Red Hat OpenStack Platform 16.1

External Load Balancing for the Overcloud

Configuring a Red Hat OpenStack Platform environment to use an external load balancer

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Abstract

Configure a Red Hat OpenStack Platform (RHOSP) environment to use an external load balancer for the overcloud. This includes configuration guidelines for your load balancer and configuration of the overcloud with Red Hat OpenStack Platform director.

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Red Hat is committed to replacing problematic language in our code, documentation, and web properties. We are beginning with these four terms: master, slave, blacklist, and whitelist. Because of the enormity of this endeavor, these changes will be implemented gradually over several upcoming releases. For more details, see our CTO Chris Wright's message.

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CHAPTER 1. CONFIGURING THE OVERCLOUD TO USE AN EXTERNAL LOAD BALANCER

In Red Hat OpenStack Platform (RHOSP), the overcloud uses multiple Controller nodes together as a high availability cluster to ensure maximum operational performance for your OpenStack services. The cluster also provides load balancing for OpenStack services, which evenly distributes traffic to the Controller nodes and reduces server overload for each node.

By default, the overcloud uses an open source tool called HAProxy to manage load balancing. HAProxy load balances traffic to the Controller nodes that run OpenStack services. The **haproxy** package contains the **haproxy** daemon that listens to incoming traffic, and includes logging features and sample configurations.

The overcloud also uses the high availability resource manager Pacemaker to control HAProxy as a highly available service. This means that HAProxy runs on each Controller node and distributes traffic according to a set of rules that you define in each configuration.

You can also use an external load balancer to perform this distribution. For example, your organization might use a dedicated hardware-based load balancer to handle traffic distribution to the Controller nodes. To define the configuration for an external load balancer and the overcloud creation, you perform the following processes:

1. Install and configure an external load balancer.
2. Configure and deploy the overcloud with heat template parameters to integrate the overcloud with the external load balancer. This requires the IP addresses of the load balancer and of the potential nodes.

Before you configure your overcloud to use an external load balancer, ensure that you deploy and run high availability on the overcloud.

1.1. PREPARING YOUR ENVIRONMENT FOR AN EXTERNAL LOAD BALANCER

To prepare your environment for an external load balancer, first create a node definition template and register blank nodes with director. Then, inspect the hardware of all nodes and manually tag nodes into profiles.

Use the following workflow to prepare your environment:

- Create a node definition template and register blank nodes with Red Hat OpenStack Platform director. A node definition template **instackenv.json** is a JSON format file and contains the hardware and power management details to register nodes.
- Inspect the hardware of all nodes. This ensures that all nodes are in a manageable state.
- Manually tag nodes into profiles. These profile tags match the nodes to flavors. The flavors are then assigned to a deployment role.

Procedure

1. Log in to the director host as the **stack** user and source the director credentials:

```
$ source ~/stackrc
```

2. Create a node definition template **instackenv.json** and copy and edit the following example based on your environment:

```
{
    "nodes":[
        {
            "mac":[
                "bb:bb:bb:bb:bb:bb"
            ],
            "cpu":"4",
            "memory":"6144",
            "disk":"40",
            "arch":"x86_64",
            "pm_type":"pxe_ipmitool",
            "pm_user":"admin",
            "pm_password":"p@55w0rd!",
            "pm_addr":"192.0.2.205"
        },
        {
            "mac":[
                "cc:cc:cc:cc:cc:cc"
            ],
            "cpu":"4",
            "memory":"6144",
            "disk":"40",
            "arch":"x86_64",
            "pm_type":"pxe_ipmitool",
            "pm_user":"admin",
            "pm_password":"p@55w0rd!",
            "pm_addr":"192.0.2.206"
        },
        {
            "mac":[
                "dd:dd:dd:dd:dd:dd"
            ],
            "cpu":"4",
            "memory":"6144",
            "disk":"40",
            "arch":"x86_64",
            "pm_type":"pxe_ipmitool",
            "pm_user":"admin",
            "pm_password":"p@55w0rd!",
            "pm_addr":"192.0.2.207"
        },
        {
            "mac":[
                "ee:ee:ee:ee:ee:ee"
            ],
            "cpu":"4",
            "memory":"6144",
            "disk":"40",
            "arch":"x86_64",
            "pm_type":"pxe_ipmitool",
            "pm_user":"admin",
            "pm_password":"p@55w0rd!",
            "pm_addr":"192.0.2.208"
```

```
        }
    ]
}
```

3. Save the file to the home directory of the **stack** user, **/home/stack/instackenv.json**, then import it into director and register the nodes to the director:

```
$ openstack overcloud node import ~/instackenv.json
```

4. Assign the kernel and ramdisk images to all nodes:

```
$ openstack overcloud node configure
```

5. Inspect the hardware attributes of each node:

```
$ openstack overcloud node introspect --all-manageable
```

IMPORTANT

The nodes must be in the manageable state. Ensure that this process runs to completion. This process usually takes 15 minutes for bare metal nodes.

6. Get the list of your nodes to identify their UUIDs:

```
$ openstack baremetal node list
```

7. Manually tag each node to a specific profile by adding a profile option in the **properties/capabilities** parameter for each node. For example, to tag three nodes to use a Controller profile and one node to use a Compute profile, use the following commands:

```
$ openstack baremetal node set 1a4e30da-b6dc-499d-ba87-0bd8a3819bc0 --property
capabilities='profile:control,boot_option:local'
$ openstack baremetal node set 6faba1a9-e2d8-4b7c-95a2-c7fbdc12129a --property
capabilities='profile:control,boot_option:local'
$ openstack baremetal node set 5e3b2f50-fcd9-4404-b0a2-59d79924b38e --property
capabilities='profile:control,boot_option:local'
$ openstack baremetal node set 58c3d07e-24f2-48a7-bbb6-6843f0e8ee13 --property
capabilities='profile:compute,boot_option:local'
```

The **profile:compute** and **profile:control** options tag the nodes into each respective profile.

Additional resources

- Planning your overcloud

1.2. CONFIGURING THE OVERCLOUD NETWORK FOR AN EXTERNAL LOAD BALANCER

To configure the network for the overcloud, isolate your services to use specific network traffic and then configure the network environment file for your local environment. This file is a heat environment file that describes the overcloud network environment, points to the network interface configuration templates, and defines the subnets and VLANs for your network and the IP address ranges.

Procedure

1. To configure the node interfaces for each role, customize the following network interface templates:
   - To configure a single NIC with VLANs for each role, use the example templates in the following directory:

     ```
     /usr/share/openstack-tripleo-heat-templates/network/config/single-nic-vlans
     ```

   - To configure bonded NICs for each role, use the example templates in the following directory:

     ```
     /usr/share/openstack-tripleo-heat-templates/network/config/bond-with-vlans
     ```

2. Create a network environment file by copying the file from **/home/stack/network-environment.yaml** and editing the content based on your environment.

Additional resources

- Basic network isolation
- Custom composable networks
- Custom network interface templates
- Overcloud networks

1.3. CREATING AN EXTERNAL LOAD BALANCER ENVIRONMENT FILE

To deploy an overcloud with an external load balancer, create a new environment file with the required configuration. In this example file, several virtual IPs are configured on the external load balancer, one virtual IP on each isolated network, and one for the Redis service, before the overcloud deployment starts. Some of the virtual IPs can be identical if the overcloud node NICs configuration supports the configuration.

Procedure

- Use the following example environment file **external-lb.yaml** to create the environment file, and edit the content based on your environment.

```
parameter_defaults:
  ControlFixedIPs: [{'ip_address':'192.0.2.250'}]
  PublicVirtualFixedIPs: [{'ip_address':'172.16.23.250'}]
  InternalApiVirtualFixedIPs: [{'ip_address':'172.16.20.250'}]
  StorageVirtualFixedIPs: [{'ip_address':'172.16.21.250'}]
  StorageMgmtVirtualFixedIPs: [{'ip_address':'172.16.19.250'}]
  RedisVirtualFixedIPs: [{'ip_address':'172.16.20.249'}]
  # IPs assignments for the Overcloud Controller nodes. Ensure these IPs are from each
respective allocation pools defined in the network environment file.
  ControllerIPs:
    external:
    - 172.16.23.150
    - 172.16.23.151
    - 172.16.23.152
```

```
  internal_api:
  - 172.16.20.150
  - 172.16.20.151
  - 172.16.20.152
  storage:
  - 172.16.21.150
  - 172.16.21.151
  - 172.16.21.152
  storage_mgmt:
  - 172.16.19.150
  - 172.16.19.151
  - 172.16.19.152
  tenant:
  - 172.16.22.150
  - 172.16.22.151
  - 172.16.22.152
  # CIDRs
  external_cidr: "24"
  internal_api_cidr: "24"
  storage_cidr: "24"
  storage_mgmt_cidr: "24"
  tenant_cidr: "24"
RedisPassword: p@55w0rd!
ServiceNetMap:
  NeutronTenantNetwork: tenant
  CeilometerApiNetwork: internal_api
  AodhApiNetwork: internal_api
  GnocchiApiNetwork: internal_api
  MongoDbNetwork: internal_api
  CinderApiNetwork: internal_api
  CinderIscsiNetwork: storage
  GlanceApiNetwork: storage
  GlanceRegistryNetwork: internal_api
  KeystoneAdminApiNetwork: internal_api
  KeystonePublicApiNetwork: internal_api
  NeutronApiNetwork: internal_api
  HeatApiNetwork: internal_api
  NovaApiNetwork: internal_api
  NovaMetadataNetwork: internal_api
  NovaVncProxyNetwork: internal_api
  SwiftMgmtNetwork: storage_mgmt
  SwiftProxyNetwork: storage
  HorizonNetwork: internal_api
  MemcachedNetwork: internal_api
  RabbitMqNetwork: internal_api
  RedisNetwork: internal_api
  MysqlNetwork: internal_api
  CephClusterNetwork: storage_mgmt
  CephPublicNetwork: storage
  ControllerHostnameResolveNetwork: internal_api
  ComputeHostnameResolveNetwork: internal_api
  BlockStorageHostnameResolveNetwork: internal_api
  ObjectStorageHostnameResolveNetwork: internal_api
  CephStorageHostnameResolveNetwork: storage
```

NOTE

- The **parameter_defaults** section contains the VIP and IP assignments for each network. These settings must match the same IP configuration for each service on the load balancer.
- The **parameter_defaults** section defines an administrative password for the Redis service (RedisPassword) and contains the **ServiceNetMap** parameter, which maps each OpenStack service to a specific network. The load balancing configuration requires this services remap.

1.4. CONFIGURING SSL FOR EXTERNAL LOAD BALANCING

To configure encrypted endpoints for the external load balancer, create additional environment files that enable SSL to access endpoints and then install a copy of your SSL certificate and key on your external load balancing server. By default, the overcloud uses unencrypted endpoints services.

Prerequisites

- If you are using an IP address or domain name to access the public endpoints, choose one of the following environment files to include in your overcloud deployment:
  - To access the public endpoints with a domain name service (DNS), use the file **/usr/share/openstack-tripleo-heat-templates/environments/tls-endpoints-public-dns.yaml**.
  - To access the public endpoints with an IP address, use the file **/usr/share/openstack-tripleo-heat-templates/environments/tls-endpoints-public-ip.yaml**.

Procedure

1. If you use a self-signed certificate or if the certificate signer is not in the default trust store on the overcloud image, inject the certificate into the overcloud image by copying the **inject-trust-anchor.yaml** environment file from the heat template collection:

```
$ cp -r /usr/share/openstack-tripleo-heat-templates/environments/inject-trust-anchor.yaml
~/templates/
```

2. Open the file in a text editor and copy the contents of the root certificate authority file to the **SSLRootCertificate** parameter:

```
parameter_defaults:
  SSLRootCertificate: |
  -----BEGIN CERTIFICATE-----
  MIIDgzCCAmugAwIBAgIJAKk46qw6ncJaMA0GCSqGSIb3DQEBCwUAMFgxCzAJBgNV
  ...
  sFW3S2roS4X0Af/kSSD8mlBBTFTCMBAj6rtLBKLaQbIxEpIzrgvp
  -----END CERTIFICATE-----
```

IMPORTANT

The certificate authority content requires the same indentation level for all new lines.

3. Change the resource URL for the **OS::TripleO::NodeTLSCAData:** parameter to an absolute URL:

```
resource_registry:
  OS::TripleO::NodeTLSCAData: /usr/share/openstack-tripleo-heat-
templates/puppet/extraconfig/tls/ca-inject.yaml
```

4. Optional: If you use a DNS hostname to access the overcloud through SSL/TLS, create a new environment file **~/templates/cloudname.yaml** and define the hostname of the overcloud endpoints in the following parameters:

```
parameter_defaults:
  CloudName: overcloud.example.com
  DnsServers: 10.0.0.1
```

Replace the following values with actual values in your environment:

- **CloudName**: Replace **overcloud.example.com** with the DNS hostname for the overcloud endpoints.
- **DnsServers**: List of the DNS servers that you want to use. The configured DNS servers must contain an entry for the configured **CloudName** that matches the IP for the Public API.

1.5. DEPLOYING THE OVERCLOUD WITH AN EXTERNAL LOAD BALANCER

To deploy an overcloud that uses an external load balancer, run the **openstack overcloud deploy** and include the additional environment files and configuration files for the external load balancer.

Prerequisites

- Environment is prepared for an external load balancer. For more information about how to prepare your environment, see Section 1.1, “Preparing your environment for an external load balancer”
- Overcloud network is configured for an external load balancer. For information about how to configure your network, see Section 1.2, “Configuring the overcloud network for an external load balancer”
- External load balancer environment file is prepared. For information about how to create the environment file, see Section 1.3, “Creating an external load balancer environment file”
- SSL is configured for external load balancing. For information about how to configure SSL for external load balancing, see Section 1.4, “Configuring SSL for external load balancing”

Procedure

1. Deploy the overcloud with all the environment and configuration files for an external load balancer:

```
$ openstack overcloud deploy --templates /
  -e /usr/share/openstack-tripleo-heat-templates/environments/network-isolation.yaml /
  -e ~/network-environment.yaml /
```

```
  -e /usr/share/openstack-tripleo-heat-templates/environments/external-loadbalancer-vip.yaml
/
  -e ~/external-lb.yaml --control-scale 3 --compute-scale 1 --control-flavor control --compute-
flavor compute /
  -e <SSL/TLS endpoint environment file> /
  -e <DNS hostname environment file> /
  -e <root certificate injection environment file> /
  -e <additional_options_if_needed>
```

Replace the values in angle brackets **<>** with the file paths you defined for your environment.

IMPORTANT

You must add the network environment files to the command in the order listed in this example.

This command includes the following environment files:

- **network-isolation.yaml**: Network isolation configuration file.
- **network-environment.yaml**: Network configuration file.
- **external-loadbalancer-vip.yaml**: External load balancing virtual IP addresses configuration file.
- **external-lb.yaml**: External load balancer configuration file. You can also set the following options for this file and adjust the values for your environment:
  - **--control-scale 3**: Scale the Controller nodes to three.
  - **--compute-scale 3**: Scale the Compute nodes to three.
  - **--control-flavor control**: Use a specific flavor for the Controller nodes.
  - **--compute-flavor compute**: Use a specific flavor for the Compute nodes.
- SSL/TLS environment files:
  - **SSL/TLS endpoint environment file**: Environment file that defines how to connect to public endpoinst. Use **tls-endpoints-public-dns.yaml** or **tls-endpoints-public-ip.yaml**.
  - (Optional) **DNS hostname environment file**: The environment file to set the DNS hostname.
  - **Root certificate injection environment file**: The environment file to inject the root certificate authority.

During the overcloud deployment process, Red Hat OpenStack Platform director provisions your nodes. This process takes some time to complete.

2. To view the status of the overcloud deployment, enter the following commands:

```
$ source ~/stackrc
$ openstack stack list --nested
```

1.6. ADDITIONAL RESOURCES

- Load balancing traffic with HAProxy.

CHAPTER 2. EXAMPLE CONFIGURATION: OVERCLOUD WITH AN EXTERNAL HAPROXY LOAD BALANCER

This example configuration shows an overcloud that uses a federated HAProxy server to provide external load balancing. You can choose a different external load balancer based on your environment requirements.

The example configuration includes the following elements:

- An external load balancing server that runs HAProxy.
- One Red Hat OpenStack Platform (RHOSP) director node.
- An overcloud that consists of 3 Controller nodes in a highly available cluster and 1 Compute node.
- Network isolation with VLANs.

The example uses the following IP address assignments for each network:

- Internal API: **172.16.20.0/24**
- Tenant: **172.16.22.0/24**
- Storage: **172.16.21.0/24**
- Storage management: **172.16.19.0/24**
- External: **172.16.23.0/24**

These IP ranges include IP assignments for the Controller nodes and virtual IPs that the load balancer binds to OpenStack services.

2.1. EXAMPLE HAPROXY CONFIGURATION FILE

The example file shows the internal HAProxy configuration parameters. You can use the sample configuration parameters as a basis for configuring your external load balancer.

The HAProxy configuration file contains the following sections:

- Global configuration
- Defaults configuration
- Services configurations

Director provides this configuration in the **/etc/haproxy/haproxy.conf** file on each Controller node for non-containerized environments, and in the **/var/lib/config-data/puppet-generated/haproxy/etc/haproxy/haproxy.cfg** file for containerized environments.

NOTE

In addition to the global, default, and services parameters, you must also configure other HAProxy parameters. For more information about HAProxy parameters, see the *HAProxy Configuration Manual* located in **/usr/share/doc/haproxy-*/configuration.txt** on the Controller nodes or on any system where the **haproxy** package is installed.

Example HAProxy configuration file

```
global
  daemon
  group  haproxy
  log  /dev/log local0
  maxconn  10000
  pidfile  /var/run/haproxy.pid
  user  haproxy

defaults
  log  global
  mode  tcp
  retries  3
  timeout  http-request 10s
  timeout  queue 1m
  timeout  connect 10s
  timeout  client 1m
  timeout  server 1m
  timeout  check 10s

listen aodh
  bind 172.16.20.250:8042
  bind 172.16.20.250:8042
  mode http
  server overcloud-controller-0 172.16.20.150:8042 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8042 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.252:8042 check fall 5 inter 2000 rise 2

listen ceilometer
  bind 172.16.20.250:8777
  bind 172.16.23.250:8777
  server overcloud-controller-0 172.16.20.150:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8777 check fall 5 inter 2000 rise 2

listen cinder
  bind 172.16.20.250:8776
  bind 172.16.23.250:8776
  server overcloud-controller-0 172.16.20.150:8776 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8776 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8776 check fall 5 inter 2000 rise 2

listen glance_api
  bind 172.16.23.250:9292
  bind 172.16.21.250:9292
  server overcloud-controller-0 172.16.21.150:9292 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.21.151:9292 check fall 5 inter 2000 rise 2
```

```
  server overcloud-controller-2 172.16.21.152:9292 check fall 5 inter 2000 rise 2

listen glance_registry
  bind 172.16.20.250:9191
  server overcloud-controller-0 172.16.20.150:9191 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:9191 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:9191 check fall 5 inter 2000 rise 2

listen gnocchi
  bind 172.16.23.250:8041
  bind 172.16.21.250:8041
  mode http
  server overcloud-controller-0 172.16.20.150:8041 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8041 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8041 check fall 5 inter 2000 rise 2

listen heat_api
  bind 172.16.20.250:8004
  bind 172.16.23.250:8004
  mode http
  server overcloud-controller-0 172.16.20.150:8004 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8004 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8004 check fall 5 inter 2000 rise 2

listen heat_cfn
  bind 172.16.20.250:8000
  bind 172.16.23.250:8000
  server overcloud-controller-0 172.16.20.150:8000 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.152:8000 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.151:8000 check fall 5 inter 2000 rise 2

listen heat_cloudwatch
  bind 172.16.20.250:8003
  bind 172.16.23.250:8003
  server overcloud-controller-0 172.16.20.150:8003 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8003 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8003 check fall 5 inter 2000 rise 2

listen horizon
  bind 172.16.20.250:80
  bind 172.16.23.250:80
  mode http
  cookie SERVERID insert indirect nocache
  server overcloud-controller-0 172.16.20.150:80 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:80 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:80 check fall 5 inter 2000 rise 2

listen keystone_admin
  bind 172.16.23.250:35357
  bind 172.16.20.250:35357
  server overcloud-controller-0 172.16.20.150:35357 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:35357 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:35357 check fall 5 inter 2000 rise 2

listen keystone_admin_ssh
  bind 172.16.20.250:22
```

```
  server overcloud-controller-0 172.16.20.150:22 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:22 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:22 check fall 5 inter 2000 rise 2

listen keystone_public
  bind 172.16.20.250:5000
  bind 172.16.23.250:5000
  server overcloud-controller-0 172.16.20.150:5000 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:5000 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:5000 check fall 5 inter 2000 rise 2

listen mysql
  bind 172.16.20.250:3306
  option tcpka
  option httpchk
  stick on dst
  stick-table type ip size 1000
  timeout client 0
  timeout server 0
  server overcloud-controller-0 172.16.20.150:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2
  server overcloud-controller-1 172.16.20.151:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2
  server overcloud-controller-2 172.16.20.152:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2

listen neutron
  bind 172.16.20.250:9696
  bind 172.16.23.250:9696
  server overcloud-controller-0 172.16.20.150:9696 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:9696 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:9696 check fall 5 inter 2000 rise 2

listen nova_ec2
  bind 172.16.20.250:8773
  bind 172.16.23.250:8773
  server overcloud-controller-0 172.16.20.150:8773 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8773 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8773 check fall 5 inter 2000 rise 2

listen nova_metadata
  bind 172.16.20.250:8775
  server overcloud-controller-0 172.16.20.150:8775 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8775 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8775 check fall 5 inter 2000 rise 2

listen nova_novncproxy
  bind 172.16.20.250:6080
  bind 172.16.23.250:6080
  balance source
  server overcloud-controller-0 172.16.20.150:6080 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:6080 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:6080 check fall 5 inter 2000 rise 2

listen nova_osapi
  bind 172.16.20.250:8774
```

```
  bind 172.16.23.250:8774
  server overcloud-controller-0 172.16.20.150:8774 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8774 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8774 check fall 5 inter 2000 rise 2

listen nova_placement
  bind 172.16.20.250:8778
  bind 172.16.23.250:8778
  mode http
  server overcloud-controller-0 172.16.20.150:8778 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8778 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8778 check fall 5 inter 2000 rise 2

listen panko
  bind 172.16.20.250:8779 transparent
  bind 172.16.23.250:8779 transparent
  server overcloud-controller-0 172.16.20.150:8779 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8779 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8779 check fall 5 inter 2000 rise 2

listen redis
  bind 172.16.20.249:6379
  balance first
  option tcp-check
  tcp-check send AUTH\ p@55w0rd!\r\n
  tcp-check send PING\r\n
  tcp-check expect string +PONG
  tcp-check send info\ replication\r\n
  tcp-check expect string role:master
  tcp-check send QUIT\r\n
  tcp-check expect string +OK
  server overcloud-controller-0 172.16.20.150:6379 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:6379 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:6379 check fall 5 inter 2000 rise 2

listen swift_proxy_server
  bind 172.16.23.250:8080
  bind 172.16.21.250:8080
  server overcloud-controller-0 172.16.21.150:8080 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.21.151:8080 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.21.152:8080 check fall 5 inter 2000 rise 2
```

2.1.1. Global configuration parameters: Example HAProxy configuration file

The global configuration parameters section defines a set of process-wide parameters for the load balancer. You can use the example parameters from the configuration file to configure your external load balancer. Adjust the parameter values based on your environment.

Global configuration parameters

```
global
  daemon
  user  haproxy
  group  haproxy
```

```
  log  /dev/log local0
  maxconn  10000
  pidfile  /var/run/haproxy.pid
```

The example shows the following parameters:

- **daemon**: Run as a background process.
- **user haproxy** and **group haproxy**: Define the Linux user and group that owns the process.
- **log**: Defines the syslog server to use.
- **maxconn**: Sets the maximum number of concurrent connections to the process.
- **pidfile**: Sets the file to use for the process IDs.

2.1.2. Default values configuration parameters: Example HAProxy configuration file

The default values configuration parameters section defines a set of default values to use when running the external load balancer services. You can use the example parameters from the configuration file to configure your external load balancer. Adjust the parameter values based on your environment.

Default values configuration parameters

```
defaults
  log  global
  mode  tcp
  retries  3
  timeout  http-request 10s
  timeout  queue 1m
  timeout  connect 10s
  timeout  client 1m
  timeout  server 1m
  timeout  check 10s
```

The example shows the following parameters:

- **log**: Enables logging for the service. The **global** value means that the logging functions use the **log** parameters from the **global** section.
- **mode**: Defines the protocol to use. In this case, the default is TCP.
- **retries**: Sets the number of retries to perform on a server before reporting a connection failure.
- **timeout**: Sets the maximum time to wait for a particular function. For example, **timeout http-request** sets the maximum time to wait for a complete HTTP request.

2.1.3. Service-level configuration parameters: Example HAProxy configuration file

The service-level configuration parameters section defines a set of parameters to use when load balancing traffic to a specific Red Hat OpenStack Platform (RHOSP) service. You can use the example parameters from the configuration file to configure your external load balancer. Adjust the parameter values based on your environment, and copy the section for each service that you want to load balance.

Service-level configuration parameters

This example shows the configuration parameters for the **ceilometer** service.

```
listen ceilometer
  bind 172.16.20.250:8777
  bind 172.16.23.250:8777
  server overcloud-controller-0 172.16.20.150:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8777 check fall 5 inter 2000 rise 2
```

Each service that you want to load balance must correspond to a section in the configuration file. Each service configuration includes the following parameters:

- **listen**: The name of the service that listens for requests.
- **bind**: The IP address and TCP port number the on which the service listens. Each service binds a different address that represents a different network traffic type.
- **server**: The name of each server that provides the service, the server IP address and listening port, and connection parameters:
- **check**: (Optional) Enables health checks.
- **fall 5**: (Optional) After five failed health checks, the service is considered offline.
- **inter 2000**: (Optional) The interval between two consecutive health checks set to 2000 milliseconds, or 2 seconds.
- **rise 2**: (Optional) After two successful health checks, the service is considered operational.

In the **ceilometer** example, the service identifies the IP addresses and ports on which the ceilometer service is offered as **172.16.20.2500:8777** and **172.16.23.250:8777**. HAProxy directs the requests for those addresses to **overcloud-controller-0** (172.16.20.150:8777), **overcloud-controller-1** (172.16.20.151:8777), or **overcloud-controller-2** (172.16.0.152:8777).

Additional resources

- Section 2.2, “Configuration parameters for services that use load balancing”

2.2. CONFIGURATION PARAMETERS FOR SERVICES THAT USE LOAD BALANCING

For each service in the overcloud that uses load balancing, use the following examples as a guide to configure your external load balancer. Adjust the parameter values based on your environment, and copy the section for each service that you want to load balance.

NOTE

Most services use the default health check configuration:

- The interval between two consecutive health checks set to 2000 milliseconds, or 2 seconds.
- After two successful health checks, a server is considered operational.
- After five failed health checks, the service is considered offline.

Each service indicates the default health check or additional options in the **Other information** section of that service.

aodh

Port number: 8042

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen aodh
  bind 172.16.20.250:8042
  bind 172.16.23.250:8042
  server overcloud-controller-0 172.16.20.150:8042 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8042 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8042 check fall 5 inter 2000 rise 2
```

ceilometer

Port number: 8777

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen ceilometer
  bind 172.16.20.250:8777
  bind 172.16.23.250:8777
  server overcloud-controller-0 172.16.20.150:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8777 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8777 check fall 5 inter 2000 rise 2
```

-

cinder

Port number: 8776

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen cinder
  bind 172.16.20.250:8776
  bind 172.16.23.250:8776
  server overcloud-controller-0 172.16.20.150:8776 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8776 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8776 check fall 5 inter 2000 rise 2
```

glance_api

Port number: 9292

Binds to: storage, external

Target network or server: storage on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen glance_api
  bind 172.16.23.250:9292
  bind 172.16.21.250:9292
  server overcloud-controller-0 172.16.21.150:9292 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.21.151:9292 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.21.152:9292 check fall 5 inter 2000 rise 2
```

glance_registry

Port number: 9191

Binds to: internal_api

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen glance_registry
  bind 172.16.20.250:9191
  server overcloud-controller-0 172.16.20.150:9191 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:9191 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:9191 check fall 5 inter 2000 rise 2
```

gnocchi

Port number: 8041

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen gnocchi
  bind 172.16.20.250:8041
  bind 172.16.23.250:8041
  server overcloud-controller-0 172.16.20.150:8041 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8041 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8041 check fall 5 inter 2000 rise 2
```

heat_api

Port number: 8004

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.
- This service uses HTTP mode instead of the default TCP mode.

HAProxy example:

```
listen heat_api
  bind 172.16.20.250:8004
  bind 172.16.23.250:8004
  mode http
  server overcloud-controller-0 172.16.20.150:8004 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8004 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8004 check fall 5 inter 2000 rise 2
```

heat_cfn

Port number: 8000

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen heat_cfn
  bind 172.16.20.250:8000
  bind 172.16.23.250:8000
  server overcloud-controller-0 172.16.20.150:8000 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.152:8000 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.151:8000 check fall 5 inter 2000 rise 2
```

heat_cloudwatch

Port number: 8003

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen heat_cloudwatch
  bind 172.16.20.250:8003
  bind 172.16.23.250:8003
  server overcloud-controller-0 172.16.20.150:8003 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8003 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8003 check fall 5 inter 2000 rise 2
```

horizon

Port number: 80

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.
- This service uses HTTP mode instead of the default TCP mode.

- This service uses cookie-based persistence for interactions with the UI.

HAProxy example:

```
listen horizon
  bind 172.16.20.250:80
  bind 172.16.23.250:80
  mode http
  cookie SERVERID insert indirect nocache
  server overcloud-controller-0 172.16.20.150:80 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:80 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:80 check fall 5 inter 2000 rise 2
```

keystone_admin

Port number: 35357

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen keystone_admin
  bind 172.16.23.250:35357
  bind 172.16.20.250:35357
  server overcloud-controller-0 172.16.20.150:35357 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:35357 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:35357 check fall 5 inter 2000 rise 2
```

keystone_admin_ssh

Port number: 22

Binds to: internal_api

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen keystone_admin_ssh
  bind 172.16.20.250:22
  server overcloud-controller-0 172.16.20.150:22 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:22 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:22 check fall 5 inter 2000 rise 2
```

keystone_public

Port number: 5000

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen keystone_public
  bind 172.16.20.250:5000
  bind 172.16.23.250:5000
  server overcloud-controller-0 172.16.20.150:5000 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:5000 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:5000 check fall 5 inter 2000 rise 2
```

mysql

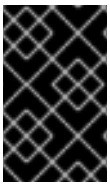
Port number: 3306

Binds to: internal_api

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check. However, the health checks use port 9200.
- This service is load balanced to only one server at a time.
- Each server is only used in load balancing only when all other non-backup servers are unavailable.
- If the server is offline, all connections are immediately terminated.
- You must enable the sending of TCP keepalive packets on both sides.
- You must enable HTTP protocol to check on the servers health.
- You can configure a stickiness table to store IP addresses, to help maintain persistence.



IMPORTANT

The **mysql** service uses Galera to provide a highly available database cluster. Galera supports an active-active configuration, but to avoid lock contention, you must use an active-passive configuration that is enforced by the load balancer.

HAProxy example:

```
listen mysql
  bind 172.16.20.250:3306
  option tcpka
  option httpchk
  stick on dst
  stick-table type ip size 1000
  timeout client 0
  timeout server 0
  server overcloud-controller-0 172.16.20.150:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2
  server overcloud-controller-1 172.16.20.151:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2
  server overcloud-controller-2 172.16.20.152:3306 backup check fall 5 inter 2000 on-marked-down
shutdown-sessions port 9200 rise 2
```

neutron

Port number: 9696

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen neutron
  bind 172.16.20.250:9696
  bind 172.16.23.250:9696
  server overcloud-controller-0 172.16.20.150:9696 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:9696 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:9696 check fall 5 inter 2000 rise 2
```

nova_ec2

Port number: 8773

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen nova_ec2
  bind 172.16.20.250:8773
  bind 172.16.23.250:8773
```

```
  server overcloud-controller-0 172.16.20.150:8773 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8773 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8773 check fall 5 inter 2000 rise 2
```

nova_metadata

Port number: 8775

Binds to: internal_api

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen nova_metadata
  bind 172.16.20.250:8775
  server overcloud-controller-0 172.16.20.150:8775 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8775 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8775 check fall 5 inter 2000 rise 2
```

nova_novncproxy

Port number: 6080

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.
- The default load balancing method is round-robin. However, for this service, use a **source** method. This method hashes the source IP address and divides it by the total weight of the running servers. This method also designates the server that receives the request and ensures that the same client IP address always reaches the same server unless server goes down or up. If the hash result changes due to a change in the number of running servers, the load balancer redirects the clients to a different server.

HAProxy example:

```
listen nova_novncproxy
  bind 172.16.20.250:6080
  bind 172.16.23.250:6080
  balance source
  server overcloud-controller-0 172.16.20.150:6080 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:6080 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:6080 check fall 5 inter 2000 rise 2
```

nova_osapi

Port number: 8774

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen nova_osapi
  bind 172.16.20.250:8774
  bind 172.16.23.250:8774
  server overcloud-controller-0 172.16.20.150:8774 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8774 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8774 check fall 5 inter 2000 rise 2
```

nova_placement

Port number: 8778

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen nova_placement
  bind 172.16.20.250:8778
  bind 172.16.23.250:8778
  server overcloud-controller-0 172.16.20.150:8778 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8778 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8778 check fall 5 inter 2000 rise 2
```

panko

Port number: 8779

Binds to: internal_api, external

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen panko
  bind 172.16.20.250:8779
  bind 172.16.23.250:8779
  server overcloud-controller-0 172.16.20.150:8779 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:8779 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:8779 check fall 5 inter 2000 rise 2
```

redis

Port number: 6379

Binds to: internal_api (redis service IP)

Target network or server: internal_api on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.
- Perform health checks using **tcp-check** send/expect sequences. The string to send is **info\ replication\r\n** and the response is **role:master**.
- The Redis service uses a password for authentication. For example, the HAProxy configuration uses a **tcp-check** with the AUTH method and the Redis administration password. Director normally generates a random password, but you can define a custom Redis password.
- The default balancing method is **round-robin**. However, for this service, use the **first** method. This ensures that the first server that has available connection slots receives the connection.

HAProxy example:

```
listen redis
  bind 172.16.20.249:6379 transparent
  balance first
  option tcp-check
  tcp-check send AUTH\ p@55w0rd!\r\n
  tcp-check send PING\r\n
  tcp-check expect string +PONG
  tcp-check send info\ replication\r\n
  tcp-check expect string role:master
  tcp-check send QUIT\r\n
  tcp-check expect string +OK
  server overcloud-controller-0 172.16.20.150:6379 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.20.151:6379 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.20.152:6379 check fall 5 inter 2000 rise 2
```

swift_proxy_server

Port number: 8080

Binds to: storage, external

Target network or server: storage on overcloud-controller-0, overcloud-controller-1, and overcloud-controller-2

Other information:

- Each target server uses a default health check.

HAProxy example:

```
listen swift_proxy_server
  bind 172.16.23.250:8080
  bind 172.16.21.250:8080
  server overcloud-controller-0 172.16.21.150:8080 check fall 5 inter 2000 rise 2
  server overcloud-controller-1 172.16.21.151:8080 check fall 5 inter 2000 rise 2
  server overcloud-controller-2 172.16.21.152:8080 check fall 5 inter 2000 rise 2
```