In-Guest High Availability (HA) Configuration in Red Hat OpenStack Cloud using Veritas InfoScale Availability (VCS)

Who should read this paper

Administrators who want to implement in-guest HA architectures for unmanaged application services in the cloud

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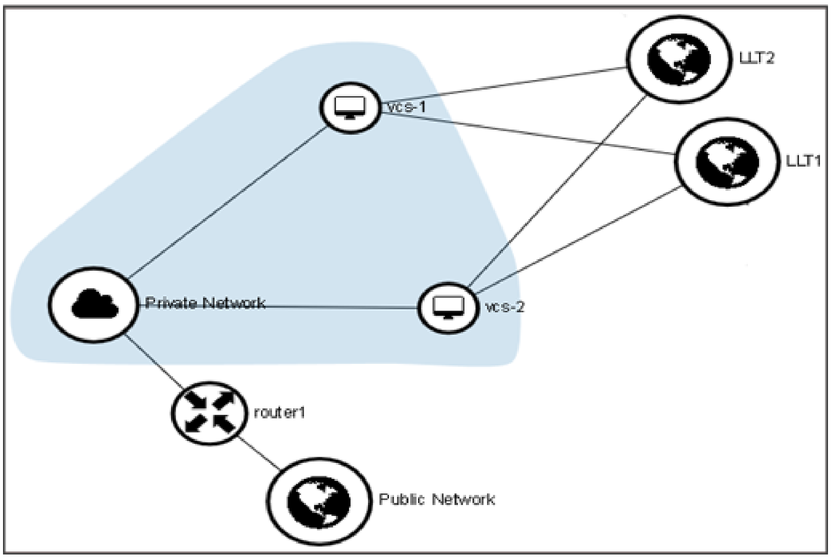
Introduction

OpenStack is based entirely on open source software and is backed by a vibrant global ecosystem of users and vendors. Initiated in 2010, this flexible cloud platform has matured rapidly and is now ready for production cloud deployments in many environments.

In this document, we describe how to prepare Red Hat OpenStack to configure a virtual IP (VIP) for high availability (HA). Veritas InfoScale Availability (formerly Veritas Cluster Server or VCS) is used to provide in-guest HA to the VIP.

Configuration

The following graphic depicts an OpenStack network configuration with two VCS nodes running on a Red Hat OpenStack virtual machine (VM) in the same availability zones:



Note: This sample configuration uses Red Hat OpenStack version 10 deployed with the KVM hypervisor, and Veritas InfoScale Availability 7.2 is configured on an OpenStack VM.

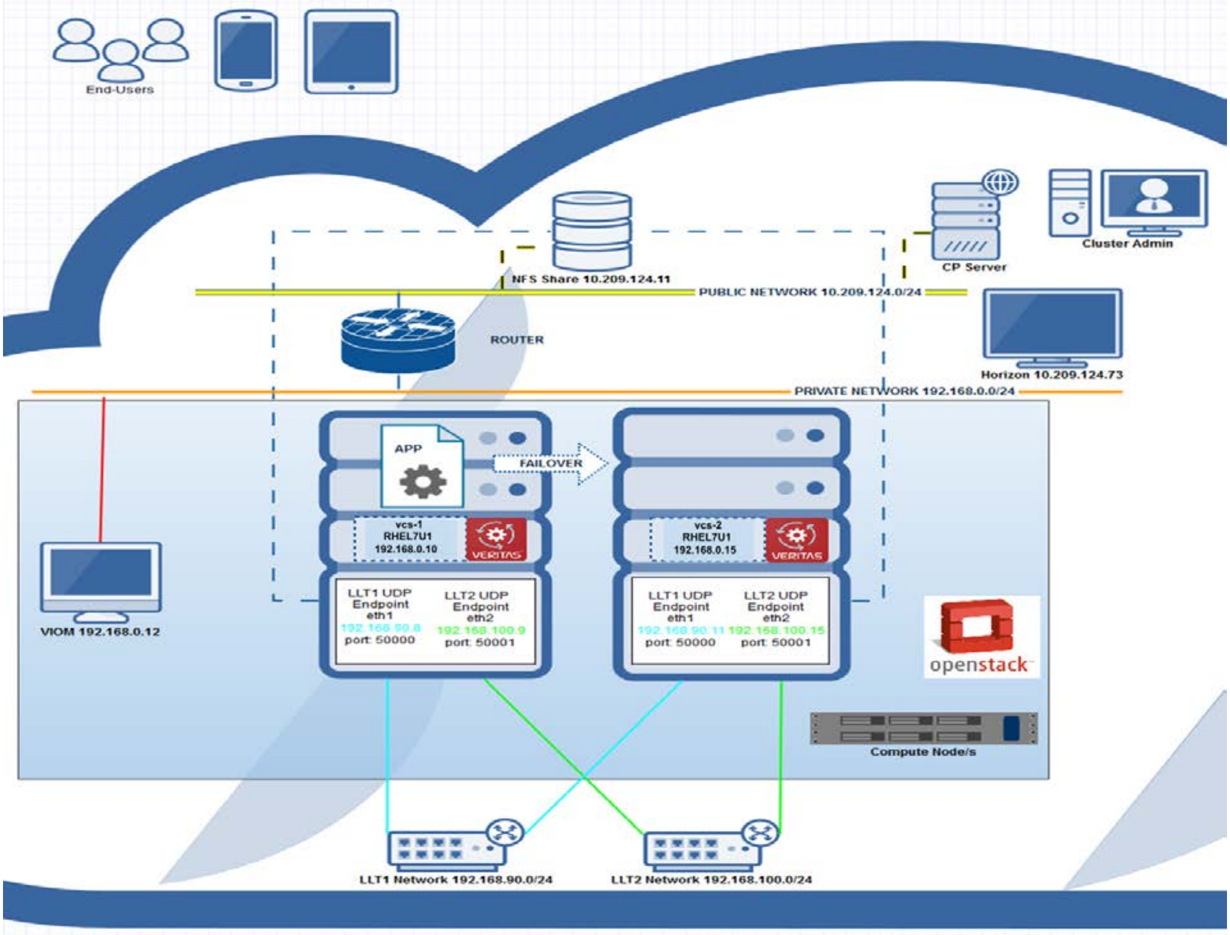
This graphic includes the following elements:

Element	Description
Public network	A public network contains a floating IP address, which is a service provided by Neutron. It does not use any DHCP service or an IP is not set statically within the guest. The operating system of the guest does not know that it was assigned a floating IP address. The L3 agent of Neutron is responsible for the delivery of packets to the interface with the assigned floating address. Instances that have a floating IP address assigned can be accessed from the public network by using the floating IP.

Element	Description
Private network	A private network contains a private IP address, which the DHCP server assigns to the network-interface of an instance. The address is visible from within the instance by using a command like “`ip a`”. The address is typically part of a private network and is used for communication between instances.
Router 1	The router that connects the private network to the public network to further access any external networks.
vcs-1 and vcs-2	These VMs are created in the OpenStack environment within the same availability zone, and they would form the VCS cluster nodes.
LLT1 and LLT2	These networks are used for low latency transport (LLT) communication between the VCS cluster nodes. Note: These networks must have static IP address. Otherwise, a network partition may occur and the cluster may get into a jeopardy situation.

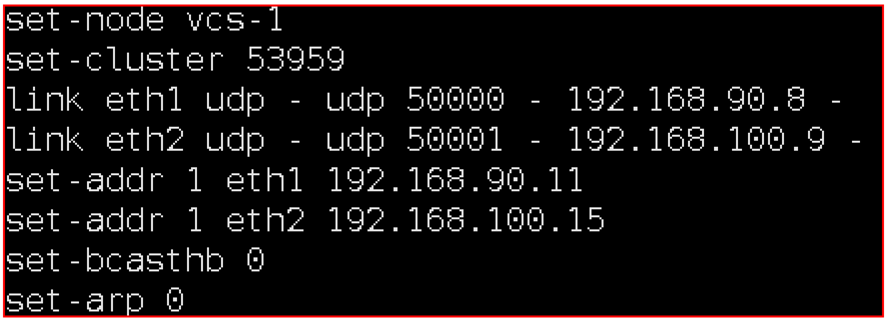
In-guest HA configuration in Red Hat OpenStack cloud using Veritas InfoScale Availability (VCS)

The following graphic depicts an application configured for in-guest HA in Red Hat OpenStack using VCS:



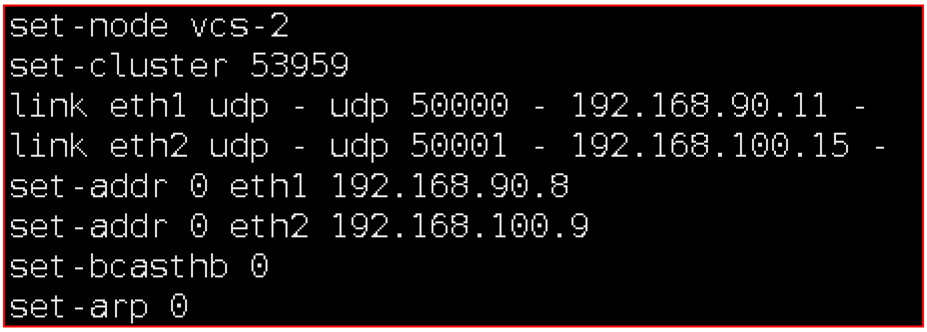
- The OpenStack instances host Apache web server and an application, the binaries of which are placed on an NFS location, all of which are managed by VCS. Both the instances exist in a private subnet and are connected to the public network via a router for internet access.
- This sample configuration uses LLT over UDP. However, if you are using a single availability zone and subnet, you can also use LLT over Ethernet.
- Each OpenStack VM has two network interfaces, eth1 and eth2. Both the instances, vcs-1 and vcs-2, has subnet 192.168.90.0/24 on eth1 and subnet 192.168.100.0/24 on eth2.
- The LLT links are configured to use both these subnets as a part of the intra-cluster communication.

The following graphic depicts a sample `/etc/llttab` file for the OpenStack instance, vcs-1:



```
set-node vcs-1
set-cluster 53959
link eth1 udp - udp 50000 - 192.168.90.8 -
link eth2 udp - udp 50001 - 192.168.100.9 -
set-addr 1 eth1 192.168.90.11
set-addr 1 eth2 192.168.100.15
set-bcasthb 0
set-arp 0
```

The following graphic depicts a sample `/etc/llttab` file for the OpenStack instance, vcs-2:



```
set-node vcs-2
set-cluster 53959
link eth1 udp - udp 50000 - 192.168.90.11 -
link eth2 udp - udp 50001 - 192.168.100.15 -
set-addr 0 eth1 192.168.90.8
set-addr 0 eth2 192.168.100.9
set-bcasthb 0
set-arp 0
```

- The application runs inside the OpenStack instances, while the application binaries are placed over the NFS location 10.209.124.11, which is outside the OpenStack network. The scope of this configuration includes the mount agent only, which has been tested with NFS v3 and NFS v4 in this sample.
- A coordination point (CP) server is configured outside the OpenStack network, which takes care of fencing in case there is a network partition between the two cluster nodes. If required, you can also configure a CP server inside the OpenStack network.
- The OpenStack instances have Apache server installed and running, to make the Apache service highly available across the cluster nodes. For access to these from outside the OpenStack environment, a virtual private IP is configured, all of which are managed by VCS.

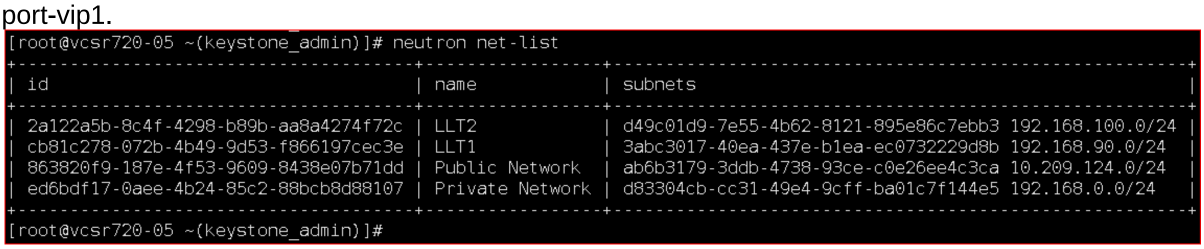
Preparing OpenStack to configure a VIP for high availability

To allow a VIP to communicate across cluster nodes, you need to map the same VIP to multiple ports. Neutron does not allow such a configuration by default. To work around this limitation and provide HA for a VIP, we use the allowed-address-pairs feature that Neutron provides.

Allowed-address-pairs allow you to specify IP address (CIDR) pairs that pass through a port. This enables the use of protocols such as VRRP, which floats an IP address between two instances to enable fast data plane failover.

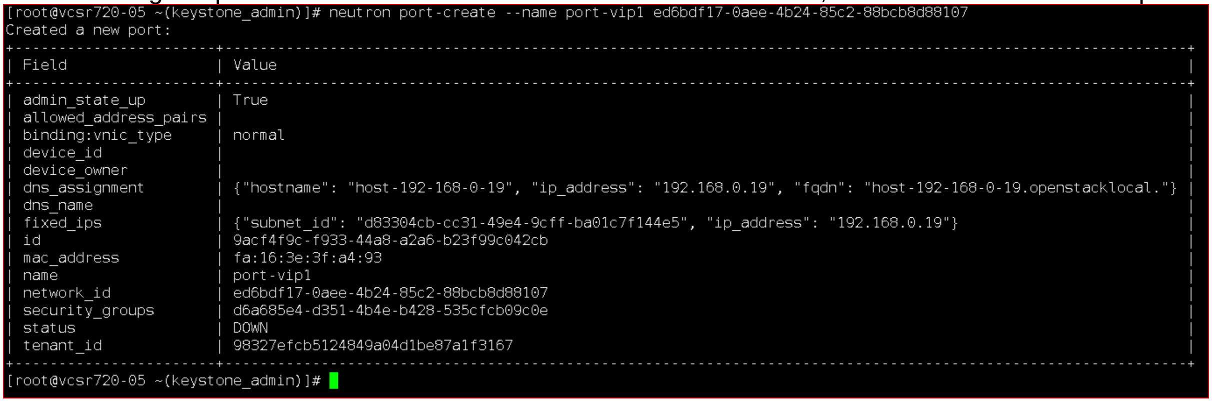
To map the VIP with the instance port

1. Create a Neutron port for VIP with the appropriate network. This example uses a private network named port-vip1.



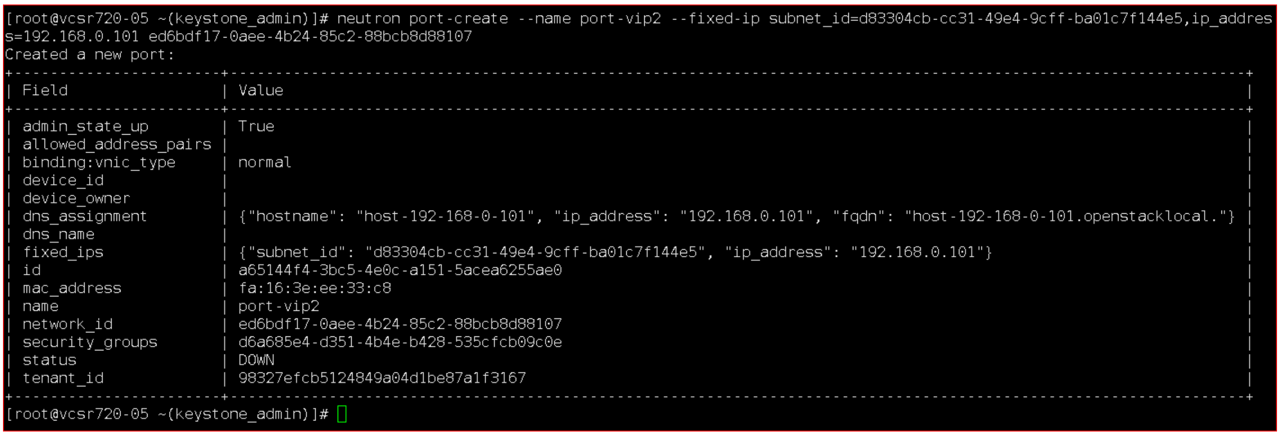
```
[root@vcsr720-05 ~(keystone_admin)]# neutron net-list
+--------------------------------------+-----------------+-----------------------------------------------------+
| id                                   | name            | subnets                                             |
+--------------------------------------+-----------------+-----------------------------------------------------+
| 2a122a5b-8c4f-4298-b89b-aa8a4274f72c | LLT2            | d49c01d9-7e55-4b62-8121-895e86c7ebb3 192.168.100.0/24 |
| cb81c278-072b-4b49-9d53-f866197cec3e | LLT1            | 3abc3017-40ea-437e-b1ea-ec0732229d8b 192.168.90.0/24  |
| 863820f9-187e-4f53-9609-8438e07b71dd | Public Network  | ab6b3179-3ddb-4738-93ce-c0e26ee4c3ca 10.209.124.0/24  |
| ed6bdf17-0aee-4b24-85c2-88bcb8d88107 | Private Network | d83304cb-cc31-49e4-9cff-ba01c7f144e5 192.168.0.0/24   |
+--------------------------------------+-----------------+-----------------------------------------------------+
[root@vcsr720-05 ~(keystone_admin)]#
```

2. After creating the port IP address 192.168.0.19 can be used as a VIP, which the DHCP network provided:



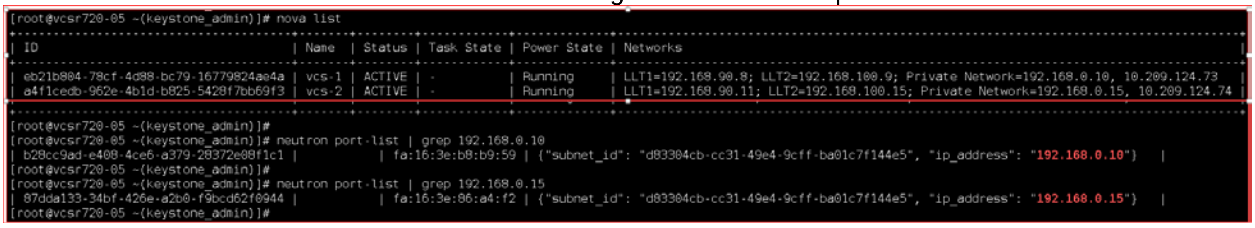
```
[root@vcsr720-05 ~(keystone_admin)]# neutron port-create --name port-vip1 ed6bdf17-0aee-4b24-85c2-88bcb8d88107
Created a new port:
+-----------------------+------------------------------------------------------------------------------------------------+
| Field                 | Value                                                                                          |
+-----------------------+------------------------------------------------------------------------------------------------+
| admin_state_up        | True                                                                                           |
| allowed_address_pairs |                                                                                                |
| binding:vnic_type     | normal                                                                                         |
| device_id             |                                                                                                |
| device_owner          |                                                                                                |
| dns_assignment        | {"hostname": "host-192-168-0-19", "ip_address": "192.168.0.19", "fqdn": "host-192-168-0-19.openstacklocal."} |
| dns_name              |                                                                                                |
| fixed_ips             | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.19"}           |
| id                    | 9acf4f9c-f933-44a8-a2a6-b23f99c042cb                                                           |
| mac_address           | fa:16:3e:3f:a4:93                                                                              |
| name                  | port-vip1                                                                                      |
| network_id            | ed6bdf17-0aee-4b24-85c2-88bcb8d88107                                                           |
| security_groups       | d6a685e4-d351-4b4e-b428-535cfcb09c0e                                                           |
| status                | DOWN                                                                                           |
| tenant_id             | 98327efcb5124849a04d1be87a1f3167                                                               |
+-----------------------+------------------------------------------------------------------------------------------------+
[root@vcsr720-05 ~(keystone_admin)]#
```

Alternatively, you can assign a specific IP address to the newly created port using the following command:

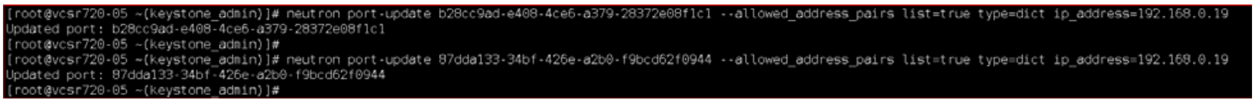


```
[root@vcsr720-05 ~(keystone_admin)]# neutron port-create --name port-vip2 --fixed-ip subnet_id=d83304cb-cc31-49e4-9cff-ba01c7f144e5,ip_addres
s=192.168.0.101 ed6bdf17-0aee-4b24-85c2-88bcb8d88107
Created a new port:
+-----------------------+--------------------------------------------------------------------------------------------------+
| Field                 | Value                                                                                            |
+-----------------------+--------------------------------------------------------------------------------------------------+
| admin_state_up        | True                                                                                             |
| allowed_address_pairs |                                                                                                  |
| binding:vnic_type     | normal                                                                                           |
| device_id             |                                                                                                  |
| device_owner          |                                                                                                  |
| dns_assignment        | {"hostname": "host-192-168-0-101", "ip_address": "192.168.0.101", "fqdn": "host-192-168-0-101.openstacklocal."} |
| dns_name              |                                                                                                  |
| fixed_ips             | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.101"}            |
| id                    | a65144f4-3bc5-4e0c-a151-5acea6255ae0                                                             |
| mac_address           | fa:16:3e:ee:33:c8                                                                                |
| name                  | port-vip2                                                                                        |
| network_id            | ed6bdf17-0aee-4b24-85c2-88bcb8d88107                                                             |
| security_groups       | d6a685e4-d351-4b4e-b428-535cfcb09c0e                                                             |
| status                | DOWN                                                                                             |
| tenant_id             | 98327efcb5124849a04d1be87a1f3167                                                                 |
+-----------------------+--------------------------------------------------------------------------------------------------+
[root@vcsr720-05 ~(keystone_admin)]#
```

3. Now, map your VIP (192.168.0.19) with the appropriate ports of all the cluster nodes, so that the VIP can fail over and communicate across the cluster using allowed-address-pairs:

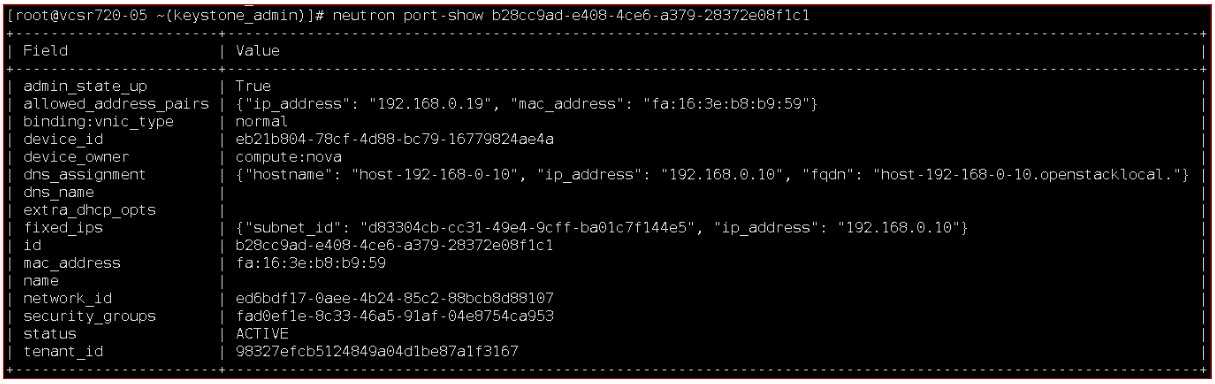


```
[root@vcsr720-05 ~(keystone_admin)]# nova list
+--------------------------------------+-------+--------+------------+-------------+-----------------------------------------------------------------------------------+
| ID                                   | Name  | Status | Task State | Power State | Networks                                                                          |
+--------------------------------------+-------+--------+------------+-------------+-----------------------------------------------------------------------------------+
| eb21b804-78cf-4d88-bc79-16779824ae4a | vcs-1 | ACTIVE | -          | Running     | LLT1=192.168.90.8; LLT2=192.168.100.9; Private Network=192.168.0.10, 10.209.124.73  |
| a4f1cedb-962e-4b1d-b825-5428f7bb69f3 | vcs-2 | ACTIVE | -          | Running     | LLT1=192.168.90.11; LLT2=192.168.100.15; Private Network=192.168.0.15, 10.209.124.74 |
+--------------------------------------+-------+--------+------------+-------------+-----------------------------------------------------------------------------------+
[root@vcsr720-05 ~(keystone_admin)]#
[root@vcsr720-05 ~(keystone_admin)]# neutron port-list | grep 192.168.0.10
| b28cc9ad-e408-4ce6-a379-28372e08f1c1 |           | fa:16:3e:b8:b9:59 | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.10"}   |
[root@vcsr720-05 ~(keystone_admin)]#
[root@vcsr720-05 ~(keystone_admin)]# neutron port-list | grep 192.168.0.15
| 87dda133-34bf-426e-a2b0-f9bcd62f0944 |           | fa:16:3e:86:a4:f2 | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.15"}   |
[root@vcsr720-05 ~(keystone_admin)]#
```

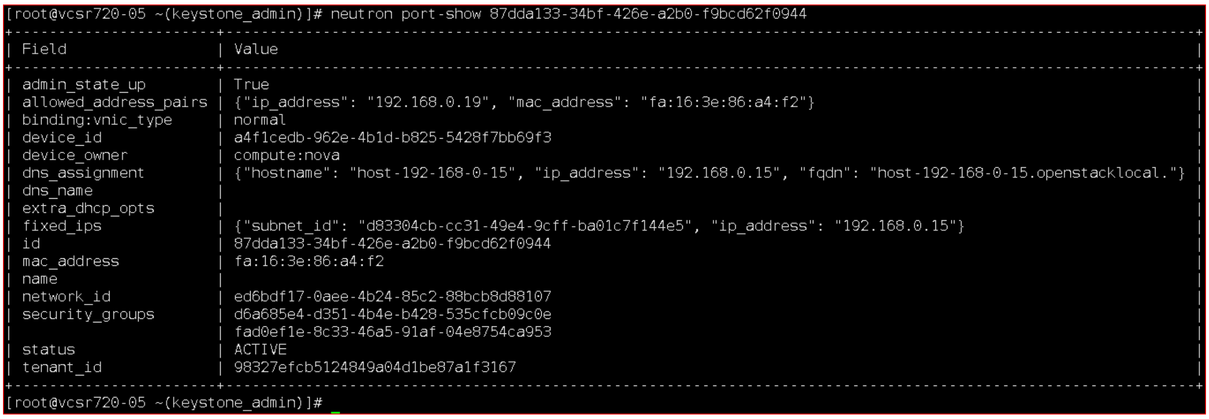


```
[root@vcsr720-05 ~(keystone_admin)]# neutron port-update b28cc9ad-e408-4ce6-a379-28372e08f1c1 --allowed_address_pairs list=true type=dict ip_address=192.168.0.19
Updated port: b28cc9ad-e408-4ce6-a379-28372e08f1c1
[root@vcsr720-05 ~(keystone_admin)]#
[root@vcsr720-05 ~(keystone_admin)]# neutron port-update 87dda133-34bf-426e-a2b0-f9bcd62f0944 --allowed_address_pairs list=true type=dict ip_address=192.168.0.19
Updated port: 87dda133-34bf-426e-a2b0-f9bcd62f0944
[root@vcsr720-05 ~(keystone_admin)]#
```

The allowed-address-pairs values are successfully updated for both the instances:



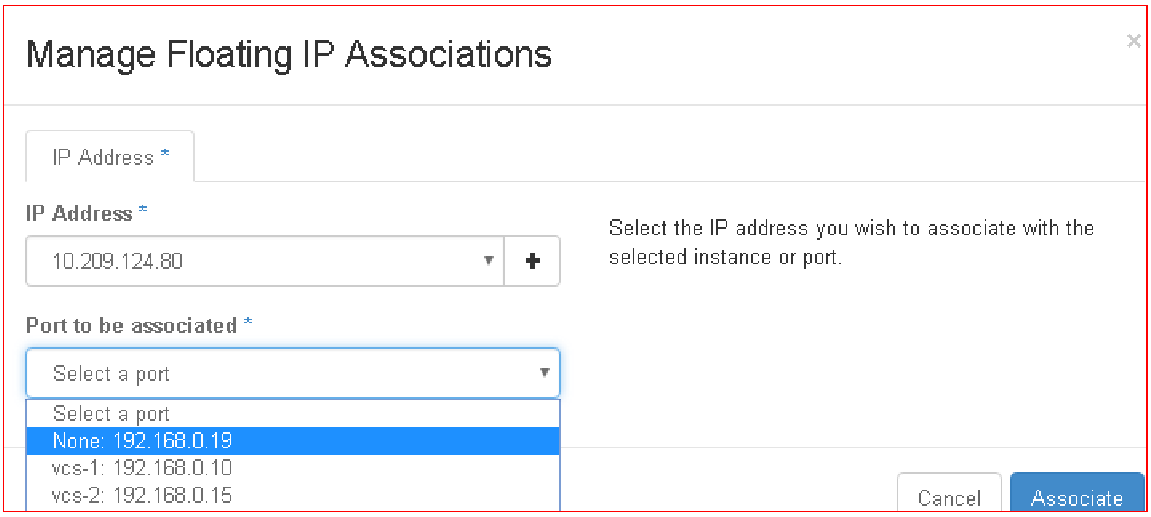
```
[root@vcsr720-05 ~(keystone_admin)]# neutron port-show b28cc9ad-e408-4ce6-a379-28372e08f1c1
+-----------------------+-------------------------------------------------------------------------------------------------------------+
| Field                 | Value                                                                                                       |
+-----------------------+-------------------------------------------------------------------------------------------------------------+
| admin_state_up        | True                                                                                                        |
| allowed_address_pairs | {"ip_address": "192.168.0.19", "mac_address": "fa:16:3e:b8:b9:59"}                                          |
| binding:vnic_type     | normal                                                                                                      |
| device_id             | eb21b804-78cf-4d88-bc79-16779824ae4a                                                                        |
| device_owner          | compute:nova                                                                                                |
| dns_assignment        | {"hostname": "host-192-168-0-10", "ip_address": "192.168.0.10", "fqdn": "host-192-168-0-10.openstacklocal."} |
| dns_name              |                                                                                                             |
| extra_dhcp_opts       |                                                                                                             |
| fixed_ips             | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.10"}                         |
| id                    | b28cc9ad-e408-4ce6-a379-28372e08f1c1                                                                        |
| mac_address           | fa:16:3e:b8:b9:59                                                                                           |
| name                  |                                                                                                             |
| network_id            | ed6bdf17-0aee-4b24-85c2-88bcb8d88107                                                                        |
| security_groups       | fad0ef1e-8c33-46a5-91af-04e8754ca953                                                                        |
| status                | ACTIVE                                                                                                      |
| tenant_id             | 98327efcb5124849a04d1be87a1f3167                                                                            |
+-----------------------+-------------------------------------------------------------------------------------------------------------+
```



```
[root@vcsr720-05 ~(keystone_admin)]# neutron port-show 87dda133-34bf-426e-a2b0-f9bcd62f0944
+-----------------------+-------------------------------------------------------------------------------------------------------------+
| Field                 | Value                                                                                                       |
+-----------------------+-------------------------------------------------------------------------------------------------------------+
| admin_state_up        | True                                                                                                        |
| allowed_address_pairs | {"ip_address": "192.168.0.19", "mac_address": "fa:16:3e:86:a4:f2"}                                          |
| binding:vnic_type     | normal                                                                                                      |
| device_id             | a4f1cedb-962e-4b1d-b825-5428f7bb69f3                                                                        |
| device_owner          | compute:nova                                                                                                |
| dns_assignment        | {"hostname": "host-192-168-0-15", "ip_address": "192.168.0.15", "fqdn": "host-192-168-0-15.openstacklocal."} |
| dns_name              |                                                                                                             |
| extra_dhcp_opts       |                                                                                                             |
| fixed_ips             | {"subnet_id": "d83304cb-cc31-49e4-9cff-ba01c7f144e5", "ip_address": "192.168.0.15"}                         |
| id                    | 87dda133-34bf-426e-a2b0-f9bcd62f0944                                                                        |
| mac_address           | fa:16:3e:86:a4:f2                                                                                           |
| name                  |                                                                                                             |
| network_id            | ed6bdf17-0aee-4b24-85c2-88bcb8d88107                                                                        |
| security_groups       | d6a685e4-d351-4b4e-b428-535cfcb09c0e                                                                        |
|                       | fad0ef1e-8c33-46a5-91af-04e8754ca953                                                                        |
| status                | ACTIVE                                                                                                      |
| tenant_id             | 98327efcb5124849a04d1be87a1f3167                                                                            |
+-----------------------+-------------------------------------------------------------------------------------------------------------+
[root@vcsr720-05 ~(keystone_admin)]# _
```

After performing the previously listed steps the VIP 192.168.0.19 can be used to communicate across the cluster within network.

4. To enable communication outside the OpenStack environment, associate the floating IP to port-vip1 using the dashboard:



Manage Floating IP Associations

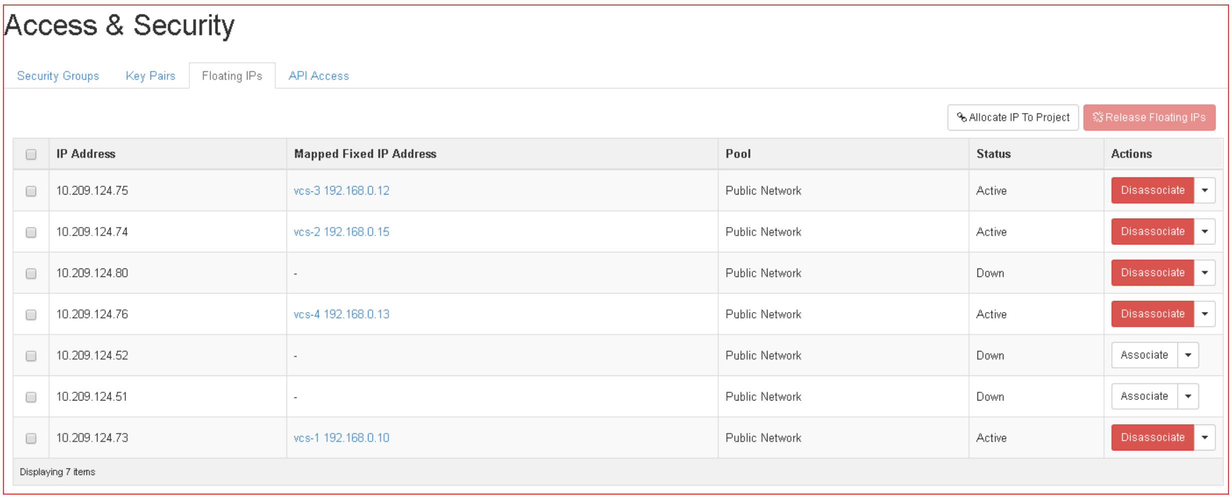
IP Address *

IP Address *: 10.209.124.80

Port to be associated *: Select a port

Select a port
None: 192.168.0.19
vcs-1: 192.168.0.10
vcs-2: 192.168.0.15

Select the IP address you wish to associate with the selected instance or port.



Access & Security

□	IP Address	Mapped Fixed IP Address	Pool	Status	Actions
□	10.209.124.75	vcs-3 192.168.0.12	Public Network	Active	Disassociate ▾
□	10.209.124.74	vcs-2 192.168.0.15	Public Network	Active	Disassociate ▾
□	10.209.124.80	-	Public Network	Down	Disassociate ▾
□	10.209.124.76	vcs-4 192.168.0.13	Public Network	Active	Disassociate ▾
□	10.209.124.52	-	Public Network	Down	Associate ▾
□	10.209.124.51	-	Public Network	Down	Associate ▾
□	10.209.124.73	vcs-1 192.168.0.10	Public Network	Active	Disassociate ▾

Displaying 7 items

CP server configuration

The coordination point server (CP server) is a software solution that runs on a remote system or cluster. CP server provides arbitration functionality by allowing the VCS cluster nodes to perform the following tasks:

- Self-register to become a member of an active VCS cluster (registered with CP server) with access to the data drives.
- Check which other nodes are registered as members of this active VCS cluster.
- Self-unregister from this active VCS cluster.
- Forcefully unregister other nodes (preempt) as members of this active VCS cluster.
- If required, set the `loser_exit_delay` parameter in the `/etc/vxfenmode` file according to your cluster setup.

In short, the CP server functions as another arbitration mechanism that integrates within the existing I/O fencing module.

You can configure a CP server by invoking the `/opt/VRTS/install/installer -configcps` command.

Sample VCS configuration file (main.cf)

```
include "OracleASMTypes.cf"
include "types.cf"
include "Db2udbTypes.cf"
include "OracleTypes.cf"
include "SybaseTypes.cf"

cluster openclus (
      SecureClus = 1
      DefaultGuestAccess = 1
      UseFence = SCSI3
      )


system vcs-1 (
      )

system vcs-2 (
      )

group AppGrp (
      SystemList = { openvm4 = 0, openvm5 = 1 }
      ProPCV = 1
      )

      Application appres (
            StartProgram = "/nfslocation/Application_TestIMFAPP/testapp_start2"
            StopProgram = "/nfslocation/Application_TestIMFAPP/testapp_stop2"
            CleanProgram = "/nfslocation/Application_TestIMFAPP/testapp_clean2"
            MonitorProgram = "/nfslocation/Application_TestIMFAPP/testapp_monitor2"
            PidFiles = { "/nfslocation/Application_TestIMFAPP/testapp.pid",
                  "/nfslocation/Application_TestIMFAPP/testapp2.pid" }
            MonitorProcesses = {
                  "/usr/bin/sh /nfslocation/Application_TestIMFAPP/testapp",
                  "/usr/bin/sh /nfslocation/Application_TestIMFAPP/testapp2" }
            )

      Mount nfs-mount (
            MountPoint = "/nfslocation"
            BlockDevice = "10.209.124.133:/nfsshare/"
            FSType = nfs
            MountOpt =
"rw,bg,hard,nointr,tcp,nfsvers=3,timeo=600,rsize=32768,wsize=32768"
            CreateMntPt = 1
            RecursiveMnt = 1
            )
```

```
        appres requires nfs-mount


        // resource dependency tree
        //
        //      group AppGrp
        //      {
        //              Application appres
        //              {
        //                      Mount nfs-mount
        //              }
        //      }


group ApacheGroup (
        SystemList = { vcs-1 = 0, vcs-2 = 1 }
        )



        Apache apache_res (
                httpdDir = "/usr/sbin"
                HostName = "192.168.0.19"
                ConfigFile = "/etc/httpd/conf/httpd.conf"
                LevelTwoMonitorFreq = 1
                )

        IP apache_ipres (
                Device = eth0
                Address = "192.168.0.19"
                NetMask = "255.255.255.0"
                )

        NIC apache_nicres (
                Device = eth0
                )

        apache_ipres requires apache_nicres
        apache_res requires apache_ipres



group vxfen (
        SystemList = { vcs-1 = 0, vcs-2 = 1 }
        AutoFailOver = 0
        Parallel = 1
        )

        CoordPoint coordpoint (
                )

        Phantom RES_phantom_vxfen (
            )


        // resource dependency tree
        //
        //      group vxfen
        //      {
        //              Phantom RES_phantom_vxfen
        //              CoordPoint coordpoint
        //      }
```

Tested configurations

The following configurations have been tested:

OpenStack version	Guest operating system version	InfoScale Availability (VCS) version
RHOSP 8	RHEL 7.1, 7.2	VCS 6.2.1*****
RHOSP 8	RHEL 7.1, 7.2	InfoScale Availability 7.x
RHOSP 10	RHEL 7.1, 7.2, 7.3	VCS 6.2.1*****
RHOSP 10	RHEL 7.1, 7.2	InfoScale Availability 7.x
RHOSP 11	RHEL 6.x, RHEL 7.x, SLES 11, SLES 12	VCS 6.2.1*****
RHOSP 11	RHEL 6.x, RHEL 7.x, SLES 11, SLES 12	InfoScale Availability 7.x
Mirantis 9	RHEL 6.x, RHEL 7.x, SLES 11, SLES 12	VCS 6.2.1*****
Mirantis 9	RHEL 6.x, RHEL 7.x, SLES 11, SLES 12	InfoScale Availability 7.x

***** These VCS versions require product patches. For information about the relevant product patches, visit: https://sort.veritas.com/productmatrix

Limitations

The following limitations currently exist with these configurations:

- Any agent that requires a storage component is not supported.
- All the limitations that apply to the allowed-address-pair feature also apply to these configurations.

References

https://access.redhat.com/documentation/en/red-hat-openstack-platform/10/paged/networking-guide/chapter-18-configure-allowed-address-pairs

About Veritas Technologies LLC

Veritas Technologies LLC enables organizations to harness the power of their information, with solutions designed to serve the world's largest and most complex heterogeneous environments. Veritas works with 86 percent of Fortune 500 companies today, improving data availability and revealing insights to drive competitive advantage.

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