



Red Hat OpenStack Platform 10

High Availability for Compute Instances

Configure High Availability for Compute Instances

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Abstract

A guide for configuring High Availability for Compute Instances (Instance HA) in Red Hat OpenStack Platform. This document focuses on enabling Instance HA through Ansible.

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CHAPTER 1. OVERVIEW

This guide describes how to implement *Instance High Availability (Instance HA)*. Instance HA allows Red Hat OpenStack Platform to automatically re-spawn instances on a different Compute node when their host Compute node breaks.

Instance HA automates the evacuation of an instance whenever its host Compute node fails. The evacuation process triggered by Instance HA is similar to what users can do manually, as described in [Evacuate Instances](#). Instance HA works on shared storage and local storage environments, which means that evacuated instances will maintain the same network configuration (static ip, floating ip, and so on) and characteristics inside the new host, even if they are spawned from scratch.

Instance HA is managed by three resource agents:

Agent name	Name inside cluster	Role
fence_compute	fence-nova	Marks a Compute node for evacuation when the node becomes unavailable
NovaEvacuate	nova-evacuate	Evacuates instances from failed nodes, and runs on one of the Controller nodes
nova-compute-wait	nova-compute-checkevacuate	Restarts Compute services on an instance once it is fully evacuated to a functional Compute host.

This guide focuses on enabling Instance HA on an overcloud through Ansible.



NOTE

For a brief description of the detection and evacuation process performed by Instance HA, see [Appendix A, Automated Evacuation Through Instance HA](#).

CHAPTER 2. ENVIRONMENT REQUIREMENTS AND ASSUMPTIONS

In order to enable Instance HA, your Red Hat OpenStack Platform overcloud must meet the following requirements:

- The environment was deployed using Red Hat OpenStack Platform director. See [Director Installation and Usage](#) for details.
- Fencing has already manually been enabled on the control plane.
- The following packages are installed on all nodes:
 - `fence-agents-4.0.11-66.e17_4.3` (or greater)
 - `pacemaker-1.1.16-12.e17.x86_64` (or greater)
 - `resource-agents-3.9.5-105.e17.x86_64` (or greater)
- The environment can tolerate a full outage of both Compute and Control planes.
- Shared storage is enabled within the environment for ephemeral and block storage. See [Section 2.1, “Exceptions for Shared Storage”](#) for related information.
- The Message Broker (AMQP) recognizes each Compute node’s hostname as valid. To check the hostname of a Compute node:


```
heat-admin@compute-n $ sudo crudini --get /etc/nova/nova.conf
                        DEFAULT host
```
- Each Compute node should be able to reach the endpoint set in `$OS_AUTH_URL`. In addition, this environment variable must be set to either:
 - The overcloud’s authentication service (which requires access to the external network), or
 - The internal authentication URL.



WARNING

When Instance HA is enabled, overcloud upgrade or scale-up operations are not possible. Any attempts to do so will fail. This includes both minor and major upgrades.

Before upgrading or scaling your overcloud, disable Instance HA first. For instructions, see [Chapter 5, Rollback](#).

2.1. EXCEPTIONS FOR SHARED STORAGE

Typically, enabling Instance HA requires shared storage. If you attempt to use the `no-shared-storage` option, you are likely to receive an `InvalidSharedStorage` error during evacuation, and

instances will not power up on the other node. However, if all your instances are configured to boot up from a Block Storage (**cinder**) volume, then you will not need shared storage to store the disk image of instances; you will be able to evacuate all instances using the **no-shared-storage** option.

During evacuation, if your instances are configured to boot from a Block Storage volume, any evacuated instances can be expected to boot up from the same volume, but on another Compute node. As a result, the evacuated instances can immediately restart their jobs, as the OS image and application data are kept on the Block Storage volume.

**NOTE**

The ansible-based deployment procedure in this guide supports installation with **no-shared-storage** option.

CHAPTER 3. DEPLOYMENT

The following procedure involves the use of *Ansible* to enable Instance HA. For more information about Ansible, see [Ansible Documentation](#).

3.1. CREATING THE NECESSARY ANSIBLE CONFIGURATION FILES

Enabling Instance HA through Ansible requires an *inventory file* and *SSH arguments file*. Both files pass the Ansible variables necessary for implementing Instance HA on your overcloud.

Inventory File

The inventory file lists the different target hosts for the ansible playbooks. It is divided into two sections: the first section lists each node (by name), along with the hostname, username, and private key file that Ansible should use for each playbook command. For example:

```
overcloud-controller-0 ansible_host=overcloud-controller-0
ansible_user=heat-admin ansible_private_key_file=/home/stack/.ssh/id_rsa
```

The second section lists each node under the following headings (or *node types*): **compute**, **undercloud**, **overcloud**, or **controller**.

Create an inventory file named `/home/stack/hosts`. The following sample demonstrates the syntax required for this:

```
undercloud ansible_host=undercloud ansible_user=stack
ansible_private_key_file=/home/stack/.ssh/id_rsa
overcloud-compute-1 ansible_host=overcloud-compute-1 ansible_user=heat-
admin ansible_private_key_file=/home/stack/.ssh/id_rsa
overcloud-compute-0 ansible_host=overcloud-compute-0 ansible_user=heat-
admin ansible_private_key_file=/home/stack/.ssh/id_rsa
overcloud-controller-2 ansible_host=overcloud-controller-2
ansible_user=heat-admin ansible_private_key_file=/home/stack/.ssh/id_rsa
overcloud-controller-1 ansible_host=overcloud-controller-1
ansible_user=heat-admin ansible_private_key_file=/home/stack/.ssh/id_rsa
overcloud-controller-0 ansible_host=overcloud-controller-0
ansible_user=heat-admin ansible_private_key_file=/home/stack/.ssh/id_rsa
```

```
[compute]
overcloud-compute-1
overcloud-compute-0
```

```
[undercloud]
undercloud
```

```
[overcloud]
overcloud-compute-1
overcloud-compute-0
overcloud-controller-2
overcloud-controller-1
overcloud-controller-0
```

```
[controller]
```

```
overcloud-controller-2
overcloud-controller-1
overcloud-controller-0
```

To generate a complete inventory of all hosts in both undercloud and overcloud, run the following command:

```
stack@director $ tripleo-ansible-inventory --list
```

This command will generate a detailed and updated inventory in JSON format. See [Running Ansible Automation](#) for more details.

SSH Arguments File

The SSH arguments file passes the necessary credentials and authentication settings needed by Ansible to run the playbooks on each target host.

Create an SSH arguments file using the following commands (from `/home/stack`):

```
stack@director $ cat /home/stack/.ssh/id_rsa.pub >>
/home/stack/.ssh/authorized_keys
stack@director $ echo -e "Host undercloud\n Hostname 127.0.0.1\n
IdentityFile /home/stack/.ssh/id_rsa\n User stack\n StrictHostKeyChecking
no\n UserKnownHostsFile=/dev/null\n" > ssh.config.ansible
stack@director $ source /home/stack/stackrc
stack@director $ openstack server list -c Name -c Networks | awk
'/ctlplane/ {print $2, $4}' | sed s/ctlplane=//g | while read node; do
node_name=$(echo $node | cut -f 1 -d " "); node_ip=$(echo $node | cut -f 2
-d " "); echo -e "Host $node_name\n Hostname $node_ip\n IdentityFile
/home/stack/.ssh/id_rsa\n User heat-admin\n StrictHostKeyChecking no\n
UserKnownHostsFile=/dev/null\n"; done >> ssh.config.ansible
```

These commands will result in the creation of an SSH arguments file named `/home/stack/ssh.config.ansible`, which will contain host-specific connection options for each overcloud node. For example:

```
Host overcloud-controller-0
  Hostname 192.168.24.11
  IdentityFile /home/stack/.ssh/id_rsa
  User heat-admin
  StrictHostKeyChecking no
  UserKnownHostsFile=/dev/null
```

3.2. PREPARING THE UNDERCLOUD

After creating the *inventory file* and *SSH arguments file* (from [Section 3.1, “Creating the Necessary Ansible Configuration Files”](#)), you can now prepare the overcloud for Instance HA:

1. Log in to the undercloud as the **stack** user.
2. Clone the **tripleo-ha-utils** Git repository.

```
stack@director $ git clone git://github.com/openstack/tripleo-ha-
utils
```

This repository contains the playbooks, roles, and other utilities necessary to enable and test Instance HA with Ansible.

3. Create `/home/stack/ansible.cfg` with the following contents:

```
[defaults]
roles_path = /home/stack/tripleo-ha-utils/roles
```

4. Export the `ansible.cfg`, hosts (the inventory file), and `ssh.config.ansible` (the SSH arguments file) to the following environment variables:

```
stack@director $ export ANSIBLE_CONFIG="/home/stack/ansible.cfg"
stack@director $ export ANSIBLE_INVENTORY="/home/stack/hosts"
stack@director $ export ANSIBLE_SSH_ARGS="-F
/home/stack/ssh.config.ansible"
```

5. Ensure that the node definition template of the overcloud (by default, `instackenv.json`) is located in `/home/stack/`. For more information about the node definition template, see [Registering Nodes for the Overcloud](#).

3.3. ENABLING INSTANCE HA

Once the undercloud is fully prepared, you can now run the prescribed playbooks you downloaded and extracted in [Section 3.2, “Preparing the Undercloud”](#). These playbooks allow you to enable Instance HA with or without configuring STONITH for Controller and Compute nodes. For more information about STONITH, see [Fencing the Controller Nodes](#).

To enable Instance HA and configure STONITH for both Controller and Compute nodes:

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-
utils/playbooks/overcloud-instance-ha.yml \
-e release="RELEASE"
```

By default, the playbook will install the instance-ha solution with shared storage enabled. If your overcloud does not use shared storage, use the `instance_ha_shared_storage=false` option:

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-
utils/playbooks/overcloud-instance-ha.yml \
-e release="RELEASE" -e instance_ha_shared_storage=false
```



NOTE

See [Section 2.1, “Exceptions for Shared Storage”](#) for more information about shared storage in Instance HA.

To enable Instance HA *without* configuring STONITH for both Controller and Compute nodes:

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-
utils/playbooks/overcloud-instance-ha.yml \
-e release="RELEASE" -e stonith_devices="none"
```

To enable Instance HA and configure STONITH only on Compute nodes (for example, if STONITH is already configured on the Controller nodes):

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-  
utils/playbooks/overcloud-instance-ha.yml \  
-e release="RELEASE" -e stonith_devices="computes"
```

CHAPTER 4. TESTING



WARNING

The following procedure involves deliberately crashing a Compute node. Doing so forces the automated evacuation of instances through Instance HA.

1. Boot one or more instances on the overcloud before crashing the Compute node hosting the instances in question:

```
stack@director $ . overcloudrc
stack@director $ nova boot --image cirros --flavor 2 test-failover
stack@director $ nova list --fields name,status,host
```

2. Log in to the Compute node hosting the instances you just booted (as in, *compute-n*):

```
stack@director $ . stackrc
stack@director $ ssh -lheat-admin compute-n
heat-admin@compute-n $
```

3. Crash the node:

```
heat-admin@compute-n $ echo c > /proc/sysrq-trigger
```

4. After several minutes, verify that these instances restarted on online Compute nodes. To check:

```
stack@director $ nova list --fields name,status,host
stack@director $ nova service-list
```

CHAPTER 5. ROLLBACK

When Instance HA is enabled, upgrade or scale-up operations are not possible. Any attempts to do so will fail. This includes both minor and major upgrades. Before upgrading or scaling your overcloud, disable Instance HA first.

To disable Instance HA, run the following as the **stack** user on the undercloud:

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-
utils/playbooks/overcloud-instance-ha.yml \
-e release="RELEASE" -e instance_ha_action="uninstall"
```

If you used the **stonith_devices** option when you enabled Instance HA , you need to specify the same option during rollback. For example, if your Instance HA configuration has STONITH disabled (as in [Section 3.3, “Enabling Instance HA”](#)), use:

```
stack@director $ ansible-playbook /home/stack/tripleo-ha-
utils/playbooks/overcloud-instance-ha.yml \
-e release="RELEASE" -e instance_ha_action="uninstall" -e
stonith_devices="none"
```

APPENDIX A. AUTOMATED EVACUATION THROUGH INSTANCE HA

With Instance HA, OpenStack automates the process of evacuating instances from a Compute node when that node fails. The following process describes the sequence of events triggered in the event of a Compute node failure.

1. When a Compute node fails, the **IPMI** agent performs *first-level fencing* and physically resets the node to ensure that it is powered off. Evacuating instances from online Compute nodes could result in data corruption or multiple identical instances running on the overcloud. Once the node is powered off, it is considered *fenced*.
2. After the physical IPMI fencing, the **fence-nova** agent performs *second-level fencing* and marks the fenced node with the “**evacuate=yes**” cluster per-node attribute. To do this, the agent runs:

```
$ attrd_updater -n evacuate -A name="evacuate" host="FAILEDHOST" value="yes"
```

Where *FAILEDHOST* is the hostname of the failed Compute node.

3. The **nova-evacuate** agent constantly runs in the background, periodically checking the cluster for nodes with the “**evacuate=yes**” attribute. Once **nova-evacuate** detects that the fenced node has this attribute, the agent starts evacuating the node using the same process as described in [Evacuate Instances](#).
4. Meanwhile, while the failed node is booting up from the IPMI reset, the **nova-compute-checkevacuate** agent will wait (by default, for 120 seconds) before checking whether **nova-evacuate** is finished with evacuation. If not, it will check again after the same time interval.
5. Once **nova-compute-checkevacuate** verifies that the instances are fully evacuated, it triggers another process to make the fenced node available again for hosting instances.

APPENDIX B. MANUAL PROCEDURE AUTOMATED BY ANSIBLE PLAYBOOKS

The Ansible-based solution provided by this document is designed to automate a manual procedure for configuring Instance HA in a supported manner. For reference, this appendix provides the steps automated by the solution.

1. Stop and disable the Compute service on each Compute node:

```
heat-admin@compute-n $ sudo systemctl stop openstack-nova-compute
heat-admin@compute-n $ sudo systemctl disable openstack-nova-compute
```

2. Create an authentication key for use with *pacemaker-remote*. Perform this step on the director node:

```
stack@director # dd if=/dev/urandom of=~/.authkey bs=4096 count=1
```

3. Copy this key to the Compute and Controller nodes:

```
stack@director # scp authkey heat-admin@node-n:~/
stack@director # ssh heat-admin@node-n:~/
heat-admin@node-n $ sudo mkdir -p --mode=0750 /etc/pacemaker
heat-admin@node-n $ sudo chgrp haclient /etc/pacemaker
heat-admin@node-n $ sudo mv authkey /etc/pacemaker/
heat-admin@node-n $ sudo chown root:haclient /etc/pacemaker/authkey
```

4. On each Compute node, enable the *pacemaker-remote* service and configure the firewall accordingly:

```
heat-admin@compute-n $ sudo systemctl enable pacemaker_remote
heat-admin@compute-n $ sudo systemctl start pacemaker_remote
heat-admin@compute-n $ sudo iptables -I INPUT 11 -p tcp --dport 3121
-j ACCEPT ; /sbin/service iptables save
```

5. Confirm that the required versions of the pacemaker (**1.1.12-22.e17_1.4.x86_64**) and resource-agents (**3.9.5-40.e17_1.5.x86_64**) packages are installed on the Controller and Compute nodes:

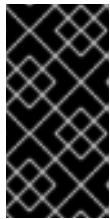
```
heat-admin@controller-n $ sudo rpm -qa | egrep
\'(pacemaker|resource-agents)\'
```

6. Create a *NovaEvacuate* active/passive resource using the *overcloudrc* file to provide the **auth_url**, **username**, **tenant** and **password** values:

```
stack@director # scp overcloudrc heat-admin@controller-1:~/
heat-admin@controller-1 $ . ~/overcloudrc
heat-admin@controller-1 $ sudo pcs resource create nova-evacuate
ocf:openstack:NovaEvacuate auth_url=$OS_AUTH_URL
username=$OS_USERNAME password=$OS_PASSWORD
tenant_name=$OS_TENANT_NAME
```

**NOTE**

If you are not using shared storage, include the **no_shared_storage=1** option. See [Section 2.1, “Exceptions for Shared Storage”](#) for more information.

**IMPORTANT**

As mentioned earlier in [Chapter 2, *Environment Requirements and Assumptions*](#), the **\$OS_AUTH_URL** must be reachable by each Compute node. This environment variable should be set to either the overcloud's authentication service or the internal authentication URL.

7. Confirm that *nova-evacuate* is started after the floating IP resources, and the Image Service (glance), OpenStack Networking (neutron), Compute (nova) services:

```
heat-admin@controller-1 $ for i in $(sudo pcs status | grep IP | awk
\{'{ print $1 }\'}); do sudo pcs constraint order start $i then nova-
evacuate ; done
```

8. Create a list of the current Controllers using **cibadmin** data:

```
heat-admin@controller-1 $ controllers=$(sudo cibadmin -Q -o nodes |
grep uname | sed s/.\*uname../ | awk -F" \{'{print $1}\'}')
heat-admin@controller-1 $ echo $controllers
```

9. Use this list to tag these nodes as Controllers with the **osprole=controller** property:

```
heat-admin@controller-1 $ for controller in ${controllers}; do sudo
pcs property set --node ${controller} osprole=controller ; done
heat-admin@controller-1 $ sudo pcs property
```

The newly-assigned roles should be visible under the **Node attributes** section.

10. Build a list of *stonith* devices already present in the environment:

```
heat-admin@controller-1 $ stonithdevs=$(sudo pcs stonith | awk
\{'{print $1}\'}')
heat-admin@controller-1 $ echo $stonithdevs
```

11. Tag the control plane services to make sure they only run on the Controllers identified above, skipping any stonith devices listed:

```
heat-admin@controller-1 $ for i in $(sudo cibadmin -Q --xpath
//primitive --node-path | tr ' ' '\n' | awk -F "id=\"" '{print $2}'
| awk -F "\"" '{print $1}' | uniq); do
    found=0
    if [ -n "$stonithdevs" ]; then
        for x in $stonithdevs; do
            if [ $x = $i ]; then
                found=1
            fi
        done
    fi
    if [ $found = 0 ]; then
```

```

sudo pcs constraint location $i rule resource-
discovery=exclusive score=0 osprole eq controller
fi
done

```

12. Populate the *nova-compute* resources within *pacemaker*.

```

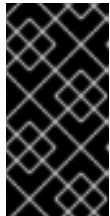
heat-admin@controller-1 $ . /home/heat-admin/overcloudrc
heat-admin@controller-1 $ sudo pcs resource create nova-compute-
checkevacuate ocf:openstack:nova-compute-wait auth_url=$OS_AUTH_URL
username=$OS_USERNAME password=$OS_PASSWORD
tenant_name=$OS_TENANT_NAME domain=localdomain op start timeout=300
--clone interleave=true --disabled --force

```



NOTE

This command assumes that you are using the default cloud domain name **localdomain**. If you are using a custom cloud domain name, set it as the value of the **domain=** parameter.



IMPORTANT

As mentioned earlier in [Chapter 2, Environment Requirements and Assumptions](#), the **\$OS_AUTH_URL** must be the reachable by each Compute node. This environment variable should be set to either the overcloud's authentication service or the internal authentication URL.

```

heat-admin@controller-1 $ sudo pcs constraint location nova-compute-
checkevacuate-clone rule resource-discovery=exclusive score=0
osprole eq compute
heat-admin@controller-1 $ sudo pcs resource create nova-compute
systemd:openstack-nova-compute op start timeout=60s --clone
interleave=true --disabled --force
heat-admin@controller-1 $ sudo pcs constraint location nova-compute-
clone rule resource-discovery=exclusive score=0 osprole eq compute
heat-admin@controller-1 $ sudo pcs constraint order start nova-
compute-checkevacuate-clone then nova-compute-clone require-all=true
heat-admin@controller-1 $ sudo pcs constraint order start nova-
compute-clone then nova-evacuate require-all=false

```

13. Add stonith devices for the Compute nodes. Run the following command for each Compute node:

```

heat-admin@controller-1 $ sudo pcs stonith create ipmilan-overcloud-
compute-N fence_ipmilan pcmk_host_list=overcloud-compute-0
ipaddr=10.35.160.78 login=IPMILANUSER passwd=IPMILANPW lanplus=1
cipher=1 op monitor interval=60s;

```

Where:

- *N* is the identifying number of each compute node (for example, **ipmilan-overcloud-compute-1**, **ipmilan-overcloud-compute-2**, and so on).

- `IPMILANUSER` and `IPMILANPW` are the username and password to the IPMI device.

14. Create a separate `fence-nova` stonith device:

```
heat-admin@controller-1 $ . overcloudrc
heat-admin@controller-1 $ sudo pcs stonith create fence-nova
fence_compute \
                                auth-url=$OS_AUTH_URL \
                                login=$OS_USERNAME \
                                passwd=$OS_PASSWORD \
                                tenant-name=$OS_TENANT_NAME \
                                record-only=1 --force \
                                domain=localdomain
```



NOTE

This command assumes that you are using the default cloud domain name **localdomain**. If you are using a custom cloud domain name, set it as the value of the **domain=** parameter.

If you are not using shared storage, include the **no_shared_storage=1** option. See [Section 2.1, “Exceptions for Shared Storage”](#) for more information.

15. Configure the required constraints for `fence-nova`:

```
heat-admin@controller-1 $ sudo pcs constraint location fence-nova
rule resource-discovery=never score=0 osprole eq controller
heat-admin@controller-1 $ sudo pcs constraint order promote galera-
master then fence-nova require-all=false
heat-admin@controller-1 $ sudo pcs constraint order start fence-nova
then nova-compute-clone
```

16. Make certain the Compute nodes are able to recover after fencing:

```
heat-admin@controller-1 $ sudo pcs property set cluster-recheck-
interval=1min
```

17. Create Compute node resources and set the stonith *level 1* to include both the nodes’s physical fence device and `fence-nova`. To do so, run the following for each Compute node:

```
heat-admin@controller-1 $ sudo pcs resource create overcloud-
compute-N ocf:pacemaker:remote reconnect_interval=60 op monitor
interval=20
heat-admin@controller-1 $ sudo pcs property set --node overcloud-
compute-N osprole=compute
heat-admin@controller-1 $ sudo pcs stonith level add 1 overcloud-
compute-N ipmilan-overcloud-compute-N,fence-nova
heat-admin@controller-1 $ sudo pcs stonith
```

Replace *N* with the identifying number of each compute node (for example, **overcloud-compute-1**, **overcloud-compute-2**, and so on). Use these identifying numbers to match each Compute nodes with the stonith devices created earlier (for example, **overcloud-compute-1** and **ipmilan-overcloud-compute-1**).

Allow some time for the environment to settle before cleaning up any failed resources:

```
heat-admin@controller-1 $ sleep 60
heat-admin@controller-1 $ sudo pcs resource cleanup
heat-admin@controller-1 $ sudo pcs status
heat-admin@controller-1 $ sudo pcs property set stonith-enabled=true
```