

Cloudpath Enrollment System Replication Configuration Guide, 5.5

Supporting Software Cloudpath Release 5.5

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Contents

Introduction.....	4
Replication Topologies.....	4
Prerequisites.....	5
Ports Used by Replication.....	5
Test Connectivity.....	5
Configuring Replication.....	5
Configuring an Active - Standby Replication.....	5
Configuring an Active - Active Replication.....	9
Monitoring the Cluster.....	12
Running Replication Diagnostic Tests.....	14
Showing the Replication Configuration.....	14
Showing the Replication Status.....	14
Pinging the Load Balancer (for Active - Active Setups Only).....	15
Checking Cluster Service Configuration.....	16
Firewall Settings.....	16
Checking Workflow Snapshots.....	18
Repairing the Cluster.....	18
Tearing Down the Cluster.....	19
Upgrading the Cluster.....	20
Replication Commands.....	20

Introduction

In addition to VMware-based high availability, Cloudpath supports replication (native clustering) capabilities. Clustering provides high-availability and high-scalability using two servers that are available for active use, with an active/standby option also available.

Configuration is performed entirely in the CLI.. Monitoring the cluster can be done through both the CLI and the UI.

Replication Topologies

Cloudpath supports the following topologies for replication, using a MariaDB database:

NOTE

For this release, only two-node clusters are supported.

- **Active - Standby:** In this topology, one node is designated *primarily active* and the other one is *secondarily standby*. Only one cluster node (the primarily active node by default) actively processes all enrollment requests from clients while the other one acts as a standby. The standby node is ready to take over to serve if the active node encounters problems and cannot serve. The failover is seamless to users. The primarily active node takes over again as soon as the problems have been resolved. This topology uses a virtual (or "floating") IP address that can be passed between identically configured servers to allow for failover.
- **Active - Active (with or without Network address translation):** Both cluster nodes simultaneously process enrollment requests through a load balancer. In this topology, both nodes are instantaneously in sync once initial setup is complete. If one node fails, the load balancer sends all requests to the other node .

An active - active setup also has the concept of a primary node and secondary node. The primary node is the server that is composed of initial data that will be replicated to the secondary server during the replication setup. Be sure you know which node is your primary node before you proceed to configuration.

NOTE

When configuring an active - active setup with NAT, you will need both the private and public IP addresses of the nodes.

A load balancer is required for this topology. How to configure the load balancer is outside the scope of this manual. You can consult the documentation for the load balancer of your choice. Many open-source load balancers are available. Be sure to configure your load balancer with the information it needs about the nodes that will compose your cluster.

NOTE

Do not use a Cloudpath System as a load balancer.

New System Activation: Primary Server vs. Add On:

When you first activate a new system, you are presented with a System Setup screen that contains the question: "Which Type Of Server is This?" For the node that will serve as your primary node in the cluster, select the "Standard Server (Default)" option. For the node that will serve as your secondary server, select the "Add On Server For Cluster" option. Refer to the *Cloudpath Enrollment System Deployment Administration Guide* for more information.

Prerequisites

To configure replication, set up two Cloudpath virtual appliances with the same OVA. When configuring these virtual appliances, all application and network properties must be the same for both servers in the cluster.

NOTE

For replication setup, all hosts must be able to communicate with all other nodes.

Each server must have a unique **FQDN Hostname** and network IP address. The DNS servers and gateway need not be the same as long as there is network connectivity between the servers.

Ports Used by Replication

Replication configuration opens the following ports between two servers:

- 3306 for database replication
- 5701 for application replication
- 8022 or 22 for SSH connection

Test Connectivity

When configuring replication, be sure that each system can resolve DNS and that each virtual appliance can communicate with the other server nodes to be replicated.

Configuring Replication

Cloudpath supports two types of replication. Proceed to the applicable topic:

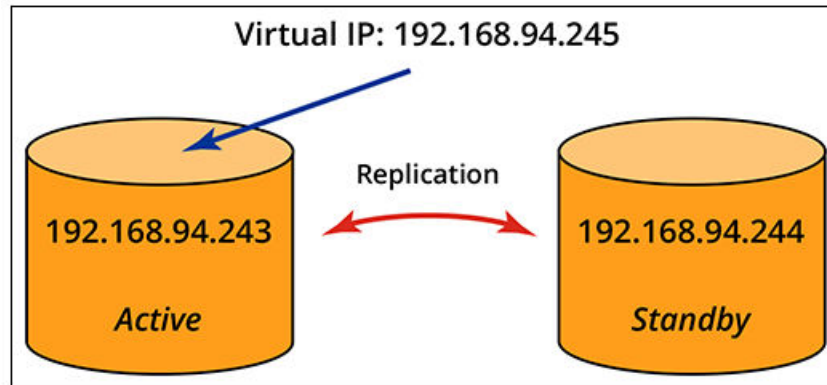
- [Configuring an Active - Standby Replication](#) on page 5
- [Configuring an Active - Active Replication](#) on page 9

Configuring an Active - Standby Replication

You can configure a two-node, active - standby replication, which uses a virtual IP address.

The following figure depicts an active - standby setup, with example IP addresses that will be used throughout this topic.

FIGURE 1 Active - Standby Replication



The steps below show you how to configure this type of cluster. It is assumed that you have already deployed two Cloudpath ES systems with the same .OVA file.

1. On the Cloudpath system that you want to be the "active" system (192.168.94.243 in the figure), open a terminal window and log in to the service account:
 - Port 8022 with SSH unless you change the port number
 - Username: cpn_service
 - Password: Enter the password.

The command-line configuration utility prompt (#) should display.

2. Enter the command: **replication setup**
3. When presented with cluster-type options, select **Active-Standby** and continue.
4. When you are asked if you want the node you are on to be the primary database node, answer yes and continue:

```
Do you want this node (192.168.94.243) to be the primary database node? [y/n]
```

5. Enter the IP address of the standby node when you are prompted for the "Secondary node IP:"

```
Secondary database cluster node configuration:
```

```
Secondary node IP: 192.168.94.244
```

6. Enter 8022 for the SSH port of the standby node when prompted (unless you have changed this port number):

```
Secondary node SSH Port: 8022
```

7. When presented with the following warning, you can answer yes and proceed:

```
-----  
WARNINGS:  
Configuring the cluster will cause any data existing on 192.168.94.244 be  
deleted and replaced with the data currently on 192.168.94.243  
-----  
  
Do you want to continue? [y/n]
```

8. You will then be presented with the following to confirm that your setup is what you expect:

```
192.168.94.244 will be the secondary database cluster node.
```

```
-----  
Database cluster has been defined:  
Primary: 192.168.94.243  ssh port# 8022  
Secondary: 192.168.94.244  ssh port# 8022  
  
Cluster Type: Active-Standby  
-----
```

```
Is this correct? [y/n]
```

If the information above is correct (as it is for this example), answer yes and proceed.

9. You are then prompted to enter the Virtual IP address. Be sure that the Virtual IP you enter is in the same domain as the primary and secondary nodes and that you enter an IP address not currently in use, then proceed:

```
Virtual IP: 192.168.94.245
```

10. You are then presented with the following:

```
-----  
Cluster DNS Name - The cluster as a whole must have a single unified DNS name  
it is known as. This is most likely the fully qualified  
domain name (FQDN) of the HTTPS certificate for the  
enrollment portal as a whole.  
  
This DNS name in most cases will resolve to the load  
balancer fronting the cluster. Example:  
Node 1 : node1.my-company.com  
Node 2 : node2.my-company.com  
Cluster DNS Name : wifi-onboarding.my-compandy.com  
  
IMPORTANT: If certificate based enrollments already exist you must re-use  
the hostname that was in place at the time of the enrollments  
occurred as the "Cluster DNS Name". If this name is modified,  
all existing certificates will be invalidated as their OCSP URL  
will no longer match the answering address of the CA (which must  
be the cluster as a whole.)  
  
Cluster DNS Name: jeff243.cloudpath.net  
- Please ensure this is correct.  
- This name should match up with the host portion of the "OCSP URL" within  
the browser based Admin UI. See "Certificate Authority > Manage CAs"  
If this is a new install you may want to create a new root CA if this  
does not match.  
- This value may not be changed after certificate based enrollments occur  
without requiring users to re-enroll.  
-----  
  
Do you want to keep jeff243.cloudpath.net? [y/n]
```

It is recommended to enter **yes** and proceed.

NOTE

If you enter **no** and proceed, you will later need to follow instructions from the command dialogue to update certificates.

11. You are then presented with the following:

```
-----  
Cluster Name is set: jeff243.cloudpath.net.  
At later time, you will need to make DNS changes:  
Assign jeff243.cloudpath.net to 192.168.94.245 (Virtual IP).  
Rename hostname of the primary Database node.  
-----
```

```
-----  
Do you want to continue? [y/n]
```

Enter **yes** to proceed.

NOTE

The dialogue informs you that you will need to make some DNS changes. This is described following these numbered steps.

12. The process completes, as shown in the following example. Check that you receive "Replication cluster setup complete:"

```
Will establish ssh 192.168.94.244:8022 ...  
-----  
* You will be prompted for the password of the remote VM 192.168.94.244.  
-----  
yes: standard output: Broken pipe  
yes: write error  
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/repl_user/.ssh/id_rsa.pub"  
cpn_service@192.168.94.244's password:  
id_rsa.pub  
100% 406 1.1MB/s 00:00  
Checking remote host 192.168.94.244 ...  
Will copy cluster configuration to node 192.168.94.244 ...  
Will establish ssh from 192.168.94.244 to 192.168.94.243 ...  
SSH connection from 192.168.94.244 to 192.168.94.243: SSH test succeeded  
Will update network configuration ...  
Will update database server configuration ...  
Will stop local application service ...  
Will restart database service...  
Will configure local database service permission ...  
Will transfer application database to the secondary database node at 192.168.94.244 ...  
Will restart local application service ...  
Will provision new remote node 192.168.94.244 ...  
Done provisioning new remote node 192.168.94.244 :  
Will replicate web cluster name jeff243.cloudpath.net ...  
Will replicate web cluster name jeff243.cloudpath.net on 192.168.94.244 ...  
Done replicating web cluster name.  
Will configure keepalived on 192.168.94.243 ...  
Created symlink from /etc/systemd/system/multi-user.target.wants/keepalived.service to /usr/lib/  
systemd/system/keepalived.service.  
Done keepalived configuration on 192.168.94.243 ...  
Will configure keepalived on on 192.168.94.244 ...  
Created symlink from /etc/systemd/system/multi-user.target.wants/keepalived.service to /usr/lib/  
systemd/system/keepalived.service.  
Done keepalived configuration on 192.168.94.244 ...  
Will enable local cluster monitoring service ...  
Created symlink from /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service to /etc/  
systemd/system/cloudpath-repld.service.  
Will enable cluster monitoring service on 192.168.94.244 ...  
Created symlink from /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service to /etc/  
systemd/system/cloudpath-repld.service.  
Replication cluster setup complete.  
#
```

Changes to Make Before Using Cluster for Enrollments:

Before you begin using the cluster for enrollments, you need to make the DNS changes (using your DNS configuration tool) that were listed in the command dialogue as you entered your information. Those changes are necessary for the virtual IP to be able to failover to the secondary node if the primary node goes down. In the example shown above, two DNS changes are required:

```
Cluster Name is set: jeff243.cloudpath.net.  
At later time, you will need to make DNS changes:  
Assign jeff243.cloudpath.net to 192.168.94.245 (Virtual IP).  
Rename hostname of the primary Database node.
```

1. Assign the cluster name (jeff243.cloudpath.net) the virtual IP address 192.168.94.245.

NOTE

The cluster name *must* be assigned the virtual IP address.

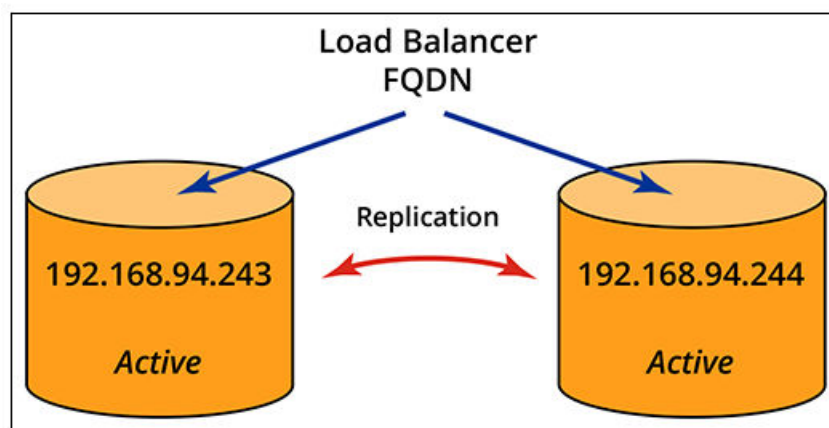
2. Rename the host name of the primary node from jeff243.cloudpath.net to a different name so that it does not conflict with cluster name.

Configuring an Active - Active Replication

You can configure a two-node active - active replication, which requires a load balancer.

The following figure depicts an active - active setup, with example IP addresses that will be used throughout this topic.

FIGURE 2 Active - Active Replication



The steps below show you how to configure this type of cluster. It is assumed that you have already deployed two Cloudpath ES systems with the same .OVA file.

1. On the primary Cloudpath system, open a terminal window and log in to the service account:

NOTE

For purposes of this example, the node whose IP address is 192.168.94.243 is the primary node.

- Port 8022 with SSH unless you change the port number
- Username: cpn_service
- Password: Enter the password.

The command-line configuration utility prompt (#) should display.

2. Enter the command: **replication setup**
3. When presented with cluster-type options, select **Active-Active** and continue.

You are then presented with the following options for Active - Active:

```
-----  
* Active-Active cluster configuration  
  
1) Without NAT - Cluster nodes are bidirectionally reachable directly with  
   the given IP address of each node.  
  
2) Behind NAT - Cluster nodes are reachable via a public IP address which
```

differs from configured private IP address of each node.

4. This example continues with the assumption that option 1 (Without NAT) is selected, and the dialogue continues.

NOTE

If you are setting up an active - active system with NAT, you will need to know both the private and public IP addresses of the cluster nodes. Otherwise, the process is basically the same as active - active without NAT.

5. You are next presented with the following information, to which, after reading, you can answer yes to proceed :

WARNINGS:

1. The node which replication setup is initiated (this node) will be considered the primary database node. The data on this node will be retained and replicated to the second database node. Some future maintenance operations such as software updates will be need initiated from the primary database node.
2. All data existing on the secondary node will be deleted and replaced with the data currently on the primary node. Before proceeding, create a VM snapshot of all cluster nodes.
3. The application running on both nodes will be shutdown. This process should be run during a maintenance period.

Do you want to continue? [y/n]

6. You are next presented with the following, to which you should answer yes and proceed:

An existing database cluster configuration was not found. A new cluster configuration will be defined.

Do you want this node (192.168.94.243) to be the primary database node? [y/n]

7. After answering yes, you are prompted to enter the IP address of the other node, which is 192.168.94.244 in this example, then continue:

192.168.94.243 will be the primary database node.

Secondary database cluster node configuration:

Secondary node IP: 192.168.94.244

8. You are prompted to enter the SSH port for the secondary node. Enter 8022 (unless you have changed it), then proceed.

9. You are presented with the following information; answer yes and proceed:

WARNINGS:

Configuring the cluster will cause any data existing on 192.168.94.244 be deleted and replaced with the data currently on 192.168.94.243

Do you want to continue? [y/n]

10. You are presented with the following; check to be sure it is correct and then proceed:

Database cluster has been defined:
Primary: 192.168.94.243 ssh port# 8022
Secondary: 192.168.94.244 ssh port# 8022

Cluster Type: Active-Active
Network: Without NAT

Is this correct? [y/n]

11. You are then prompted to enter the virtual name of your load balancer, which you have set up in advance. Enter the name and continue.

```
Load Balancer Virtual Host Name: jeff245.cloudpath.net
```

12. You are next presented with the following information:

```
-----  
Cluster DNS Name - The cluster as a whole must have a single unified DNS name  
it is known as. This is most likely the fully qualified  
domain name (FQDN) of the HTTPS certificate for the  
enrollment portal as a whole.  
  
This DNS name in most cases will resolve to the load  
balancer fronting the cluster. Example:  
Node 1 : node1.my-company.com  
Node 2 : node2.my-company.com  
Cluster DNS Name : wifi-onboarding.my-compandy.com  
  
IMPORTANT: If certificate based enrollments already exist you must re-use  
the hostname that was in place at the time of the enrollments  
occurred as the "Cluster DNS Name". If this name is modified,  
all existing certificates will be invalidated as their OCSP URL  
will no longer match the answering address of the CA (which must  
be the cluster as a whole.)  
  
Cluster DNS Name: jeff243.cloudpath.net  
- Please ensure this is correct.  
- This name should match up with the host portion of the "OCSP URL" within  
the browser based Admin UI. See "Certificate Authority > Manage CAs"  
If this is a new install you may want to create a new root CA if this  
does not match.  
- This value may not be changed after certificate based enrollments occur  
without requiring users to re-enroll.  
-----
```

```
Do you want to keep jeff243.cloudpath.net? [y/n]
```

It is recommended to enter **yes** and proceed.

NOTE

If you enter **no** and proceed, you will later need to follow instructions from the command dialogue to update certificates.

13. You are then presented with the following:

```
-----  
Cluster DNS Name is set: jeff243.cloudpath.net.  
At later time, you will need to make DNS changes:  
Rename Load Balancer's Host Name to jeff243.cloudpath.net.  
Rename hostname of the primary database node.  
-----
```

```
Do you want to continue? [y/n]
```

Enter **yes** to proceed.

NOTE

The dialogue informs you that you will need to make some DNS changes. This is described following these numbered steps.

14. The process completes, as shown in the following example. Check that you receive "Replication cluster setup complete:"

```
Will establish ssh 192.168.94.244:8022 ...
-----
* You will be prompted for the password of the remote VM 192.168.94.244.
-----
yes: standard output: Broken pipe
yes: write error
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/repl_user/.ssh/id_rsa.pub"
cpn_service@192.168.94.244's password:
id_rsa.pub
  100% 406  940.8KB/s   00:00
Checking remote host 192.168.94.244 ...
Will copy cluster configuration to node 192.168.94.244 ...
Will establish ssh from 192.168.94.244 to 192.168.94.243 ...
SSH connection from 192.168.94.244 to 192.168.94.243: SSH test succeeded
Will update network configuration ...
Will update database server configuration ...
Will stop local application service ...
Will restart database service...
Will configure local database service permission ...
Will transfer application database to the secondary database node at 192.168.94.244 ...
Will restart local application service ...
Will provision new remote node 192.168.94.244 ...
Done provisioning new remote node 192.168.94.244 :
Will replicate web cluster name jeff243.cloudpath.net ...
Will replicate web cluster name jeff243.cloudpath.net on 192.168.94.244 ...
Done replicating web cluster name.
Will enable local cluster monitoring service ...
Created symlink from /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service to /etc/
systemd/system/cloudpath-repld.service.
Will enable cluster monitoring service on 192.168.94.244 ...
Created symlink from /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service to /etc/
systemd/system/cloudpath-repld.service.
Replication cluster setup complete.
#
```

Changes to Make Before Using Cluster for Enrollments:

Before you begin using the cluster for enrollments, you need to make the DNS changes (using your DNS configuration tool) that were listed in the command dialogue as you entered your information. Those changes are necessary for the load balancer to be able to route traffic to both nodes in the cluster. In the example shown above, two DNS changes are required:

```
Cluster DNS Name is set: jeff243.cloudpath.net.
At later time, you will need to make DNS changes:
Rename Load Balancer's Host Name to jeff243.cloudpath.net.
Rename hostname of the primary database node.
```

1. Rename the load balancer from jeff245.cloudpath.net to jeff243.cloudpath.net so that the load balancer and the cluster host names are the same.

NOTE

The cluster host name *must* be the host name of the load balancer.

2. Rename the host name of the primary node from jeff243.cloudpath.net to a different name so that it does not conflict with cluster name.

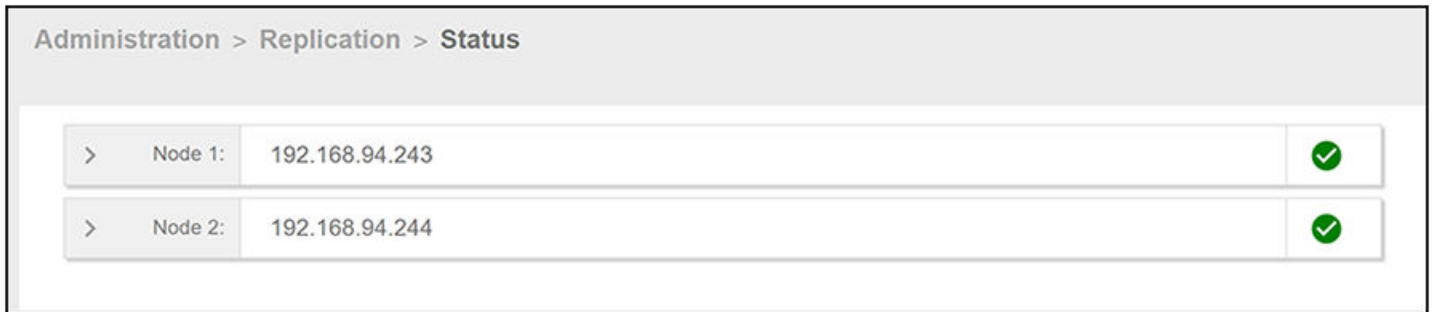
Monitoring the Cluster

You can monitor various aspects of the cluster in the user interface.

Once your cluster has been created, you can go to the **Administration > Replication** area of the Cloudpath UI.

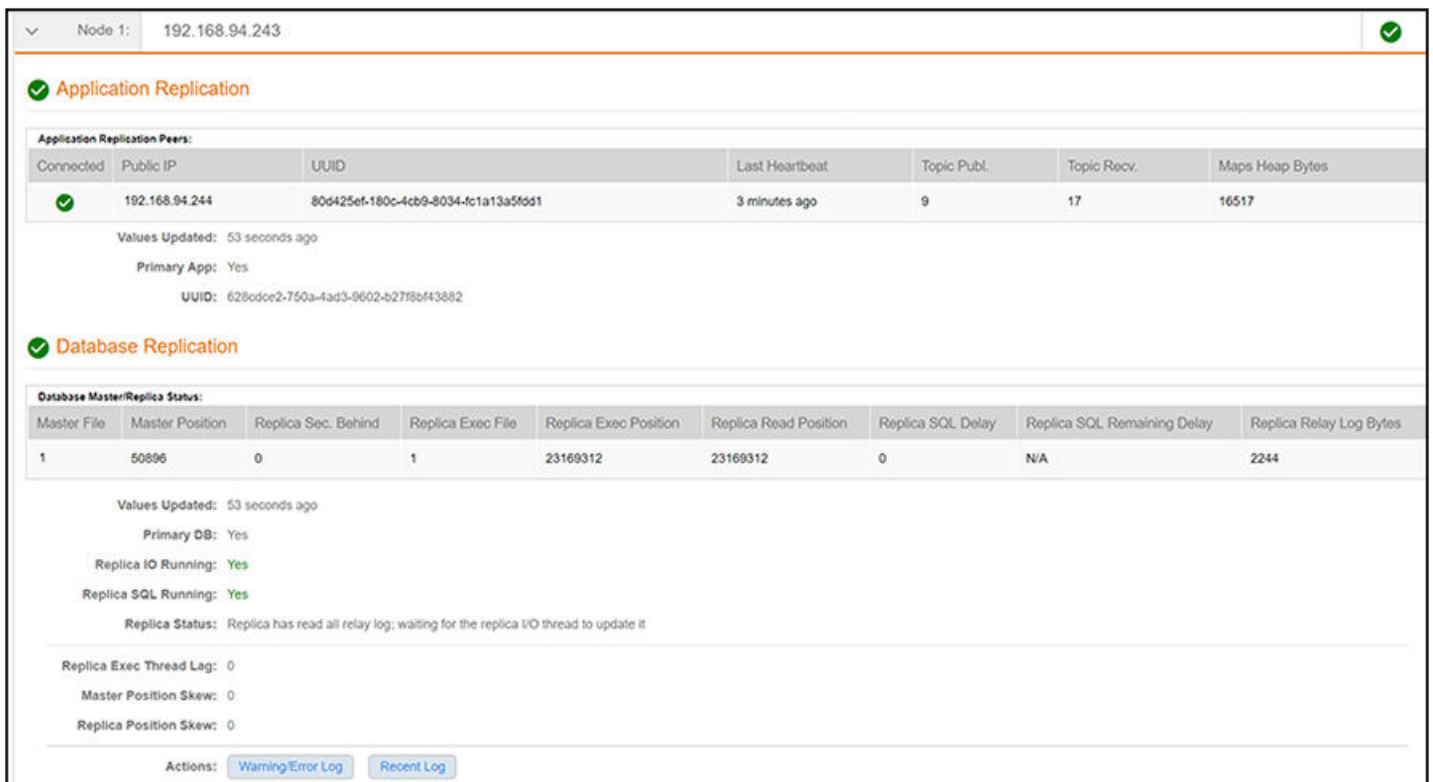
If the cluster was successfully created, green check marks will appear to the right of the IP address of each node, as shown in the example below. If green check marks do not appear, expand the node information by clicking on the arrows, and click one of the log buttons (as shown in [Figure 4](#)).

FIGURE 3 Replication Status in the Cloudpath UI



You can expand the information for the nodes by clicking on the arrow. The following figure shows an example of Node 1 expanded:

FIGURE 4 Detailed Information for a Node in the Cluster



You can click the two log buttons at the bottom of the screen for additional information.

Running Replication Diagnostic Tests

Commands are available that show the status and configuration of your cluster. You can run these commands merely as a check, or if you suspect there is an issue with the cluster.

Showing the Replication Configuration

You can run the **replication show-config** command from either cluster node to view status about each node.

The following command (and corresponding output) is an example from the active (primary) node that was shown in [Configuring an Active - Standby Replication](#) on page 5:

```
# replication show-config
-----
Primary - 192.168.94.243  ssh port# 8022
Secondary - 192.168.94.244  ssh port# 8022

Type - ACTIVE-STANDBY

Virtual IP - 192.168.94.245

Cluster Name - jeff243.cloudpath.net

INET:
inet 192.168.94.243/22 brd 192.168.95.255 scope global ens32
inet 192.168.94.245/32 scope global ens32
```

NOTE

Note that, under "INET," the virtual IP address of 192.168.94.245 is shown, indicating that the primary node is currently the active node. If the **replication show-config** command were run on the standby node, the "INET" output would not list the virtual IP unless the standby node had taken over due to a failure on the primary node.

Showing the Replication Status

You can run the **replication show-status** command from either cluster node. The following command (and corresponding output) is an example from the cluster that was shown in [Configuring an Active - Standby Replication](#) on page 5:

```
# replication show-status
[sudo] password for cpn_service:
***** MASTER(192.168.94.243) >>>>> REPLICA (192.168.94.244) *****

Master (192.168.94.243) Status
-----
      File: mysql-bin.000009
      Position: 39455
-----

Replica (192.168.94.244) Status
-----
      Replica_IO_State: Waiting for master to send event
      Master_Host: 192.168.94.243
      Master_Log_File: mysql-bin.000009
      Read_Master_Log_Pos: 39455
      Relay_Log_File: mysql-relay-log.000003
      Relay_Log_Pos: 37516
      Relay_Master_Log_File: mysql-bin.000009
      Replica_IO_Running: Yes
      Replica_SQL_Running: Yes
      Last_Errno: 0
      Last_Error:
      Exec_Master_Log_Pos: 39455
      Seconds_Behind_Master: 0
```

```
      Last_IO_Errno: 0
      Last_IO_Error:
      Last_SQL_Errno: 0
      Last_SQL_Error:
      SQL_Delay: 0
      SQL_Remaining_Delay: NULL
      Replica_SQL_Running_State: Replica has read all relay log; waiting for the replica I/O thread to
update it
-----

***** MASTER(192.168.94.244) >>>>> REPLICA (192.168.94.243) *****

Master (192.168.94.244) Status
-----
      File: mysql-bin.000010
      Position: 23246974
-----

Replica (192.168.94.243) Status
-----
      Replica_IO_State: Waiting for master to send event
      Master_Host: 192.168.94.244
      Master_Log_File: mysql-bin.000010
      Read_Master_Log_Pos: 23246974
      Relay_Log_File: mysql-relay-log.000003
      Relay_Log_Pos: 3111
      Relay_Master_Log_File: mysql-bin.000010
      Replica_IO_Running: Yes
      Replica_SQL_Running: Yes
      Last_Errno: 0
      Last_Error:
      Exec_Master_Log_Pos: 23246974
      Seconds_Behind_Master: 0
      Last_IO_Errno: 0
      Last_IO_Error:
      Last_SQL_Errno: 0
      Last_SQL_Error:
      SQL_Delay: 0
      SQL_Remaining_Delay: NULL
      Replica_SQL_Running_State: Replica has read all relay log; waiting for the replica I/O thread to
update it
*****
```

Some important items to check in the preceding output include making sure the following are true:

- Replication is occurring:

```
      Replica_IO_Running: Yes
      Replica_SQL_Running: Yes
```

- No errors:

```
      Last_Errno: 0
      Last_Error:
      Last_IO_Errno: 0
      Last_IO_Error
```

- Master and replica are in sync: The value of Master position is the same as (or very close to) the values of Read_Master_Log_Pos and Exec_Master_Log_Pos for both Master/Replica outputs above.

Pinging the Load Balancer (for Active - Active Setups Only)

You can check the availability of each node in the cluster from the load balancer by running the following command: `https://<cloudpathhostname>/admin/pingnode`

where *cloudpathhostname* is the fully qualified domain name of a node in the cluster.

The HTTP return should be a "Success" message, and the HTTP status code should be 200.

Checking Cluster Service Configuration

After replication setup, the HTTPS server names on both cluster nodes must match the Cluster DNS name that you chose while running the **replication setup** command.. You can run the **show config** command from each cluster node to view the cluster service configuration. For example, based on the active-standby setup described in [Configuring an Active - Standby Replication](#) on page 5, if the **show config** command is run on the secondary node, the output would appear as:

```
# show config
VM CPU: Intel(R) Xeon(R) CPU E5-2697 v3 @ 2.60GHz
VM Cores: 2 (CPUs * Cores Per CPU)
VM Memory: 6 GB
FIPS: Disabled
Network Config: Static
Hostname: jeff244.cloudpath.net
IP: 192.168.94.244
Netmask: 255.255.252.0
Gateway: 192.168.92.1
DNS: 192.168.222.254
Proxy: Disabled.
NTP: pool.ntp.org
Timezone: America/Denver [MDT]
HTTPS: Enabled on port 443 (80).
HTTPS Server Name: jeff243.cloudpath.net
Admin Web UI: Not restricted.
Hostname Restriction: Not restricted.
SSH Access: Permitted on port 8022.
#
```

The IP of the secondary node is displayed correctly as 192.168.94.244, and the HTTPS server name is displayed correctly as jeff243.cloudpath.net, which is the cluster name specified while running the **replication setup** command.

Firewall Settings

The Cloudpath Admin UI provides a table that lists the inbound and outbound traffic of your Cloudpath system. This information is dynamically generated based on the current system configuration and can changes as the system configuration is modified.

Go to **Administration > Firewall Requirements** to ensure that your firewall ports have been correctly configured for replication.

FIGURE 5 Firewall Requirements - Outbound

Traffic: Outbound from this System				
Purpose	System Address	External Address	Protocol	Reason
System	jeff243.cloudpath.net	bvt.cloudpath.net:443	TCP / HTTP(s)	System interacting with cloud services (licensing, wizards, built-in email, etc).
System	jeff243.cloudpath.net	support.cloudpath.net:8022	TCP	(Optional) Support tunnel for remote assistance. Only necessary when support tunnel is enabled.
System	jeff243.cloudpath.net	dist.cloudpath.net:443	TCP / HTTP(s)	Retrieve system updates.
System	jeff243.cloudpath.net	dist2.cloudpath.net:443	TCP / HTTP(s)	Retrieve system updates.
OCSP Stapling	jeff243.cloudpath.net	ocsp.godaddy.com:80	TCP / HTTP(s)	Send OCSP request to web server certificate provider for OCSP stapling.
OCSP Stapling	jeff243.cloudpath.net	jeff243.cloudpath.net:80	TCP / HTTP(s)	Send OCSP request to RADIUS server certificate provider for OCSP stapling.
Authentication Server	jeff243.cloudpath.net	192.168.4.170:636	TCP	Authenticate to Active Directory server 'Corporate AD' at 'ldaps://192.168.4.170'.
System	jeff243.cloudpath.net		TCP	LinkedIn authentication enabled but firewall specifics not available.
NTP	jeff243.cloudpath.net	pool.ntp.org:123	UDP / NTP	Perform NTP synchronization.
Replication	jeff243.cloudpath.net	192.168.94.244:3306	TCP	Replication Database.
Replication	jeff243.cloudpath.net	192.168.94.244:5701	TCP	Replication Application.
Replication	jeff243.cloudpath.net	192.168.94.244:8022	TCP	Replication SSH.
RADIUS COA	jeff243.cloudpath.net	*:3799	UDP / RADIUS COA	Send COA to wired/wireless infrastructure (default RADIUS client).
DPSK API	jeff243.cloudpath.net		TCP / HTTP(s)	Send API calls to Ruckus Onboard controller.

FIGURE 6 Firewall Requirements - Inbound

Traffic: Inbound to this System				
Purpose	System Address	External Address	Protocol	Reason
Web Interface	jeff243.cloudpath.net:443		TCP / HTTP(s)	Administrator, API, and end-user access to the web interface.
Onboard CA	jeff243.cloudpath.net:80		TCP / HTTP(s)	OCSP requests coming from external systems.
SSH	jeff243.cloudpath.net:8022		TCP	SSH access to the system.
Onboard RADIUS	jeff243.cloudpath.net:1812		UDP	Receive RADIUS authentication requests from external systems.
Onboard RADIUS	jeff243.cloudpath.net:1813		UDP	Receive RADIUS accounting requests from external systems.
Replication	jeff243.cloudpath.net	192.168.94.244:3306	TCP	Replication Database.
Replication	jeff243.cloudpath.net	192.168.94.244:5701	TCP	Replication Application.
Replication	jeff243.cloudpath.net	192.168.94.244:8022	TCP	Replication SSH.

Replication ports are provided when replication is configured and running.

Checking Workflow Snapshots

Log on to the Cloudpath system administration portal for each cluster node, go to **Configuration > Workflows**, and ensure that there are no error messages for any accounts indicating the following: "Enrollment Portal URL and HTTPS server are mismatched."

Repairing the Cluster

You can attempt to repair the cluster without tearing it down by running the **replication repair** command.

An example of when you might try running the **replication repair** command is if you find that replication between the two cluster nodes is out of sync (refer to [Showing the Replication Status](#) on page 14). Check your log files in `/var/log/replication/repl.log` or via the UI (**Administration > Replication > Status**), then expand the node information and click on the Log buttons) for indication of this type of "fatal error." Running the **replication repair** command may fix this sync issue.

NOTE

The repair tool must be run on the cluster node whose database is in good condition so that it provides a good replication database during the repair process.

The following command (and corresponding output) is an example from the cluster that was shown in [Configuring an Active - Standby Replication](#) on page 5

```
# replication repair
-----
* You will be prompted for the password of local system.
-----
[sudo] password for cpn_service:

-----
WARNINGS:
  1. Database Replication Repair routine must be performed on the database
     node whose database is in good condition and will provide a replication
     base during the database repair process. Before proceeding, create a VM
     snapshot of this database node.
  2. During Database replication repair, any data existing on the other
     database node will be deleted and replaced with the data currently on
     this node.
-----

Do you want to continue? [y/n]

Please answer yes or no.

Do you want to continue? [y/n] y

-----
WARNING:
Database cluster has been setup:
  Local Node: 192.168.94.243  ssh port# 8022
  Remote Node: 192.168.94.244  ssh port# 8022

  During database replication repair, any data existing on the remote node
  will be deleted and replaced with the data currently on the local node.
-----

Do you want to continue? [y/n] y

Checking remote node 192.168.94.244 ...
Will start database replication repair ...
Will set maintenance mode for remote node 192.168.94.244 ...
```

```

ts=20190821 180936.427, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Executing...
ts=20190821 180936.430, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message= - Param: /etc/httpd/conf/
httpd.conf
ts=20190821 180936.444, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Will enable maintenance
mode restriction in httpd conf...
ts=20190821 180936.453, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Done.
Will stop local cluster monitoring service on 192.168.94.243 ...
Will stop remote cluster monitoring service on 192.168.94.244 ...
Will stop database replication on 192.168.94.243 ...
Will stop remote database replication on 192.168.94.244 ...
Will transfer application database to the secondary database node at
192.168.94.                               244 ...
Will provision new remote node 192.168.94.244 ...
Done provisioning new remote node 192.168.94.244 :
Will unset maintenance mode for the remote node 192.168.94.244 ...
ts=20190821 180955.302, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Executing...
ts=20190821 180955.305, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message= - Param: /etc/httpd/conf/
httpd.conf
ts=20190821 180955.321, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Will not enable
maintenance mode restriction in httpd conf.
ts=20190821 180955.332, lvl=INFO, action=RUN_SCRIPT, script=update-httpd-
mainten                               ance, message=Done.
Will start local cluster monitoring service 192.168.94.243 ...
Will start remote cluster monitoring service on 192.168.94.244 ...
Database replication repair completed.
#

```

After the repair process completes, run the **replication show-status** command again to see if the issue appears to be resolved. Also, check your log files again.

Tearing Down the Cluster

If necessary, you can tear down the entire cluster to remove all replication configurations and to set both cluster nodes back to single Cloudpath Enrollment System mode.

You can run the **replication teardown** command from either cluster node. The following command (and corresponding output) is an example from the cluster that was shown in [Configuring an Active - Standby Replication](#) on page 5

```

# replication teardown
-----
* You will be prompted for the password of local system.
-----

WARNINGS:
 1. Teardown cluster routine will disassemble the entire cluster.
 2. After Cluster Teardown, all features that have been established to support
    replication cluster will be removed; however, the databases on both primary
    and secondary nodes will be intact.
-----

Do you want to continue? [y/n] y

-----

WARNING:
Cluster Database Nodes:
  Database node: 192.168.94.243   ssh port# 8022
  Database node: 192.168.94.244   ssh port# 8022

```

Upgrading the Cluster

```
During Cluster Teardown processing, with exception of the replicated
secondary Database, all features that have been established to support
replication cluster will be removed.
```

```
-----
Do you want to continue? [y/n] y

Checking remote host 192.168.94.244 ...
Will remove keepalived configuration on local node 192.168.94.243 ...
Removed symlink /etc/systemd/system/multi-user.target.wants/keepalived.service.
Will remove keepalived configuration on remote node 192.168.94.244 ...
Removed symlink /etc/systemd/system/multi-user.target.wants/keepalived.service.
Will reset web server cluster name on local node 192.168.94.243 ...
Will reset web server cluster name on remote node 192.168.94.244 ...
Will disable local cluster monitoring service on 192.168.94.243 ...
Removed symlink /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service.
Will disable remote cluster monitoring service on 192.168.94.244 ...
Removed symlink /etc/systemd/system/multi-user.target.wants/cloudpath-repld.service.
Will stop replication on local node 192.168.94.243 ...
Will stop replication on remote node 192.168.94.244 ...
Remove Database repl_mon ...
Will remove database_service permissions ...
Will revert database replication configuration ...
Will remove network configuration for replication ...
Will remove cluster configurations from all cluster nodes ...
Will restart local application services on 192.168.94.243 ...
Will restart remote application services on 192.168.94.244 ...
Cluster teardown completed.
#
```

You can now run a show-status command, and the output indicates that replication is not configured:

```
# replication show-status
Replication is not enabled on this system.
```

Upgrading the Cluster

Instructions on how to upgrade your cluster to the latest release are provided in the release notes.

Replication Commands

Replication commands are used for setting up replication, tearing down or repairing replication, upgrading, and viewing status and configuration of the cluster.

Replication commands are run from the command-line configuration utility prompt (#).

NOTE

From the command-line configuration utility, enter the **console** command to access the Linux shell. From the Linux shell, enter the **config** command to access the command-line configuration utility.

Command	Description
replication repair	Used to attempt to repair a cluster without tearing down the entire cluster.
replication setup	Creates a cluster of two Cloudpath ES nodes. You can create either an active - standby cluster or an active - active (with or without NAT) cluster. You are prompted from the command dialog to enter which options you are configuring.

Command	Description
replication show-config	<p>Displays the configuration of the cluster. Example output:</p> <pre> ----- ----- Primary - 192.168.94.243 ssh port# 8022 Secondary - 192.168.94.244 ssh port# 8022 Type - MULTISITE-ACTIVE-ACTIVE-NO-NAT Cluster Name - jeff245.cloudpath.net ----- ----- </pre>
replication show-status	Displays database replication status.
replication teardown	Tears down the cluster and sets each cluster node back to a single-node Cloudpath system.



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