS-IS. This section shows you how to install Quagga and then configure it on Ubuntu Linux.

1. Install Quagga using apt-get:

```
$ sudo apt-get install quagga quagga-doc
```

2. Create an empty file (/etc/quagga/zebra.conf) and set permissions.

   The Quagga files and configurations will be stored in /etc/quagga:

```
$ sudo touch /etc/quagga/zebra.conf
$ sudo chown quagga.quagga /etc/quagga/zebra.conf
$ sudo chmod 640 /etc/quagga/zebra.conf
```

3. Update quagga daemon file.

   You can enable/disable the daemons routing in the /etc/quagga/daemons file. Update /etc/quagga/daemons to enable zebra and bgp:

```
zebra=yes
bgpd=yes
ospfd=no
ospf6d=no
ripd=no
ripngd=no
isisd=no
```

4. Update /etc/quagga/zebra.conf:

```
# Zebra configuration
# name of the router
hostname quagga_1
password zebra

# log
log file /var/log/quagga/zebra.log
```

5. Update /etc/quagga/bgpd.conf:

```
# declare a router with local-as 1000
router bgp 1000

# set router-id to the network address we announce
bgp router-id 10.156.18.20

# expose neighbor network which dynamic routing agent is using
neighbor 10.156.18.21 remote-as 12345

# treat neutron dynamic routing agent as a passive peer in case
# quagga keeps making futile connection attempts
neighbor 10.156.18.21 passive

# log
log file /var/log/quagga/bgpd.log

debug bgp events
debug bgp filters
debug bgp fsm
debug bgp keepalives
debug bgp updates
```

6. Restart the Quagga daemon:

```
$ sudo systemcl restart bgpd
```

### 6.2.4 Service Test

1. As the dynamic routing is only supported by admin, source the devstack admin credentials:

```
$ . devstack/openrc admin admin
```

2. Verify that the neutron dynamic routing agent is running.

```
$ openstack network agent list --agent-type bgp
+--------------------+--------------------+-------------------
↪-+-------------------+-------+-------+---------------------+
| ID                 | Agent Type         | Host
↪ | Availability Zone | Alive | State | Binary              |
+--------------------+--------------------+-------------------
↪-+-------------------+-------+-------+---------------------+
| 69ad386f-e055-4284 | BGP dynamic        | devstack-bgp-dr
↪ |                   | :-)   | UP    | neutron-bgp-dragent |
| -8c8e-ef9bd540705c | routing agent      |
↪ |                   |       |       |                     |
+--------------------+--------------------+-------------------
↪-+-------------------+-------+-------+---------------------+
```

3. Create an address scope.

   The provider(external) and tenant networks must belong to the same address scope for the agent to advertise those tenant network prefixes.

```
$ openstack address scope create --ip-version 4 --share public
+------------+--------------------------------------+
| Field      | Value                                |
+------------+--------------------------------------+
| id         | c02c358a-9d35-43ea-8313-986b3e4a91c0 |
| ip_version | 4                                    |
| name       | public                               |
| project_id | b3ac05ef10bf441fbf4aa17f16ae1e6d     |
| shared     | True                                 |
+------------+--------------------------------------+
```

4. Create subnet pools. The provider and tenant networks use different pools.

   - Create the provider network pool.

```
$ openstack subnet pool create --pool-prefix 172.24.4.0/24 \
  --address-scope public provider
+-------------------+--------------------------------------+
| Field             | Value                                |
+-------------------+--------------------------------------+
| address_scope_id  | 18f74828-5f38-4d84-b030-ed642f2157c5 |
| created_at        | 2020-08-28T15:12:11Z                 |
| default_prefixlen | 8                                    |
| default_quota     | None                                 |
| description       |                                      |
| id                | d812a10e-5981-4686-90c4-d6fff454b38a |
| ip_version        | 4                                    |
| is_default        | False                                |
| max_prefixlen     | 32                                   |
| min_prefixlen     | 8                                    |
```

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```
| name                | provider                                 |
| prefixes            | 172.24.4.0/24                            |
| project_id          | 17c884da94bc4259b20ace3da6897297         |
| revision_number     | 0                                        |
| shared              | False                                    |
| tags                |                                          |
| updated_at          | 2020-08-28T15:12:11Z                     |
+---------------------+------------------------------------------+
```

- Create tenant network pool.

```
$ openstack subnet pool create --pool-prefix 10.0.0.0/16 \
  --address-scope public --share selfservice
+-------------------+--------------------------------------+
| Field             | Value                                |
+-------------------+--------------------------------------+
| address_scope_id  | 18f74828-5f38-4d84-b030-ed642f2157c5 |
| created_at        | 2020-08-28T15:15:31Z                 |
| default_prefixlen | 8                                    |
| default_quota     | None                                 |
| description       |                                      |
| id                | 8b9d1c9b-6aba-416f-8d10-1e7a0f6052f6 |
| ip_version        | 4                                    |
| is_default        | False                                |
| max_prefixlen     | 32                                   |
| min_prefixlen     | 8                                    |
| name              | selfservice                          |
| prefixes          | 10.0.0.0/16                          |
| project_id        | 17c884da94bc4259b20ace3da6897297     |
| revision_number   | 0                                    |
| shared            | True                                 |
| tags              |                                      |
| updated_at        | 2020-08-28T15:15:31Z                 |
+-------------------+--------------------------------------+
```

5. Create the provider and tenant networks.

   - Create the provider network.

```
$ openstack network create --external --provider-network-type␣
↪flat \
  --provider-physical-network public provider
+---------------------------+-------------------------------------
↪-----+
| Field                     | Value                              ␣
↪     |
+---------------------------+-------------------------------------
↪-----+
| admin_state_up            | UP                                 ␣
↪     |
| availability_zone_hints   |                                    ␣
↪     |
| availability_zones        |                                    ␣
↪     |
| created_at                | 2020-08-28T15:24:07Z               ␣
↪     |
```

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```
| description               |                                                                  ␣
↪      |
| dns_domain                |                                                                  ␣
↪      |
| id                        | 18f9a9c0-f8f5-4360-822a-
↪b687c1008bf7 |
| ipv4_address_scope        | None                                                             ␣
↪      |
| ipv6_address_scope        | None                                                             ␣
↪      |
| is_default                | False                                                            ␣
↪      |
| is_vlan_transparent       | None                                                             ␣
↪      |
| mtu                       | 1500                                                             ␣
↪      |
| name                      | provider                                                         ␣
↪      |
| port_security_enabled     | True                                                             ␣
↪      |
| project_id                |␣
↪17c884da94bc4259b20ace3da6897297     |
| provider:network_type     | flat                                                             ␣
↪      |
| provider:physical_network | public                                                           ␣
↪      |
| provider:segmentation_id  | None                                                             ␣
↪      |
| qos_policy_id             | None                                                             ␣
↪      |
| revision_number           | 1                                                                ␣
↪      |
| router:external           | External                                                         ␣
↪      |
| segments                  | None                                                             ␣
↪      |
| shared                    | False                                                            ␣
↪      |
| status                    | ACTIVE                                                           ␣
↪      |
| subnets                   |                                                                  ␣
↪      |
| tags                      |                                                                  ␣
↪      |
| updated_at                | 2020-08-28T15:24:07Z                                             ␣
↪      |
+---------------------------+------------------------------------
↪-----+
```

- Create a subnet on the provider network using an IP address allocation from the provider subnet pool.

```
$ openstack subnet create --network provider --subnet-pool␣
↪provider \
  --prefix-length 24 provider
+----------------------+-----------------------------------------
↪+
```

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```
| Field                 | Value                                                                ␣
↪|
+-----------------------+-------------------------------------
↪+
| allocation_pools      | 172.24.4.2-172.24.4.254                                              ␣
↪|
| cidr                  | 172.24.4.0/24                                                        ␣
↪|
| created_at            | 2020-08-28T15:27:00Z                                                 ␣
↪|
| description           |                                                                      ␣
↪|
| dns_nameservers       |                                                                      ␣
↪|
| dns_publish_fixed_ip  | False                                                                ␣
↪|
| enable_dhcp           | True                                                                 ␣
↪|
| gateway_ip            | 172.24.4.1                                                           ␣
↪|
| host_routes           |                                                                      ␣
↪|
| id                    | 4ed8ac88-2c19-4f94-9362-7b301e743438                                 ␣
↪|
| ip_version            | 4                                                                    ␣
↪|
| ipv6_address_mode     | None                                                                 ␣
↪|
| ipv6_ra_mode          | None                                                                 ␣
↪|
| name                  | provider                                                             ␣
↪|
| network_id            | 18f9a9c0-f8f5-4360-822a-b687c1008bf7                                 ␣
↪|
| prefix_length         | 24                                                                   ␣
↪|
| project_id            | 17c884da94bc4259b20ace3da6897297                                     ␣
↪|
| revision_number       | 0                                                                    ␣
↪|
| segment_id            | None                                                                 ␣
↪|
| service_types         |                                                                      ␣
↪|
| subnetpool_id         | a8fecc3d-a489-46ca-87fb-dff4e3371503                                 ␣
↪|
| tags                  |                                                                      ␣
↪|
| updated_at            | 2020-08-28T15:27:00Z                                                 ␣
↪|
+-----------------------+-------------------------------------
↪+
```

- Create the tenant network.

```
$ openstack network create private
+---------------------------+--------------------------------------
↪-----+
| Field                     | Value                                ␣
↪     |
+---------------------------+--------------------------------------
↪-----+
| admin_state_up            | UP                                   ␣
↪     |
| availability_zone_hints   |                                      ␣
↪     |
| availability_zones        |                                      ␣
↪     |
| created_at                | 2020-08-28T15:28:06Z                 ␣
↪     |
| description               |                                      ␣
↪     |
| dns_domain                |                                      ␣
↪     |
| id                        | 43643543-6edb-4c2b-a087-
↪4553b75b6799 |
| ipv4_address_scope        | None                                 ␣
↪     |
| ipv6_address_scope        | None                                 ␣
↪     |
| is_default                | False                                ␣
↪     |
| is_vlan_transparent       | None                                 ␣
↪     |
| mtu                       | 1442                                 ␣
↪     |
| name                      | private                              ␣
↪     |
| port_security_enabled     | True                                 ␣
↪     |
| project_id                |␣
↪17c884da94bc4259b20ace3da6897297     |
| provider:network_type     | geneve                               ␣
↪     |
| provider:physical_network | None                                 ␣
↪     |
| provider:segmentation_id  | 1                                    ␣
↪     |
| qos_policy_id             | None                                 ␣
↪     |
| revision_number           | 1                                    ␣
↪     |
| router:external           | Internal                             ␣
↪     |
| segments                  | None                                 ␣
↪     |
| shared                    | False                                ␣
↪     |
| status                    | ACTIVE                               ␣
↪     |
| subnets                   |                                      ␣
↪     |
```

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```
| tags                      |                                                  ␣
↪      |
| updated_at                | 2020-08-28T15:28:06Z                             ␣
↪      |
+---------------------------+--------------------------------------
↪-----+
```

- Create a subnet on the tenant network using an IP address allocation from the private subnet pool.

```
$ openstack subnet create --network private --subnet-pool␣
↪selfservice \
  --prefix-length 24 selfservice
+----------------------+--------------------------------------
↪+
| Field                | Value                                            ␣
↪|
+----------------------+--------------------------------------
↪+
| allocation_pools     | 10.0.0.2-10.0.0.254                              ␣
↪|
| cidr                 | 10.0.0.0/24                                      ␣
↪|
| created_at           | 2020-08-28T15:29:20Z                             ␣
↪|
| description          |                                                  ␣
↪|
| dns_nameservers      |                                                  ␣
↪|
| dns_publish_fixed_ip | False                                            ␣
↪|
| enable_dhcp          | True                                             ␣
↪|
| gateway_ip           | 10.0.0.1                                         ␣
↪|
| host_routes          |                                                  ␣
↪|
| id                   | 12eec8cb-8303-4829-8b16-e9a75072fcb0             ␣
↪|
| ip_version           | 4                                                ␣
↪|
| ipv6_address_mode    | None                                             ␣
↪|
| ipv6_ra_mode         | None                                             ␣
↪|
| name                 | selfservice                                      ␣
↪|
| network_id           | 43643543-6edb-4c2b-a087-4553b75b6799             ␣
↪|
| prefix_length        | 24                                               ␣
↪|
| project_id           | 17c884da94bc4259b20ace3da6897297                 ␣
↪|
| revision_number      | 0                                                ␣
↪|
| segment_id           | None                                             ␣
↪|
```

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```
| service_types         |                                                                 ␣
↪|
| subnetpool_id         | 574f9d33-65b6-49a1-ab43-866085d06804␣
↪|
| tags                  |                                                                 ␣
↪|
| updated_at            | 2020-08-28T15:29:20Z                                            ␣
↪|
+-----------------------+-----------------------------------------
↪+
```

6. Create and configure router

   - Create a router.

```
$ openstack router create router
+-------------------------+-------------------------------------
↪---+
| Field                   | Value                                                           ␣
↪   |
+-------------------------+-------------------------------------
↪---+
| admin_state_up          | UP                                                              ␣
↪   |
| availability_zone_hints |                                                                 ␣
↪   |
| availability_zones      |                                                                 ␣
↪   |
| created_at              | 2020-08-28T15:30:09Z                                            ␣
↪   |
| description             |                                                                 ␣
↪   |
| external_gateway_info   | null                                                            ␣
↪   |
| flavor_id               | None                                                            ␣
↪   |
| id                      | 250e5cc1-4cfc-4dff-a3a3-
↪eb206c071621 |
| name                    | router                                                          ␣
↪   |
| project_id              | 17c884da94bc4259b20ace3da6897297                                ␣
↪   |
| revision_number         | 1                                                               ␣
↪   |
| routes                  |                                                                 ␣
↪   |
| status                  | ACTIVE                                                          ␣
↪   |
| tags                    |                                                                 ␣
↪   |
| updated_at              | 2020-08-28T15:30:09Z                                            ␣
↪   |
+-------------------------+-------------------------------------
↪---+
```

   - Add the private subnet as an interface on the router.

```
$ openstack router add subnet router selfservice
```

- Add the provide network as a gateway on the router

```
$ openstack router set --external-gateway provider router
```

- Verify router ports. Note: from this result, you can see what the advertised routes are.

```
$ openstack port list --router router
+--------------------------------------+------+---------------
↪----+-----------------------------------------------------------
↪---------------------+--------+
| ID                                   | Name | MAC Address
↪    | Fixed IP Addresses                                       
↪                     | Status |
+--------------------------------------+------+---------------
↪----+-----------------------------------------------------------
↪---------------------+--------+
| 218c455f-f565-4e37-a2ac-999da24efa66 |      |
↪fa:16:3e:74:d8:61 | ip_address='10.0.0.1', subnet_id=
↪'12eec8cb-8303-4829-8b16-e9a75072fcb0'    | ACTIVE |
| 44dcb7d3-b444-4177-82a1-233b1f3bed23 |      |
↪fa:16:3e:5b:4b:2d | ip_address='172.24.4.24', subnet_id=
↪'4ed8ac88-2c19-4f94-9362-7b301e743438' | ACTIVE |
+--------------------------------------+------+---------------
↪----+-----------------------------------------------------------
↪---------------------+--------+
```

7. Create and configure the BGP speaker

   The BGP speaker advertised the next-hop IP address for the tenant network prefix.

   - Create the BGP speaker.

   Replace LOCAL_AS with an appropriate local autonomous system number. The example configuration uses AS 12345.

```
$ openstack bgp speaker create  --ip-version 4 \
  --local-as LOCAL_AS bgp-speaker
+-------------------------------+-------------------------
↪-------------+
| Field                         | Value                   
↪             |
+-------------------------------+-------------------------
↪-------------+
| advertise_floating_ip_host_routes | True                
↪             |
| advertise_tenant_networks     | True                    
↪             |
| id                            | 19cdf669-4d4d-442f-bbf6-
↪510a97ad8cd8 |
| ip_version                    | 4                       
↪             |
| local_as                      | 12345                   
↪             |
| name                          | bgp-speaker             
↪             |
```

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```
| networks                            | []                                  |
| peers                               | []                                  |
| project_id                          | 17c884da94bc4259b20ace3da6897297    |
+-------------------------------------+-------------------------------------+
```

- Associate the BGP speaker with the provider network.

A BGP speaker requires association with a provider network to determine eligible prefixes. After the association, the BGP speaker can advertise the tenant network prefixes with the corresponding router as the next-hop IP address.

```
$ openstack bgp speaker add network bgp-speaker provider
```

- Verify the association of the provider network with the BGP speaker.

Checking the `networks` attribute.

```
$ openstack bgp speaker show bgp-speaker
+-------------------------------------+-------------------------------------+
| Field                               | Value                               |
+-------------------------------------+-------------------------------------+
| advertise_floating_ip_host_routes   | True                                |
| advertise_tenant_networks           | True                                |
| id                                  | 19cdf669-4d4d-442f-bbf6-510a97ad8cd8 |
| ip_version                          | 4                                   |
| local_as                            | 12345                               |
| name                                | bgp-speaker                         |
| networks                            | ['18f9a9c0-f8f5-4360-822a-b687c1008bf7'] |
| peers                               | []                                  |
| project_id                          | 17c884da94bc4259b20ace3da6897297    |
+-------------------------------------+-------------------------------------+
```

- Verify the prefixes and next-hop ip addresses that the BGP speaker advertises.

```
$ openstack bgp speaker list advertised routes bgp-speaker
+-------------+-------------+
| destination | next_hop    |
+-------------+-------------+
```

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```
| 10.0.0.0/24 | 172.24.4.3 |
+-------------+------------+
```

- Create a BGP peer.

Here the BGP peer is pointed to the quagga VM. Replace REMOTE_AS with an appropriate remote autonomous system number. The example configuration uses AS 12345 which triggers iBGP peering.

```
$ openstack bgp peer create --peer-ip 10.156.18.20 \
  --remote-as REMOTE_AS bgp-peer
+------------+--------------------------------------+
| Field      | Value                                |
+------------+--------------------------------------+
| auth_type  | none                                 |
| id         | 37291604-de77-4333-8f27-4ca336e021f2 |
| name       | bgp-peer                             |
| peer_ip    | 10.156.18.20                         |
| project_id | 17c884da94bc4259b20ace3da6897297     |
| remote_as  | 12345                                |
+------------+--------------------------------------+
```

- Add a BGP peer to the BGP speaker.

```
$ openstack bgp speaker add peer bgp-speaker bgp-peer
```

- Verify the association of the BGP peer with the BGP speaker.

Checking the `peers` attribute.

```
$ openstack bgp speaker show bgp-speaker
+-----------------------------------+--------------------------
↪-----------------+
| Field                             | Value                    
↪                 |
+-----------------------------------+--------------------------
↪-----------------+
| advertise_floating_ip_host_routes | True                     
↪                 |
| advertise_tenant_networks         | True                     
↪                 |
| id                                | 19cdf669-4d4d-442f-bbf6-
↪510a97ad8cd8     |
| ip_version                        | 4                        
↪                 |
| local_as                          | 12345                    
↪                 |
| name                              | bgp-speaker              
↪                 |
| networks                          | ['18f9a9c0-f8f5-4360-
↪822a-b687c1008bf7'] |
| peers                             | ['37291604-de77-4333-
↪8f27-4ca336e021f2'] |
| project_id                        |
↪17c884da94bc4259b20ace3da6897297       |
+-----------------------------------+--------------------------
↪-----------------+
```

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8. Schedule the BGP speaker to an agent.

   - Schedule the BGP speaker to `BGP dynamic routing agent`

   The first BGP speaker is scheduled to the first dynamic routing agent automatically. So for a simple setup, there is nothing to be done here.

   - Verify scheduling of the BGP speaker to the agent.

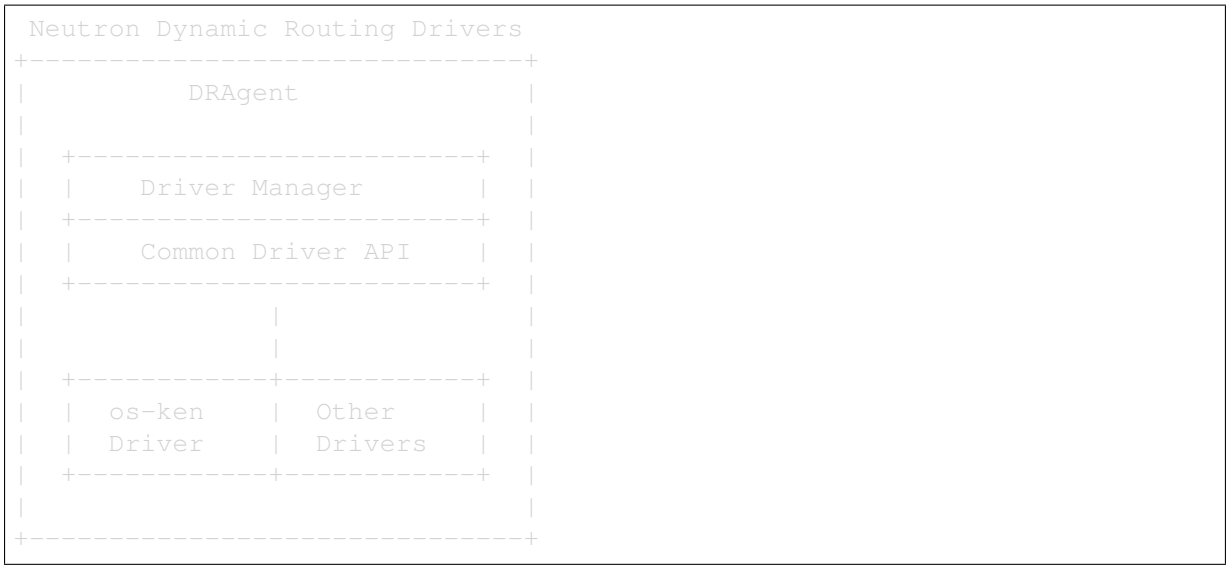
```
$ openstack bgp dragent list --bgp-speaker bgp-speaker
+--------------------------------------+---------------------
↪-----+----------------+-------+
| id                                   | host                ␣
↪     | admin_state_up | alive |
+--------------------------------------+---------------------
↪-----+----------------+-------+
| 239996c8-2d59-4131-98b8-d64372c812cc | devstack-bgp-dr     ␣
↪     | True           | :-)   |
+--------------------------------------+---------------------
↪-----+----------------+-------+
```

## 6.3 DRAgent Drivers

### 6.3.1 Introduction

The Neutron dynamic routing drivers are used to support different dynamic routing protocol stacks which implement the dynamic routing functionality.

As shown in the following figure, the drivers are managed by DRAgent through a Driver Manager which provides consistent APIs to realize the functionality of a dynamic routing protocol:




**Note:** In the first release, only the integration with os-ken is supported. Later release will have support for Quagga, Bird etc. Besides, BGP is the only protocol supported now but support for more dynamic

routing protocols might come in the future.

### 6.3.2 Configuration

Driver configurations are done in a separate configuration file.

#### BGP Driver

There are two configuration parameters related to BGP which are specified in `bgp_dragent.ini`.

- bgp_speaker_driver, to define BGP speaker driver class. Default is os-ken (neutron_dynamic_routing.services.bgp.agent.driver.os_ken.driver.OsKenBgpDriver).
- bgp_router_id, to define BGP identity (typically an IPv4 address). Default is a unique loopback interface IP address.

### 6.3.3 Common Driver API

Common Driver API is needed to provide a generic and consistent interface to different drivers. Each driver need to implement the provided base driver class.

#### BGP

Following interfaces need to be implemented by a driver for realizing BGP functionality.

| API name | Description |
|---|---|
| add_bgp_speaker() | Add a BGP Speaker |
| delete_bgp_speaker() | Delete a BGP speaker |
| add_bgp_peer() | Add a BGP peer |
| delete_bgp_peer() | Delete a BGP peer |
| advertise_route() | Add a new prefix to advertise |
| withdraw_route() | Withdraw an advertised prefix |
| get_bgp_speaker_statistics() | Collect BGP Speaker statistics |
| get_bgp_peer_statistics() | Collect BGP Peer statistics |