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## NexentaStor 5.0 HA CLI QuickStart Guide

The NexentaStor High Availability (HA) cluster is an enterprise-proven add-on feature to NexentaStor that manages the availability of critical storage pools. This Admin Guide demonstrates the basic steps and commands for configuring and managing the NexentaStor 5.0 HA cluster using the NexentaStor 5.0 Command Line Interface (CLI). For additional user documentation, see <https://nexenta.com/products/documentation>.

### Document History

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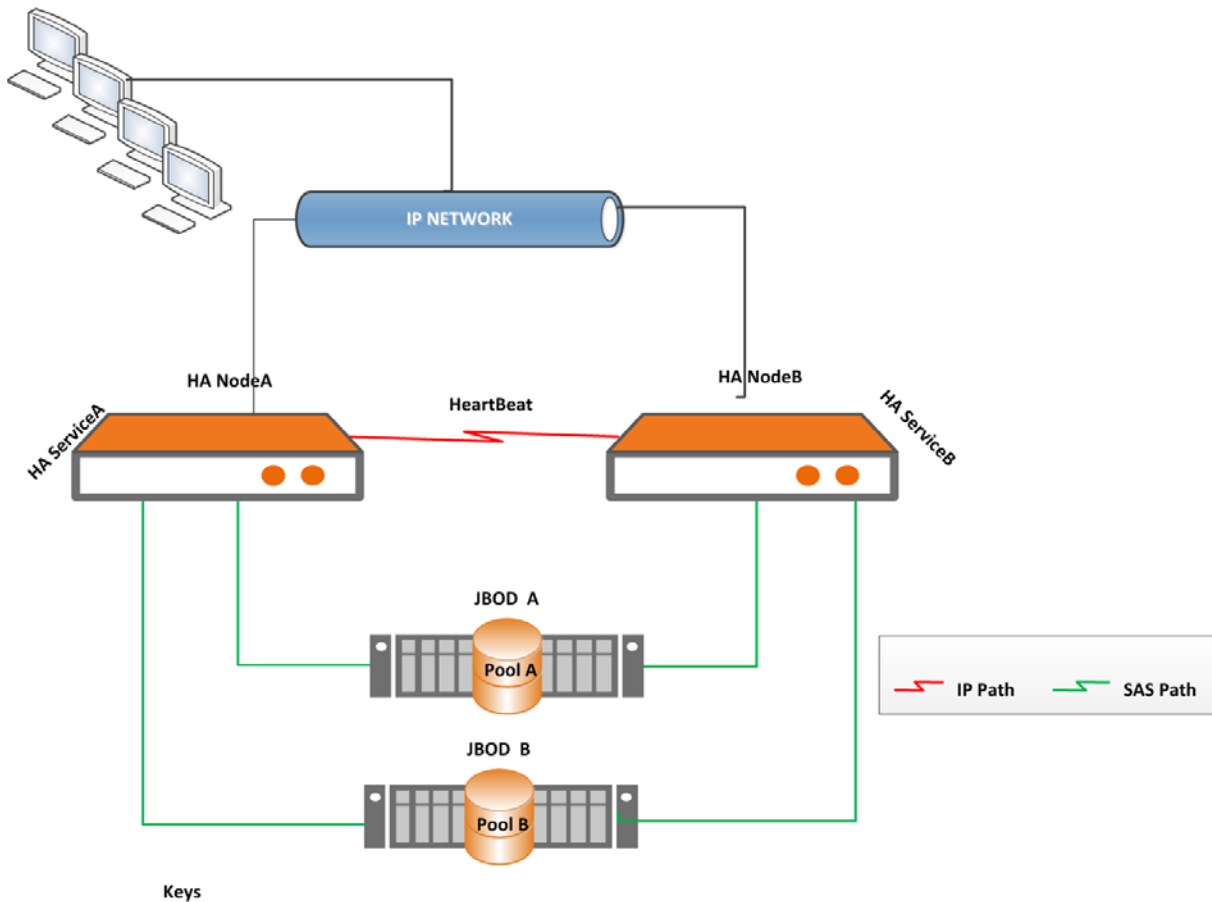
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## About NexentaStor HA

An HA cluster consists of two servers with shared storage that can have any number of configured HA services. Each service in the cluster contains one or more storage pools with associated VIPs. Pools must be built using shared storage devices that are accessible from both the nodes. The high availability of the pools is maintained by the cluster software that manages the startup and failover of the HA services within the cluster.

The following diagram shows a typical Active / Active 2-node (NodeA, NodeB) HA cluster configuration consisting of two HA services (ServiceA, ServiceB), each of which has one pool (Pool A, Pool B). Under normal operation, each node is responsible for providing services to one pool. In the event of a node failure, the surviving node takes over the HA services for both the pools.



- Pools should be built using shared disks.
- Pools must be explicitly imported on the node that handles HA service creation request.

When the failed node is repaired and restarted, it rejoins the cluster and the administrator can control when the redistribution of the services.

Each node in the cluster communicates with the other node through different heartbeat mechanisms. The HA cluster detects system failure when no heartbeat updates from a node have been seen across all mechanisms for a specified time period.

## Definition of Terms

The terms in Table 1 are used throughout this document.

**Table 1: Definition of Terms**

Term	Definition
HA Cluster	<p>The term HA Cluster refers to the set of hardware that encompasses a pair of NexentaStor appliances with the shared storage. These clustered nodes are configured to exchange heartbeats through specified communication channels that provide information about their states.</p> <p><code>hacluster</code> lists all the HA cluster CLI subcommands.  <code>hacluster &lt;subcommand name&gt; -h</code> lists the available options for the subcommand.</p>
HA Service	<p>The term HA service refers to the service that is run on the clustered nodes to provide high availability access to the user's data. HA service consists of a pool residing on shared storage and optionally one or more VIP addresses for data access. When the HA service detects a node failure, it transfers ownership of the shared storage to the other node in the cluster pair.</p> <p><code>haservice</code> lists all the HA service CLI subcommands.  <code>haservice &lt;subcommand name&gt; -h</code> lists the available options for the subcommand.</p>

An HA cluster:

- Is a pair of NexentaStor appliances with the HA feature licensed on both nodes.
- Runs a defined set of services and monitors each cluster node member for failures. These NexentaStor appliances are connected through various communication channels and exchange heartbeats that provide information about their states.
- Can have one or more multiple pools per HA service.
- Includes a built-in monitoring mechanism that detects a failure in the interface (for example, public network interface or Fibre Channel interface) between the clients and the datasets that can trigger an automatic failover to the other node in the cluster.

An HA service:

- Has any number of VIPs that fail over with the pool.
- Has a sequence of startup and shutdown scripts that describe how to secure and release physical storage, import and export the pools, start file services, and VIPs. These scripts also contain configurable timeout parameters to set how long the nodes should wait before failing over the services.

HA services are managed independently from one another and can be in several possible states.

**Table 2: HA Service States**

Service State	Description
Starting	The startup scripts associated with the service are being launched.
Running	The service is operating and the associated pool(s) is now accessible. For this state, VIPs are also configured.
Stopping	The shutdown scripts associated with the service are being launched.
Stopped	The shutdown scripts successfully completed, the service has halted and access to the associated pool is now denied.
Broken_safe	A problem occurred while starting the service on the server, but it has been stopped safely and can be started again elsewhere.
Broken_unsafe	A fatal problem occurred while starting or stopping the service on the server. The service cannot

	be safely run on any other server in the cluster until it has been repaired by the operator.
Bouncing	Upon user request, the stop scripts for a service are launched. If they succeed, the service is immediately restarted on this server.
Panicking	A problem has been detected, and an attempt to take some corrective action is being made.
Panicked	A fatal error occurred whilst running a service, and it cannot run on any server until it is repaired.
Aborting	The startup scripts for a service have failed, and the stop scripts are being run in an attempt to make the service safe to run elsewhere.

**Note:** The failover and recovery time is largely dependent on the amount of time it takes to fail over the pool components (such as disks, filesystems, and volumes) to the alternate appliance. Failover time is reduced when using fewer volumes or file systems in each pool.

## Preparing for HA

For a successful rollout of HA services, ensure that the following items are in place:

- License token for the HA feature is available and activated for each node in the cluster.
- Static IP address for each node in a cluster is known.
- Shared physical storage across 2 nodes in a cluster exists.
- Private network connection established via a network patch cable using two unused ethernet ports between the heads is recommended.

## Outline of HA Service Configuration

- Create a cluster named `democluster` on cluster nodes `nef06` and `nef07`.
- Discover unclustered pools that are available to become members of the cluster.
- Create an HA service named `hapool` for a shared pool with one or more VIP services.
- Optionally, add more pools to the HA service `hapool`.
- Now initiate the service, start `hapool` service on `nef06`.
- Set the service `hapool` to failover manually or automatically.

## Configuring Cluster

The cluster creation process involves the following tasks:

- Verify that the HA feature is licensed and enabled on both NexentaStor appliances in the cluster.
- Update the host table on both the nodes so that the cluster nodes can resolve the IP address(es) of it's partner without relying on DNS services.
- Verify that the system day and time settings on each of the cluster member nodes are in sync.
- Create a new cluster.
- Verify the cluster status.

## Verify HA Cluster Feature

The HA feature is available after activating the product license with the HighAvailability option has been applied on each of the cluster member nodes. Using the command below, verify that the HA feature is indeed running on each node in the cluster.

```
CLI@nexenta> license show
```

Command output:

```
PROPERTY      VALUE
guid          44454c4c-5200-1051-8058-b3c04f563532
valid         yes
status        ok
type          ENTERPRISE
product       NexentaStor
version       5.0.0.1
licensee      h.s@acme.com
serial        SR-DEV-NS-201614507
features      highAvailability
issued       Mon Sep 19 17:00:00 2016
expires       Sun Oct 30 17:00:00 2016
capacity      no limit
subscription  Mon Sep 19 17:00:00 2016 - Sun Oct 30 17:00:00 2016 (valid)
```

If the HA feature is not listed under the features, contact [sales@nexenta.com](mailto:sales@nexenta.com) to obtain your HA license token then run:

```
CLI@nexenta> license activate <Activation Token>
```

## Update the Host Table

On the first node in a cluster environment, update the hosts to ensure that they resolve to each other.

```
CLI@nexenta> net create host <IP address of the second node> <host name of the second node>
```

Example:

```
CLI@nexenta> net create host 10.3.53.110 nef07
```

Do the equivalent on the second node.

```
CLI@nexenta> net create host 10.3.53.109 nef06
```

Verify if they resolve to each other by running the following command on both the nodes.

```
CLI@nexenta> net list host
```

Example:

ADDRESS	HOSTNAME	ALIAS	PROTOCOL
::1	localhost	-	ipv6
127.0.0.1	localhost	loghost	ipv4
10.3.53.109	nef06	-	ipv4
10.3.53.110	nef07	-	ipv4

## Enable the HA Service

To find out if the HA service is running on each cluster node:

```
CLI@nexenta> svc list ha
```

NAME	DESCRIPTION	STATE
ha	HA cluster service	online

If HA service is not online, enable it:

```
CLI@nexenta> svc enable ha
```

## Discover Un-configured Nodes

Run the following command from both the nodes.

```
CLI@nexenta> hacluster find-nodes
```

NODE	ADDRESS	CRC	STARTUP TIME
nef07	10.3.53.110	ba52	2016-03-24T16:49:44
nef06	10.3.53.109	ba52	2016-03-24T16:49:43

## Create a New Cluster

Before creating a cluster, verify that the system day and time settings on each of the cluster member nodes are in sync.

```
CLI@nexenta> config list system.date
```

NAME	FLAGS	VALUE
system.date	--	Fri Mar 31 08:58:11 2017

To set the system date and time:

```
CLI@nexenta> config set system.date=3/31/2017 9:20:00
```

On one node, create a cluster by providing the hostnames of the two nodes in this command. The following command creates a cluster named `democluster` on the two nodes `nef06` and `nef07`.

```
CLI@nexenta> hacluster create -d "NEF cluster" nef06,nef07 democluster
```

When creating the cluster, you may add network heartbeats using the `-H` option in the command. See the following example.

```
CLI@nexenta> hacluster create -d "Extra HBs" -H nef06-priv:nef07-priv,nef07-priv:nef06-priv nef06,nef07 democluster
```

## Add Heartbeats

Once you create a HA cluster, you can add a network or a disk heartbeat.

To add a network heartbeat, Nexenta recommends using a private dedicated network connection available between the nodes.

```
CLI@nexenta> hacluster add-net-heartbeat nef06-hb2 192.168.71.3 nef07-hb2 192.168.71.4
```

To add a disk heartbeat:

```
CLI@nexenta> hacluster add-disk-heartbeat nef06 nef07 hb c2t0d0
```

## View the Cluster Status

Now that the cluster `testcluster` is created, you can use the command below to view the status of the two-node cluster with a network heartbeat between the nodes. Sample output is included below.

```
CLI@nexenta> hacluster status
```

Command output:

```
== Cluster status ==
NAME          STATUS  NODES  SERVICES  DESCRIPTION
democluster  ok      2/2    0/0        No description given

== Cluster configuration ==
FC MONITORING  SERIAL HEARTBEATS  ENABLED  NETWORK MONITORING
no             no                  yes      yes

== Nodes ==
NODE    STATUS  SERVICES  ADDRESS          HostId  Release
nef06   up      0/0       10.3.53.109     4ef54012 3.12.0
nef07   up      0/0       10.3.53.110     93c69949 3.12.0

== Heartbeats ==
FROM    TO      STATUS  TYPE
nef07   nef06   up      network
nef06   nef07   up      network
```



## Manage Cluster

You can manage the cluster using the `hacluster` subcommands in Table 4.

**Table 4: Managing an HA Cluster**

Cluster Tasks	Description	Command
Reset	Removes the cluster service without destroying it.	<code>CLI@nexenta&gt; hacluster reset &lt;cluster&gt;</code>
Remove/destroy cluster	Once you remove a cluster, all clustered pools remain imported. If any cluster services are not in an Exported or Available state, they will need to be repaired before this command will succeed. The administrator must explicitly repair the broken service first, and then destroy the cluster.	To destroy a cluster: <code>CLI@nexenta&gt; hacluster destroy &lt;cluster&gt;</code>
Remove a shared pool from the cluster	Before removing a shared pool from a cluster, make sure you remove the HA service associated with that pool using the <code>haservice delete-pool</code> command. Otherwise, the <code>poolremove</code> or <code>pool export</code> command will fail.	<code>CLI@nexenta&gt; pool remove [-nv] &lt;pool&gt; &lt;disk&gt;</code> after removing the HA service which hosts the pool.
Import a shared pool	To put a shared pool under cluster control, you must import it.	<code>CLI@nexenta&gt; pool import [-nvD] [-s paths] [-c &lt;cache-file&gt;] [-R altroot] [-o &lt;properties&gt;] &lt;pool&gt; [&lt;new-name&gt;]</code>
Find the list of exported pools	The <code>pool import</code> subcommand with no argument yields the list of exported pools.	<code>CLI@nexenta&gt; pool import</code>

# Configuring HA Services

## Prerequisites

Before creating the HA service after the cluster is created, complete the following tasks:

- Verify that the cluster exists. See the previous chapter on how to create a cluster.
- Create a new pool or import an existing pool using devices that reside on shared storage.
- Validate that the shared pool is visible to both nodes and eligible to be placed under cluster control.
- Discover unclustered pools that are available to become members of a cluster.
- HA services can be created only from imported pools. Pools must be explicitly imported on the node that initiated the service creation request.
- The HA service name must be identical to the pool name and must contain only alpha-numeric characters.  
See the *NexentaStor 5.0 CLI Configuration QuickStart* for instructions on how to create and import a pool.
- After you have completed all these configuration steps, proceed with creating an HA service for the shared pool. You do not have to explicitly add a pool to the HA service. You can create an HA service with zero to any number of virtual IP addresses (VIPs).
- Optionally, add more disks or network interfaces to the heartbeat configuration after the service is configured.

Note: You don't require VIP for FibreChannel (FC) failover.

## Discover Unclustered Pools

Using the command below, you can find imported pools that can be used later when you create an HA service. On both the nodes, ensure that the pool is available for clustering.

```
CLI@nexenta> hacluster find-pools
```

Command output:

NAME	GUID
test	1797983880284287424
hapool	5795983885284640389

Note: this command will only show pools that have all of their components online and `_visible_` to both nodes. If one node of the cluster does not detect all of the components of a pool, it will not be eligible to be added in as a service.

Nexenta recommends that you always verify that the shared pool is in a healthy state before creating an HA service. The HA cluster command does not detect disk and pool failures.

```
CLI@nexenta> pool status <name of the pool>
```

## Create an HA Service

We can now add a service named `hapool` to control the currently imported pool (also named `hapool`) on node `nef06` with the VIP address `vip01(10.3.53.111/255.255.255.0` in the example below). When creating a service, you can specify the node where you intend the service to start. You can also specify the list of nodes on which the HA service is allowed to run. If you do not provide the node name, the service is initiated from a random node among available cluster nodes.

You can create an HA service with or without virtual IP addresses (VIPs). Nexenta recommends to create VIP(s) for nfs, smb shares and iSCSI LUNs for successful failover of the shares in case of a disaster.

Create the HA service using the following command:

```
CLI@nexenta> haservice create [-evnf] [-d <description>] [-m <node>] [-r
<timeout>] [-i <delay>] [-g <guid>] [-N <nodes>] [-V <vips>] <pool>
```

Example:

```
CLI@nexenta> haservice create -V
vip01@10.3.53.111/255.255.255.0=nef06:e1000g0,nef07:e1000g0 -m nef06
hapool
```

**Note:** The HA service name must match the pool name, a required argument to the command.

The example above configures the following:

- Using the `-m` flag, the node `nef06` is designated as the main or local server from which the HA service `hapool` should run.
- The VIP is created as part of the HA service creation so no additional steps are required to add a VIP to the HA service. These VIPs are resolvable for both nodes and assigns the address to the given interfaces.
- The HA service immediately starts on one of the cluster nodes right after service creation, either on the local node (if the `-m` flag is used) or on a different node as specified in the `haservice create` command.

## View HA Services

You can view the list of HA services you created using the command below. If you do not specify the service name, all the services for the cluster are listed. The following command below displays the nodes, VIPs, HA service state, and cluster nodes associated with the `hapool` HA service.

```
CLI@nexenta> haservice list
```

Command output:

NAME	DESCRIPTION	VIPS	NODES	RUNNING	STOPPED	BROKEN
hapool	zup service	vip01	nef06,nef07	nef06	nef07	-

## Add Pools to an HA service

You can also add a second pool to the HA service you created. When you add a second pool to the HA service, both the pools are now associated with the same `hapool` service and will failover together as members of the cluster.

```
CLI@nexenta> haservice add-pool <service> <pool> <guid>
```

Example:

```
CLI@nexenta> haservice add-pool hapool smallHa <guid>
```

## Initiate HA Service

After you created an HA service, you can set the specific service to start either in automatic (-a) or manual (-m) mode. The command below specifies that the hapool service will be started automatically.

```
CLI@nexenta> haservice set-mode [-amnv] <service> <node>
```

Example:

```
CLI@nexenta> haservice set-mode -a hapool nef06
```

If you selected the manual mode, restart the service manually with the following CLI command.

```
CLI@nexenta> haservice start <service> <node>
```

Example:

```
CLI@nexenta> haservice start hapool nef06
```

See the *Troubleshooting* chapter at the end of this document if the HA service fails to start.

## Verify the Service

Verify the service you created.

```
CLI@nexenta> haservice status <service>
```

Example:

```
CLI@nexenta> haservice status hapool
==service==

hapool

==status==

NODE          STATUS          MODE          UNBLOCKED

nef06         broken_safe     automatic     yes

nef07         broken_unsafe   automatic     yes

==pools==

NAME          GUID              PRIMARY

hapool       13660110209781822772  yes

==VIP==

NAME          ADDRESS          IPv6  NODE    NIC

vip01        10.3.53.111/255.255.255.0  no    nef06   e1000g0
```

```
nef07 e1000g0
```

```
init timeout: 20

run timeout: 8

disk heartbeats: not available

==SCSI reservations==

NODE      DISK      TYPE

universe  c2t2d0    SCSI2
```

## Update Default Netmask and VIP

You provided a network mask as part of the VIP information when you created the HA service. You can modify this default netmask value according to your configuration needs at any time. The command below reconfigures the VIP address in a clustered service `hapool`.

```
CLI@nexenta> haservice update-vip [-nv] [-a <address>] [-N <nics>]
<service> <vip>
```

Example:

```
CLI@nexenta> haservice update-vip -a 1.2.3.4/255.0.0.0 hapool vip05
```

## Preparing FC and iSCSI for Failover

Table 3 below provides a checklist that can be used to prepare for a successful iSCSI and FC volume failovers. When the following configurations are completed on one of the cluster nodes, they are shared across the nodes in the cluster.

For more information on creating and sharing FC and iSCSI CLI volumes, configuring targets, target groups, and mapping LUNS see the *NexentaStor CLI Configuration QuickStart* at <https://nexenta.com/products/documentation>.

**Table 3: FC and iSCSI Failover Checklist**

Checklist Items	Related FC CLI Commands	Related iSCSI CLI Commands
Configure targets	fctarget	iscsitarget, iscsiauth
Configure target groups	targetgroup	targetgroup
Map LUNs	Lunmapping, logicalunit	Lunmapping, logicalunit
Verify that you can mount volume shares for clients		
Check for network connectivity between primary and failover node		

Following are the additional steps needed for a successful FC failover:

1. Enable ALUA on any one of the HA cluster node.
2. Ensure that you have cluster setup before enabling ALUA.

```
CLI@nexenta> config set ha.alua.enabled=true
```

3. Verify if ALUA is enabled.

```
CLI@nexenta> config list ha.alua
```

```
NAME      FLAGS  VALUE
ha.alua  --    enabled: true
```

## Failover

In the event of either node failing (nef06 failing in this example) the surviving node, nef07, takes over the HA service for the pool if it is built using the shared storage devices that are accessible from both the nodes.

The following example shows how the HA service (hapool) failed over to the node (nef07) when the node (nef06) was powered off.

1. List the HA services running on the clustered nodes.

```
CLI@nef06> haservice list
NAME      DESCRIPTION      NODES          RUNNING  STOPPED  BROKEN
hapool    myclusterservice nef06,nef07    nef06    nef07    -
```

This example shows a single HA service (hapool) running on node nef06.

2. Verify the existing pools on both the nodes.

```
CLI@nef06> pool list
NAME      SIZE    ALLOC  FREE  AVAIL  DEDUP  EXPANDSZ  FRAG  HEALTH
hapool    9.63G  100.2M  9.53G  99%    1.00x  -         0%    ONLINE
rpool     12.47G  7.41G  5.06G  41%    1.00x  -         26%   ONLINE
```

**3. Verify the status of the HA service.**

```
CLI@nef06> haservice status

Service: hapool
NODE      STATUS   MODE      UNBLOCKED

nef06     running automatic yes

nef07     stopped  automatic yes
```

From the above example you notice that the service is running on the node nef06.

**4. Now power off the node that has the HA (nef06) service running.**

```
CLI@nef06> poweroff
```

**5. Now check the status of the HA service from the surviving node.**

The example here shows only one cluster service running on nef06. If you have more than one service on the node, when failing over, all the services will fail over to the other node in the cluster.

```
CLI@nef07> haservice status

Service: hapool
NODE      STATUS   MODE      UNBLOCKED

nef06     stopped  automatic yes

nef07     running  automatic yes
```

**6. Now check the status of the HA cluster from the surviving node.**

```
CLI@nef07> hacluster status

== Nodes ==

NODE      STATUS  SERVICES  ADDRESS      HostId      Release
nef06    up      0/1       10.3.53.109  1fb4ba7c   3.12.0
nef07    up      1/1       10.3.53.110  808b556b   3.12.0
```

**7. From nef07 verify that the pool(hapool) imported to it.**

```
CLI@nef07> pool list
NAME     SIZE     ALLOC    FREE    AVAIL    DEDUP    EXPANDSZ    FRAG    HEALTH
hapool  9.63G   100.2M   9.53G   99%     1.00x    -           0%     ONLINE
rpool   12.47G   7.41G    5.06G   41%     1.00x    -           26%    ONLINE
```

To force a failover of all running services from one cluster node to another:

```
CLI@nexenta> haservice failover <from-node> <to-node>
```

## Failback

When the failed node is repaired and restarted, it rejoins the cluster and you as an administrator can control where the pool is redistributed. Now to failback the pool (hapool) to the repaired node nef06 run the following command on the nef07 node.

```
CLI@nexenta> haservice move <service> <node>
```

Example:

```
CLI@nef07> haservice move hapool nef06
```

This sets the cluster back in its original configuration with the pool (hapool) on node (nef06).



## Manage HA Services

Using the `haservice` subcommands in Table 5, you can perform the following operations on an HA service:

**Table 5: Managing an HA Service.**

Service Operation	Command
List all the created HA services	CLI@nexenta> <code>haservice list</code>
Stop service on a specific node. Start service on a specific node.	CLI@nexenta> <code>haservice stop &lt;service&gt;</code> <node> CLI@nexenta> <code>haservice stop hapool nef06</code> CLI@nexenta> <code>haservice start hapool nef06</code>
Remove a specific service. Once the service has been destroyed, the associated pools are exported.	CLI@nexenta> <code>haservice destroy hapool</code> Deletes the service <code>hapool</code> .
Force a failover of all running services from one cluster node to another.	CLI@nexenta> <code>haservice failover [-ynvs]</code> <from-node> <to-node>
Fail over an HA service to a different node.	CLI@nexenta> <code>haservice move hapool nef07</code> Moves the service <code>hapool</code> to node <code>nef07</code> .
Mark the <code>broken_unsafe</code> service as recovered. Note: The failure that caused the broken service has to be resolved before running this or you will risk crashing the head or possible data corruption.	CLI@nexenta> <code>haservice mark hapool nef07</code> Marks the service <code>hapool</code> as recovered.
Set the service to start on auto ( <code>-a</code> ) or manual ( <code>-m</code> ) mode.	CLI@nexenta> <code>haservice set-mode -m hapool nef06</code> Sets the HA service <code>hapool</code> to manual mode in node <code>nef06</code> .
Display the HA service status and the configured VIPs for a specified service.	CLI@nexenta> <code>haservice status &lt;service name&gt;</code>
Delete a pool from an HA service	CLI@nexenta> <code>haservice delete-pool hapool &lt;pool name&gt;</code>
Adding VIP to an existing HA service: The appliances in the HA Cluster group must be resolvable to each other. This means they must be able to detect each other on the network and communicate. When you configure or create the cluster, NexentaStor automatically adds the VIPs to the <code>/etc/hosts</code> file on both the appliances. In the following example, the VIP <code>vip05</code> with IP address <code>9.8.7.6</code> and netmask <code>255.0.0.0</code> is added to the HA service named <code>hapool</code> .	CLI@nexenta> <code>haservice add-vip hapool vip05 9.8.7.6/255.0.0.0 nef06:e1000g0,nef07:e1000g0</code>
Delete, or update a VIP address associated with an HA service.	CLI@nexenta> <code>haservice delete-vip hapool vip05</code> CLI@nexenta> <code>haservice update-vip hapool vip05</code>

---

## Advanced Configuration

### Add Disks or Network Interfaces to the Heartbeat Configuration

Once the cluster is configured, the nodes in the HA cluster constantly monitor the state and status of the other appliance in the cluster using a heartbeat mechanism. Heartbeats are used to ascertain that a cluster node has failed before the fallback node takes over its services.

NexentaStor provides several heartbeat channels to communicate between the nodes in the cluster. Each node in the Cluster communicates with the other node using a shared disk or a network interface. HA cluster detects a system failure when no updates are received from all heartbeat mechanisms for a specified time interval. To improve reliability, you can add more disks or network interface to the heartbeat configuration using the following commands.

```
CLI@nexenta> hacluster add-disk-heartbeat [-nyv] <first-node> <second-node>
<service> <disk>
```

Example:

```
CLI@nexenta> hacluster add-disk-heartbeat nef06 nef07 democluster <disk>
```

where `democluster` is the HA service running on the node where the disk resides.

If a network interface fails on any one of the nodes, you can add a second interface to the heartbeat configuration to maintain the heartbeat communication.

```
CLI@nexenta> hacluster add-net-heartbeat <first-node> <first-ip> <second-
node> <second-ip>
```

To remove a node from the cluster or to change the heartbeat disk or the NIC, you must delete the heartbeat.

```
CLI@nexenta> hacluster delete-heartbeat <id>
```

# Troubleshooting

This chapter includes tips and tools to help in troubleshooting common problems.

## Diagnose Unsuccessful HA Cluster Creation or Cluster Start

- Check if the HA feature is enabled on the clustered nodes using the `license show` command. If not enabled, obtain an HA license token from [sales@nexenta.com](mailto:sales@nexenta.com) then run the following command:

```
CLI@nexenta> license activate <Activation Token>
```

- Verify if both the nodes resolve to each other by running the following command on both the nodes.

```
CLI@nexenta> net list host
```

ADDRESS	HOSTNAME	ALIAS	PROTOCOL
::1	localhost	-	ipv6
127.0.0.1	localhost	loghost	ipv4
10.3.53.109	nef06	-	ipv4
10.3.53.110	nef07	-	ipv4

If it is not mapped correctly, update the hosts on both the nodes to ensure that they resolve to each other. On the first node, run the following command.

```
CLI@nexenta> net create host [-nv] <IP address of the second node>
<hostname of the second node>
```

Run the above command on the second node to update the hosts.

Verify that the new entry was added correctly using the following command:

```
CLI@nexenta> net list host
```

You should be able to see the IP address of each other.

- Check the state of the HA services. See Table 2 for the list of possible service states.

```
CLI@nexenta> haservice status - to see status of all HA services
```

```
CLI@nexenta> haservice status <HA service name> - to see status of a
specific HA service
```

## Verify Virtual IP Address

In the example below, the `hacluster check-vip` command verifies the VIP `vip01` is consistent, or resolves across all the nodes in the cluster.

```
CLI@nexenta> hacluster check-vip vip01
```

Command output:

VIP Name	CONSISTENT
vip01	yes

## View HA Service Status

You can view the status information on all HA services as shown by the example below. You can also query the status of a specific HA service.

For the complete list of HA service status values, refer to Table 2.

```
CLI@nexenta> haservice status
```

Command output:

```
status:
NODE      STATUS   MODE      UNBLOCKED
nef06     running  automatic yes
nef07     stopped  manual    yes

pools:
NAME      GUID          PRIMARY
hapool    575415499326140623  yes

vips:
NAME      ADDRESS          IPv6  NODE      NIC
zvrip     10.3.53.110/24  no    nef06     e1000g0
          TESTVIP         10.10.10.10/16  no    nef06     e1000g0
          Nef07           e1000g0

init timeout: 20
run timeout:  8
```

## View RSF Logs

To view the information on why an HA service goes into a faulted state, consult the RSF logs using the `journal show` command.

First list all the available journals.

```
CLI@nexenta> journal list
```

NAME	SIZE	UPDATED	ARCHIVES
install/caiman	11.7K	Wed Dec 21 13:45:34 2016	0
install/messages	79.9K	Wed Dec 21 13:42:09 2016	0
install/nef	5.8K	Wed Dec 21 13:45:34 2016	0
messages	264.6K	Fri Feb 3 09:52:55 2017	4
nef	1.1M	Fri Feb 3 09:53:06 2017	8
rsf/nef-api	12.1M	Fri Feb 3 09:52:31 2017	0
rsf/rsfmon	1.2M	Fri Feb 3 09:52:55 2017	2
rsf/stmfha	2.9K	Wed Feb 1 16:30:21 2017	2

Now print all the `rsf/rsfmon` journal.

```
CLI@nexenta> journal show rsf/rsfmon
```