Oracle® Communications

Cloud Native Core, cnDBTier User Guide

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Oracle Communications Cloud Native Core, cnDBTier User Guide, Release 25.1.103

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Preface

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Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
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Acronyms

The following table lists the acronyms and the terminologies used in the document.

Table 1 Acronyms and Terminologies

Term	Definition
AES	Advanced Encryption Standard
API	Application Programming Interface
ASM	Aspen Service Mesh
cnDBTier	Oracle Communications Cloud Native Core, cnDBTier
CNE	Oracle Communications Cloud Native Core, Cloud Native Environment
CNLB	Cloud Native Load Balancer
CSAR	Cloud Service Archive
DB	Database
FQDN	Fully Qualified Domain Name
GR	Georeplication
GRR	Georeplication Recovery
IPv4	IP addresses Version 4
JVM	Java Virtual Machine
MOS	My Oracle Support
MTA	MultiThreaded Appliers
NDB	Network Database
NF	Network Function
PDB	Pod Disruption Budget
PEM	Privacy Enhanced Mail
PSP	Pod Security Policies
PV	Persistent Volume
PVC	Persistent Volume Claim
SSH	Secure Shell
SFTP	Secure File Transfer Protocol
SQL	Structured Query Language
TDE	Transparent Data Encryption
TLS	Transport Layer Security

What's New in This Guide

This section introduces the documentation updates for release 25.1.1xx.

Release 25.1.103 - G20393-06 - December 2025

Made editorial changes in the cnDBTier Features chapter.

Release 25.1.103 - G20393-05 - December 2025

Updated the Extracting cnDBTier Cluster Script section to correct the CSAR package version.

Release 25.1.103 - G20393-04 - August 2025

Updated the Removing cnDBTier Cluster 1 section to specify which site should be used as the source when using `dbtremovesite` script.

Release 25.1.102 - G20393-03 - July 2025

Added a note in the Maintenance Procedures section to notify users to perform manual procedures or use fatal georeplication recovery procedures in case of any script failure during any operations.

Release 25.1.101 - G20393-02, May 2025

Added a note in the Scaling ndbmtd Pods section to provide the information about rerunning the `dbt_reorg_table_partition` script when a restart or a backup operation is ongoing.

Release 25.1.100 - G20393-01, April 2025

Feature Updates:
New Features:
Enhanced Georeplication Recovery using Parallel Backup Transfer and Restore:

- Added the Enhanced Georeplication Recovery using Parallel Backup Transfer and Restore section to provide an overview about this feature.
- Added the cnDBTier Parallel Backup Transfer Progress Metrics section to provide details about the metrics that are used to measure the parallel backup progress.

Storing `ndbmtd` Pod Logs in PVC:

- Added the Storing NDB Logs in PVC section to provide an overview about how the system stores NDB logs in PVC.

cnDBTier Cluster Events APIs:

- Added the Monitoring Cluster Events to Determine Data Loss in Clusters section to provide an overview about the cnDBTier cluster event APIs and their usage.
- Added the cnDBTier Cluster Events APIs section to provide details about the APIs that are used to retrieve cluster event details and update the cluster status.
- Updated the description of the `db_tier_cluster_disconnect` metric in the cnDBTier Node Status Metrics section.
- Updated the Summary, Condition, and Recommended Actions columns of the `MYSQL_NDB_CLUSTER_DISCONNECT` alert in the cnDBTier Cluster Status Alerts section.

Feature Enhancement:

Support for TLS:

- Updated the feature description in the Support for TLS section to include details about enabling and configuring TLS in application SQL pod to establish a secure connection for communication between cnDBTier and Network Functions (NFs).
- Restructured and added the following sub-sections in the Managing TLS section to provide the procedures to enable TLS and modify cnDBTier certificates:
  - Managing TLS for Communication with NFs
  - Enabling TLS for Communication with NFs
  - Modifying cnDBTier Certificates to Establish TLS for Communication with NFs

cnDBTier Automated Backup:

- Updated the cnDBTier Automated Backup to include details about automated backup metrics, alerts, and APIs.
- Added details about the `http://<base-uri>/db-tier/status/cluster/local/backup` API in the cnDBTier Backup APIs section.
- Added the `db_tier_ndb_backup_in_progress` metric in the cnDBTier Automated Backup Metrics section, which states if a data node backup is in progress in the current site.
- Added the `DB_TIER_NDB_BACKUP_IN_PROGRESS` alert in the cnDBTier Automated Backup Alerts section, which is triggered when a data node backup is in progress in the current site.

Automating Vertical Scaling of PVCs Using `dbtscale_vertical_pvc`:

- Added information about the `dbtscale_vertical_pvc` script in the cnDBTier Scaling section.
- Updated the following vertical scaling procedures to include the steps to scale PVCs using the `dbtscale_vertical_pvc` script:
  - Scaling ndbmtd Pods
  - Scaling ndbappmysqld Pods
  - Scaling ndbmysqld Pods
  - Vertical Scaling of db-replication-svc Pods
  - Scaling of ndbmgmd Pods

General Updates:

- Added the cnDBTier Scaling section to provide an overview about the horizontal and vertical scaling of cnDBTier resources.
- Metrics:
  - Added the following metrics to the monitor parallel backup transfer status in the cnDBTier Parallel Backup Transfer Progress Metrics section:
    - local_backup_transfer_progress
    - remote_backup_transfer_progress
  - Removed the "cnDBTier JVM Heap Metrics" section from the document as these metrics are no more fetched by cnDBTier.
  - Removed the "cnDBTier PVC Health Monitoring Metrics" section as these metrics are removed in this release to reduce the load on DB monitor service.

  - Added the following metrics to record the progress of NDB restore in the cnDBTier Fault Recovery State Metrics section:
    * db_tier_ndb_restore_meta_progress
    * db_tier_ndb_restore_data_progress
- Alerts:
  - Removed the "cnDBTier PVC Health Monitoring Alerts" section from the document as these alerts are removed in this release to reduce the load on DB monitor service.
  - Updated the backup size limit after which the `BACKUP_SIZE_GROWTH` alert is triggered from 5% to 20% in the cnDBTier Automated Backup Alerts section.
  - Added the following data node alerts, that are triggered when the NDB application node is slow, in the cnDBTier Node Data Volume Alerts:
    * DB_TIER_API_SEND_NODE_DATA_VOLUME_LOW
    * DB_TIER_API_RECEIVE_NODE_DATA_VOLUME_LOW
    * DB_TIER_SEND_DATA_NODE_DATA_VOLUME_LOW
    * DB_TIER_RECEIVE_DATA_NODE_DATA_VOLUME_LOW
    * DB_TIER_DATA_NODE_SCAN_FRAGMENT_SLOW
- Maintenance Procedures:
  - Added a note in the Maintenance Procedures section to state that cnDBTier doesn't support monitoring or alarming about certificate expiry.
  - Updated the sample outputs in the Changing Authentication Plugin on cnDBTier Sites section.
  - Added a note in the Modifying Remote Server Configurations for Secure Transfer of Backups section to inform the user that the `faultrecoverybackuptransfer` parameter is set to *false* by default.
  - Updated the steps to modify the HTTPS certificates in the Modifying HTTPS Certificates section.
  - Updated the procedures to start and stop georeplication in the following sections:
    * Starting cnDBTier Georeplication Between Sites
    * Stopping cnDBTier Georeplication Between Sites
- Updated the MySQL version from "8.4.2" to "8.4.3" in the entire document.
- Updated the timestamps in the sample outputs in the entire document.

1

Introduction

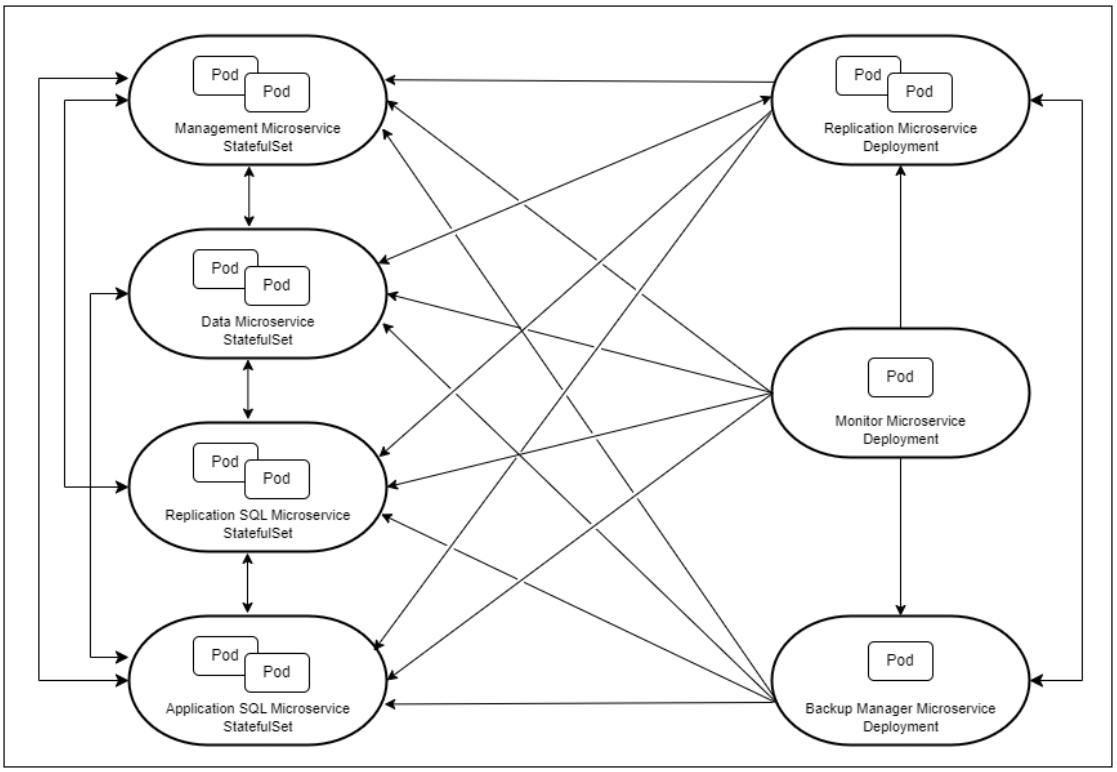
Oracle Communications Cloud Native Core, cnDBTier (cnDBTier) is the geodiverse database layer that provides persistence storage for state and subscriber data on a cloud environment such as Oracle Communications Cloud Native Core, Cloud Native Environment (CNE) or Oracle Cloud Infrastructure (OCI). This document provides information about the architecture, features, APIs, observability metrics and alerts, and the manual procedures for configuring cnDBTier.

2
cnDBTier Architecture

cnDBTier comprises various microservices deployed in Kubernetes-based cloud native environments, for example: Oracle Communications Cloud Native Core, Cloud Native Environment (CNE) or Oracle Cloud Infrastructure (OCI). Cloud native environments provide various common services such as logs, metric data collection, analysis, graphs, and chart visualization. cnDBTier microservices integrate with these common services and provide them with the necessary data such as logs and metrics.

The following diagram depicts the overall architecture of the cnDBTier:

Figure 2-1 cnDBTier Architecture



The following are the microservices of cnDBTier and their usages:

1. **Management Microservice:**
   - The Management microservice is responsible for managing other nodes within the NDB Cluster. It performs functions such as providing configuration data and running backups.
   - This microservice node is started first before any other node as it manages the configurations of other nodes in the cluster.
   - This microservice manages and reads the cluster configuration file and distributes the information to all nodes in the cluster that request for it.

- This microservice maintains a log of cluster activities. Management clients can connect to the management server to check the status of the cluster.
- The management server manages the cluster logs. The data nodes transfer information about any events that occur on the data nodes to the management server. The management server in turn writes these information to the cluster log.

2. **Data Microservice:**
   - The Data microservice stores all the cluster data in key-value pairs.
   - cnDBTier supports two replicas, that is a single node group can have up to two data nodes. For example, if there are four data nodes, then there will be two node groups, where the first group consists of the first two data nodes and the second group consists of the last two data nodes. All the data nodes of a single node group store the same data for redundancy and high availability. Therefore, at least one data node from each node group must be alive all the time to process or support CRUD (Create, Retrieve, Update, Delete) operations.
   - The Data microservice is used to handle all the data in the tables using the NDB Cluster storage engine.
   - This microservice empowers a data node to accomplish many activities, but not limited to the following:
     - Distributed transaction handling
     - Node recovery
     - Checkpointing to disk
     - Online backup
3. **Replication SQL (API) Microservice:**
   - The Replication SQL microservice hosts a MySQL server that connects to the data pods and provides bidirectional georeplication support to the remote sites.
   - This microservice receives the events from the data nodes, maintains binlogs on PVC, and uses the binlogs to perform replication.
   - cnDBTier uses a set of two Replication SQL microservices to establish replication with the mate site. Where, one microservice is hosted as an active replication channel and the other hosted as a standby replication channel to handle georeplication failures.
4. **Application SQL (APP) Microservice:**
   - The Application SQL microservice is used by the Network Functions (NF) for performing CRUD (Create, Retrieve, Update, Delete) operations on cnDBTier.
   - This microservice is responsible for performing cnDBTier initializations such as database creation, table creation, and user creation.
5. **Monitor Microservice:**
   - The Monitor microservice stores information about the current behavior of cnDBTier in the form of metrics. These metrics are sent to Prometheus or a similar monitoring tool when the tool requests for these metrics or data.
   - The monitor microservice hosts multiple REST APIs. These REST APIs are used for handling many specific use cases such as creating on-demand backups. It also hosts other REST APIs that are used by CNC Console to integrate cnDBTier on CNC Console GUI, thereby making cnDBTier more user friendly. For more information about cnDBTier APIs, see the cnDBTier APIs section.
6. **Backup Manager Microservice:**

- This Backup Manager microservice is responsible for coordinating all kinds of backup creations—scheduled backups by CronJob, on-demand backups by end user, and Fault recovery backups.
- The Backup Manager microservice uses the Backup Executor service to run the mentioned or instructed commands on the respective data microservice. The Backup Manager microservice is also responsible for coordinating with the Backup Executor service to perform the following operations:
  - Transferring the backups to local replication service when a fault recovery is triggered.
  - Purging the old backups to save space on data microservice and prevent the data microservice from crashing.

7. **Replication Microservice:**
   - The Replication microservice is responsible for setting up the replication between cnDBTier sites. It also manages the replication channels between cnDBTier sites.
   - This microservice has the following optional features:
     - Skip replication errors when there is an irrecoverable error on the replication channels. This helps to resume the replication channels post an error.
     - Transfer backups to remote server over a secure channel using SFTP.
   - This microservice handles replication fault recovery to recover the failed sites. When there is a replication failure, this microservice performs the following tasks:
     a. Fetches data backup from a healthy site and uses the backup in a failed site to recover the data.
     b. Reestablishes the replication channel thereby recovering the failed sites.
   - This microservice checks the growth in Binlogs and purges the binlogs according to the configuration. This helps to save the space in replication SQL microservice and prevent it from crashing.

2.1 cnDBTier Setups

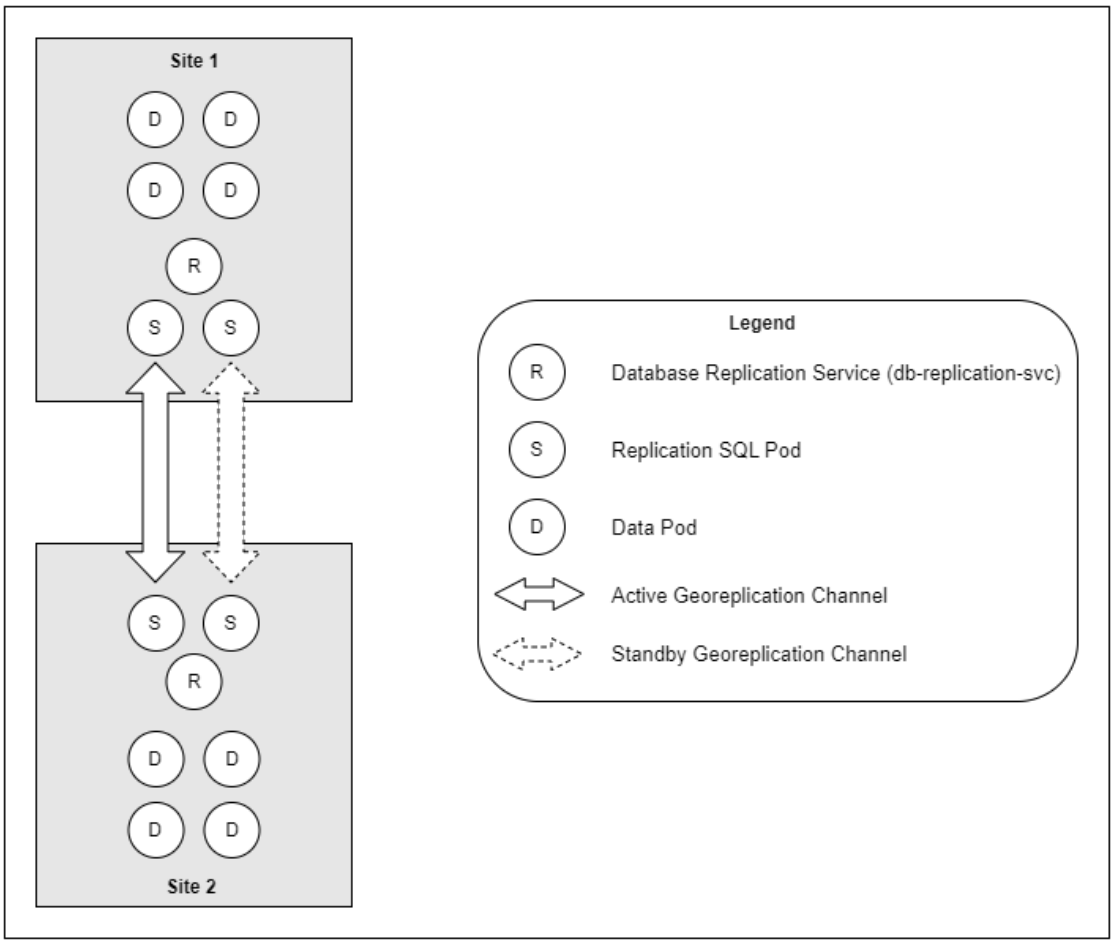
cnDBTier supports two-site, three-site, and four-site georeplication setups. This section provides information and figures to understand the replication setups between cnDBTier sites based on their topology.

> **Note**
>
> The setups detailed in this section are for reference only. You must choose your cnDBTier setups depending on your requirements and traffic intensity analysis.

Two Site Replication

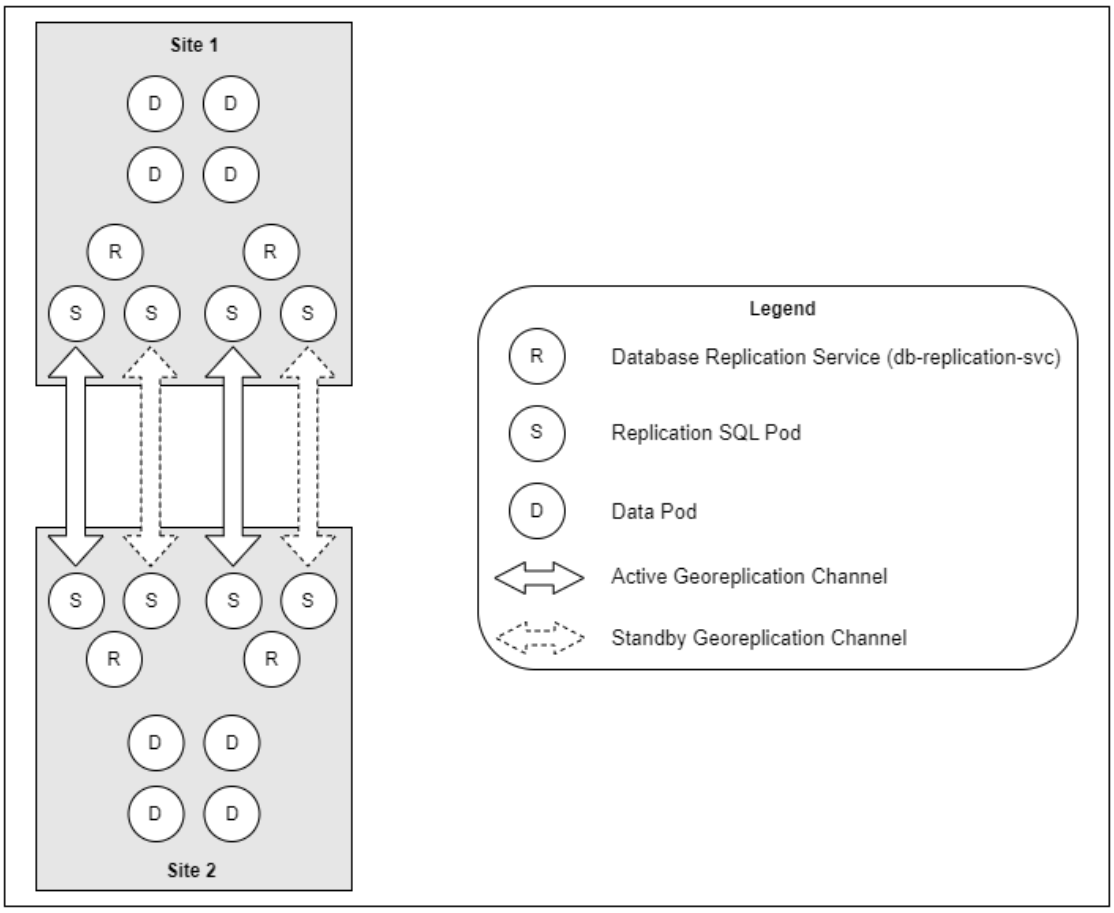
The following images depict the replication SQL pod connection between two cnDBTier sites with single or multiple replication channel groups. They also depict how replication service pods communicate with each other to set up the replication.

Figure 2-2 Two-Site Setup with Single Replication Channel Group



This sample setup contains two cnDBTier sites (Site 1 and Site 2). Each site has a single replication channel group consisting of a database replication service pod and two replication SQL pods. The replication channel group on both the sites communicate with each other for replication through a georeplication channel. The replication channel group consists of one active and one standby channel where the active channel is responsible for georeplication. When the active replication channel fails, the standby channel switches as the active channel for replication.

Figure 2-3 Two-Site Setup with Multiple Replication Channel Groups

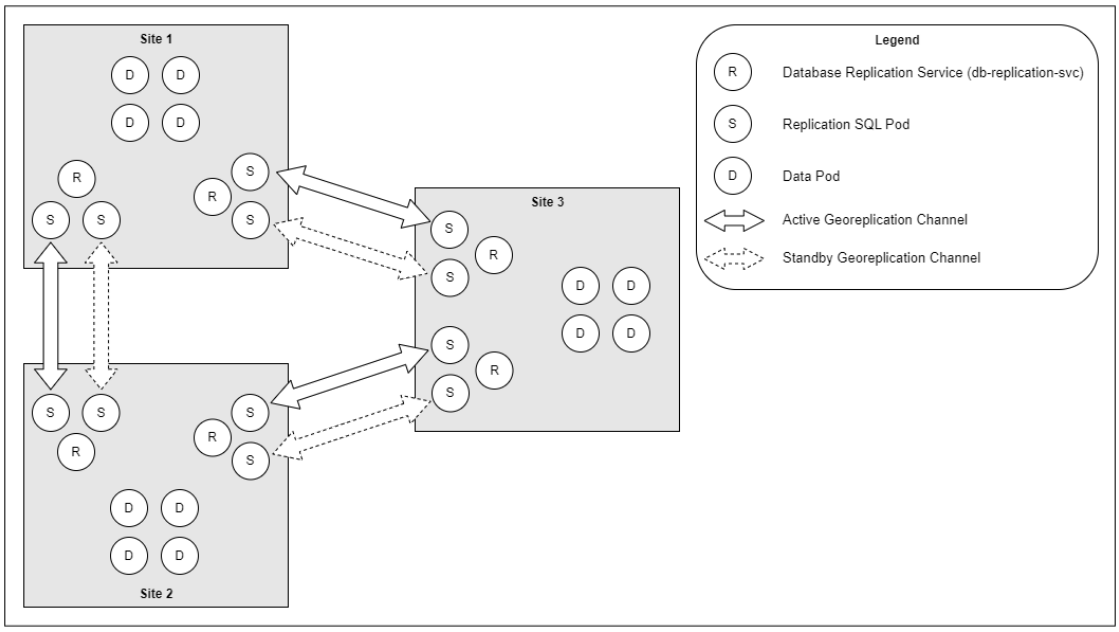


This sample setup contains two cnDBTier sites (Site 1 and Site 2). Each site has two replication channel groups and each replication channel group contains a database replication service pod and two replication SQL pods. One replication channel group on one site (Site a) communicates with one replication group on the other site (Site 2) through a georeplication channel. Each replication channel group consists of one active and one standby channel, where the active channel is responsible for georeplication. When the active replication channel fails, the standby channel switches as the active channel for replication.

Three Site Replication

The following diagram depicts the replication SQL pod connection between three cnDBTier sites for replication. It also depicts how replication service pods communicate with each other to set up the replication:

Figure 2-4 Three-Site Replication



This sample setup contains three cnDBTier sites (Site 1, Site 2, and Site 3). Each site is configured with two replication channel groups. Each replication channel group contains a database replication service pod and two replication SQL pods. One replication channel group on one site (For example: Site a) communicates with one replication group on the other sites (For example: Site 2 or Site 3) through a georeplication channel. Each replication channel group consists of one active and one standby channel, where the active channel is responsible for georeplication. When the active replication channel fails, the standby channel switches as the active channel for replication.

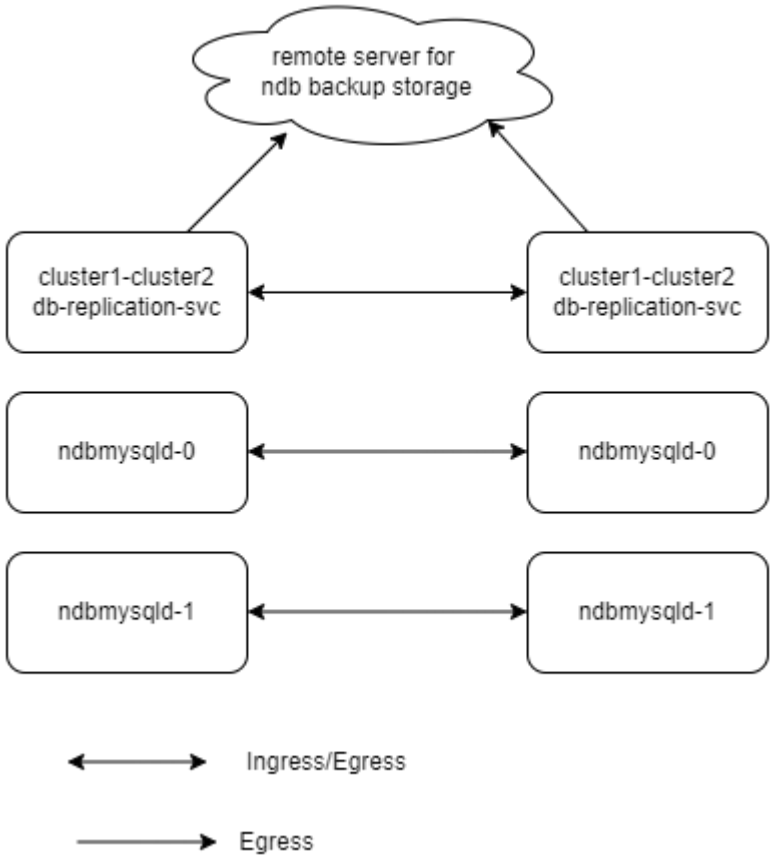
> **Note**
>
> You can extend the three site setup for creating a four-site georeplication setup.

2.2 Ingress and Egress Communication Over External IPs

If cnDBTier is deployed with two or more clusters, it requires external Load Balancer IPs to facilitate communication between these clusters. The db-replication-svc pods in one cluster must be able to communicate (Ingress or Egress) with the `db-replication-svc` pods in all the other clusters to establish and monitor replication channels. Similarly, each cluster's active and standby `ndbmysqld` pods must communicate (Ingress or Egress) with the active and standby `ndbmysqld` pods of the other clusters to perform controller-controller replication.

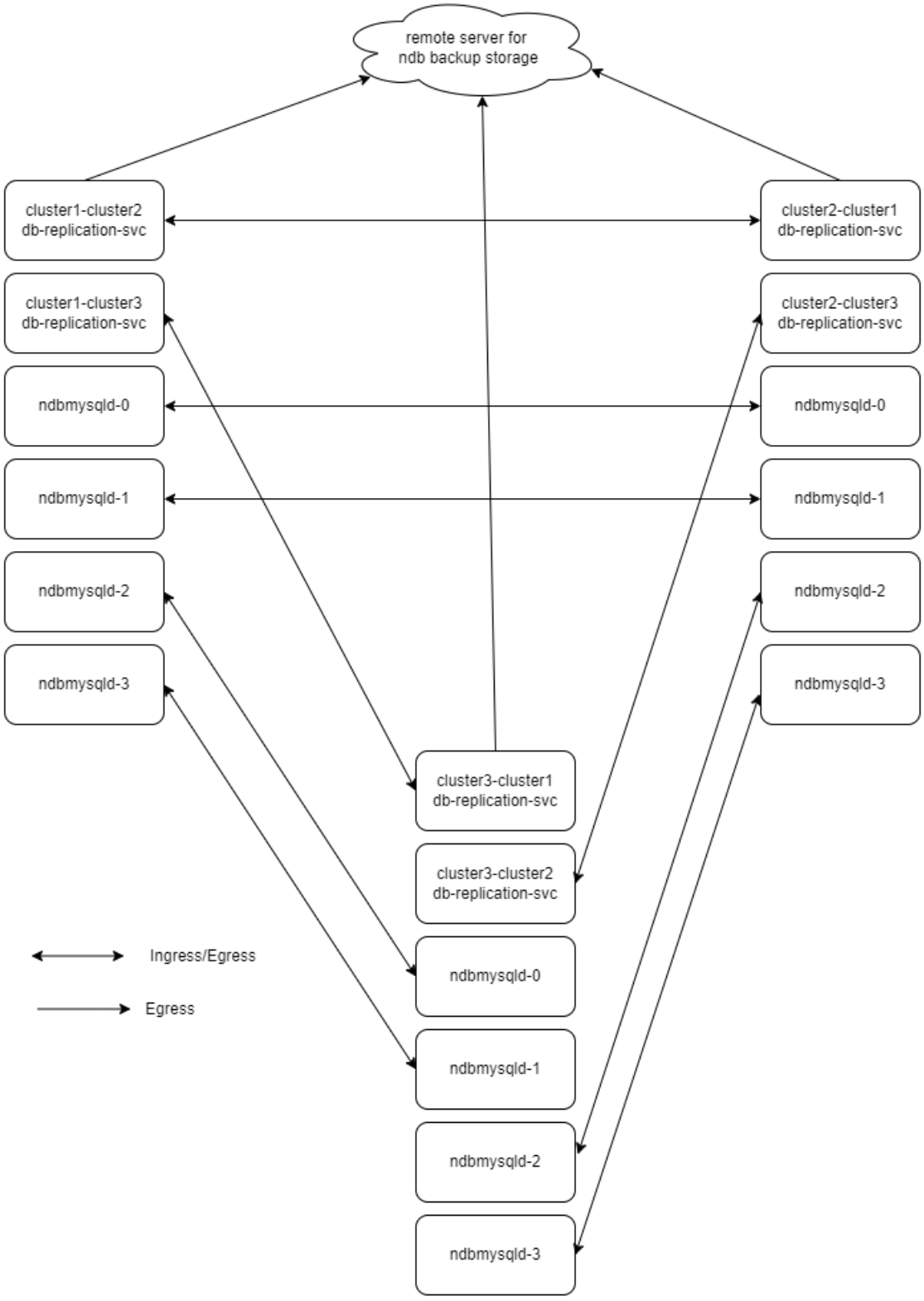
The following diagram depicts the ingress or egress routes in a two-cluster setup:

Figure 2-5 Two_Cluster_Ingress_Egress_Routes



The following diagram depicts the ingress or egress routes in a three-cluster setup:

Figure 2-6 Three_Cluster_Ingress_Egress_Routes



3
cnDBTier Features

This chapter describes the key features of cnDBTier.

3.1 Monitoring Cluster Events to Determine Data Loss in Clusters

Cluster disconnections due to network issues can lead to loss of data in the clusters. However, there were no means to identify the loss of data. With this feature, cnDBTier provides the following REST APIs to monitor cnDBTier cluster events to determine any data loss:

- http://<base-uri>/db-tier/reset/parameter/cluster_restart_disconnect
- http://<base-uri>/db-tier/reset/cluster/{cluster-name}/parameter/cluster_restart_disconnect
- http://<base-uri>/db-tier/cluster/status
- http://base-uri/db-tier/cluster/status/events/{numberOfLastEvents}
- http://<base-uri>/db-tier/all/cluster/status/
- http://<base-uri>/db-tier/all/cluster/status/events/{numberOfLastEvents}

For more information about these APIs, see cnDBTier Cluster Events APIs.

cnDBTier monitors the following cluster events and records them each time they occur:

- Cluster install start
- Cluster restart
- Cluster checkpoint
- Cluster restore
- Cluster re-sync
- Cluster failure

cnDBTier uses the records of these events to determine a data loss in the cluster due to cluster disconnect and triggers an alert when it identifies a data loss. On identifying a data loss in a cluster, NFs can decide if they have to divert the traffic to other sites and then start a georeplication recovery on the identified cnDBTier cluster to restore and re-sync the database.

Metrics

cnDBTier uses the existing `db_tier_cluster_disconnect` metric to record the number of times a cluster disconnects. For more information about this metric, see cnDBTier Node Status Metrics.

Alerts

cnDBTier uses the existing `MYSQL_NDB_CLUSTER_DISCONNECT` alert to inform about the data loss in the cluster. For more information about this alert, see cnDBTier Cluster Status Alerts.

3.2 Storing NDB Logs in PVC

cnDBTier stores all NDB pod (`ndbmgmd`, `ndbmtd`, `ndbmysqld`, `ndbappmysqld`) logs in PVC. These logs remain persistent even when the pods restart and they can be used to debug any data node related issues. This feature is enabled in cnDBTier by default and doesn't require any configuration.

`ndbmtd` pod logs:

`ndbmtd` pod logs are stored in the `data_node_<node_id>.log` file in the `/var/occnedb/dbdata/data` directory. When the size of a log file exceeds 200 MB, the log file is archived and stored in the same directory in the following file name format: `data_node_<node_id>_<file_creation_timestamp>.log.gz`. The system archives a maximum of five such log files and deletes the older ones.

`ndbmysqld` or `ndbappmysqld` server logs:

`mysqld` server logs are stored in the `mysqld.log` file in the `/var/occnedb/mysql` directory. When the size of a log file exceeds 200 MB, the log file is archived and stored in the same directory in the following file name format: `mysqld.log.old.<serial_number>` (for example, `mysqld.log.old.1`). The system archives a maximum of five such log files and deletes the older ones.

`ndbmysqld` general logs:

If `/global/api/general_log` is set to *true*, `ndbmysqld` pod logs are stored in the `ndbmysqld_general_log.log` file. When the size of a log file exceeds 200 MB, the log file is archived and stored in the same directory in the following file name format: `ndbmysqld_general_log.log.old.<serial_number>` (for example, `ndbmysqld_general_log.log.old.1`). The system archives a maximum of five such log files and deletes the older ones.

`ndbmgmd` cluster logs:

`ndbmgmd` pod logs are stored in the `ndbmgmd_cluster.log` file in the `/var/occnedb/mysqlndbcluster` directory. When the size of a log file exceeds 10 M, the log file is archived and stored in the same directory in the following file name format: `cluster.log.<serial_number>` (for example, `cluster.log.1`). The system archives a maximum of ten such log files and deletes the older ones.

3.3 Enhanced Georeplication Recovery using Parallel Backup Transfer and Restore

Earlier, transferring and restoring backup during a georeplication recovery involved additional data compression at the data node and serial backup transfer to the remote sites. This process consumed more time and impacted the performance of georeplication recovery. With this feature, cnDBTier implements the following enhancements in backup transfer and restore thereby improving the performance and efficiency of georeplication recovery:

- Avoids additional backup compression.
- Supports parallel backup transfer from healthy cluster to georeplication recovery cluster.
- Restores data node backups in parallel, as and when the backups are transferred from the healthy cluster to the georeplication recovery cluster.

Testing this feature using sample data showed considerable improvement in the performance of georeplication recovery. The following table provides information about the cluster configuration used to test this feature:

Table 3-1 Cluster Configuration

Cluster Detail	Configuration
Number of data nodes in each cluster	8
CPU count of backup manager service	1
RAM size of backup manager service	1Gi
CPU count of each node in backup executor service	1
RAM size of each node in backup executor service	1Gi
CPU count of replication service	2
RAM size of replication service	2Gi

The following table provides information about the time taken to complete georeplication recovery when parallel backup transfer is enabled or disabled, considering different data sizes in each data node:

Table 3-2 Georeplication Recovery Time when Parallel Backup is Enabled or Disabled

Data Size Per Node (GB)	Parallel Backup Transfer and Restore (Enabled or Disabled)	Time Taken for Georeplication Recovery (Seconds)	Improvement in Performance (%)
5	Disabled	1255	NA
5	Enabled	1125	10.92
10	Disabled	1858	NA
10	Enabled	1565	17.12
15	Disabled	2503	NA
15	Enabled	1997	22.49
20	Disabled	3074	NA
20	Enabled	2439	23.04
25	Disabled	3723	NA
25	Enabled	2859	26.25

> **Note**
>
> The performance measures provided in the table are as per the sample data used for testing the feature on a sample cnDBTier environment, and are not the promised values. The actual performance varies from system to system depending on various factors including cluster configuration and data load.

Managing Parallel Backup Transfer and Restore

The following sections provide details about managing parallel backup transfer and restore:

Enabling or Disabling Parallel Backup Transfer and Restore

You can enable or disable parallel backup transfer and restore for georeplication recovery by setting the `/global/parallelbackuptransferandrestore/enable` parameter to *true* or *false* respectively in the `custom_values.yaml` file. For more information about enabling and configuring this feature, see the "customizing cnDBTier" section in *Oracle Communications Cloud Native Core, Cloud Native Environment Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> If you want to enable or disable parallel backup transfer and restore after installing cnDBTier, update the parameter in the `custom_values.yaml` file and perform an upgrade with the updated `custom_values.yaml` file. For the procedure to upgrade cnDBTier, see *Oracle Communications Cloud Native Core, Cloud Native Environment Installation, Upgrade, and Fault Recovery Guide*.

Metrics

The following metrics are added to observe the progress of parallel backup and restore during georeplication recovery:

- db_tier_local_backup_transfer_progress
- db_tier_remote_backup_transfer_progress

For more information about these metrics, see cnDBTier Parallel Backup Transfer Progress Metrics.

3.4 Transparent Data Encryption (TDE)

Transparent Data Encryption (TDE) encrypts data at the storage layer, that is the files stored in the disk or PVC of the data nodes. TDE encrypts and decrypts data dynamically as it is written to or read from the storage, without requiring any modifications to the application's code. This guarantees that the sensitive data stored in the database files on disk remains encrypted while at rest, offering a crucial security layer against unauthorized access, particularly in situations where physical security controls fail.

Enabling TDE slightly increases the restart time of the data nodes as TDE handles encryption and decryption dynamically. The following table provides information about the time taken for the data nodes to restart when TDE is enabled or disabled, considering different data sizes in each data node:

Table 3-3 Data Node Restart Time When TDE is Enabled or Disabled

Data Size Per Node (in GB)	TDE Enabled or Disabled	Average Restart Time (in seconds)	Increase in Restart Time when TDE is Enabled (in percentage)
10	Disabled	166.5	NA
10	Enabled	181.5	9%
20.7	Disabled	216	NA
20.7	Enabled	242.5	12.27%
30	Disabled	329	NA
30	Enabled	349.75	6.32%
37	Disabled	376	NA

Table 3-3 (Cont.) Data Node Restart Time When TDE is Enabled or Disabled

Data Size Per Node (in GB)	TDE Enabled or Disabled	Average Restart Time (in seconds)	Increase in Restart Time when TDE is Enabled (in percentage)
37	Enabled	397.5	5.72%

> **Note**
>
> Analysis and testing of this feature with sample data reveal that enabling TDE increases the restart time of data nodes by an average of 8.33%. However, the performance vary depending on your cnDBTier setup and data size. Ensure that you test and understand the performance impact while using TDE for data encryption.

Managing Transparent Data Encryption (TDE)

The following sections provide details about managing Transparent Data Encryption (TDE):

Enabling Transparent Data Encryption (TDE)
You can enable or disable the TDE feature using the `/global/ndb/EncryptedFileSystem` parameter in the `custom_values.yaml` file. For more information about enabling and disabling this feature, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Configuring Transparent Data Encryption (TDE)
Before enabling TDE, you must create the necessary secrets that are used to encrypt the data in data nodes. For information about creating secrets for TDE, see the "Creating Secret" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

3.5 Support for CNE Cloud Native Load Balancer (CNLB)

cnDBTier supports network segregation using CNE Cloud Native Load Balancer (CNLB) to effectively manage ingress and egress traffic flows in the system. CNLB is an alternate solution to the existing LBVM solution. To leverage this feature, you must perform the following configurations:

1. Configure the ingress and egress destination subnet addresses in the `cnlb.ini` file before installing CNE. For more information about ingress and egress destination subnet addresses, see the Ingress and Egress Communication Over External IPs section.
2. Configure the required traffic segregation details in the `custom_values.yaml` file before installing cnDBTier.

Managing Cloud Native Load Balancer (CNLB)

The following sections provide details on managing the CNLB feature:

Enabling or Disabling CNLB
As CNLB is powered by CNE, you can enable or disable CNLB while installing CNE. For more information about enabling and configuring CNLB, see *Oracle Communications Cloud Native Core, Cloud Native Environment Installation, Upgrade, and Fault Recovery Guide*.

Configuring CNLB for cnDBTier Traffic Segregation

Depending on your requirement, you must perform the following configurations to use CNLB network segregation:

- To use network segregation for active and standby replication channels, configure the required CNLB annotations for `ndbmysql` pods in the `custom_values.yaml` file.
- To allow communication between local and remote site replication pods over a separate network, configure CNLB ingress or egress annotations for the `db-replication-svc` pods in the `custom_values.yaml` file.

For more information about configuring CNLB for traffic segregation, see the "Configuring Cloud Native Load Balancer" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

3.6 Multithreaded Applier (MTA)

The Multithreaded Applier (MTA) feature provides the functionality allows independent binlog transactions to be run in parallel at a replica thereby increasing the peak replication throughput. NDB replication is modified to support the use of generic MySQL server MTA mechanism.

Managing Multithreaded Applier (MTA)

The following sections provide details on managing the MTA feature:

Enabling or Disabling MTA

You can enable or disable the MTA feature using the `replica_parallel_workers` parameter in the `custom_values.yaml` file. This feature is disabled when `replica_parallel_workers` is set to *1* and enabled when the parameter is set to a value greater than *1*. This feature is disabled by default. For more information on this parameter, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

You can refer to the following sample configurations to enable or disable MTA in the `custom_values.yaml` file:

Sample configuration to enable MTA:

```
global:
  additionalndbconfigurations:
    mysqld:
      replica_parallel_workers: 4
      binlog_transaction_dependency_tracking: "WRITESET"
      ndb_log_transaction_dependency: 'ON'
```

Sample configuration to disable MTA:

```
global:
  additionalndbconfigurations:
    mysqld:
      replica_parallel_workers: 1
      binlog_transaction_dependency_tracking: "COMMIT_ORDER"
      ndb_log_transaction_dependency: 'OFF'
```

For more information on the MTA feature, see MySQL documentation.

Configuring MTA

Additional configurations are not applicable to this feature.

3.7 Support for TLS

Transport Layer Security (TLS) is a cryptographic protocol designed to safeguard the communication between a client and a server. This protocol ensures that private and sensitive information such as passwords are transferred over encrypted communication channels. cnDBTier supports both TLS 1.2 and TLS 1.3.

cnDBTier uses TLS to secure data transfer in the following scenarios:

- **Georeplication between cnDBTier Sites**:
  Earlier, cnDBTier provided support to configure the replication SQL pods manually to establish Transport Layer Security (TLS) for georeplication between cnDBTier sites. With this feature, cnDBTier automates the process of configuring TLS for georeplication between cnDBTier sites.

  When TLS feature is enabled for replication, cnDBTier performs or supports the following operations during replication:

  - The replication SQL pod uses the certificates provided or configured to establish an encrypted connection for georeplication. This encrypted connection remains throughout the life cycle of the replication. When the replication breaks and a switchover occurs, the standby replication SQL pod establishes a new replication channel using the given certificates and provides the encrypted connection.
  - cnDBTier reestablishes the TLS connection after a georeplication recovery. That is, when a georeplication recovery completes successfully, the system reestablishes the encrypted connection between the replication channels. This ensures that the TLS is kept intact even after a georeplication recovery.
  - cnDBTier supports maintaining separate certificates for each replication channel groups and each site replicating to other site.
  - cnDBTier supports maintaining list of chipers used for replication.
- **Communication between cnDBTier and Network Functions**:
  cnDBTier supports TLS for application SQL pods to establish secure connection for communication with Network Functions (NFs).

  When TLS feature is enabled, cnDBTier performs or supports the following operations during communication with NFs:

  - The application SQL pod uses the certificates provided or configured to establish an encrypted connection for communication with NFs. This encrypted connection remains throughout the life cycle of the connection between NF and cnDBTier.
  - cnDBTier reestablishes the TLS connection between NFs and cnDBTier after a georeplication recovery. That is, when a georeplication recovery completes successfully, the system reestablishes the encrypted connection between the NFs and cnDBTier. This ensures that the TLS is kept intact even after a georeplication recovery.

Managing TLS

The following sections provide details about managing TLS:

Enabling TLS

You can enable or disable TLS for georeplication, NF communication, or both using the `custom_values.yaml` file as follows:

- To enable TLS for secure georeplication, use the `/global/tls/enable` parameter in the `custom_values.yaml` file. You must also configure the other TLS parameters to provide the

necessary certificates for the `ndbmysqld` pods in the `custom_values.yaml` file. For the procedure to enable TLS for georeplication, see Enabling TLS for Georeplication. For more information about the TLS parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

- To enable TLS for a secure connection between cnDBTier and NFs, use the `/global/ndbappTLS/enable` parameter in the `custom_values.yaml` file. You must also configure the other TLS parameters to provide the necessary certificates for the `ndbappmysqld` pods in the `custom_values.yaml` file. For the procedure to enable TLS for communication between cnDBTier and NFs, see Enabling TLS for Communication with NFs. For more information about the TLS parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Modifying cnDBTier Certificates for TLS

You can modify the cnDBTier certificates that the system uses to establish encrypted connections for georeplication and communication with NFs. For procedures, see Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites and Modifying cnDBTier Certificates to Establish TLS for Communication with NFs.

3.8 Network Policies

Network Policies is an application-centric construct that allows cnDBTier pods to control or restrict the incoming and outgoing network traffic. This ensures security and isolation of services within a Kubernetes cluster.

Network Policies creates pod-level rules to specify how pods (Containers) in a Kubernetes cluster communicate with each other and with external resources. cnDBTier uses Network Policies on the pods to enhance the security and control both incoming and outgoing traffic effectively. For more information about Network Policies, see Kubernetes Network Policies documentation.

Enabling and Configuring Network Policies

You can enable or disable network policies for different pods using the network policy parameters in the `custom_values.yaml` file. For more information about enabling or disabling this feature for cnDBTier pods, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

3.9 REST APIs for CNC Console

cnDBTier supports CNC Console to integrate cnDBTier functionalists on CNC Console GUI. To enable this feature, cnDBTier exposes REST APIs. CNC Console uses these REST APIs to integrate cnDBTier data on CNC console GUI.
For detailed information about the REST APIs, see cnDBTier APIs for CNC Console.
Network Functions (NFs) can integrate cnDBTier on CNC Console to perform the following (but not limited to) operations:

- Checking the status of cnDBTier cluster or georeplication.
- Checking the list of completed backups.
- Checking cnDBTier version.
- Checking the health status of cnDBTier services such as replication service, monitor service, data service, and backup manager service.

- Initiating on-demand backup.
- Performing georeplication recovery.

To integrate and customize cnDBTier on CNC Console, NFs must configure the `menuCncc.json` file as shown in the following example:

```
{
  "menu": {
    "routeConfig": {
      "home": {
        "label": "Home",
        "value": "home",
        "isDefault": true
      },
      "commonServices": {
        "label": "Common Services",
        "value": "commonServices",
        "isDefault": true
      },
      "services/{nf}/{service}": {
        "label": "Services",
        "value": "services"
      },
      "configurations/{nf}/{configType}": {
        "label": "Configurations",
        "value": "configurations"
      }
    },
    "menuItems": [
      {
        "attr": {
          "id": "cnDBTier",
          "name": "cnDBTier",
          "sequence": 10
        },
        "children": [
          {
            "attr": {
              "id": "services/<NF Name>/dbconfig-backupList",
              "name": "Backup List",
              "sequence": 10
            }
          },
          {
            "attr": {
              "id": "cnDBTierHealth",
              "name": "cnDBTier Health",
              "sequence": 20
            },
            "children": [
              {
                "attr": {
                  "id": "services/<NF Name>/dbconfig-backupHealthStatus",
                  "name": "Backup Manager Health Status",
                  "sequence": 100
                }
```

```
                    },
                    {
                      "attr": {
                        "id": "services/<NF Name>/dbconfig-monitorHealthStatus",
                        "name": "Monitor Health Status",
                        "sequence": 110
                      }
                    },
                    {
                      "attr": {
                        "id": "services/<NF Name>/dbconfig-ndbHealthStatus",
                        "name": "NDB Health Status",
                        "sequence": 120
                      }
                    },
                    {
                      "attr": {
                        "id": "services/<NF Name>/dbconfig-replicationHealthStatus",
                        "name": "Replication Health Status",
                        "sequence": 130
                      }
                    }
                  ]
                },
                {
                  "attr": {
                    "id": "services/<NF Name>/dbconfig-version",
                    "name": "cnDBTier Version",
                    "sequence": 30
                  }
                },
                {
                  "attr": {
                    "id": "services/<NF Name>/dbconfig-databaseStatisticsReport",
                    "name": "Database Statistics Report",
                    "sequence": 40
                  }
                },
                {
                  "attr": {
                    "id": "GeoreplicationRecovery",
                    "name": "Georeplication Recovery",
                    "sequence": 50
                  },
                  "children": [
                    {
                      "attr": {
                        "id": "services/<NF Name>/dbconfig-updateClusterAsFailed",
                        "name": "Update Cluster As Failed",
                        "sequence": 100
                      }
                    },
                    {
                      "attr": {
                        "id": "services/<NF Name>/dbconfig-
startGeoreplicationRecovery",
```

```
                    "name": "Start Georeplication Recovery",
                    "sequence": 110
                  }
                },
                {
                  "attr": {
                    "id": "services/<NF Name>/dbconfig-
georeplicationRecoveryStatus",
                    "name": "Georeplication Recovery Status",
                    "sequence": 120
                  }
                }
              ]
            },
            {
              "attr": {
                "id": "configurations/<NF Name>/dbconfig-geoReplicationStatus",
                "name": "Georeplication Status",
                "sequence": 60
              }
            },
            {
              "attr": {
                "id": "services/<NF Name>/dbconfig-clusterStatus",
                "name": "Local Cluster Status",
                "sequence": 70
              }
            },
            {
              "attr": {
                "id": "services/<NF Name>/dbconfig-onDemandBackup",
                "name": "On Demand Backup",
                "sequence": 80
              }
            },
            {
              "attr": {
                "id": "services/<NF Name>/dbconfig-heartBeatStatus",
                "name": "Replication HeartBeat Status",
                "sequence": 90
              }
            }
          ]
        }
      ]
    }
}
```

References:

- For procedures to perform georeplication recovery using CNC Console, see the "Restoring Georeplication (GR) Failure" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
- For information about CNC Console GUI, see *Oracle Communications Cloud Native Configuration Console User Guide*.

- For more information about integrating cnDBTIer APIs on CNC Console for a specific NF, see the respective NF documents.

3.10 PVC Health Monitoring

The platform-level issues and hardware failures impact the PVC health that in turn impacts the cnDBTier health. Before implementing this feature, to identify any PVC issues, you must wait for the MySQL Cluster processes to log an error. With this feature, cnDBTier provides options to monitor the health of PVCs that are mounted on cnDBTier pods.

Managing PVC Health Monitoring

The following sections provide details about managing PVC Health Monitoring:

Enabling and Configuring PVC Health Monitoring
You can enable or disable PVC Health Monitoring using the PVC health global parameters available in the `custom_values.yaml` file. For more information about enabling or disabling this feature, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Monitoring PVC Health Through Metrics and Alerts
PVC Health Monitoring facilitates each pod to monitor its PVC and pass the PVC health condition to the monitor service. The monitor service combines this data and produces metrics for each PVC's health. For information about PVC Health Monitoring metrics, see cnDBTier Metrics.

3.11 cnDBTier Automated Backup

The cnDBTier backup service creates and safely stores database backups periodically so that the user can always have a relatively recent copy of the data, to recover from cnDBTier fault scenarios. cnDBTier backup service works on each MySQL cluster data node. Each data node creates a backup of the hosted data and maintains a copy of the backup.

The automatic backup runs when all the database nodes are running. The retention period and frequency of the backup are configurable. The status of the database backups taken is stored in the database nodes and is available to database monitor service to include in metrics. The following table describes these parameters and their default values.

Table 3-4 DB Backup Service

Parameter	Units	Default	Description
backup_period	integer	1	The number of days between each backup.
num_backups_to_retain	integer	3	The number of backups to retain. Recommended number of backups is at least 3. This ensures at least one backup remains, in case the automated backup system force purges additional backups, due to backup size growth.

Monitoring Automated Backups

The status of the database backups is stored in the database nodes and is accessible to the database Monitor service. The system maintains metrics and alerts to monitor and track automatic backups. Additionally, it triggers an alert when the current NDB cluster performs a backup. For information about automatics backup metrics, see cnDBTier Automated Backup

Metrics. For information about automatic backup alerts, see cnDBTier Automated Backup Alerts.

REST APIs

cnDBTier provides the `http://<base-uri>/db-tier/status/cluster/local/backup` REST API to fetch the details of the data node backups that are in progress in the NDB cluster. For more information about this REST API, see cnDBTier Backup APIs.

> **Note**
>
> MySQL doesn't allow schema change in a cluster when a backup is in progress. Therefore, ensure that you don't make any schema changes in a cluster when a data node backup is in progress. You can use the `http://<base-uri>/db-tier/status/cluster/local/backup` API to:
>
> - check if the current cluster is performing a database back up.
> - retrieve the timestamp of the next scheduled routine backup.
> - determine the time window for NF upgrades.

3.12 cnDBTier Password Encryption

cnDBTier provides the password encryption feature to encrypt for replication username and password stored in the database to ensure that the passwords are secure and are not exposed. When the password encryption feature is enabled, the replication username and password are encrypted throughout the life cycle of cnDBTier unless the feature is disabled.

Managing cnDBTier Password Encryption

The following sections provide details about managing cnDBTier password encryption:

Enabling cnDBTier Password Encryption
You can enable or disable the cnDBTier password encryption feature using the `/global/encryption/enable` parameter in the `custom_values.yaml` file. For more information about enabling and disabling this feature, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Configuring cnDBTier Password Encryption
Before enabling cnDBTier password encryption, you must create the necessary secrets that are used to encrypt the passwords. For information about creating secrets for password encryption, see the "Creating Secret" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

You can modify the encryption key used to encrypt the replication username and password. For the procedure to modify the password encryption key, see the Modifying cnDBTier Password Encryption Key section.

3.13 Database Backup Encryption and Secure Transfer

cnDBTier supports creation of database backups at configured intervals which are used to restore database during a georeplication recovery. These backups contain sensitive subscriber data that are transferred to remote servers and sites for performing fault recovery. Therefore,

it's important to encrypt the backups to protect the sensitive data and avoid any misuse. cnDBTier uses the encrypt and decrypt options provided by MySQL NDB cluster to encrypt the on-demand or periodic backups at the cluster level.

cnDBTier provides the functionality to securely transfer the backups stored in the data nodes to remote sites using Secure File Transfer Protocol (SFTP). This ensures that there is no loss of backups due to purging in cnDBTier as the backups are stored in remote servers. The backups in the remote server are saved under the `<remote server path>/<cnDBTier site name>` path where,

- `<remote server path>`, is the path of the remote server configured in the `/global/remotetransfer/remoteserverpath` parameter in the `custom_values.yaml` file.
- `<cnDBTier site name>`, is the name of the cnDBTier site.

The backups in the remote server are saved in the following formats:

- `backup_<backup_id>_Encrypted.zip`, if backup encryption is enabled.
- `backup_<backup_id>_Unencrypted.zip`, if backup encryption is disabled.

Managing Database Backup Encryption and Secure Transfer

The following sections provide details about managing database backup encryption and secure backup transfer:

Enabling Database Backup Encryption

Each cnDBTier cluster has an option to enable or disable the backup encryption independently. You can enable or disable the database encryption using the `/global/backupencryption/enable` parameter in the `custom_values.yaml` file. For more information about enabling and disabling this feature, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

When this feature is enabled, the backup data record and log files written by each data node are encrypted using the password present in the "occne-backup-encryption-secret" secret and a Salt that is randomly generated using a key derivation function (KDF) that employs the PBKDF2-SHA256 algorithm to generate a symmetric encryption key for that file.

Configuring Database Backup Encryption

You must provide the required credentials to encrypt the backups when the backup is initiated (on-demand backups, periodic backups, or backups initiated during restore georeplication). cnDBTier uses secret keys to encrypt database backups. You can configure these keys using Kubernetes secret during the installation. When the `START BACKUP` command is initiated, the DB backup manager service reads these keys and initiates the backup using the encrypt password(ENCRYPT PASSWORD=password). For information about creating secrets for encrypting backups, see the "Creating Secret" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

cnDBTier provides an option to modify the backup encryption password when required. For information about modifying cnDBTier backup encryption password, see Modifying cnDBTier Backup Encryption Password.

> **Note**
>
> The password used for encryption must follow the cnDBTier password requirement or standard.

Enabling Secure Backup Transfer

You can enable or disable secure backup transfer using the `/global/remotetransfer/enable` parameter in the `custom_values.yaml` file. For more information about enabling and disabling this secure backup transfer, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Configuring Secure transfer of backups to Remote Server
cnDBTier requires the remote server configurations to securely transfer backups. You can use the `custom_values.yaml` file to configure the details about remote servers such as remote server IP, port, and path. These configurations can be done during an installation or upgrade. For more information about configuring the remote server details, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

cnDBTier uses SSH key and username to securely transfer backups to remote servers. You can configure these keys and username using Kubernetes secret during the installation or upgrade. For information about creating secrets for secure backup transfer, see the "Creating Secret" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

cnDBTier also provides an option to modify the remote server configurations, such as IP, port, path, usernname, and SSH key in cnDBTier. For more information about modifying remote server configurations in cnDBTier, see Modifying Remote Server Configurations for Secure Transfer of Backups.

> **Note**
>
> Currently, cnDBTier doesn't support using the remote server backups for performing any restore or recovery procedures.

3.14 Node Selector and Node Affinity

The Node Selector and Node Affinity feature allows the Kubernetes scheduler to determine the type of nodes in which the cnDBTier pods are to be scheduled, depending on the predefined node labels or constraints. cnDBTier uses nodeSelector and nodeAffinity options to schedule cnDBTier pods to specific worker nodes.

nodeSelector is the basic form of cluster node selection constraint. It allows you to define the node labels (constraints) in the form of key-value pairs. When the nodeSelector feature is used, Kubernetes schedules the pods to only the nodes that match each of the node labels you specify.

nodeAffinity allows you to define advanced constraints to limit the pod scheduling on specific nodes. There are two types of node affinity:

- requiredDuringSchedulingIgnoredDuringExecution (Hard type): In this type, the scheduler doesn't schedule the pods unless the defined rules are met.
- preferredDuringSchedulingIgnoredDuringExecution (Soft type): In this type, the scheduler tries to find a node that meets the defined rules. However, even if a matching node is not available, the scheduler still schedules the pod.

Managing Node Selector and Node Affinity Feature

The following sections provide details on managing the Node Selector and Node Affinity feature:

Enabling Node Selector and Node Affinity
You can enable or disable the `nodeSelector` and `nodeAffinity` options for the pods using the `custom_values.yaml` file. For more information on enabling and disabling parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> - You can enable either nodeSelector or nodeAffinity option to schedule cnDBTier pods to specific worker nodes.
> - By default, both nodeSelector and nodeAffinity options are disabled.

Configuring Node Selector and Node Affinity
Depending on the nodeSelector or nodeAffinity option enabled, you can configure its parameters in the `custom_values.yaml` file. For more information on the node selector and node affinity configuration parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> Configure the node selector or node affinity parameters only when either of the options is enabled.

3.15 cnDBTier Scaling

cnDBTier provides the ability to expand or contract the capacity of your resources to support the changing usage of your application. This includes scaling out and in, or scaling up and down the resources. cnDBTier supports two types of scaling:

- Horizontal Scaling: Horizontal scaling refers to adding additional nodes to the pool of resources to share the load. cnDBTier supports horizontal scaling for the following pods:
  - `ndbappmysqld`: cnDBTier supports both manual and auto-scaling of `ndbappmysqld` pods. When horizontal auto-scaling is enabled, `ndbappmysqld` scales automatically depending on the CPU and RAM usage. In this case, the higher and lower limits for scaling are defined in the `custom_values.yaml` file. When auto-scaling is disabled, cnDBTier provides an option to manually scale the `ndbappmysqld` pods as per your requirement.
  - `ndbmtd`: cnDBTier supports only manual scaling up of `ndbmtd` data pods, and doesn't support scaling down.
- Vertical Scaling: Vertical scaling refers to increasing the processing power (CPU, memory, and PVC) of a cluster. cnDBTier supports manual vertical scaling for the following pods:
  - `ndbmtd`
  - `ndbappmysqld`
  - `ndbmysqld`
  - `db-replication-svc`
  - `ndbmgmd`

Additionally, cnDBTier provides the `dbtscale_vertical_pvc` script to automatically update the PVC values of the pods.

For horizontal and vertical scaling procedures, see Scaling cnDBTier Pods.

Managing cnDBTier Scaling

The following sections provide details on managing the cnDBTier scaling feature:

Enabling Horizontal Pod Auto-Scaler
You can enable or disable horizontal auto-scaling for `ndbappmysqld` pods using the `/global/autoscaling/ndbapp/enabled` parameter in the `custom_values.yaml` file. You can enable or disable horizontal auto-scaling on the basis of memory consumption, CPU consumption, or both using the following parameters:

- `/api/ndbapp/horizontalPodAutoscaler/memory/enabled`
- `/api/ndbapp/horizontalPodAutoscaler/cpu/enabled`

For more information about these parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Configuring Horizontal Pod Auto-Scaler
You can use the following parameters to configure the average memory utilization and CPU utilization using the following parameters which triggers the auto-scaling when the average memory or CPU utilization reaches the specified percentage:

- /api/ndbapp/horizontalPodAutoscaler/memory/averageUtilization
- /api/ndbapp/horizontalPodAutoscaler/cpu/averageUtilization

For more information about these parameters, see the "Customizing cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

3.16 Support for Automated Certificate Lifecycle Management

In cnDBTier 25.1.2xx and earlier, the Transport Layer Security (TLS) certificates were managed manually. When multiple instances of cnDBTier were deployed in a 5G network, certificate management, such as certificate creation, renewal, removal, and so on, became tedious and error-prone.

Starting with cnDBTier 25.2.1xx, you can integrate cnDBTier with Oracle Communications Cloud Native Core, Certificate Management (OCCM) to support automation of certificate lifecycle management. OCCM manages TLS certificates stored in Kubernetes secrets by integrating with Certificate Authority (CA) using the Certificate Management Protocol Version 2 (CMPv2) protocol in the Kubernetes secret. OCCM obtains and signs TLS certificates within the cnDBTier namespace. For more information about OCCM, see *Oracle Communications Cloud Native Core, Certificate Management User Guide*.

This feature enables automated TLS certificate lifecycle management for HTTPS, MySQL replication SQL pods and MySQL application SQL pods within the cnDBTier environment, ensuring secure and uninterrupted communication during certificate updates.

Certificate Monitoring for HTTPS and TLS Certificates

A certificate monitoring service is responsible for ensuring that TLS/HTTPS certificates are continuously observed for changes and updated in a controlled, zero-downtime manner.

- **Continuous Monitoring**: The monitoring service continuously watches TLS/HTTPS certificates for any updates.
- **Change detection**: The monitoring services detects the change whenever a TLS/HTTPS certificate or secret is updated, and appropriate reload actions are initiated based on the pod type and connection behavior.
- **No Service restart**: The monitoring service does not force an immediate restart or a full service disruption is performed, in case of a change in the certificate alone.

Replication SQL Pods for Monitoring the TLS Certificate

The Replication SQL pods are responsible for MySQL replication between the cnDBTier sites. TLS is used for securing MySQL replication traffic.

When a Certificate change is detected, the following is the workflow:

1. **Monitoring for Changes**: A monitoring service detects for any changes in the certificates. Upon certificate update, the change is detected and validated.
2. **Reloading Certificate on Detection**: The updated certificates are reloaded into the replication SQL pod. However, no restart or switchover is triggered immediately.
3. **Deferred Usage of New Certificates**: The new certificates are loaded, but not actively used in ongoing replication sessions. The active replication sessions continue using the old TLS session until a natural replication session switchover event occurs, for example new TLS handshake or replication session restart, to begin using the new certificate.This avoids disruption to ongoing replication sessions.

APP SQL Pods for Monitoring the TLS Certificate

The APP SQL pods handle application-related SQL traffic, primarily servicing Network Function (NF) workloads. These workloads often involve high-throughput, low-latency, and long-lived connections, making seamless TLS handling crucial for availability and stability.

On Certificate update, following is the workflow:

1. The pod reloads the TLS so that APP SQL pod is loaded with new certificate.
2. Existing NF connections remain active and active sessions continue to use the old certificate to prevent disruption.
3. New connections are automatically established using the new Certificate.

Scheduled Switchover via Cron Job for Replication SQL and APP SQL Pods

A cron job is scheduled to run at predefined intervals to enforce a switchover or reload when a Certificate change is detected. This ensures updated Certificates are applied promptly, avoiding the risks associated with outdated or expired Certificates.

In case of Replication SQL pods, if the Certificate change has occurred but no natural switchover has happened, then the cron job triggers a forced reload or a switchover, applying the new Certificate.

In case of APP SQL pods:

1. The pod reloads the TLS so that APP SQL pod is loaded with new certificate.
2. Existing NF connections remain active and active sessions continue to use the old Certificate to prevent disruption.
3. New connections are automatically established using the new Certificate.

4
cnDBTier APIs

This chapter describes the APIs used in cnDBTier and their parameters.

> **Note**
>
> The "occne-cndbtier" namespace name used in this section is only an example. Ensure that you configure the namespace name according to your environment.

4.1 cnDBTier Cluster Events APIs

cnDBTier cluster events APIs are used to retrieve or update the following details about a cnDBTier cluster:

- Retrieve information about the events that occur in a cluster. The following table provides information about the cluster events:

Table 4-1 Cluster Event Types

Cluster Event	Description
START	This event is recorded when the cluster is installed.
RESTART	This event is recorded when the cluster is restarted after the cluster is disconnected and started.
RESTORE	This event is recorded when the cluster is restored from the backup during Georeplication.
RE-SYNC	This event is recorded when the cluster is synced after the cluster is restored and georeplication channels are established, and after all the data is synced from remote sites after the restore is performed.
FAILURE	This event is recorded when the cluster is in failed state.
CHECKPOINT	This event is recorded when the database is completely restored from the remote site, from this timestamp, it means that the database is in sync with remote sites until other restarts.

- Reset the counter value of `cluster_restart_disconnect` to *0* to indicate that the cluster is in healthy state currently.

These details can be used to determine if there is a data loss due to the events in a cluster. These APIs are hosted by the DB monitor service.

Table 4-2 cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
http://<base-uri>/db-tier/reset/parameter/cluster_restart_disconnect	This API is used to reset the counter value of `cluster_restart_disconnect` to zero in the current cluster to indicate that the cluster is currently healthy. Service Type: Realtime. This API provides real time data.	POST	NA	• 200 OK Successfully Updated `cluster_restart_disconnect` to 0. • 500 INTERNAL SERVER ERROR - failed to reset `cluster_restart_disconnect`.	NA
http://<base-uri>/db-tier/reset/cluster/{cluster-name}/parameter/cluster_restart_disconnect	This API is used to reset the counter value of `cluster_restart_disconnect` to zero in the specified cluster to indicate that the cluster is currently healthy. Service Type: Realtime. This API provides real time data.	POST	NA	• 200 OK Successfully Updated `cluster_restart_disconnect` to 0. • 404 Not Found - The cluster name has not been configured. • 500 INTERNAL SERVER ERROR - failed to reset cluster_restart_disconnect.	NA

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/db-tier/cluster/status	This API is used to retrieve the timestamps of the events from the current cluster along with details of the latest event that occurred in the cluster. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Successfully fetched the cluster status with the last event occurred.
				• 500 INTERNAL SERVER ERROR - Unable to fetch cluster status with the last event occurred.
					<pre>{
					  "clusterName": "<cluster name>",
					  "currentTS": "<current timestamp in UTC format>",
					  "lastStartTS": "<last start Time Stamp if present else blank>",
					  "lastRestoreTS": "<last restore Time Stamp if present else blank>",
					  "lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>",
					  "lastRestartTS": "<last Restart Time Stamp if present else blank>",
					
					  "lastFailureTS": "<last Failure Time Stamp if present else blank>",
					  "lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>",
					  "lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>",
					
					"clusterDisconnectCount": "<Cluster Disconnect Count>",
					  "eventsList": [
					    {
					      "eventType": "<event Type>",
					      "eventTS": "<Time Stamp at which event occurred>"
					    }
					  ],
					  "remoteSitesMonitorTS": [
					    {
					      "clusterName": "<cluster name>",</pre>

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					},
					{
					"clusterName": "<cluster name>",
					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					}
					]
					}

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://base-uri/db-tier/cluster/status/events/{numberOfLastEvents}	This API is used to retrieve the timestamps of the events from the current cluster along with details of the specified number of latest events that occurred in the cluster.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK: Successfully fetched the cluster status with the last the last <numberOfLastEvents> events occurred.
				• 400 BAD REQUEST - If {numberOfLastEvents} exceeds the configured max count which is by default 10
				• 500 INTERNAL SERVER ERROR: Unable to fetch cluster status with the last event occurred.
					<pre>{
					"clusterName": "<cluster name>",
					"currentTS": "<current timestamp in UTC format>",
					"lastStartTS": "<last start Time Stamp if present else blank>",
					"lastRestoreTS": "<last restore Time Stamp if present else blank>",
					"lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>",
					"lastRestartTS": "<last Restart Time Stamp if present else blank>",
					
					"lastFailureTS": "<last Failure Time Stamp if present else blank>",
					"lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>",
					"lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>",
					
					"clusterDisconnectCount": "<Cluster Disconnect Count>",
					"eventsList": [
					{
					"eventType": "<event Type>",
					"eventTS": "<Time Stamp at which event occurred>"
					},
					
					{
					"eventType": "<event Type>",
					"eventTS": "<Time Stamp at which event</pre>

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					occurred>"
					}
					],
					"remoteSitesMonitorTS":
					[
					{
					"clusterName":
					"<cluster name>",
					"monitorTS": "<Last
					Monitor Time Stamp for
					the cluster If present
					else blank>"
					},
					{
					"clusterName":
					"<cluster name>",
					"monitorTS": "<Last
					Monitor Time Stamp for
					the cluster If present
					else blank>"
					}
					]
					}

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/db-tier/all/cluster/status/	This API is used to retrieve the timestamps of events from all the clusters along with details of the latest event occurred in the clusters.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - Successfully fetched the cluster status with the last event occurred.
				• 500 INTERNAL SERVER ERROR - Unable to fetch cluster status with the last event occurred.
					[
					{
					"clusterName": "<cluster name>",
					"currentTS": "<current timestamp in UTC format>",
					"lastStartTS": "<last start Time Stamp if present else blank>",
					"lastRestoreTS": "<last restore Time Stamp if present else blank>",
					"lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>",
					"lastRestartTS": "<last Restart Time Stamp if present else blank>",
					"lastFailureTS": "<last Failure Time Stamp if present else blank>",
					"lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>",
					"lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>",
					"clusterDisconnectCount": "<Cluster Disconnect Count>",
					"eventsList": [
					{
					"eventType": "<event Type>",
					"eventTS": "<Time Stamp at which event occurred>"
					}
					],

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"remoteSitesMonitorTS": [
					{
					"clusterName": "<cluster name>",
					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					},
					{
					"clusterName": "<cluster name>",
					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					}
					]
					},
					
					{
					"clusterName": "<cluster name>",
					"currentTS": "<current timestamp in UTC format>",
					"lastStartTS": "<last start Time Stamp if present else blank>",
					"lastRestoreTS": "<last restore Time Stamp if present else blank>",
					"lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>",
					"lastRestartTS": "<last Restart Time Stamp if present else blank>",
					
					"lastFailureTS": "<last Failure Time Stamp if present else blank>",
					"lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>",

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>",
					
					"clusterDisconnectCount": "<Cluster Disconnect Count>",
					"eventsList": [
					{
					"eventType": "<event Type>",
					"eventTS": "<Time Stamp at which event occurred>"
					}
					],
					
					"remoteSitesMonitorTS": [
					{
					"clusterName": "<cluster name>",
					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					},
					{
					"clusterName": "<cluster name>",
					"monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>"
					}
					]
					}
					]

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
http://<base-uri>/db-tier/all/cluster/status/events/{numberOfLastEvents}	This API is used to retrieve the timestamps of events from all the clusters along with details of the specified number of latest events that occurred in the clusters. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK: Successfully fetched the cluster status with the last the last <numberOfLastEvents> events occurred. • 400 BAD REQUEST - If {numberOfLastEvents} exceeds the configured max count which is by default 10. • 500 INTERNAL SERVER ERROR: Unable to fetch cluster status with the last event occurred.	[{ "clusterName": "<cluster name>", "currentTS": "<current timestamp in UTC format>", "lastStartTS": "<last start Time Stamp if present else blank>", "lastRestoreTS": "<last restore Time Stamp if present else blank>", "lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>", "lastRestartTS": "<last Restart Time Stamp if present else blank>", "lastFailureTS": "<last Failure Time Stamp if present else blank>", "lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>", "lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>", "clusterDisconnectCount": "<Cluster Disconnect Count>", "eventsList": [{ "eventType": "<event Type>", "eventTS": "<Time Stamp at which event occurred>" }, {

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					<pre>"eventType": "<event Type>", "eventTS": "<Time Stamp at which event occurred>" }], "remoteSitesMonitorTS": [{ "clusterName": "<cluster name>", "monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>" }, { "clusterName": "<cluster name>", "monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>" }] }, { "clusterName": "<cluster name>", "currentTS": "<current timestamp in UTC format>", "lastStartTS": "<last start Time Stamp if present else blank>", "lastRestoreTS": "<last restore Time Stamp if present else blank>", "lastDBResyncTS": "<last DB Resync Time Stamp if present else blank>", "lastRestartTS": "<last Restart Time Stamp if present else blank>",</pre>

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					"lastFailureTS": "<last Failure Time Stamp if present else blank>", "lastCheckpointTS": "<last Checkpoint Time Stamp if present else blank>", "lastMonitorPollTS": "<last Monitor Poll Time Stamp if present else blank>", "clusterDisconnectCount": "<Cluster Disconnect Count>", "eventsList": [{ "eventType": "<event Type>", "eventTS": "<Time Stamp at which event occurred>" }, { "eventType": "<event Type>", "eventTS": "<Time Stamp at which event occurred>" }], "remoteSitesMonitorTS": [{ "clusterName": "<cluster name>", "monitorTS": "<Last Monitor Time Stamp for the cluster If present else blank>" }, { "clusterName": "<cluster name>", "monitorTS":

Table 4-2 (Cont.) cnDBTier Cluster Events APIs

Rest API URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					"<Last Monitor Time Stamp for the cluster If present else blank>" }] }]

> **Note**
>
> Replace the value of <base-uri> in the REST URL with <db-monitor-svc service name>.<namespace>:8080.
> Refer to the following examples to use these REST APIs to update or retrieve the cluster details:
>
> ```
> $ curl -X POST http://<base-uri>/db-tier/reset/parameter/
> cluster_restart_disconnect
> $ curl -X POST http://<base-uri>/db-tier/reset/cluster/{cluster-name}/
> parameter/cluster_restart_disconnect
> $ curl -X GET http://<base-uri>/db-tier/cluster/status
> $ curl -X GET http://<base-uri>/db-tier/cluster/status/events/
> {numberoflastevents}
> $ curl -X GET http://<base-uri>/db-tier/all/cluster/status
> $ curl -X GET http://<base-uri>/db-tier/all/cluster/status/events/
> {numberoflastevents}
> ```

4.2 cnDBTier APIs for CNC Console

cnDBTier APIs facilitate CNC Console to determine the status of cnDBTier and the associated cross-site replication. The DB replication service hosts these APIs.

Table 4-3 cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/status/replication/realtime/{remoteSiteName}	This API provides site-specific replication status. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Fetched the list of backups present in cnDBTier.
				• 400 Bad Request
				• 404 Not Found
				• 500 Internal Server Error.
				• 503 Service Unavailable - Cross-site replication is not enabled.
					• 200 OK:
					{
					"localSiteName":"<current-site-name>",
					"remoteSiteName":"<remote-site-name>",
					"replicationStatus":"UP/DOWN/INITIALIZING"
					"secondsBehindRemote":
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					"replicationGroupDelay": [
					{
					"replchannel_group_id": "1",
					"secondsBehindRemote": <seconds>,
					"channelDetails": [
					{
					"remote_replication_ip": "127.0.0.1",
					"role": "ACTIVE"
					},
					{
					"remote_replication_ip": "127.0.0.2",
					"role": "STANDBY"
					}
					]
					},
					{

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"replchannel_group_id" : "2",
					
					"secondsBehindRemote": <seconds>,
					
					"channelDetails": [{
					
					"remote_replication_ip": "127.0.0.3", "role": "ACTIVE" }, {
					
					"remote_replication_ip": "127.0.0.4", "role": "STANDBY" }] }]
					}
					• 400 Bad Request:
					
					{ "title": "Bad Request", "status": 400, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params>
					}
					• 404 Not Found:
					
					{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams":

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					<params>
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}
					• 503 Service Unavailable - Cross-site replication is not enabled:
					{
					"title": "Service Unavailable",
					"status": 503,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/status/replication/realtime	This API provides the overall replication status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - Cross-site replication is active
				• 500 Internal Server Error
				• 503 Service Unavailable - Cross-site replication is not enabled
					• 200 OK - Cross-site replication is active:
					{
					[
					{
					"localSiteName":"<current-site-name>",
					"remoteSiteName":"<remote-site-name>",
					"replicationStatus":"UP/DOWN/INITIALIZING"
					"secondsBehindRemote":
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					"replicationGroupDelay":
					[{
					replchannel_group_id: 1,
					secondsBehindRemote: <seconds>
					},
					{
					replchannel_group_id: 2,
					secondsBehindRemote: <seconds>
					}]
					},
					{
					"localSiteName":"<current-site-name>",
					"remoteSiteName":"<remote-site-name>",

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"replicationStatus":"UP/DOWN/INITIALIZING"
					"secondsBehindRemote":
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					"replicationGroupDelay":
					[{
					replchannel_group_id: 1,
					secondsBehindRemote: <seconds>
					},
					{
					replchannel_group_id: 2,
					secondsBehindRemote: <seconds>
					}]
					}
					]
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					• 503 Service Unavailable - Cross-site replication is not enabled: `{ "title": "Service Unavailable", "status": 503, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

http://<base-uri>/ocdbtier/status/cluster/local/realtime	This API provides the local cluster status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK- The local NDB cluster is UP or DOWN
				• 500 Internal Server Error
					• 200 OK- The local NDB cluster is UP or DOWN:
					
					`{ "clusterName":"<current-cluster-name>", "clusterStatus":"UP/DOWN" }`
					• 500 Internal Server Error:
					
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/version	This API provides the cnDBTier version. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 500 Internal Server Error
					• 200 OK:
					{
					"cndbtier_version": "25.1.103",
					"ndb_version": "ndb-8.4.3"
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/list/backups	This API provides the list of backups completed in the current site. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Fetched the Heart Beat Status of every replication service running on the current cluster
				• 404 NOT FOUND Table Missing
				• 500 Internal Server Error
					• 200 OK:
					{
					"localSiteName": "<current_site_name>",
					"backupDetails": [
					{
					"backupId": "<backup identifier>",
					"backupSize": "<size of backup>",
					"creationTimeStamp": "<timestamp at which backup was initiated>"
					},
					{
					"backupId": "<backup identifier>",
					"backupSize": "<size of backup>",
					"creationTimeStamp": "<timestamp at which backup was initiated>"
					},
					{
					"backupId": "<backup identifier>",
					"backupSize": "<size of backup>",
					"creationTimeStamp": "<timestamp at which backup was initiated>"
					}
					]
					}
					• 404 NOT FOUND Table Missing:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "DBTIER_BACKUP_INFO table doesn't exist

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					in the current site so cannot list the backup",
					"cause": null,
					"invalidParams": null
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "Could not list the backups",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/statistics/report/dbinfo	This API provides database statistic reports. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 500 INTERNAL_SERVER_ERROR
				• 503 SERVICE_UNAVAILABLE
					• 200 OK:
					{
					"databaseCount": <database count>,
					"databaseTablesCount": [
					{
					"dbName": "<database name>",
					"tableCount": <table count>
					},
					{
					"dbName": "<database name>",
					"tableCount": <table count>
					}
					],
					"databaseTableRowsCount": [
					{
					"dbName": "<database name>",
					"tables": [
					{
					"tableName": "<table name>",
					"rowCount": <row count>
					}
					]
					},
					{
					"dbName": "<database name>",
					"tables": [
					{
					"tableName": "<table name>",
					"rowCount": <row count>

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					<pre>},
					{
					
					"tableName": "<table name>",
					"rowCount": <row count>
					}
					]
					}
					]
					
					}</pre>
					• 500 INTERNAL_SERVER_ERROR:
					<pre>{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception Details>",
					"cause": null,
					"invalidParams": null
					}</pre>
					• 503 SERVICE_UNAVAILABLE:
					<pre>{
					"title": "Service Unavailable",
					"status": 503,
					"detail": "<Exception details>",
					"cause": null,
					"invalidParams": null
					}</pre>

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/heartbeat/status	This API provides the overall HeartBeat Status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK
				• 503 SERVICE_UNAVAILABLE - Not able to query the Database
				• 500 INTERNAL_SERVER_ERROR - Could Not Check The HeartBeat Status
					• 200 OK:
					{
					"heartBeatDetails":
					[
					{
					"remoteSiteName":
					"<remote_site_name>",
					"heartBeatStatus":
					"<SUCCESS/FAILURE>",
					"heartBeatLag":
					"<Heart Beat Lag in Seconds>",
					"replicationChannelGroupId": <replication channel group id>
					},
					{
					"remoteSiteName":
					"<remote_site_name>",
					"heartBeatStatus":
					"<SUCCESS/FAILURE>",
					"heartBeatLag":
					"<Heart Beat Lag in Seconds>",
					"replicationChannelGroupId": <replication channel group id>
					}
					],
					"siteName":
					"<current_site_name>",
					}
					• 503 SERVICE_UNAVAILABLE - Not able to query the Data Base:
					{
					"title": "Service Unavailable",
					"status": 503,
					"detail": "Not able

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					to query the Data Base",
					"cause": null,
					"invalidParams": null
					}
					• 500 INTERNAL_SERVER_ERROR - Could Not Check The HeartBeat Status:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "Could Not Check The HeartBeat Status",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
http://<base-uri>/ocdbtier/on-demand/backup/initiate	This API initiates an on-demand backup. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK • 404 NOT FOUND • 500 INTERNAL_SERVER_ERROR	• 200 OK: { "siteName": "<current_site_name>", "drStatus": "<drStatus>", "backupId": "<backupId>", "backupStatus": "<backupStatus>", "remoteTransferStatus" : "<remoteTransferStatus>", "initiateBackup": false/true, "transferStatus": "<transferStatus>" } • 404 NOT FOUND: { "title": "Not Found", "status": 404, "detail": "<Exception message>", "cause": null, "invalidParams": null } • 500 INTERNAL_SERVER_ERROR : { "title": "Internal Server Error", "status": 500, "detail": "<Exception message>", "cause": null, "invalidParams": null }

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
http://<base-uri>/ocdbtier/on-demand/backup/initiate	This API initiates on-demand backup as per the provided requirements. Service Type: Realtime. This API provides real time data.	POST	{ "siteName": "<current_site_name>", "drStatus": "<drStatus>", "backupId": "<backupId>", "backupStatus": "<backupStatus>", "remoteTransferStatus": "<remoteTransferStatus>", "initiateBackup":false/true, "transferStatus": "<transferStatus>" }	• 200 OK • 400 BAD REQUEST • 404 NOT FOUND • 500 INTERNAL_SERVER_ERROR	• 200 OK: { "siteName": "<current_site_name>", "drStatus": "<drStatus>", "backupId": "<backupId>", "backupStatus": "<backupStatus>", "remoteTransferStatus": "<remoteTransferStatus>", "initiateBackup": false/true, "transferStatus": "<transferStatus>" } • 404 BAD REQUEST: { "title": "Bad Request", "status": 400, "detail": "Couldn't initiate the backup when initiateBackup flag is set to false", "cause": null, "invalidParams": [{ "param": "initiateBackup", "reason": "Couldn't initiate the backup when initiateBackup flag is set to false" }] }

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					• 404 NOT FOUND:
					
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Exception message>",
					"cause": null,
					"invalidParams": null
					}
					• 500 INTERNAL_SERVER_ERROR:
					
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "BACKUP_INITIATION_FAILED",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/health-info/replication-svc/status	This API provides the health status of the replication service.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK
				• 503 SERVICE_UNAVAILABLE - Replication Service IP is empty
				• 500 INTERNAL_SERVER_ERROR - Could Not Check The Replication Health Status
					• 200 OK:
					{
					"localSiteName": "<siteName>",
					"healthStatusDetails": [
					{
					"serviceName": "<serviceName>",
					"serviceStatus": "UP/DOWN",
					"connectionToDbStatus": "UP/DOWN",
					"overAllReplicationServiceHealth": "UP/DOWN"
					},
					{
					"serviceName": "<serviceName>",
					"serviceStatus": "UP/DOWN",
					"connectionToDbStatus": "UP/DOWN",
					"overAllReplicationServiceHealth": "UP/DOWN"
					}.....
					]
					}
					• 503 SERVICE_UNAVAILABLE - Replication Service IP is empty:
					{
					"title": "Service Unavailable",
					"status": 503,
					"detail": "Replication Service

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					IP is empty",
					"cause": null,
					"invalidParams":
					null
					}
					• 500 INTERNAL_SERVER_ERROR - Could Not Check The Replication Health Status:
					
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "Could Not Check The Health Status",
					"cause": null,
					"invalidParams":
					null
					}

http://<base-uri>/ocdbtier/health-info/monitor-svc/status	This API provides the health status of monitor service. Service Type: Realtime. This API provides real time data.	GET	NA	200 OK (Monitor Service is healthy)	200 OK:
					
					{
					"serviceName": "mysql-cluster-db-monitor-svc",
					"connectionToDbStatus": "UP",
					"metricScrapeStatus": "UP",
					
					"overAllMonitorServiceHealth": "UP"
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/health-info/ndb-svc/status	This API provides the overall health status of NDB data service. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 404 NOT FOUND - sitename not found
				• 500 INTERNAL_SERVER_ERROR - Could Not Check The Health Status
					• 200 OK:
					{
					"localSiteName": "<siteName>",
					"ndbHealthStatusDetails": [
					{
					"serviceName": "<serviceName>",
					"serviceStatus": "UP/DOWN",
					"pvcHealthStatus": "UP/DOWN"
					},
					{
					"serviceName": "<serviceName>",
					"serviceStatus": "UP/DOWN",
					"pvcHealthStatus": "UP/DOWN"
					}.....
					]
					}
					• 404 NOT FOUND - sitename not found:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "sitename not found",
					"cause": null,
					"invalidParams": null
					}
					• 500 INTERNAL_SERVER_ERROR

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					- Could Not Check The Health Status:
					
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "Could Not Check The Health Status",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/health-info/backup-mgr-svc/status	This API provides the health status of the backup manager service. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 500 INTERNAL_SERVER_ERROR - Could Not Check The Health Status
					• 200 OK:
					<pre>{
					"serviceName": "mysql-cluster-db-backup-manager-svc",
					"connectionToDbStatus": "UP",
					"serviceStatus": "UP",
					"backupExecutorHealthStatus": [
					{
					"nodeId": 2,
					"connectionToDbStatus": "UP"
					},
					{
					"nodeId": 1,
					"connectionToDbStatus": "UP"
					}
					],
					"overAllBackupManagerHealth": "UP"
					}</pre>
					• 500 INTERNAL_SERVER_ERROR - Could Not Check The Health Status:
					<pre>{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "Could Not Check The Health Status",
					"cause": null,
					"invalidParams": null
					}</pre>

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/list/clusterdetails	This API provides the cnDBTier cluster details.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK
				• 404 NOT FOUND
				• 500 INTERNAL SERVER ERROR
					• 200 OK:
					`[ { "clusterName": "<clusterName>", "clusterId": "1", "status": "ACTIVE/FAILED" }, { "clusterName": "<clusterName>", "clusterId": "2", "status": "ACTIVE/FAILED" }, { "clusterName": "<clusterName>", "clusterId": "3", "status": "ACTIVE/FAILED" } ]`
					• 404 NOT FOUND:
					`{ "title": "Not Found", "status": 404, "detail": "<Error message>", "cause": null, "invalidParams": null }`
					• 500 INTERNAL SERVER ERROR:
					`{ "title": "INTERNAL_SERVER_ERROR", "status": 500, "detail": "<Error message>",`

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					"cause": null, "invalidParams": null }

http://<base-uri>/ocdbtier/markcluster/failed	This API fetches information about failed cnDBTier clusters. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 404 NOT FOUND
				• 500 INTERNAL SERVER ERROR
					• 200 OK:
					{
					"clusterNameTobeMarkedAsFailed": "",
					"failedClusterNames": [
					"<failedcluster1>",
					"<failedcluster2>"
					]
					}
					• 404 NOT FOUND:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}
					• 500 INTERNAL SERVER ERROR:
					{
					"title": "INTERNAL_SERVER_ERROR",
					"status": 500,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/markcluster/failed	This API is used to mark cnDBTier clusters as Failed.
	Service Type: Realtime. This API provides real time data.
		PUT	{
			
			"clusterNameTobeMarkedAsFailed": "<failedcluster>",
			
			"failedClusterNames": []
			}
				• 200 OK
				• 400 BAD REQUEST
				• 404 NOT FOUND
				• 500 INTERNAL SERVER ERROR
				• 503 SERVICE_UNAVAILABLE
					• 200 OK:
					
					{
					
					"clusterNameTobeMarkedAsFailed": "",
					
					"failedClusterNames": [
					
					"<failedcluster1>",
					"<failedcluster2>"
					]
					}
					• 400 BAD REQUEST:
					
					{
					"title": "BAD_REQUEST",
					"status": 400,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}
					• 404 NOT FOUND:
					
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}
					• 500 INTERNAL SERVER ERROR:
					
					{
					"title": "INTERNAL_SERVER_ERROR",
					"status": 500,
					"detail": "<Error

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					message>",
					"cause": null,
					"invalidParams":
					null
					}
					• 503 SERVICE_UNAVAILABLE:
					
					{
					"title": "Service
					Unavailable",
					"status": 503,
					"detail": "<Error
					message>",
					"cause": null,
					"invalidParams":
					null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/faultrecovery/status	This API is used to monitor the status of georeplication recovery. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
				• 404 NOT FOUND
				• 500 INTERNAL SERVER ERROR
					• 200 OK:
					{
					"localClusterName": "<local cluster name>",
					"faultRecoverStatus": [
					{
					"clusterName": "<clusterName>",
					"faultRecoverState": "<faultRecoverState>"
					},
					{
					"clusterName": "<clusterName>",
					"faultRecoverState": "<faultRecoverState>"
					},
					{
					"clusterName": "<clusterName>",
					"faultRecoverState": "<faultRecoverState>"
					}
					]
					}
					• 404 NOT FOUND:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					• 500 INTERNAL SERVER ERROR:
					
					{
					"title": "INTERNAL_SERVER_ERROR",
					"status": 500,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/ocdbtier/faultrecovery/start	This PAI is used to start georeplication recovery. Service Type: Realtime. This API provides real time data.	PUT	{ "backupClusterName": "<backup cluster name>", "failedClusterName": "<failed cluster name>" }	• 200 OK
				• 400 BAD REQUEST
				• 404 NOT FOUND
				• 409 CONFLICT
				• 500 INTERNAL SERVER ERROR
				• 503 SERVICE_UNAVAILABLE
					• 200 OK:
					{
					"backupClusterName": "<backup cluster name>",
					"failedClusterName": "<failed cluster name>"
					}
					• 400 BAD REQUEST:
					{
					"title": "INVALID INPUT",
					"status": 400,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}
					• 404 NOT FOUND:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}
					• 409 CONFLICT:
					{
					"title": "Conflict",
					"status": 409,
					"detail": "<Error message>",
					"cause": null,
					"invalidParams": null
					}

Table 4-3 (Cont.) cnDBTier APIs for CNC Console

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					• 500 INTERNAL SERVER ERROR:
					
					`{ "title": "INTERNAL_SERVER_ERROR", "status": 500, "detail": "<Error message>", "cause": null, "invalidParams": null }`
					• 503 SERVICE_UNAVAILABLE:
					
					`{ "title": "Service Unavailable", "status": 503, "detail": "<Error message>", "cause": null, "invalidParams": null }`

> **Note**
>
> Replace the value of `<base-uri>` in the URL with `<db-monitor-svc service name>.<namespace>:8080`.
> For example: `curl http://mysql-cluster-db-monitor-svc.occne-cndbtier:8080/ocdbtier/status/replication/realtime`

4.3 cnDBTier Backup APIs

cnDBTier backup APIs are used to create on-demand database backups and check the status of the backups in cnDBTier. The cnDBTier backup API is hosted by the DB backup manager service.

Table 4-4 cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/db-tier/on-demand/backup/initiate	This API is used to initiate site-specific on-demand backup creation. Service Type: Realtime. This API provides real time data.	POST	NA	• 200 OK - Successfully started the on-demand backup
				• 400 BAD REQUEST request is invalid
				• 409 CONFLICT backup is already going on
				• 500 INTERNAL SERVER ERROR - Could not initiate on-demand backup.
				• 503 SERVICE UNAVAILABLE data node is down
					• 200 OK:
					{
					"backup_id":"<Backup id>",
					"status":"<Backup Initiation Status>"
					"backup_encryption_flag": "<backup encryption enabled/disabled>"
					}
					• 400 BAD REQUEST request is invalid:
					{
					"backup_id":"",
					"status":"BACKUP_INITIATION_FAILED"
					"backup_encryption_flag": "true/false"
					}
					• 409 CONFLICT backup is already going on:
					{
					"backup_id":"",
					"status":"BACKUP_INITIATION_FAILED"
					"backup_encryption_flag": "true/false"
					}
					• 500 INTERNAL SERVER ERROR:
					{
					"error_type":"<error type>",
					"error_message":"<erro

Table 4-4 (Cont.) cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload

					r message>"
					}
					• 503 SERVICE UNAVAILABLE data node is down:
					{
					"backup_id":"",
					"status":"BACKUP_INITIATION_FAILED"
					"backup_encryption_flag": "true/false"
					}

Table 4-4 (Cont.) cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/db-tier/on-demand/backup/<BACKUP_ID_INITIATED>/status	This API is used to get site-specific on-demand backup status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - Successfully started the on-demand backup
				• 400 BAD REQUEST Request is invalid
				• 404 NOT FOUND backup_id does not exist
				• 500 INTERNAL SERVER ERROR - Could not check the status for the specified on-demand backup ID
					• 200 OK:
					Response payload when `.Values.global.remotetransfer.enable` is set to *true*:
					`{`
					`"backup_status":"<Backup status>",`
					`"transfer_status":"<Transfer Status>"`
					`}`
					Note: The `"transfer_status"` parameter in the response payload indicates the backup transfer status from `db-backup-manager-svc` to `db-replication-svc` and not to the remote server.
					Response payload when `.Values.global.remotetransfer.enable` is set to *false*:
					`{`
					`"status": "<Backup status>"`
					`}`
					• 400 BAD REQUEST Request is invalid:
					`{`
					`"error_description": "<error_description>",`
					`"error_type": "<error type>"`
					`}`
					• 404 NOT FOUND backup_id does not exist:
					`{`

Table 4-4 (Cont.) cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload
					"error_description": "<error_description>", "error_type": "<error type>" } • 500 INTERNAL SERVER ERROR: { "error_type":"<error type>", "error_message":"<error message>" }

Table 4-4 (Cont.) cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload

http://<base-uri>/db-tier/health	This API is used to perform a cnDBTier health check.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK
				• 500 INTERNAL SERVER ERROR
					• 200 OK:
					{
					"is_connected_to_db": "<true|false>",
					"overall_status": "<true|false>",
					"service_name": "<mysql-cluster-db-backup-manager-svc>"
					"executor_status_list" :
					[
					{
					"_node_id": "<node_id>",
					"_is_connected_to_db": "<true|false>",
					"_is_running": "<true|false>"
					},
					...
					]
					}
					• 500 INTERNAL SERVER ERROR:
					{
					"error_type":"<error type>",
					"error_message":"<error message>"
					}

Table 4-4 (Cont.) cnDBTier Backup API

Rest URL		HTTP Method	Request Payload	Response Code	Response Payload

This API is used to get the cnDBTier NDB backup status. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK
			• 500 INTERNAL SERVER ERROR
				• 200 OK:
				{
				"isNdbBackupInProgress": "<true if an NDB backup is in progress; otherwise, false>",
				"nextBackupScheduleTime": "<UTC timestamp for the next scheduled routine backup>",
				"currentTimestamp": "<Current UTC timestamp from the NDB cluster>"
				}
				• 500 INTERNAL SERVER ERROR:
				Not able to fetch Current NDB Backup Status	

> **Note**
>
> Replace the value of `<base-uri>` in the URL with `<db-backup-manager-svc svc>:8080`.

For example,

- Run the following command to get the db-backup-manager-svc pod name from cnDBTier cluster:

  ```
  $ kubectl -n <namespace of cnDBTier cluster> get pods | grep "db-backup-manager-svc" | awk  '{print $1}'
  ```

- Run the following command get the db-backup-manager-svc svc name from cnDBTier cluster:

  ```
  $ kubectl -n <namespace of cnDBTier cluster> get svc | grep "db-backup-manager-svc" | awk  '{print $1}'
  ```

- Run the following commands to login to the db-backup-manager-svc pod, use the REST APIs to create an on-demand backup, and check the backup status:

  ```
  $ kubectl -n <namespace of cnDBTier cluster> exec -it <db-backup-manager-svc pod> -- bash
  $ curl -i -X POST http://<db-backup-manager-svc svc>:8080/db-tier/on-demand/backup/initiate
  $ curl -i -X GET http://<db-backup-manager-svc svc>:8080/db-tier/on-demand/backup/<BACKUP_ID_INITIATED>/status
  ```

4.4 cnDBTier Replication Service APIs

This section provides details about cnDBTier replication service APIs.

4.4.1 cnDBTier Switchover APIs

cnDBTier Switchover APIs are used to start or stop switchovers on replication services.

Table 4-5 cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/start/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}	This API is used to start replication switchover for a site with respect to remote site and group ID. Service Type: Realtime. This API provides real time data.	PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{ "replicationSwitchOver":"start" }`
					• 404 Not Found:
					`{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`
					• 500 Internal Server Error:
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Table 4-5 (Cont.) cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/stop/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}	This API is used to stop replication switchover for a site with respect to remote site and group ID. Service Type: Realtime. This API provides real time data.	PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					{
					"replicationSwitchOver":"stop"
					}
					• 404 Not Found:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-5 (Cont.) cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/start/sitename/{siteName}/remotesitename/{remoteSiteName}	This API is used to start replication switchover for a site with respect to remote site name.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{ "replicationSwitchOver":"start" }`
					• 404 Not Found:
					`{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`
					• 500 Internal Server Error:
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Table 4-5 (Cont.) cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/stop/sitename/{siteName}/remotesitename/{remoteSiteName}	This API is used to stop replication switchover for a site with respect to remote site name.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{ "replicationSwitchOver":"stop" }`
					• 404 Not Found:
					`{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`
					• 500 Internal Server Error:
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Table 4-5 (Cont.) cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/start/sitename/{siteName}	This API is used to start replication switchover with respect to site name.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{ "replicationSwitchOver":"start" }`
					• 404 Not Found:
					`{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`
					• 500 Internal Server Error:
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Table 4-5 (Cont.) cnDBTier Switchover APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/switchover/stop/sitename/{siteName}	This API is used to stop replication switchover for a site with respect to site name. Service Type: Realtime. This API provides real time data.	PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{ "replicationSwitchOver":"stop" }`
					• 404 Not Found:
					`{ "title": "Not Found", "status": 404, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`
					• 500 Internal Server Error:
					`{ "title": "Internal Server Error", "status": 500, "detail": "<Exception details>", "cause": <cause>, "invalidParams": <params> }`

Note

The value of <base-uri> in the REST URL is <db-replication-svc Loadbalancer IP>: <db-replication-svc Loadbalancer PORT>.
Depending on your scenario, choose one of the following methods to obtain the LoadBalancer IP and LoadBalancer Port of the replication service in a cnDBTier cluster:

- When HTTP is enabled in a cnDBTier cluster:
  - Run the following command to get the LoadBalancer IP of the replication service for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the LoadBalancer Port of the replication service for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/
    switchover/start/sitename/{siteName}
    ```

- When HTTPS is enabled in a cnDBTier cluster:
  - Create the key PEM file (file.key.pem) and cert PEM file (file.crt.pem) using the p12 certificate (replicationcertificate.p12). Use the same p12 certificate that was used to enable the HTTPS while installing cnDBTier.
  - Run the following command to get the LoadBalancer IP of the replication service for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the LoadBalancer Port of the replication service for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl --cert file.crt.pem --cert-type PEM --key file.key.pem --
    key-type PEM --pass PUT NextGenCne https://$IP:$PORT/ocdbtier/
    georeplication/switchover/start/sitename/{siteName}
    ```

4.4.2 cnDBTier Stop Replica APIs

cnDBTier Stop Replica APIs are used to stop a replication channel.

Table 4-6 cnDBTier Stop Replica APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/stopreplica/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}	This API is used to stop replication on a site with respect to remote site name and replication channel group ID.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					{
					"stopReplica":"stop"
					}
					• 404 Not Found:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-6 (Cont.) cnDBTier Stop Replica APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/stopreplica/sitename/{siteName}/remotesitename/{remoteSiteName}	This API is used to stop replication on a site with respect to remote site names.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					{
					"stopReplica":"stop"
					}
					• 404 Not Found:
					{
					"title": "Not Found",
					"status": 404,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}
					• 500 Internal Server Error:
					{
					"title": "Internal Server Error",
					"status": 500,
					"detail": "<Exception details>",
					"cause": <cause>,
					"invalidParams": <params>
					}

Table 4-6 (Cont.) cnDBTier Stop Replica APIs

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/ocdbtier/georeplication/stopreplica/sitename/{siteName}	This API is used to stop replica on a site with respect to site name.
	Service Type: Realtime. This API provides real time data.
		PUT	NA	• 200 OK
				• 404 Not Found
				• 500 Internal Server Error
					• 200 OK:
					`{`
					`"stopReplica":"stop"`
					`}`
					• 404 Not Found:
					`{`
					`"title": "Not Found",`
					`"status": 404,`
					`"detail": "<Exception details>",`
					`"cause": <cause>,`
					`"invalidParams": <params>`
					`}`
					• 500 Internal Server Error:
					`{`
					`"title": "Internal Server Error",`
					`"status": 500,`
					`"detail": "<Exception details>",`
					`"cause": <cause>,`
					`"invalidParams": <params>`
					`}`

Note

- Run the `Stop Switchover` API before running the `Stop Replica` API else, if you stop the replica without first stopping the switchover, a switchover will still occur afterwards, resulting in the replication channel not being stopped.
- The value of `<base-uri>` in the REST URL is `<db-replication-svc Loadbalancer IP>: <db-replication-svc Loadbalancer PORT>`.

Depending on your scenario, choose one of the following methods to obtain the LoadBalancer IP and LoadBalancer Port of the replication service in a cnDBTier cluster:

- When HTTP is enabled in a cnDBTier cluster:
  - Run the following command to get the LoadBalancer IP of the replication service for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the LoadBalancer Port of the replication service for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/
    stopreplica/sitename/{siteName}
    ```

- When HTTPS is enabled in a cnDBTier cluster:
  - Create the key PEM file (file.key.pem) and cert PEM file (file.crt.pem) using the p12 certificate (replicationcertificate.p12). Use the same p12 certificate that was used to enable the HTTPS while installing cnDBTier.
  - Run the following command to get the LoadBalancer IP of the replication service for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the LoadBalancer Port of the replication service for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl --cert file.crt.pem --cert-type PEM --key file.key.pem --
    key-type PEM --pass NextGenCne PUT https://$IP:$PORT/ocdbtier/
    georeplication/stopreplica/sitename/{siteName}
    ```

4.4.3 cnDBTier Listbackups API

cnDBTier Listbackups API is used to determine the backups present in the cnDBTier. The cnDBTier Listbackups API is hosted by the DB Replication service.

Table 4-7 cnDBTier Listbackups API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/backup/site/{siteName}/listbackups	This API is used to list site-specific backups. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Fetched the list of backups present in cnDBTier.
				• 404 Not Found - Improper Site details or missing table.
				• 503 INTERNAL SERVER ERROR - Could not list the backups.
					• 200 OK:
					{
					"localSiteName":"<current_site_name>",
					"backupDetails":[
					{
					"backupId":"<backup>",
					"backupSize":"<size of backup>",
					"creationTimeStamp":"<timestamp at which backup was initiated>"
					},
					{
					"backupId":"<backup_id>",
					"backupSize":"<size of backup>",
					"creationTimeStamp":"<timestamp at which backup was initiated>"
					},
					{
					"backupId":"<backup_id>",
					"backupSize":"<size of backup>",
					"creationTimeStamp":"<timestamp at which backup was initiated>"
					}
					]
					}
					• 404 Not Found: The response payload can be one of the following:
					– Site Name is null so cannot list the backup

Table 4-7 (Cont.) cnDBTier Listbackups API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					– Site: <siteName> doesn't match with the current site Name so cannot list the backup – DBTIER_BACKUP_INFO table doesn't exist in the current site so cannot list the backup • 503 INTERNAL SERVER ERROR: Could not list the backups, <Exception Message>

Note

The value of <base-uri> in the REST URL is <db-replication-svc Loadbalancer IP>: <db-replication-svc Loadbalancer PORT>.
Depending on your scenario, refer to the following points to obtain the LoadBalancer IP and LoadBalancer Port of a cnDBTier cluster:

- When HTTP is enabled in a cnDBTier cluster:
  - Run the following command to get the replication service LoadBalancer IP for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the replication service LoadBalancer Port for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl -i -X GET http://$IP:$PORT/db-tier/backup/site/cluster1/
    listbackups
    ```

- When HTTPS is enabled in a cnDBTier cluster:
  - Create the key PEM file (file.key.pem) and cert PEM file (file.crt.pem) using the p12 certificate (replicationcertificate.p12). Use the same p12 certificate that was used to enable the HTTPS while installing cnDBTier.
  - Run the following command to get the replication service LoadBalancer IP for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the replication service LoadBalancer Port for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl --cert file.crt.pem --cert-type PEM --key file.key.pem --
    key-type PEM --pass NextGenCne https://$IP:$PORT/db-tier/backup/
    site/cluster1/listbackups
    ```

4.4.4 cnDBTier Replication Service Heartbeat API

cnDBTier Replication Service Heartbeat API is used to provide the Heartbeat statuses of all replication services running on the current cluster.

Table 4-8 cnDBTier Replication Service Heartbeat API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/status/db-replication-svc/realtime	This API is used to list site-specific heartbeat status. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Fetched the heartbeat status of each replication service running on the current cluster.
				• 503 SERVICE_UNAVAILABLE - Not able to query the database
				• 503 INTERNAL SERVER ERROR - Could not check the replication service status.
					• 200 OK:
					{
					"localSiteName":"<current_site_name>",
					"heartBeatDetails":[
					{
					"remoteSiteName":"<remote_site_name>",
					"heartBeatStatus":"<SUCCESS/FAILURE>",
					"heartBeatLag":"<Heart Beat Lag in Seconds>",
					"replicationChannelGroupId":<replication channel group id>
					},
					{
					"remoteSiteName":"<remote_site_name>",
					"heartBeatStatus":"<SUCCESS/FAILURE>",
					"heartBeatLag":"<Heart Beat Lag in Seconds>",
					"replicationChannelGroupId":<replication channel group id>
					}
					]
					}
					• 503 SERVICE_UNAVAILABLE: Not able to query the Data Base
					• 500 INTERNAL_SERVER_ERROR: Could not check the replication service

Table 4-8 (Cont.) cnDBTier Replication Service Heartbeat API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload
					status, <Exception Message>

Note

The value of <base-uri> in the REST URL is <db-replication-svc Loadbalancer IP>: <db-replication-svc Loadbalancer PORT>.
Depending on your scenario, refer to the following points to obtain the LoadBalancer IP and LoadBalancer Port of a cnDBTier cluster:

- When HTTP is enabled in a cnDBTier cluster:
  - Run the following command to get the replication service LoadBalancer IP for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the replication service LoadBalancer Port for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl -i -X GET http://$IP:$PORT/db-tier/status/db-replication-
    svc/realtime
    ```

- When HTTPS is enabled in a cnDBTier cluster:
  - Create the key PEM file (file.key.pem) and cert PEM file (file.crt.pem) using the p12 certificate (replicationcertificate.p12). Use the same p12 certificate that was used to enable the HTTPS while installing cnDBTier.
  - Run the following command to get the replication service LoadBalancer IP for cluster1:

    ```
    $ IP=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $4}' | head -n 1 )
    ```

  - Run the following commands to get the replication service LoadBalancer Port for cluster1:

    ```
    $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk
    '{print $5}' |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
    ```

  - Sample command to call the REST API:

    ```
    $ curl --cert file.crt.pem --cert-type PEM --key file.key.pem --
    key-type PEM --pass NextGenCne https://$IP:$PORT/db-tier/
    status/db-replication-svc/realtime
    ```

4.5 cnDBTier Status APIs

cnDBTier Status APIs enable the NF applications to determine the status of cnDBTier and the associated cross-site replication. The DB Monitor service hosts the cnDBTier Status APIs.

Table 4-9 cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/status/replication/{mate-site-name}/realtime	This API is used to get site-specific replication status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - Cross-site replication is enabled.
				• 400 Bad Request.
				• 404 Not Found - The indicated mate site has not been configured.
				• 503 Service Unavailable - Cross-site replication is not enabled and/or DOWN.
					• 200 OK:
					{
					"replicationStatus": "UP"
					"secondsBehindRemote":
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					"replicationGroupDelay":
					[{
					replchannel_group_id: 1,
					secondsBehindRemote: <seconds>
					},
					{
					replchannel_group_id: 2,
					secondsBehindRemote: <seconds>
					}]
					"siteDetails":
					[{
					remote_replication_ip: 127.0.0.1,
					role: ACTIVE
					},
					{
					remote_replication_ip: 127.0.0.2,
					role: STANDBY
					},
					{
					remote_replication_ip: 127.0.0.2,

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					role: ACTIVE
					},
					{
					
					remote_replication_ip:
					127.0.0.3,
					role: STANDBY
					}]
					}
					• 404 Not Found: NA
					• 503 Service Unavailable: NA

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/status/replication/realtime	This API is used to get the overall replication status.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - Cross-site replication is enabled.
				• 503 Service Unavailable - Cross-site replication is not enabled and/or DOWN.
					• 200 OK:
					
					{
					[
					{
					
					"localSiteName":"<current-site-name>",
					
					"remoteSiteName":"<remote-site-name>",
					
					"replicationStatus":"UP/DOWN/INITIALIZING"
					
					"secondsBehindRemote":
					
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					
					"replicationGroupDelay":
					[{
					
					replchannel_group_id:1,
					
					secondsBehindRemote:<seconds>
					},
					{
					
					replchannel_group_id:2,
					
					secondsBehindRemote:<seconds>
					}]
					},
					{
					
					"localSiteName":"<current-site-name>",
					
					"remoteSiteName":"<remote-site-name>",

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					"replicationStatus":"UP/DOWN/INITIALIZING"
					"secondsBehindRemote":
					"<greater_secondsBehindRemote_of_multiplegroups_withremotesite>"
					"replicationGroupDelay":
					[{
					replchannel_group_id: 1,
					secondsBehindRemote: <seconds>
					},
					{
					replchannel_group_id: 2,
					secondsBehindRemote: <seconds>
					}]
					}
					]
					}
					• 503 Service Unavailable: NA

http://<*base-uri*>/db-tier/status/local	This API is used to get the local cluster status. Service Type: Cached. This API doesn't provide real time data. This API is deprecated and will be removed in a future release.	GET	NA	• 200 OK - The local NDB cluster is available. • 503 Service Unavailable - The local NDB cluster is not available.	NA

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/status/replication/{mate-site-name}	This API is used to get site-specific replication status.
	Service Type: Cached. This API doesn't provide real time data. This API is deprecated and will be removed in a future release.
		GET	NA	• 200 OK - Cross-site replication is enabled.
				• 400 Bad Request.
				• 404 Not Found - The indicated mate site has not been configured.
				• 503 Service Unavailable - Cross-site replication is not enabled and/or DOWN.
					• 200 OK:
					`{`
					`"replicationStatus": "UP/DOWN/ INITIALIZING",`
					`"siteDetails":[`
					`{`
					`"remote_replication_ip ":"<ip>",`
					`"role":"ACTIVE/ STANDBY/FAILED"`
					`},`
					`{`
					`"remote_replication_ip ":"<ip>",`
					`"role":"STANDBY/ STANDBY/FAILED"`
					`}`
					`]`
					`}`
					• 404 Not Found: NA
					• 503 Service Unavailable: NA

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/status/replication	This API is used to get the overall replication status.
	Service Type: Cached. This API doesn't provide real time data. This API is deprecated and will be removed in a future release.
		GET	NA	• 200 OK - Cross-site replication is enabled.
				• 503 Service Unavailable - Cross-site replication is not enabled and/or DOWN.
					• 200 OK:
					<pre>{
					[
					{
					"localSiteName":"<current-site-name>",
					"remoteSiteName":"<remote-site-name>",
					"replicationStatus":"UP/DOWN/INITIALIZING"
					},
					{
					"localSiteName":"<current-site-name>",
					"remoteSiteName":"<remote-site-name>",
					"replicationStatus":"UP/DOWN/INITIALIZING"
					}
					]
					}</pre>
					• 503 Service Unavailable: NA

http://<*base-uri*>/db-tier/status/cluster/local/realtime	This API is used to get the local cluster status. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - The local NDB cluster is available. • 503 Service Unavailable - The local NDB cluster is not available.	NA

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

http://<*base-uri*>/db-tier/statistics/dbinfo	This API is used to get database statistics reports. Service Type: Realtime. This API provides real time data.	GET	NA	• 200 OK - Data is available.
				• 503 Service Unavailable - DB statistics report is empty.
				• 500 INTERNAL SERVER ERROR - Could not list DB statistics reports
					• 200 OK:
					{
					"databaseCount": <database count>,
					"databaseTablesCount": [
					{
					"dbName": "<database name>",
					"tableCount": <table count>
					},
					{
					"dbName": "<database name>",
					"tableCount": <table count>
					}
					],
					"databaseTableRowsCount": [
					{
					"dbName": "<database name>",
					"tables": [
					{
					"tableName": "<table name>",
					"rowCount": <row count>
					}
					]
					},
					{
					"dbName": "<database name>",
					"tables": [
					{
					"tableName": "<table name>",
					"rowCount": <row count>

Table 4-9 (Cont.) cnDBTier Status API

Rest URL	Description	HTTP Method	Request Payload	Response Code	Response Payload

					},
					{
					
					"tableName": "<table name>",
					"rowCount": <row count>
					}
					]
					}
					]
					}
					• 503 Service Unavailable: NA
					• 500 INTERNAL SERVER ERROR: NA

http://*<base-uri>*/db-tier/version	This API is used to get the cnDBTier version.
	Service Type: Realtime. This API provides real time data.
		GET	NA	• 200 OK - cnDBTier version retrieved successfully.
				• 500 INTERNAL SERVER ERROR - failed to get the cnDBTier version.
					• 200 OK:
					
					{
					"cndbtier_version": "23.2.0",
					"ndb_version": "ndb-8.4.3"
					}
					• 500 INTERNAL SERVER ERROR:
					"failed to get version"

> **Note**
>
> The value of `base-uri` in the table is `<db-monitor-svc service name>.<namespace>:8080`.
> For example: `curl http://mysql-cluster-db-monitor-svc.occne-cndbtier:8080/db-tier/status/replication/realtime`

5
cnDBTier Metrics

cnDBTier generates metrics to record or measure the specified values in cnDBTier. You can access the metrics using the Prometheus dashboard and take necessary actions. Prometheus gets installed as part of common services during the vCNE installation. This section provides details about the available cnDBTier metrics.

Dimensions Legend for Metrics

The following table provides information about metrics dimensions:

Table 5-1 Dimensions Legend

Dimension	Description
namespace	The name of the namespace in which the cnDBTier cluster is deployed.
site_name	The name of the site in which the cnDBTier cluster is deployed.
mate_site_name	The name of the remote site where replication is established.
node_id	The node ID of the database node.
remote_node_id	The node ID of the database node in the remote site.
node_type	The type of the database node. Sample values: Data node, Management node, SQL node
node_version	The version of MySQL NDB cluster software.
block_name	The name of the associated NDB kernel block. A kernel block is responsible for managing distinct operations. For more information about NDB kernal block, see SQL documentation. Sample Values: DBLQH, DBTC
block_instance	The instance number of the NDB kernel block.
counter_name	The name of the counter. Each counter is associated with a particular NDB kernel block. For more information about counters, see SQL documentation.
thr_no	The thread ID that is specific to a node.
thr_nm	The name of the threat. Sample Values: ldm, main, recv, rep
memory_type	Type of memory. Sample Values: Data memory, Index memory, Long message buffer
error_number	The error number for which the replication error is skipped. Sample Values: 13119, 1296, 1007, 1008, 1050, 1051.
service_name	Name of the cnDBTier microservice.

Table 5-1 (Cont.) Dimensions Legend

Dimension	Description
mount_path	The path within a container's file system where a volume is mounted. This path allows the container to access the contents of that volume.
hostname	The Fully Qualified Domain Name (FQDN). This value is provided in the following format: `host-name.service-name.namespace.svc.domain_name`. Sample value: • ndbmtd-0.ndbmtdsvc.occne-cndbtier.svc.cluster.local • ndbmysqld-1.ndbmysqldsvc.occne-cndbtier.svc.cluster.local
role	The role of the `mysqld` replication channel. Sample Values: active, standby
replchannel_group_id	The ID of the replication channel group.
channel_id	The ID of the `mysqld` replication channel.
master_node_ip	The IP address of the active replication SQL service in the remote site.
slave_node_ip	The IP address or hostname of the active replication SQL service in the local site.
backup_id	The ID of the backup.
status	The status of the backup operation. Sample values: STARTED, FAILED, COMPLETED, PURGED, PURGED_EARLY, BACKUP_TRANSFER_FAILED, BACKUP_TRANSFER_IN_PROGRESS, BACKUP_TRANSFER_COMPLETED
table_id	The unique ID of a table that is generated internally by NDB.
fq_name	The fully qualified name of the fragment. Fragments are the logical partitions of the data within a table. A fragment refers to a portion of a table's data that is distributed across multiple data nodes in a cluster. For more information, see SQL documentation.
parent_fq_name	The fully qualified fragment name for the parent or any fragment of the object.
remote_server_ip	The IP address of the remote server.

5.1 cnDBTier API Node Read and Write Metrics

This section provides details about the cnDBTier API node read and write metrics.

Table 5-2 db_tier_api_node_bytes_writes

Field	Details
Description	This metric provides information about the number of byte writes for `ndbappmysqld` pods and `ndbmysqld` pods.
Type	Gauge

Dimensions	`namespace`
	`node_id`
	`hostname`
	`site_name`

Table 5-3 db_tier_api_node_bytes_reads

Field	Details
Description	This metric provides information about the number of byte reads for `ndbappmysqld` pods and `ndbmysqld` pods.
Type	Gauge

Dimensions	`namespace`
	`node_id`
	`hostname`
	`site_name`

5.2 cnDBTier Remote Server Backup Transfer Status Metrics

This section provides details about the cnDBTier remote server backup transfer status metrics.

Table 5-4 db_tier_remote_server_backup_transfer_status

Field	Details
Description	Provides the status of backup transfer to a remote server. The possible values are: • "1": indicates that the transfer of backup to remote server failed. • "0": indicates that the transfer of backup to remote server completed. • "2": indicates that the transfer of backup to remote server is in progress.
Type	Gauge

Dimensions	`namespace`
	`site_name`
	`backup_id`
	`remote_server_ip`
	`status`

5.3 cnDBTier Backup Transfer Status Metrics

This section provides details about the cnDBTier backup transfer status metrics.

Table 5-5 db_tier_backup_transfer_status

Field	Details
Description	Provides the status of the backup transfer process. The possible status values are: • 0: indicates success • 1: indicates in progress • 2 and 3: indicates failed
Type	Gauge

Dimensions	`site_name`
	`namespace`
	`backup_id`
	`status`

5.4 cnDBTier Parallel Backup Transfer Progress Metrics

This section provides details about the cnDBTier parallel backup transfer progress metrics.

Table 5-6 db_tier_local_backup_transfer_progress

Field	Details
Description	Provides the percentage of the backup transfer that has completed from data node to replication service on a healthy backup site. This metric can be seen when a georeplication recovery is in progress on a failed site.
Type	Gauge

Dimensions	`namespace`
	`node_id`
	`site_name`

Table 5-7 db_tier_remote_backup_transfer_progress

Field	Details
Description	Provides the percentage of the backup transfer that has completed from the replication service of a backup site to the replication service of an unhealthy site. This metric can be seen when a georeplication recovery is in progress on a failed site.
Type	Gauge

Dimensions	`namespace`
	`node_id`
	`site_name`

5.5 cnDBTier Heartbeat Metrics

This section provides details about the cnDBTier heartbeat metrics.

Table 5-8 db_tier_heartbeat_failure

Field	Details
Description	Indicates the success or failure of heartbeat when trying to connect to a remote site. • 0: indicates that Heartbeat is successful and cnDBTier is able to connect to the remote site. • 1: indicates that Heartbeat failed and cnDBTier is unable to connect to the remote site.
Type	Gauge

Dimensions	`site_name`
	`mate_site_name`
	`replchannel_group_id`
	`namespace`

5.6 cnDBTier Node Status Metrics

The section provides details about the cnDBTier node status metrics.

Table 5-9 db_tier_node_status

Field	Details
Description	The status of the cnDBTier node. The possible values are: • "0": indicates that the node is DOWN • "1": indicates that the node is UP
Type	Gauge

Dimensions	`node_id`
	`node_type`
	`node_version`
	`site_name`
	`namespace`

Table 5-10 db_tier_cluster_status

Field	Details
Description	The status of the cnDBTier cluster. The possible values are: • "0": indicates that the cluster is DOWN • "1": indicates that the cluster is UP
Type	Gauge

Table 5-10 (Cont.) db_tier_cluster_status

Field	Details
Dimensions	site_name namespace

Table 5-11 db_tier_cluster_disconnect

Field	Details
Description	The disconnect status of the cnDBTier cluster. the value indicates the number of cluster disconnect incidents happened in the cluster.
Type	Gauge
Dimensions	site_name namespace

5.7 cnDBTier Table Read Write Metrics

The section provides details about the cnDBTier table read write metrics.

Table 5-12 db_tier_local_operations

Field	Details
Description	The total number of local operations in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-13 db_tier_transactions

Field	Details
Description	The total number of transactions in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-14 db_tier_commits

Field	Details
Description	The total number of commits in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-15 db_tier_reads

Field	Details
Description	The total number of reads in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-16 db_tier_local_reads

Field	Details
Description	The total number of local reads in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-17 db_tier_writes

Field	Details
Description	The total number of writes in cnDBTier cluster for a node.
Type	Gauge

Table 5-17 (Cont.) db_tier_writes

Field	Details
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-18 db_tier_local_writes

Field	Details
Description	The total number of local writes in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-19 db_tier_aborts

Field	Details
Description	The total number of aborted transactions in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-20 db_tier_table_scans

Field	Details
Description	The total number of table scans in cnDBTier for a node.
Type	Gauge

Table 5-20 (Cont.) db_tier_table_scans

Field	Details
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-21 db_tier_range_scans

Field	Details
Description	The total number of range scans in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-22 db_tier_transporter_overload

Field	Details
Description	The total number of transporter overload in cnDBTier for a node.
Type	Gauge
Dimensions	node_id block_name block_instance counter_name site_name namespace

Table 5-23 db_tier_scan_slowdown

Field	Details
Description	The total number of scan slowdowns in cnDBTier for a node.
Type	Gauge

Table 5-23 (Cont.) db_tier_scan_slowdown

Field	Details
Dimensions	node_id block_name block_instance counter_name site_name namespace

5.8 cnDBTier CPU Usage Metrics

This section provides details about the cnDBTier CPU usage metrics.

Table 5-24 db_tier_cpu_os_user

Field	Details
Description	Provides the CPU user statistics per thread for the specific node.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-25 db_tier_cpu_os_system

Field	Details
Description	Provides the CPU system statistics per thread for the specific node.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-26 db_tier_cpu_os_idle

Field	Details
Description	Provides the idle CPU statistics per thread for the specific node.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

5.9 cnDBTier Memory Usage Metrics

This section provides details about the cnDBTier memory usage metrics.

Table 5-27 db_tier_memory_used_bytes

Field	Details
Description	Indicates the amount of memory used by the node in bytes.
Type	Gauge

Dimensions	`node_id`
	`memory_type`
	`site_name`
	`namespace`

Table 5-28 db_tier_memory_total_bytes

Field	Details
Description	Indicates the total memory assigned for the node in bytes.
Type	Gauge

Dimensions	`node_id`
	`memory_type`
	`site_name`
	`namespace`

5.10 cnDBTier Bin Log Usage Metrics

This section provides details about the cnDBTier binlog usage metrics.

Table 5-29 db_tier_binlog_used_bytes_percentage

Field	Details
Description	Indicates the percentage of total memory used by bin log in the SQL node.
Type	Gauge

Dimensions	`node_id`
	`site_name`
	`namespace`

5.11 cnDBTier Replication Metrics

This section provides details about the cnDBTier replication metrics.

Table 5-30 db_tier_replication_status

Field	Details
Description	Indicates the status of replication. The possible values are: • "0": indicates that the replication channel status of the local site is OFF. • "1": indicates that the replication channel status of the local site is ON. • "2": indicates that the replication channel status of the local site is CONNECTING.
Type	Gauge

Dimensions	`node_id`
	`role`
	`replchannel_group_id`
	`mate_site_name`
	`channel_id`
	`site_name`
	`namespace`

Table 5-31 db_tier_replication_slave_delay

Field	Details
Description	Indicates the time (in seconds) by which the last record read by the slave is behind the latest record written by the master.
Type	Gauge

Dimensions	`channel_id`
	`master_node_ip`
	`slave_node_ip`
	`mate_site_name`
	`site_name`
	`namespace`

5.12 cnDBTier Automated Backup Metrics

This section provides details about the cnDBTier automated backup metrics.

Table 5-32 db_tier_backup_used_disk_percentage

Field	Details
Description	This metric provides the percentage of disk space used by the backup. This metric is pegged after the old backups are purged and a new one is created.
Type	Gauge

Dimensions	`node_id`
	`site_name`
	`namespace`

Table 5-33 db_tier_backup_size

Field	Details
Description	This metric provides the size of cnDBTier backup created. This metric is pegged only when a backup completes successfully.
Type	Gauge

Dimensions	`backup_id`
	`node_id`
	`site_name`
	`namespace`

Table 5-34 db_tier_backup

Field	Details
Description	This metric fetches the status of cnDBTier backup. This metric is pegged at each stage of a backup life cycle: on creation, when it fails or completes, and when it is deleted.
Type	Gauge

Dimensions	`site_name`
	`namespace`
	`status`

Table 5-35 db_tier_ndb_backup_in_progress

Field	Details
Description	This metric states if a data node backup is in progress in the current site. The possible values are: • "0": Indicates that no database backup is in progress. • "1": Indicates that cnDBTier backup is in progress.
Type	Gauge
Dimensions	`site_name` `namespace`

5.13 cnDBTier Fault Recovery State Metrics

This section provides details about the cnDBTier georeplication recovery state metrics.

Table 5-36 db_tier_georeplication_recovery_state

Field	Details
Description	Indicates if the current site is undergoing georeplication recovery.
Type	Gauge

Table 5-36 (Cont.) db_tier_georeplication_recovery_state

Field	Details
Dimensions	`site_name` (Name of the site that is undergoing georeplication recovery) `namespace`

Table 5-37 db_tier_ndb_restore_meta_progress

Field	Details
Description	Provides the completion percentage of the NDB metadata restore progress.
Type	Gauge
Dimensions	`site_name` (Name of the site that is undergoing georeplication restore) `namespace`

Table 5-38 db_tier_ndb_restore_data_progress

Field	Details
Description	Provides the completion percentage of the NDB data restore progress.
Type	Gauge

Dimensions	`site_name` (Name of the site that is undergoing georeplication restore)
	`namespace`
	`node_id`

5.14 cnDBTier Replica Status Metrics

This section provides details about the cnDBTier replica status metrics.

Table 5-39 db_tier_api_trans_commit_count

Field	Details
Description	The number of transactions committed by this replica.
Type	Gauge

Dimensions	`node_id` (of the DB node)
	`site_name`
	`namespace`

Table 5-40 db_tier_api_wait_exec_complete_count

Field	Details
Description	The number of times a thread has been blocked by this replica while waiting for execution of an operation to complete.
Type	Gauge

Dimensions	`node_id` (of the DB node)
	`site_name`
	`namespace`

Table 5-41 db_tier_api_bytes_sent_count

Field	Details
Description	The amount of data (in bytes) sent to the data nodes by this replica.
Type	Gauge

Dimensions	`node_id` (of the DB node)
	`site_name`
	`namespace`

Table 5-42 db_tier_api_pk_op_count

Field	Details
Description	The number of operations performed by this replica based on or using primary keys.
Type	Gauge

Dimensions	`node_id` (of the DB node)
	`site_name`
	`namespace`

5.15 cnDBTier ndbinfo Transporters Metrics

This section provides details about the cnDBTier ndbinfo transporters metrics.

Table 5-43 db_tier_node_transporter_bytes_sent

Field	Details
Description	The bytes sent from data node to other nodes.
Type	Gauge

Dimensions	`node_id`
	`node_type`
	`remote_node_id`
	`site_name`
	`namespace`

Table 5-44 db_tier_node_transporter_bytes_received

Field	Details
Description	The bytes received from data node to other nodes.
Type	Gauge

Dimensions	`node_id`
	`node_type`
	`remote_node_id`
	`site_name`
	`namespace`

Table 5-45 db_tier_node_transporter_overload_count

Field	Details
Description	Indicates the number of times the current connection has entered overload state since the start of the connection.
Type	Gauge

Dimensions	`node_id`
	`node_type`
	`remote_node_id`
	`site_name`
	`namespace`

Table 5-46 db_tier_node_transporter_slowdown_count

Field	Details
Description	Indicates the number of times the current connection has entered slowdown state since the start of the connecting.
Type	Gauge

Dimensions	`node_id`
	`node_type`
	`remote_node_id`
	`site_name`
	`namespace`

5.16 cnDBTier ndbinfo Threadstat Metrics

This section provides details about the cnDBTier ndbinfo thread stats metrics.

Table 5-47 db_tier_threadstat_os_time

Field	Details
Description	Indicates the OS time of the thread (ms).
Type	Gauge

Table 5-47 (Cont.) db_tier_threadstat_os_time

Field	Details
Dimensions	node_id, thr_no thr_nm site_name namespace

Table 5-48 db_tier_threadstat_os_user_cpu_time

Field	Details
Description	Indicates the OS CPU time taken by the user (µs).
Type	Gauge
Dimensions	node_id, thr_no thr_nm site_name namespace

Table 5-49 db_tier_threadstat_os_system_cpu_time

Field	Details
Description	Indicates the OS CPU time taken by the system (µs).
Type	Gauge
Dimensions	node_id, thr_no thr_nm site_name namespace

Table 5-50 db_tier_threadstat_os_voluntary_context_switches

Field	Details
Description	The number of OS voluntary context switches that happened.
Type	Gauge
Dimensions	node_id, thr_no thr_nm site_name namespace

Table 5-51 db_tier_threadstat_os_involuntary_context_switches

Field	Details
Description	The number of OS involuntary context switches that happened.
Type	Gauge

Dimensions	`node_id`,
	`thr_no`
	`thr_nm`
	`site_name`
	`namespace`

5.17 cnDBTier ndbinfo Operations Per Fragment Metrics

This section provides details about the cnDBTier ndbinfo operations per fragment metrics.

> **Note**
>
> cnDBTier ndbinfo operations per fragment metrics provide insights on the operations performed on individual fragments and their replicas within a database. For more information, see MySQL documentation.

Table 5-52 db_tier_operations_per_fragment_tot_key_reads

Field	Details
Description	The total number of key reads.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-53 db_tier_operations_per_fragment_tot_key_inserts

Field	Details
Description	The total number of key inserts.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-54 db_tier_operations_per_fragment_tot_key_updates

Field	Details
Description	The total number of key updates.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-55 db_tier_operations_per_fragment_tot_key_writes

Field	Details
Description	The total number of key writes.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-56 db_tier_operations_per_fragment_tot_key_deletes

Field	Details
Description	The total number of key deletes.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-57 db_tier_operations_per_fragment_tot_key_bytes_returned

Field	Details
Description	The total size of data and metadata returned from key read operations.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-58 db_tier_operations_per_fragment_tot_frag_scans

Field	Details
Description	The total number of scans.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-59 db_tier_operations_per_fragment_tot_scan_rows_returned

Field	Details
Description	The total number of rows returned to the client.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-60 db_tier_operations_per_fragment_tot_scan_bytes_returned

Field	Details
Description	The total size of data and metadata returned to the client.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-61 db_tier_operations_per_fragment_tot_qd_frag_scans

Field	Details
Description	The total number of times the scans were queued.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-62 db_tier_operations_per_fragment_tot_commits

Field	Details
Description	The total number of row changes committed.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-63 db_tier_operations_per_fragment_tot_scan_rows_examined

Field	Details
Description	The total number of rows examined.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

5.18 cnDBTier ndbinfo Locks Per Fragment Metrics

This section provides details about the cnDBTier ndbinfo locks per fragment metrics.

> **Note**
>
> cnDBTier ndbinfo locks per fragment metrics provide details about the number of lock claim requests and their outcomes for each fragment within a database. For more information, see MySQL documentation.

Table 5-64 db_tier_locks_per_fragment_ex_req

Field	Details
Description	The number of exclusive lock requests started.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-65 db_tier_locks_per_fragment_ex_imm_ok

Field	Details
Description	The number of exclusive lock requests granted immediately.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-66 db_tier_locks_per_fragment_ex_wait_ok

Field	Details
Description	The number of exclusive lock requests granted following a wait.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-67 db_tier_locks_per_fragment_ex_wait_fail

Field	Details
Description	The number non-granted exclusive lock requests.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-68 db_tier_locks_per_fragment_sh_req

Field	Details
Description	The number of shared lock requests started.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-69 db_tier_locks_per_fragment_sh_imm_ok

Field	Details
Description	The number of shared lock requests granted immediately.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-70 db_tier_locks_per_fragment_sh_wait_ok

Field	Details
Description	The number of shared lock requests granted following a wait.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-71 db_tier_locks_per_fragment_sh_wait_fail

Field	Details
Description	The number non-granted shared lock requests.
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-72 db_tier_locks_per_fragment_wait_ok_millis

Field	Details
Description	The waiting time of the granted lock requests (in milliseconds).
Type	Gauge

Table 5-72 (Cont.) db_tier_locks_per_fragment_wait_ok_millis

Field	Details

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

Table 5-73 db_tier_locks_per_fragment_wait_fail_millis

Field	Details
Description	The waiting time of the failed lock requests (in milliseconds).
Type	Gauge

Dimensions	`table_id`
	`fq_name`
	`parent_fq_name`
	`site_name`
	`namespace`

5.19 cnDBTier ndbinfo Disk Write Speed Aggregate Metrics

This section provides details about the cnDBTier ndbinfo disk write speed aggregate metrics.

Table 5-74 db_tier_disk_write_speed_aggregate_backup_lcp_speed_last_60sec

Field	Details
Description	The number of bytes written to the disk by the backup and LCP processes per second (averaged over the last 60 seconds).
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-75 db_tier_disk_write_speed_aggregate_redo_speed_last_60sec

Field	Details
Description	The number of bytes written to the REDO log per second (averaged over the last 60 seconds).
Type	Gauge

Table 5-75 (Cont.) db_tier_disk_write_speed_aggregate_redo_speed_last_60sec

Field	Details

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-76 db_tier_disk_write_speed_aggregate_slowdowns_due_to_io_lag

Field	Details
Description	The number of seconds since the last node start the disk writes were slowed due to the REDO log I/O lag.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-77 db_tier_disk_write_speed_aggregate_slowdowns_due_to_high_cpu

Field	Details
Description	The number of seconds since the last node start the disk writes were slowed due to high CPU usage.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-78 db_tier_disk_write_speed_aggregate_disk_write_speed_set_to_min

Field	Details
Description	The number of seconds since the last node start the disk write speed was set to minimum.
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

Table 5-79 db_tier_disk_write_speed_aggregate_current_target_disk_write_speed

Field	Details
Description	The actual speed of the disk writes per LDM thread (aggregated).
Type	Gauge

Dimensions	`node_id`
	`thr_no`
	`site_name`
	`namespace`

5.20 cnDBTier Replication Error Skip Info Metrics

This section provides details about the cnDBTier Replication Error Skip Info Metrics.

Table 5-80 db_tier_replication_halted_due_to_skiperror

Field	Details
Description	The number of times an error is skipped.
Type	Gauge

Dimensions	`site_name`
	`mate_site_name`
	`replchannel_group_id`
	`error_number`
	`namespace`

Table 5-81 db_tier_epochs_lost_due_to_skiperror

Field	Details
Description	The number of epochs lost due to a skipped replication error.
Type	Gauge

Dimensions	`site_name`
	`mate_site_name`
	`replchannel_group_id`
	`error_number`
	`namespace`

Table 5-82 db_tier_replication_switchover_due_to_clusterdisconnect

Field	Details
Description	The number of switchover that happens due to cluster disconnect error.
Type	Gauge

Table 5-82 (Cont.) db_tier_replication_switchover_due_to_clusterdisconnect

Field	Details
Dimensions	node_id site_name mate_site_name replchannel_group_id error_number namespace

5.21 cnDBTier BinLog Injector Thread Info Metrics

This section provides details about the cnDBTier replication metrics.

Table 5-83 db_tier_binlog_injector_thread

Field	Details
Description	Indicates if the Bin Log Injector thread is stalled for every replication SQL node.
Type	Gauge
Dimensions	node_id site_name namespace

Table 5-84 db_tier_binlog_injector_thread_latest_epoch

Field	Details
Description	Provides the latest epoch of the Bin Log Injector thread for every SQL node.
Type	Gauge
Dimensions	node_id site_name namespace

6
cnDBTier Alerts

cnDBTier generates alerts when cnDBTier meets a specified condition. You can access the alerts using the Prometheus dashboard and take necessary actions. Prometheus gets installed as part of common services during the vCNE installation. This section provides details about the available cnDBTier alerts.

6.1 cnDBTier Remote Server Backup Transfer Status Alerts

This section provides details about the cnDBTier remote server backup transfer status alerts.

Table 6-1 REMOTE_SERVER_BACKUP_TRANSFER_FAILED

Field	Details
Description	This alert is triggered with major severity when the transfer of backup to a remote server fails.
Summary	Secure transfer of backup to remote server failed on cnDBTier site {{ $labels.site_name }}
Severity	major
Condition	db_tier_remote_server_backup_transfer_status == 1
Expression Validity	NA
SNMP Trap ID	2031
Affects Service (Y/N)	N
Recommended Action	**Cause**: The transfer of backup to remote server failed. **Diagnostic Information**: Check the status of the `db_tier_remote_server_backup_transfer_status` metric (db_tier_remote_server_backup_transfer_status). **Recovery**: This alert is cleared automatically when the backup transfer status is updated from the failed state to other states, that is, the `db_tier_remote_server_backup_transfer_status` metric value is updated to any value other than 1. To recover from this issue: • check if the remote server is in a healthy state • check the network • check if enough space is available For any assistance, collect the logs and contact My Oracle Support.

6.2 cnDBTier Backup Transfer Status Alerts

This section provides details about the cnDBTier backup transfer status alerts.

Table 6-2 BACKUP_TRANSFER_LOCAL_FAILED

Field	Details
Description	This alert is triggered with major severity when the system fails to transfer the backup from the data node to the replication service pod on the cnDBTier site (`db_tier_backup_transfer_status` metric value is 2).
Summary	Failed to transfer backup from data node to replication service pod on cnDBTier site {{ $labels.site_name }}
Severity	major
Condition	db_tier_backup_transfer_status == 2
Expression Validity	NA
SNMP Trap ID	2026
Affects Service (Y/N)	Y
Recommended Action	**Cause**: The system failed to transfer a backup from the data node to the replication service pod on a cnDBTier site. **Diagnostic Information**: The `db_tier_backup_transfer_status` metric (db_tier_backup_transfer_status) provides information about the backup transfer status. **Recovery**: This alert is cleared automatically when the `db_tier_backup_transfer_status` metric is updated to a value other than 2. For any assistance, collect the logs and contact My Oracle Support.

Table 6-3 BACKUP_TRANSFER_FAILED

Field	Details
Description	This alert is triggered with major severity when the backup transfer failed as the system failed to transfer the backup to the remote site from the cnDBTier site (`db_tier_backup_transfer_status` metric value is 3).
Summary	Failed to transfer backup to remote site from cnDBTier site {{ $labels.site_name }}
Severity	major
Condition	db_tier_backup_transfer_status == 3
Expression Validity	NA
SNMP Trap ID	2027
Affects Service (Y/N)	Y
Recommended Action	**Cause**: The system failed to transfer a backup from the cnDBTier site to a remote site. **Diagnostic Information**: The `db_tier_backup_transfer_status` metric (db_tier_backup_transfer_status) provides information about the backup transfer status. **Recovery**: This alert is cleared automatically when the `db_tier_backup_transfer_status` metric is updated to a value other than 3. For any assistance, collect the logs and contact My Oracle Support.

Table 6-4 BACKUP_TRANSFER_IN_PROGRESS

Field	Details
Description	This alert is triggered with info severity when the backup transfer is in progress on the cnDBTier site (`db_tier_backup_transfer_status` metric value is 1).
Summary	Backup Transfer is In Progress on cnDBTier site {{ $labels.site_name }}
Severity	info
Condition	db_tier_backup_transfer_status == 1
Expression Validity	NA
SNMP Trap ID	2028
Affects Service (Y/N)	N
Recommended Action	**Cause**: Backup transfer is in progress on the cnDBTier site. **Diagnostic Information**: The `db_tier_backup_transfer_status` metric (db_tier_backup_transfer_status) provides information about the backup transfer status. **Recovery**: This alert is cleared automatically when the `db_tier_backup_transfer_status` metric is updated to a value other than 1. For any assistance, collect the logs and contact My Oracle Support.

6.3 cnDBTier Heartbeat Alerts

This section provides details about cnDBTier heartbeat alerts.

Table 6-5 HEARTBEAT_FAILED

Field	Details
Description	This alert is triggered with critical severity when HeartBeat fails on a remote site.
Summary	HeartBeat failed on cnDBTier site {{ $labels.site_name }} connected to mate site {{ $labels.mate_site_name }} on replication channel group id {{ $labels.replchannel_group_id }} and kubernetes namespace {{ $labels.namespace }}"
Severity	critical
Condition	db_tier_heartbeat_failure == 1
Expression Validity	NA
SNMP Trap ID	2025
Affects Service (Y/N)	Y

Table 6-5 (Cont.) HEARTBEAT_FAILED

Field	Details
Recommended Action	**Cause**: The system is unable to connect to remote site and Heartbeat failed. **Diagnostic Information**: The `db_tier_heartbeat_failure` metric (db_tier_heartbeat_failure) provides information about the heartbeat status and indicates whether the remote site is reachable or not. **Recovery**: This alert is cleared automatically when the `db_tier_heartbeat_failure` metric is *0*. For any assistance, collect the logs and contact My Oracle Support.

6.4 cnDBTier BinLog Injector Thread Alerts

This section provides details about cnDBTier BinLog injector alerts.

Table 6-6 BINLOG_INJECTOR_STOPPED

Field	Details
Description	This alert is triggered with critical severity when Bin Log Injector stops working. The value of `db_tier_binlog_injector_thread` or `db_tier_binlog_injector_thread_latest_epoch` indicates the status of Bin Log Injector: • 0: indicates that the Bin Log Injector thread is not stopped for the specified node ID • 1: indicates that the Bin Log Injector thread is stopped for the specified node ID
Summary	BinLog Injector Thread is stopped for MySQL node having node id {{ $labels.node_id }} on cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_binlog_injector_thread_latest_epoch == 1 or db_tier_binlog_injector_thread == 1
Expression Validity	NA
SNMP Trap ID	2024
Affects Service (Y/N)	Y

Table 6-6 (Cont.) BINLOG_INJECTOR_STOPPED

Field	Details
Recommended Action	**Cause**: Bin Log Injector thread stalled for the replication SQL node. **Diagnostic Information**: The `db_tier_binlog_injector_thread_latest_epoch` or `db_tier_binlog_injector_thread` metrics (db_tier_binlog_injector_thread_latest_epoch or db_tier_binlog_injector_thread) provide information whether the Bin Log Injector thread is stalled or not. **Recovery**: This alert is cleared automatically when the `db_tier_binlog_injector_thread_latest_epoch` or `db_tier_binlog_injector_thread` metric is *0*. For any assistance, collect the logs and contact My Oracle Support.

6.5 cnDBTier Replication Error Skip Alerts

This section provides details about the cnDBTier replication error skip alertss.

Table 6-7 REPLICATION_SWITCHOVER_DUE_CLUSTERDISCONNECT

Field	Details
Description	This alert is triggered when switch over happens on an API node due to configured cluster disconnect error, if skip replication error is enabled.
Summary	Replication channel on SQL node with node ID {{ $labels.node_id }} had switchover due to cluster disconnecterror number {{ $labels.error_number }}
Severity	info
Condition	db_tier_replication_switchover_due_to_clusterdisconnect == 1
Expression Validity	NA
SNMP Trap ID	2019
Affects Service (Y/N)	N
Recommended Action	**Cause**: Skip replication error is enabled on an API node and a switchover occurred on the node as the configured cluster disconnected. **Diagnostic Information**: The `db_tier_replication_switchover_due_to_clusterdisconnect` metric (Table 5-82) provides information whether a switchover occurred on an API node. **Recovery**: This alert is cleared automatically one hour after the event. For any assistance, collect the logs and contact My Oracle Support.

Table 6-8 REPLICATION_TOO_MANY_EPOCHS_LOST

Field	Details
Description	This alert is triggered when the epochs lost due to skip error is greater than 10000 and less than or equal to 80000. This alert is cleared one hour after the event.
Summary	Too many epochs are lost for skipping replication errors
Severity	major
Condition	(db_tier_epochs_lost_due_to_skiperror > 10000) and (db_tier_epochs_lost_due_to_skiperror <= 80000)
Expression Validity	NA
SNMP Trap ID	2020
Affects Service (Y/N)	N
Recommended Action	**Cause**: Between 10000 and 80000 epochs are lost due to skip errors. **Diagnostic Information**: The `db_tier_epochs_lost_due_to_skiperror` metric (Table 5-81) provides information about the number of epochs lost due to skip errors. **Recovery**: This alert is cleared automatically one hour after the event. For any assistance, collect the logs and contact My Oracle Support.

Table 6-9 REPLICATION_SKIP_ERRORS_LOW

Field	Details
Description	This alert is triggered when the replication is halted due to skip error count less than or equal to 5. This alert is cleared one hour after the event.
Summary	Cross-site replication errors are skipped
Severity	minor
Condition	(db_tier_replication_halted_due_to_skiperror > 0) and (db_tier_replication_halted_due_to_skiperror <= 5)
Expression Validity	NA
SNMP Trap ID	2021
Affects Service (Y/N)	N
Recommended Action	**Cause**: Replication halted due to less than five skip errors. **Diagnostic Information**: The `db_tier_replication_halted_due_to_skiperror` metric (Table 5-80) provides information about the number of skip errors due to which the replication halted. **Recovery**: This alert is cleared automatically one hour after the event. For any assistance, collect the logs and contact My Oracle Support.

Table 6-10 REPLICATION_SKIP_ERRORS_HIGH

Field	Details
Description	This alert is triggered when the replication is halted due to skip error counts greater than 5. This alert is cleared one hour after the event.
Summary	Cross-site replication errors skipped are high
Severity	major
Condition	db_tier_replication_halted_due_to_skiperror > 5
Expression Validity	NA
SNMP Trap ID	2022
Affects Service (Y/N)	N
Recommended Action	**Cause**: Replication halted due to more than five skip errors. **Diagnostic Information**: The `db_tier_replication_halted_due_to_skiperror` metric (Table 5-80) provides information about the number of skip errors due to which the replication halted. **Recovery**: This alert is cleared automatically one hour after the event. For any assistance, collect the logs and contact My Oracle Support.

Table 6-11 REPLICATION_EPOCHS_LOST

Field	Details
Description	This alert is triggered when the epochs lost due to skip error is greater than 0 and less than 2000. This alert is cleared one hour after the event.
Summary	Epochs are lost for skipping replication errors
Severity	info
Condition	db_tier_epochs_lost_due_to_skiperror > 0 and db_tier_epochs_lost_due_to_skiperror <= <Configured epoch interval lower threshold>
Expression Validity	NA
SNMP Trap ID	2023
Affects Service (Y/N)	N
Recommended Action	**Cause**: Less than 2000 epochs are lost due to skip errors. **Diagnostic Information**: The `db_tier_epochs_lost_due_to_skiperror` metric (Table 5-81) provides information about the number of epochs lost due to skip errors. **Recovery**: This alert is cleared automatically one hour after the event. For any assistance, collect the logs and contact My Oracle Support.

6.6 cnDBTier Georeplication Recovery Status Alerts

This section provides details about the cnDBTier georeplication recovery status alerts.

Table 6-12 GEOREPLICATION_RECOVERY_IN_PROGRESS

Field	Details
Description	This alert is triggered with critical severity when the georeplication recovery is in progress and the alert is cleared when georeplication recovery is complete.
Summary	Identified cnDBTier Site {{ $labels.site_name }} georeplication recovery is in progress for kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_georeplication_recovery_state == 1
Expression Validity	1m
SNMP Trap ID	2018
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When you perform georeplication recovery to recover failed site from a healthy site, that is when georeplication recovery is in progress. **Diagnostic Information**: The `db_tier_georeplication_recovery_state` metric (db_tier_georeplication_recovery_state) provides information whether georeplication recovery is in progress. **Recovery**: This alert is cleared automatically when the georeplication recovery is complete. For any assistance, collect the logs and contact My Oracle Support.

6.7 cnDBTier Cluster Status Alerts

This section provides details about cnDBTier cluster status alerts.

Table 6-13 CLUSTER_DOWN

Field	Details
Description	This alert is triggered with critical severity when cnDBTier NDB cluster is not UP.
Summary	MySQL Cluster is down for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_cluster_status == 0
Expression Validity	1m
SNMP Trap ID	2017
Affects Service (Y/N)	Y

Table 6-13 (Cont.) CLUSTER_DOWN

Field	Details
Recommended Action	**Cause**: • When pod restarts due to Kubernetes liveliness or readiness probe failures. • When cnDBTier application restarts or fails to start. **Diagnostic Information**: • Run the following command to check the status of cnDBTier namespace: `kubectl -n <namespace> exec -it ndbmgmd-0 -- ndb_mgm -e show` The cluster is down if: – the ndbappmysqld pods are down, not running, and not connected – the remaining pods are not running and not connected • Check Kubernetes events for probe failures in the platform logs. • Check if any exception is reported in the cnDBTier application logs. **Recovery**: This alert is cleared automatically when the inactive pod is active. For any assistance, collect the logs and contact My Oracle Support.

Table 6-14 MYSQL_NDB_CLUSTER_DISCONNECT

Field	Details
Description	This alert is triggered with critical severity when cnDBTier NDB cluster is not UP.
Summary	MySQL NDB Cluster Disconnected {{ $value }} times for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_cluster_disconnect > 0
Expression Validity	1m
SNMP Trap ID	2034
Affects Service (Y/N)	Y

Table 6-14 (Cont.) MYSQL_NDB_CLUSTER_DISCONNECT

Field	Details
Recommended Action	**Cause**: • When all ndbmtd pods or all ndbmtd pods of the same node group restart due to Kubernetes probe failures or infrastructure related issues. **Diagnostic Information**: • Run the following command to check the status of cnDBTier namespace: `kubectl -n <namespace> exec -it ndbmgmd-0 -- ndb_mgm -e show` The cluster is down if: all data nodes or all data nodes of the same node group are not connected. • Check Kubernetes events for probe failures in the platform logs. • Check if there is any network fluctuation or platform related issue which can cause the ndbmtd pods to restart. • Check if any exception is reported in the cnDBTier application logs. **Recovery**: This alert can be cleared by calling the `/db-tier/reset/parameter/cluster_restart_disconnect` REST API. For more information about this API, see cnDBTier Cluster Events APIs. For any assistance, collect the logs and contact My Oracle Support.

6.8 cnDBTier Automated Backup Alerts

This section provides details about the cnDBTier automated backup alerts.

Table 6-15 BACKUP_FAILED

Field	Details
Description	This alert is triggered with minor severity when the backup service fails to complete the backup successfully.
Summary	Could not backup database for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	minor
Condition	db_tier_backup{status='FAILED'}
Expression Validity	N/A
SNMP Trap ID	2011
Affects Service (Y/N)	N

Table 6-15 (Cont.) BACKUP_FAILED

Field	Details
Recommended Action	**Cause**: • When backup service fails to complete the backup successfully. • When PVC size is not enough and as a result the backup fails. **Diagnostic Information**: The `db_tier_backup` metric (db_tier_backup) provides information if the backup failed or not. **Recovery**: This alert is cleared automatically when the `db_tier_backup` metric status changes from the FAILED state to other states. For any assistance, collect the logs and contact My Oracle Support.

Table 6-16 BACKUP_PURGED_EARLY

Field	Details
Description	This alert is triggered with minor severity when the backup service purges old backups earlier than expected to create space for new backup.
Summary	A backup was deleted prematurely for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	minor
Condition	db_tier_backup{status='PURGED_EARLY'}
Expression Validity	N/A
SNMP Trap ID	2012
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the backup service purges the old backups earlier than the expected time, to create space for a new backup. **Diagnostic Information**: The `db_tier_backup` metric (db_tier_backup) provides information if the backup is purged earlier than expected. **Recovery**: This alert is cleared automatically when the `db_tier_backup` metric status changes from the PURGED_EARLY state to other states. For any assistance, collect the logs and contact My Oracle Support.

Table 6-17 BACKUP_SIZE_GROWTH

Field	Details
Description	This alert is triggered with minor severity whenever the current backup size exceeds 20% of the average of the previous backups.

Table 6-17 (Cont.) BACKUP_SIZE_GROWTH

Field	Details
Summary	Backup size exceeded expected size for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	minor
Condition	(db_tier_backup_used_disk_percentage/ (avg_over_time(db_tier_backup_used_disk_percentage[5d])))>1.05
Expression Validity	N/A
SNMP Trap ID	2013
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the current backup size exceeds 20% of the average of the previous backups. **Diagnostic Information**: The `db_tier_backup_used_disk_percentage` metric (db_tier_backup_used_disk_percentage) provides information if the current backup size exceeds 20% of the average. **Recovery**: This alert is cleared automatically when the `db_tier_backup_used_disk_percentage` metric value is reduced to the threshold percentage. For any assistance, collect the logs and contact My Oracle Support.

Table 6-18 BACKUP_STORAGE_LOW

Field	Details
Description	This alert is triggered with minor severity when the total backup size of the data node is >= 70% and < 80% of the total data node disk size.
Summary	Disk storage on DATA node with node ID {{ $labels.node_id }} at {{ $value }} percent for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	minor
Condition	(avg_over_time(db_tier_backup_used_disk_percentage[5m])>=70) and (avg_over_time(db_tier_backup_used_disk_percentage[5m])<80)
Expression Validity	N/A
SNMP Trap ID	2014
Affects Service (Y/N)	N

Table 6-18 (Cont.) BACKUP_STORAGE_LOW

Field	Details
Recommended Action	**Cause**: When the total backup size of the data node is >= 70% and < 80% of the total data node disk size. **Diagnostic Information**: The `db_tier_backup_used_disk_percentage` metric (db_tier_backup_used_disk_percentage) provides information if the current backup size is >= 70% and < 80% of the total data node disk size. **Recovery**: • This alert is cleared automatically when the `db_tier_backup_used_disk_percentage` metric value is reduced to the threshold percentage. • Increase the disk size by performing the scaling procedure. For any assistance, collect the logs and contact My Oracle Support.

Table 6-19 BACKUP_STORAGE_LOW

Field	Details
Description	This alert is triggered with major severity when the total backup size of the data node is >= 80% and < 95% of the total data node disk size.
Summary	Disk storage on DATA node with node ID {{ $labels.node_id }} at {{ $value }} percent for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	(avg_over_time(db_tier_backup_used_disk_percentage[5m])>=80) and (avg_over_time(db_tier_backup_used_disk_percentage[5m])<95)
Expression Validity	N/A
SNMP Trap ID	2015
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the total backup size of the data node is >= 80% and < 95% of the total data node disk size. **Diagnostic Information**: The `db_tier_backup_used_disk_percentage` metric (db_tier_backup_used_disk_percentage) provides information if the current backup size is >= 80% and < 95% of the total data node disk size. **Recovery**: • This alert is cleared automatically when the `db_tier_backup_used_disk_percentage` metric value is reduced to the threshold percentage. • Increase the disk size by performing the scaling procedure. For any assistance, collect the logs and contact My Oracle Support.

Table 6-20 BACKUP_STORAGE_FULL

Field	Details
Description	This alert is triggered with critical severity when the total backup size of the data node is >= 95% of the total data node disk size.
Summary	Disk storage on DATA node with node ID {{ $labels.node_id }} is full for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(avg_over_time(db_tier_backup_used_disk_percentage[5m])>=95)
Expression Validity	N/A
SNMP Trap ID	2016
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the total backup size of the data node is >= 95% of the total data node disk size. **Diagnostic Information**: The `db_tier_backup_used_disk_percentage` metric (db_tier_backup_used_disk_percentage) provides information if the current backup size is >= 95% of the total data node disk size. **Recovery**: • This alert is cleared automatically when the `db_tier_backup_used_disk_percentage` metric value is reduced to the threshold percentage. • Increase the disk size by performing the scaling procedure. **Note**: Take immediate action to avoid the cnDBTier cluster going out of service. For any assistance, collect the logs and contact My Oracle Support.

Table 6-21 DB_TIER_NDB_BACKUP_IN_PROGRESS

Field	Details
Description	This alert is triggered with minor severity when a data node backup is in progress in the current site.
Summary	Indicates that a data node backup process is in progress in the current site.
Severity	minor
Condition	db_tier_ndb_backup_in_progress == 1
Expression Validity	N/A
SNMP Trap ID	2037
Affects Service (Y/N)	N

Table 6-21 (Cont.) DB_TIER_NDB_BACKUP_IN_PROGRESS

Field	Details
Recommended Action	**Cause**: When a data node backup is in progress in the current site. **Diagnostic Information**: The `db_tier_ndb_backup_in_progress` metric (Table 5-35) provides information if a data node backup is in progress or not. Ensure that you don't make any schema changes until the backup completes. **Recovery**: This alert is cleared automatically when the backup completes in the MySQL NDB cluster. For any assistance, collect the logs and contact My Oracle Support.

6.9 cnDBTier Bin Log Usage Alerts

This section provides details about the cnDBTier binlog usage alerts.

Table 6-22 BINLOG_STORAGE_LOW

Field	Details
Description	This alert is triggered with a minor severity when the total BinLog size of the SQL node is >= 70% and < 80% of the total SQL node disk size.
Summary	Disk storage on SQL node with node ID {{ $labels.node_id }} at {{ $value }} percent for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	minor
Condition	(avg_over_time(db_tier_binlog_used_bytes_percentage[5m]) >= 70) and (avg_over_time(db_tier_binlog_used_bytes_percentage[5m]) < 80)
Expression Validity	5m
SNMP Trap ID	2007
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the total BinLog size of the SQL node is >= 70% and < 80% of the total SQL node disk size. **Diagnostic Information**: The `db_tier_binlog_used_bytes_percentage` metric (db_tier_binlog_used_bytes_percentage) provides information if the total BinLog size of the SQL node is >=70% and <80% of total SQL node disk size. **Recovery**: This alert is cleared automatically when the value of the `db_tier_binlog_used_bytes_percentage` metric is reduced to the threshold value. For any assistance, contact My Oracle Support.

Table 6-23 BINLOG_STORAGE_LOW

Field	Details
Description	This alert is triggered with major severity when the total BinLog size of the SQL node is >=80% and <95% of the total SQL node disk size.
Summary	Disk storage on SQL node with node ID {{ $labels.node_id }} at {{ $value }} percent for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	(avg_over_time(db_tier_binlog_used_bytes_percentage[5m]) >= 80) and (avg_over_time(db_tier_binlog_used_bytes_percentage[5m]) < 95)
Expression Validity	5m
SNMP Trap ID	2036
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the total BinLog size of the SQL node is >=80% and <95% of the total SQL node disk size. **Diagnostic Information**: The `db_tier_binlog_used_bytes_percentage` metric (db_tier_binlog_used_bytes_percentage) provides information if the total BinLog size of the SQL node is >=80% and <95% of total SQL node disk size. **Recovery**: This alert is cleared automatically when the value of the `db_tier_binlog_used_bytes_percentage` metric is reduced to the threshold value. For any assistance, contact My Oracle Support.

Table 6-24 BINLOG_STORAGE_FULL

Field	Details
Description	This alert is triggered with critical severity when the total BinLog size of the SQL node is >= 95% of the total SQL node disk size.
Summary	Disk storage on SQL node with node ID {{ $labels.node_id }} is full for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	avg_over_time(db_tier_binlog_used_bytes_percentage[5m]) >= 95
Expression Validity	N/A
SNMP Trap ID	2008
Affects Service (Y/N)	Y

Table 6-24 (Cont.) BINLOG_STORAGE_FULL

Field	Details
Recommended Action	**Cause**: When the total BinLog size of the SQL node is >= 95% of the total SQL node disk size. **Diagnostic Information**: The `db_tier_binlog_used_bytes_percentage` metric (db_tier_binlog_used_bytes_percentage) provides information if the total BinLog size of the SQL node is >= 95% of total SQL node disk size. **Recovery**: This alert is cleared automatically when the value of the `db_tier_binlog_used_bytes_percentage` metric is reduced to the threshold value. **Note**: Take immediate action to avoid the SQL node going into Crashbackloop and becoming inaccessible. For any assistance, contact My Oracle Support.

6.10 cnDBTier Replication Alerts

This section provides details about cnDBTier replication alerts.

Table 6-25 REPLICATION_CHANNEL_DOWN

Field	Details
Description	This alert is triggered with major severity when an ACTIVE channel goes to the FAILED state.
Summary	Cross-site replication is down on node {{ $labels.node_id }} for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	(db_tier_replication_status{role="failed"} == 0) or (db_tier_replication_status{role="active"} == 0)
Expression Validity	N/A
SNMP Trap ID	2005
Affects Service (Y/N)	N
Recommended Action	**Cause**: When any ACTIVE channel goes to the FAILED state when the crosssite replication is down on a node. **Diagnostic Information**: The following metrics provide information if the replication channel is down: • `db_tier_replication_status{role="failed"} == 0` (db_tier_replication_status{role="failed"} == 0) • `db_tier_replication_status{role="active"} == 0` (db_tier_replication_status{role="active"} == 0) **Recovery**: This alert is cleared automatically when the cross-site replication is UP on the node and ACTIVE. **Note**: Take immediate action to avoid the cnDBTier cluster going out of service. For any assistance, contact My Oracle Support.

Table 6-26 REPLICATION_FAILED

Field	Details
Description	This alert is triggered with critical severity when all the channels are in the STANDBY or FAILED state.
Summary	Cross-site replication is down for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(count by (site_name, namespace, replchannel_group_id) (db_tier_replication_status) == count by (site_name, namespace, replchannel_group_id) (db_tier_replication_status{role="standby"})) or (count by (namespace, replchannel_group_id, site_name) (db_tier_replication_status) == count by (namespace, replchannel_group_id, site_name) (db_tier_replication_status{role="failed"}))
Expression Validity	N/A
SNMP Trap ID	2006
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When all the channels are in the STANDBY or FAILED state as the cross-site replication is down for the cnDBTier site. **Diagnostic Information**: The `db_tier_replication_status` metric (db_tier_replication_status) provides information if the replication failed. **Recovery**: This alert is cleared automatically when the cross-site replication of the cnDBTier site is ACTIVE. For any assistance, contact My Oracle Support.

Table 6-27 SLAVE_REPLICATION_DELAY_HIGH

Field	Details
Description	This alert is triggered when the last record read by the slave is more than five minutes behind the latest record written by the master.
Summary	Slave replication on SQL node at {{ $labels.slave_node_ip }} is {{ $value }} seconds behind the master for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	avg(avg_over_time(db_tier_replication_slave_delay[5m])) by (master_node_ip,slave_node_ip) >= 300 and avg(avg_over_time(db_tier_replication_slave_delay[5m])) by (master_node_ip,slave_node_ip) < 48*3600
Expression Validity	1m
SNMP Trap ID	2009
Affects Service (Y/N)	N

Table 6-27 (Cont.) SLAVE_REPLICATION_DELAY_HIGH

Field	Details
Recommended Action	**Cause**: When the last record read by the worker node is more than 5 minutes and less than 48 hours behind the latest record written by the controller. **Diagnostic Information**: The `db_tier_replication_slave_delay` metric (db_tier_replication_slave_delay) provides information if there is a delay in the worker node replication. **Recovery**: This alert is cleared automatically when the when the `db_tier_replication_slave_delay` metric value is reduced below the defined threshold value. For any assistance, collect the logs and contact My Oracle Support.

Table 6-28 SLAVE_REPLICATION_FAILED

Field	Details
Description	This alert is triggered when the last record read by the slave is more than 48 hours behind the latest record written by the master.
Summary	Slave replication has fallen more than 48 hours behind the master. Manual restore from backup may be required for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	avg(avg_over_time(db_tier_replication_slave_delay[5m])) by (master_node_ip,slave_node_ip) >= 48*3600
Expression Validity	1m
SNMP Trap ID	2010
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When the last record read by the worker node is more than 48 hours behind the latest record written by the controller. **Diagnostic Information**: The `db_tier_replication_slave_delay` metric (db_tier_replication_slave_delay) provides information if the worker node replication failed. **Recovery**: Perform georeplication recovery for the DB sync. For procedures, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*. This alert is cleared automatically when the `db_tier_replication_slave_delay` metric value is reduced below the defined threshold value. For any assistance, collect the logs and contact My Oracle Support.

Table 6-29 REPLICATION_SVC_STORAGE_FULL

Field	Details
Description	This alert is triggered with critical severity whenever the PVC consumption of replication service is more than 90% of the overall storage of replication service.
Summary	Disk storage of replication service PVC {{ $labels.persistentvolumeclaim }} is full on kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(kubelet_volume_stats_used_bytes{persistentvolumeclaim=~".*replication.*"}/ kubelet_volume_stats_capacity_bytes{persistentvolumeclaim=~".*replication.*"}) * 100 > 90
Expression Validity	NA
SNMP Trap ID	2032
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When the replication service PVC is filled more than 90% of overall PVC storage. A PVC fill can lead to replication service not functioning properly. **Diagnostic Information**: This alert indicates that PVC of replication service is almost full and requires immediate attention to address the storage issue. **Recovery**: Release storage for the replication service to function properly or scale PVC to accommodate any future data as the PVC is almost full.

Table 6-30 GEOREPLICATION_RECOVERY_FAILED

Field	Details
Description	This alert is triggered with critical severity when georeplication recovery fails on a unhealthy site where georeplication recovery was started.
Summary	Georeplication recovery has failed on cnDBTier Site {{ $labels.site_name }} from kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_georeplication_recovery_state == 2
Expression Validity	NA
SNMP Trap ID	2033
Affects Service (Y/N)	Y
Recommended Action	**Cause**: Incorrect disk size, incorrect SSH key configurations, or other similar reasons. **Diagnostic Information**: This alert indicates that georeplication recovery failed on a unhealthy site and replication couldn't be reestablished using the georeplication recovery procedure. This alert requires immediate attention. **Recovery**: Check the configurations like SSH key or disk size. Contact My Oracle Support for additional support.

6.11 cnDBTier Memory Usage Alerts

This section provides details about the cnDBTier memory usage alerts.

Table 6-31 LOW_MEMORY

Field	Details
Description	This alert is triggered when the RAM usage of any node is greater than or equal to 80%.
Summary	Node ID {{ $labels.node_id }}, memory utilization at {{ $value }} percent for memory type {{ $labels.memory_type }} for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	((avg_over_time(db_tier_memory_used_bytes{memory_type="Data memory"}[1m]) / avg_over_time(db_tier_memory_total_bytes{memory_type="Data memory"}[1m])) * 100) >= 80
Expression Validity	1m
SNMP Trap ID	2003
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the RAM or memory usage of any node reaches the major level of threshold value. **Diagnostic Information**: Check if the memory usage of the following metrics are too high: • `db_tier_memory_used_bytes` (db_tier_memory_used_bytes) • `db_tier_memory_total_bytes` (db_tier_memory_total_bytes) **Recovery**: Reduce the incoming service request rate. This alert is cleared automatically when the memory usage of the cnDBTier worker pod is reduced below the defined threshold value. For any assistance, contact My Oracle Support.

Table 6-32 OUT_OF_MEMORY

Field	Details
Description	This alert is triggered with critical severity when the RAM usage of any node is greater than or equal to 90%.
Summary	Node ID {{ $labels.node_id }} out of memory for memory type {{ $labels.memory_type }} for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	((avg_over_time(db_tier_memory_used_bytes{memory_type="Data memory"}[1m]) / avg_over_time(db_tier_memory_total_bytes{memory_type="Data memory"}[1m])) * 100) >= 90

Table 6-32 (Cont.) OUT_OF_MEMORY

Field	Details
Expression Validity	1m
SNMP Trap ID	2004
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When the RAM or memory usage of any node reaches the critical level of threshold value. **Diagnostic Information**: Check if the memory usage of the following metrics are too high: • `db_tier_memory_used_bytes` (db_tier_memory_used_bytes) • `db_tier_memory_total_bytes` (db_tier_memory_total_bytes) **Recovery**: Reduce the incoming service request rate. This alert is cleared automatically when the memory usage of the cnDBTier worker pod is reduced below the defined threshold value. **Note**: Take immediate action to avoid the cnDBTier cluster going out of service. For any assistance, contact My Oracle Support.

6.12 cnDBTier CPU Usage Alerts

This section provides details about cnDBTier CPU usage alerts.

Table 6-33 HIGH_CPU

Field	Details
Description	This alert is triggered with major severity when the CPU usage of any data node is greater than or equal to 80%, and less than 90%.
Summary	Node ID {{ $labels.node_id }} CPU utilization at {{ $value }} for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	((100 - (avg(avg_over_time(db_tier_cpu_os_idle[10m])) by (node_id))) >= 80) and ((100 - (avg(avg_over_time(db_tier_cpu_os_idle[10m])) by (node_id))) < 90)
Expression Validity	1m
SNMP Trap ID	2002
Affects Service (Y/N)	N

Table 6-33 (Cont.) HIGH_CPU

Field	Details
Recommended Action	**Cause**: When the CPU utilization of any data node is greater than or equal to 80%, and less than 90%. **Diagnostic Information**: Check the CPU threshold level status from the cnDBTier worker pod logs. **Recovery**: Reduce the incoming service request rate. This alert is cleared automatically when the CPU utilization is reduced below the threshold value. For any assistance, contact My Oracle Support.

Table 6-34 HIGH_CPU

Field	Details
Description	This alert is triggered with critical severity when the CPU usage of any data node is greater than or equal to 90%.
Summary	Node ID {{ $labels.node_id }} CPU utilization at {{ $value }} for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(100 - (avg(avg_over_time(db_tier_cpu_os_idle[10m]))BY (node_id)))>= 90
Expression Validity	1m
SNMP Trap ID	2035
Affects Service (Y/N)	N
Recommended Action	**Cause**: When the CPU utilization of any data node is greater than or equal to 90%. **Diagnostic Information**: Check the CPU threshold level status from the cnDBTier worker pod logs. **Recovery**: Reduce the incoming service request rate. This alert is cleared automatically when the CPU utilization is reduced below the threshold value. **Note**: Take immediate action to avoid the cnDBTier cluster going out of service. For any assistance, contact My Oracle Support.

6.13 cnDBTier Node Status Alerts

The section provides details about cnDBTier node status alerts.

Table 6-35 NODE_DOWN

Field	Details
Description	This alert is raised with critical severity when the data node is down. db_tier_node_status value: • 0: indicates that a node is DOWN • 1: indicates that the node is UP
Summary	MySQL {{ $labels.node_type }} node having node id {{ $labels.node_id }} is down for cnDBTier site {{ $labels.site_name }} and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	db_tier_node_status == 0
Expression Validity	N/A
SNMP Trap ID	2001
Affects Service (Y/N)	Y
Recommended Action	**Cause**: • When pod restarts due to Kubernetes liveliness or readiness probe failures • When cnDBTier application restarts or fails to start **Diagnostic Information**: • Run the following command to check the status of cnDBTier namespace: `kubectl -n <namespace> exec -it ndbmgmd-0 -- ndb_mgm -e show` • Check the Kubernetes events for probe failures in the platform logs. • Check if any exception is reported in the cnDBTier application logs. **Recovery**: This alert is cleared automatically when the inactive pod becomes active. For any assistance, collect the application logs and contact My Oracle Support.

6.14 cnDBTier Node Data Volume Alerts

This section provides details about cnDBTier node data volume alerts.

Table 6-36 DB_TIER_API_SEND_NODE_DATA_VOLUME_LOW

Field	Details
Description	This alert is triggered when any NDB application node sends less data to NDB when compared to the other NDB application nodes.
Summary	Send Node Data Volume Low for API Node ID {{ $labels.remote_node_id }} at kubernetes namespace {{ $labels.namespace }}
Severity	critical

Table 6-36 (Cont.) DB_TIER_API_SEND_NODE_DATA_VOLUME_LOW

Field	Details
Condition	(((sum by (remote_node_id,namespace) (avg_over_time(rate(db_tier_node_transporter_bytes_received{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m]))/scalar(sum (avg_over_time(rate(db_tier_node_transporter_bytes_received{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m])))*100) < (100/(scalar(count(count by (remote_node_id) (db_tier_node_transporter_bytes_received{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}))*1.6))
Expression Validity	NA
SNMP Trap ID	3001
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When NDB application node sends less data to NDB when compared to other NDB application nodes. **Diagnostic Information**: The alert indicates that the NDB application node is slow, therefore check the underlying infrastructure. **Recovery**: This alert is cleared automatically when the NDB application node sends the data at the same rate as the other NDB application node. For any assistance, contact My Oracle Support.

Table 6-37 DB_TIER_API_RECEIVE_NODE_DATA_VOLUME_LOW

Field	Details
Description	This alert is triggered when any NDB sends less data to any specific NDB application node when compared to the other NDB application nodes.
Summary	Receive Node Data Volume Low for API Node ID {{ $labels.remote_node_id }} at kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(((sum by (remote_node_id,namespace) (avg_over_time(rate(db_tier_node_transporter_bytes_sent{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m]))/scalar(sum (avg_over_time(rate(db_tier_node_transporter_bytes_sent{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m])))*100) < (100/(scalar(count(count by (remote_node_id) (db_tier_node_transporter_bytes_sent{node_type=~"ndbapp_node",namespace="<${CNDBTIER_NAMESPACE}>"}))*1.6))
Expression Validity	NA
SNMP Trap ID	3002
Affects Service (Y/N)	Y

Table 6-37 (Cont.) DB_TIER_API_RECEIVE_NODE_DATA_VOLUME_LOW

Field	Details
Recommended Action	**Cause**: When NDB application node sends less data to any specific NDB application node when compared to other NDB application nodes. **Diagnostic Information**: The alert indicates that the NDB application node is slow, therefore check the underlying infrastructure. **Recovery**: This alert is cleared automatically when the NDB application node sends the data at the same rate as the other NDB application node. For any assistance, contact My Oracle Support.

Table 6-38 DB_TIER_SEND_DATA_NODE_DATA_VOLUME_LOW

Field	Details
Description	This alert is triggered when any NDB doesn't send the traffic data in the required speed or when the speed is slower when compared to another data node.
Summary	Send Data Node Data Volume Low for DATA Node ID {{ $labels.node_id }} at kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	((sum by (node_id,namespace) (avg_over_time(rate(db_tier_node_transporter_bytes_sent{namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m]))/scalar(sum (avg_over_time(rate(db_tier_node_transporter_bytes_sent{namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m])))) * 100) < (100/(scalar(count(count by (node_id) (db_tier_node_transporter_bytes_sent{namespace="<${CNDBTIER_NAMESPACE}>"})))*1.6))
Expression Validity	NA
SNMP Trap ID	3003
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When any NDB doesn't send the traffic data in the required speed or when the speed is slower when compared to another data node. **Diagnostic Information**: The alert indicates that the NDB application node is slow, therefore check the underlying infrastructure. **Recovery**: This alert is cleared automatically when the NDB application node sends the same amount of data to other data node. For any assistance, contact My Oracle Support.

Table 6-39 DB_TIER_RECEIVE_DATA_NODE_DATA_VOLUME_LOW

Field	Details
Description	This alert is triggered when any NDB doesn't receive the traffic data in the required speed or when the speed is slower when compared to another data node.
Summary	Receive Data Node Data Volume Low for DATA Node ID {{ $labels.node_id }} at kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	((sum by (node_id,namespace) (avg_over_time(rate(db_tier_node_transporter_bytes_received{namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m]))/scalar(sum (avg_over_time(rate(db_tier_node_transporter_bytes_received{namespace="<${CNDBTIER_NAMESPACE}>"}[5m])[15m:5m])))) * 100)< (100/(scalar(count(count by (node_id) (db_tier_node_transporter_bytes_received{namespace="<${CNDBTIER_NAMESPACE}>"})))*1.6))
Expression Validity	NA
SNMP Trap ID	3004
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When any NDB doesn't receive the traffic data in the required speed or when the speed is slower when compared to another data node. **Diagnostic Information**: The alert indicates that the NDB application node is slow, therefore check the underlying infrastructure. **Recovery**: This alert is cleared automatically when the NDB application node receives the same amount of data to other data node. For any assistance, contact My Oracle Support.

Table 6-40 DB_TIER_DATA_NODE_SCAN_FRAGMENT_SLOW

Field	Details
Description	This alert is triggered when any data node scan fragment is slow when compared with other data nodes.
Summary	Scan Fragment is Slow for DATA Node ID {{ $labels.node_id }} at kubernetes namespace {{ $labels.namespace }}
Severity	critical

Table 6-40 (Cont.) DB_TIER_DATA_NODE_SCAN_FRAGMENT_SLOW

Field	Details
Condition	(((sum by (node_id,comm_node_id,namespace) (rate(db_tier_tc_time_track_stats_total_scan_fragments_time{path_type="INTERNAL",namespace="<${CNDBTIER_NAMESPACE}>"}[15m]))/sum by (node_id,comm_node_id,namespace) (rate(db_tier_tc_time_track_stats_total_scan_fragments_count{path_type="INTERNAL",namespace="<${CNDBTIER_NAMESPACE}>"}[15m])))/ (scalar(sum(sum by (node_id,comm_node_id,namespace) (rate(db_tier_tc_time_track_stats_total_scan_fragments_time{path_type="INTERNAL",namespace="<${CNDBTIER_NAMESPACE}>"}[15m]))/sum by (node_id,comm_node_id,namespace) (rate(db_tier_tc_time_track_stats_total_scan_fragments_count{path_type="INTERNAL",namespace="<${CNDBTIER_NAMESPACE}>"}[15m])))))*100) > ((100/ scalar(count(sum by (node_id,comm_node_id,namespace) (db_tier_tc_time_track_stats_total_scan_fragments_time{path_type="INTERNAL",namespace="<${CNDBTIER_NAMESPACE}>"})))*1.6)
Expression Validity	NA
SNMP Trap ID	3005
Affects Service (Y/N)	Y
Recommended Action	**Cause**: When the scan fragment for any particular data node is slow. **Diagnostic Information**: The alert indicates that the NDB application node is slow, therefore check the underlying infrastructure. **Recovery**: This alert is cleared automatically when the data node fragment scan is fast as compared to other data nodes. For any assistance, contact My Oracle Support.

6.15 cnDBTier Certificate Expiry Alerts

This section provides details about cnDBTier certificate expiry alerts.

Table 6-41 DBTIER_CERTIFICATE_EXPIRY_INFO

Field	Details
Description	This alert is triggered with `info` severity whenever the certificate for a cnDBTier is set to expire within the next 90 days.
Summary	dbtier Certificate {{ $labels.certType }}for {{ $labels.hostname }} is expiring with in 90 days for cnDBTier site {{ $labels.site_name }}and kubernetes namespace {{ $labels.namespace }}
Severity	info
Condition	(db_tier_cert_expiry / 1000 - time()) > 2592000 and (db_tier_cert_expiry / 1000 - time()) <= 7776000

Table 6-41 (Cont.) DBTIER_CERTIFICATE_EXPIRY_INFO

Field	Details
Expression Validity	NA
OID	1.3.6.1.4.1.323.5.3.50.1.2.2045
Metric Used	`db_tier_cert_expiry`
Affects Service (Y/N)	N
Recommended Action	**Cause**: This alert is triggered when any cnDBTier certificate is going to expire in next 90 days. **Diagnostic Information**: This alert is triggered with `info` severity whenever the certificate for a cnDBTier is set to expire within the next 90 days. **Recommended actions**: 1. Update the cnDBTier certificates by following the steps provided in the "Update Certificate" section in *Oracle Communications Cloud Native Core, cnDBTier User Guide*. 2. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. **Note** Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see Oracle Communications Cloud Native Core, Network Function Data Collector User Guide.
Available in OCI	Yes

Table 6-42 DBTIER_CERTIFICATE_EXPIRY_MAJOR

Field	Details
Description	This alert is triggered with `major` severity whenever the certificate for a cnDBTier is set to expire within the next 30 days.
Summary	dbtier Certificate {{ $labels.certType }}for {{ $labels.hostname }} is expiring with in 30 days for cnDBTier site {{ $labels.site_name }}and kubernetes namespace {{ $labels.namespace }}
Severity	major
Condition	(db_tier_cert_expiry / 1000 - time()) > 604800 and (db_tier_cert_expiry / 1000 - time()) <= 2592000
OID	1.3.6.1.4.1.323.5.3.50.1.2.2040
Metric Used	`db_tier_cert_expiry`
Expression Validity	NA
Affects Service (Y/N)	N

Table 6-42 (Cont.) DBTIER_CERTIFICATE_EXPIRY_MAJOR

Field	Details
Recommended Action	**Cause**: This alert is triggered when any cnDBTier certificate is going to expire in next 30 days. **Diagnostic Information**: This alert is triggered with `info` severity whenever the certificate for a cnDBTier is set to expire within the next 30 days. **Recommended actions**: 1. Update the cnDBTier certificates by following the steps provided in the "Update Certificate" section in *Oracle Communications Cloud Native Core, cnDBTier User Guide*. Depending on the certificate type in alerts, follow the below procedures appropriately: • Modifying cnDBTier Certificates to Establish TLS for Communication with NFs • Modifying HTTPS Certificates 2. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. **Note** Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see Oracle Communications Cloud Native Core, Network Function Data Collector User Guide.
Available in OCI	Yes

Table 6-43 DBTIER_CERTIFICATE_EXPIRY_CRITICAL

Field	Details
Description	This alert is triggered with `critical` severity whenever the certificate for a cnDBTier is set to expire within the next 7 days.
Summary	dbtier Certificate {{ $labels.certType }}for {{ $labels.hostname }} is expiring with in 7 days for cnDBTier site {{ $labels.site_name }}and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(db_tier_cert_expiry / 1000 - time()) > 0 and (db_tier_cert_expiry / 1000 - time()) <= 604800
OID	1.3.6.1.4.1.323.5.3.50.1.2.2041
Metric Used	`db_tier_cert_expiry`
Expression Validity	NA
Affects Service (Y/N)	Y

Table 6-43 (Cont.) DBTIER_CERTIFICATE_EXPIRY_CRITICAL

Field	Details
Recommended Action	**Cause**: This alert is triggered when any cnDBTier certificate is going to expire in next 7 days. **Diagnostic Information**: This alert is triggered with `critical` severity whenever the certificate for a cnDBTier is set to expire within the next 7 days. **Recommended actions**: 1. Update the cnDBTier certificates by following the steps provided in the "Update Certificate" section in *Oracle Communications Cloud Native Core, cnDBTier User Guide*. Depending on the certificate type in alerts, follow the below procedures appropriately: • Modifying cnDBTier Certificates to Establish TLS for Communication with NFs • Modifying HTTPS Certificates 2. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. **Note** Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see Oracle Communications Cloud Native Core, Network Function Data Collector User Guide.
Available in OCI	Yes

Table 6-44 DBTIER_CERTIFICATE_EXPIRED

Field	Details
Description	This alert is triggered with `critical` severity when any cnDBTier certificate has expired.
Summary	dbtier Certificate {{ $labels.certType }}for {{ $labels.hostname }} is expiredfor cnDBTier site {{ $labels.site_name }}and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	(db_tier_cert_expiry / 1000 - time()) <= 0
OID	1.3.6.1.4.1.323.5.3.50.1.2.2041
Metric Used	`db_tier_cert_expiry`
Expression Validity	NA
Affects Service (Y/N)	Y

Table 6-44 (Cont.) DBTIER_CERTIFICATE_EXPIRED

Field	Details
Recommended Action	**Cause**: This alert is triggered when any cnDBTier certificate is going to expire in next 7 days. **Diagnostic Information**: This alert is triggered with `critical` severity whenever the certificate for a cnDBTier is set to expire within the next 7 days. **Recommended actions**: 1. Update the cnDBTier certificates by following the steps provided in the "Update Certificate" section in *Oracle Communications Cloud Native Core, cnDBTier User Guide*. Depending on the certificate type in alerts, follow the below procedures appropriately: • Modifying cnDBTier Certificates to Establish TLS for Communication with NFs • Modifying HTTPS Certificates 2. In case the issue persists, capture all the outputs for the above steps and contact My Oracle Support. **Note** Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see Oracle Communications Cloud Native Core, Network Function Data Collector User Guide.
Available in OCI	Yes

6.16 cnDBTier PVC Health Alerts

This section provides details about cnDBTier PVC health related alerts.

Table 6-45 PVC_NOT_ACCESSIBLE

Field	Details
Description	This alert is triggered with `critical` severity when db_tier_pvc_is_accesible condition is zero. • If the value of `db_tier_pvc_is_accesible` is 0, indicates that PVC is not accessible. • If the value of `db_tier_pvc_is_accesible` is 1, indicates that PVC is accessible.
Summary	PVC is not accessible on cnDBTier site {{ $labels.site_name }}
Severity	critical
Condition	db_tier_pvc_is_accesible == 0
OID	1.3.6.1.4.1.323.5.3.50.1.2.2029
Metric Used	db_tier_pvc_is_accesible

Table 6-45 (Cont.) PVC_NOT_ACCESSIBLE

Field	Details
Expression Validity	1m
Affects Service (Y/N)	Y

Table 6-45 (Cont.) PVC_NOT_ACCESSIBLE

Field	Details

Recommended Action	**Cause**: When PVC is not accessible for read or write operation.
	Diagnostic Information: The `db_tier_pvc_is_accesible` metric provides information about the PVC is accessible or not.
	Recommended steps:
	1. Verify the Cluster and Pod status.
	Run the following command to check the cluster status:
	`kubectl -n <cnDBTier Namespace> exec -it ndbmgmd-0 -- ndb_mgm -e show`
	Run the following command to check the pod status:
	`kubectl get pod -n <cnDBTier Namespace>`
	2. Retrieve the pod name whose PVC is not accessible using db_tier_pvc_is_accessible metric. It is the hostname attribute.
	3. After retrieving the the name of the pod, get the PVC associated with it and describe the pod as well as PVC. Look for PVC bound status, any mount errors, events indicating mount failure or volume timeout.
	To describe the pod, run the following command:
	`kubectl -n <cnDBTier Namespace> describe pod <pod name>`
	To retrieve the PVC associated with the Pod, run the following command:
	`kubectl -n <cnDBTier Namespace> get pvc`
	To describe the PVC, run the following command:
	`kubectl -n <cnDBTier Namespace> describe pvc <pvc name>`
	4. Check PVC Mounting Inside the pod. Get mount_path from the db_tier_pvc_is_accesible. If mount_path is missing or empty. It confirms the PVC isn't mounted properly.
	Run the following commands to check the mount_path by logging in to the pod:
	`kubectl -n <cnDBTier Namespace> exec -it <pod name> -- bash`

Table 6-45 (Cont.) PVC_NOT_ACCESSIBLE

Field	Details
	ls -l /var/occnedb df -h | grep occnedb 5. Restart the pod. Sometimes a simple restart remounts the PVC correctly. Restart the podkubectl -n <cnDBTier Namespace> delete pod <pod name> 6. Check the logs of the pod. Run the following command to check the logs of the main container: kubectl -n <cnDBTier Namespace> logs <pod name> -c <main container name> Run the following command to check logs of the infra monitor svc container: kubectl -n <cnDBTier Namespace> logs <pod name> -c <db-infra-monitor-svc container name> 7. This alert will be cleared automatically when the PVC metric db_tier_pvc_failure_count become zero. In case if the issue persists, capture all the outputs for the above steps and contact My Oracle Support. **Note** Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see *Oracle Communications Cloud Native Core, Network Function Data Collector User Guide*.

Table 6-46 PVC_STORAGE_FULL

Field	Details
Description	The PVC_STORAGE_FULL alert is triggered with critical severity when a pod's PVC reaches full capacity.
Summary	PVC is not accessible on cnDBTier site {{ $labels.site_name }

Table 6-46 (Cont.) PVC_STORAGE_FULL

Field	Details
Severity	critical
Condition	db_tier_pvc_is_accesible == 0
OID	1.3.6.1.4.1.323.5.3.50.1.2.2029
Metric Used	db_tier_pvc_is_accesible
Expression Validity	1m
Affects Service (Y/N)	Y

Table 6-46 (Cont.) PVC_STORAGE_FULL

Field	Details

Recommended Action	**Cause**: This alert is triggered when the PVC reaches full capacity, preventing further write operations..
	Diagnostic Information: The system detects that the PVC has no available space, leading to storage-related failures.
	Recommended steps:
	1. Verify the Cluster and Pod status.
	Run the following command to check the cluster status:
	`kubectl -n <cnDBTier Namespace> exec -it ndbmgmd-0 -- ndb_mgm -e show`
	Run the following command to check the pod status:
	`kubectl get pod -n <cnDBTier Namespace>`
	2. From db_tier_volume_stats_used_bytes get the name of the pod whose pvc storage is full. It is there as the hostname attribute.
	3. Verify that the cnDBTier pods are configured with the resources (CPUs, Memory and PVC size) as per cnDBTier dimensions.
	4. If the PVC is not configured as per cnDBTier dimensions, then increase the database capacity by following the scaling procedures below before performing the scaling:
	• Vertical ScalingHorizontal Scaling
	5. Ensure that the application managing the PVC properly handles storage utilization. This alert will be cleared automatically when sufficient space becomes available. In case if the issue persists, capture all the outputs for the above steps and and contact My Oracle Support.
	Note
	Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see *Oracle Communications Cloud Native Core, Network Function Data Collector User Guide*.

6.17 cnDBTier Backup Manager Svc Down Alerts

This section provides details about cnDBTier backup manager Svc down alerts.

Table 6-47 DB_BACKUP_MANAGER_SVC_DOWN

Field	Details
Description	This alert is triggered with `critical` severity when db_backup_manager_svc pod is down.
Summary	PVC is not accessible on cnDBTier site {{ $labels.site_name }
Severity	critical
Condition	kube_deployment_status_replicas_available{deployment=~".*db-backup-manager-svc.*"} == 0
OID	1.3.6.1.4.1.323.5.3.50.1.2.2039
Metric Used	`kube_deployment_status_replicas_available{deployment=~".*db-backup-manager-svc.*"}`
Expression Validity	1m
Affects Service (Y/N)	Y

Table 6-47 (Cont.) DB_BACKUP_MANAGER_SVC_DOWN

Field	Details

Recommended Action	**Cause**: When `db_backup_manager_svc` pod is down.
	Diagnostic Information: The system detects that the `db_backup_manager_svc` pod is not up and unable to connect to database.
	Recommended steps:
	1. Check the db-backup-manager service pod status. Look for CrashLoopBackOff, ImagePullBackOff, OOMKilled, Init container failures.
	Run the following command to check the pod status:
	`kubectl -n <cnDBTier namespace> get pods | grep "db-backup-manager-svc"`
	Run the following command to describe the pod:
	`kubectl -n <cnDBTier namespace> describe pod <backup-manager-pod name>`
	2. Check the deployment status.
	Look for Available replicas: 0, `Events` section for scheduling or image pull errors.
	Run the following command to get the `db-backup-manager-svc` deployment:
	`kubectl -n <cnDBTier namespace> get deployment | grep "db-backup-manager-svc"`
	Run the following command to describe the deployment:
	`kubectl -n <cnDBTier namespace> describe deployment <backup-manger-svc deployment>`
	3. Check the DB Backup Manager service pod logs to see if there are a lot of database connectivity issues.
	Run the following command to get the `backup-manager-svc` pod:
	`kubectl -n <cnDBTier namespace> get pods | grep "db-backup-manager-svc"`
	Run the following command to check the logs of the backup-manger svc pod:
	`kubectl -n <cnDBTier namespace> logs < db-backup-manager-svc pod name>`
	4. In case if the issue persists, capture all the outputs for the above steps and contact My Oracle Support.

Table 6-47 (Cont.) DB_BACKUP_MANAGER_SVC_DOWN

Field	Details
	Note Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see *Oracle Communications Cloud Native Core, Network Function Data Collector User Guide*.

6.18 cnDBTier Forced Switchover Disabled Alerts

This section provides details about cnDBTier forced switchover disabled alerts.

Table 6-48 DB_TIER_FORCED_SWITCHOVER_DISABLED

Field	Details
Description	This alert is triggered with `critical` severity when switchover is disabled forcefully.
Summary	dbtier switchover is disabled forcefully for cnDBTier {{ $labels.site_name }}and kubernetes namespace {{ $labels.namespace }}
Severity	critical
Condition	kube_deployment_status_replicas_available{deployment=~".*db-backup-manager-svc.*"} == 0
OID	1.3.6.1.4.1.323.5.3.50.1.2.2039
Metric Used	`kube_deployment_status_replicas_available{deployment=~".*db-backup-manager-svc.*"}`
Expression Validity	1m
Affects Service (Y/N)	Y

Table 6-48 (Cont.) DB_TIER_FORCED_SWITCHOVER_DISABLED

Field	Details

Recommended Action	**Cause**: When switchover is disabled forcefully.
	Diagnostic Information: The alert informs the operator that switchover is currently disabled and needs to be updated.
	Recommended steps:
	1. Check the DBTIER_REPL_SITE_INFO table for the `stop_repl_switchover` value. If the value of `stop_repl_switchover` for the current site is 1, it means switchover is disabled forcefully. Get the site_name, mate_site_name and replchannel_group_id from the `db_tier_stop_repl_switchover` metric's attribute.
	Run the following command to check the replication_info.DBTIER_REPL_SITE_INFO table
	`kubectl -n <cnDBTier namespace> ndbmysqld-0 -- mysql -h127.0.0.1 -uroot -p<root user password>;`
	Run the following query to get the value of the column stop_repl_switchover:
	`select stop_repl_switchover from DBTIER_REPL_SITE_INFO where site_name='<site name>' and mate_site_name='<mate site name>'and replchannel_group_id=<replication channel grp id>;`
	2. The alert will automatically clear once the switchover is enabled. If the `stop_repl_switchover` value retrieved from the above step is 1 and if you wish to re-enable the switchover, then call the API mentioned in the cnDBTier Switchover APIs section to re-enable the switchover.
	3. In case if the issue persists, capture all the outputs for the above steps and contact My Oracle Support.
	Note
	Use CNC NF Data Collector tool for capturing logs. For more information on how to collect logs using Data Collector tool, see *Oracle Communications Cloud Native Core, Network Function Data Collector User Guide*.

7
Maintenance Procedures

This section provides the procedures for managing and maintaining cnDBTier.

> **Note**
>
> - The "occne-cndbtier" namespace name used in the procedures is only an example. Ensure that you configure the namespace name according to your environment.
> - The OCCNE_NAMESPACE variable in the maintenance procedures is only an example. Before running any command that contains the OCCNE_NAMESPACE variable, ensure that you have set this variable to the cnDBTier namespace as stated in the following code block:
>
>   ```
>   export OCCNE_NAMESPACE=<namespace>
>   ```
>
>   where, <namespace> is the cnDBTier namespace.
> - cnDBTier doesn't support monitoring or alarming about any certificate expiry. Ensure that you track the certificates and renew them before it expires. Refer to the following procedures depending on the certificates you want to renew:
>   - Modifying cnDBTier Certificates to Establish TLS for Communication with NFs
>   - Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites
>   - Modifying HTTPS Certificates

> **Note**
>
> In the event that a script fails after completing multiple phases of an operation, use manual procedures to continue from the phase the script stopped running or initiate the fatal georeplication recovery (GRR) to recover the setup.

7.1 Starting or Stopping cnDBTier

This section provides the procedures to start or stop cnDBTier.

7.1.1 Starting cnDBTier

To start cnDBTier, perform the following steps:

1. Run the following command to scale up the management nodes:

   ```
   $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmgmd --
   replicas=<replica count for MGM pods>
   ```

   Example:

   ```
   $ kubectl -n occne-cndbtier scale sts ndbmgmd --replicas=2
   ```

2. Run the following command to scale up the data nodes:

   ```
   $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmtd --
   replicas=<replica count for DATA pods>
   ```

   Example:

   ```
   $ kubectl -n occne-cndbtier scale sts ndbmtd --replicas=4
   ```

3. Run the following command to scale up the non-georeplication SQL nodes:

   ```
   $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbappmysqld --
   replicas=<replica count for non geo SQL pods>
   ```

   Example:

   ```
   $ kubectl -n cluster1 scale sts ndbappmysqld --replicas=2
   ```

4. Run the following command to scale up the SQL nodes:

   ```
   $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmysqld --
   replicas=<replica count for SQL pods>
   ```

   Example:

   ```
   $ kubectl -n cluster1 scale sts ndbmysqld --replicas=2
   ```

5. Run the following commands to scale up db-monitor-svc, db-replication-svc, and db-backup-manager-svc:
   a. To scale up the db-monitor-svc:

      ```
      $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier monitor
      svc deployment name> --replicas=1
      ```

      Example:

      ```
      $ kubectl -n occne-cndbtier scale deploy mysql-cluster-db-monitor-svc --
      replicas=1
      ```

b. To scale up the db-replication-svc:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier
replication svc deployment name> --replicas=1
```

Example:

```
$ kubectl -n occne-cndbtier scale deploy mysql-cluster-Cluster1-
Cluster2-replication-svc --replicas=1
```

c. To scale up the db-backup-manager-svc:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier backup
manager svc deployment name> --replicas=1
```

Example:

```
$ kubectl -n occne-cndbtier scale deploy mysql-cluster-db-backup-
manager-svc --replicas=1
```

6. Run the following command on each mate site to check the replication status:

```
$ kubectl -n <namespace of cnDBTier cluster> exec -it ndbmysqld-0 -- curl
http://mysql-cluster-db-monitor-svc.<namespace of cnDBTier
cluster>:8080/db-tier/status/replication/realtime
```

The value of replicationStatus in the output indicates if the local site is able to replicate data from that remote site:

- "UP": Indicates that the local site is able to replicate data from that remote site.
- "DOWN": Indicates that the local site is not able to replicate data from the respective remote site. In this case, perform a georeplication recovery. For georeplication recovery procedure, see the "*Restoring Georeplication Failure*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

For example, run the following command to check the georeplication status of cnDBTier cluster2 configured with other remote sites:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- curl http://mysql-cluster-db-
monitor-svc.cluster2:8080/db-tier/status/replication/realtime
```

Sample output:

```
[
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster1",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
```

```
        "secondsBehindRemote": 0
      }
    ]
  },
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster3",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
      }
    ]
  },
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster4",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
      }
    ]
  }
]
```


In the sample output, the replicationStatus is "UP" for the localSiteName cluster2 for remotesiteName cluster1, cluster3, and cluster4. This indicates that the localSiteName cluster2 is able to replicate data from remotesiteName cluster1, cluster3, and cluster4.

> **Note**
>
> If georeplication is enabled, then run this procedure on all sites.

7.1.2 Stopping cnDBTier

To stop cnDBTier, perform the following steps:

1. Run the following command to scale down the non-georeplication SQL nodes:

   ```
   $ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbappmysqld --replicas=0
   ```

   For example:

   ```
   $ kubectl -n cluster1 scale sts ndbappmysqld --replicas=0
   ```

2. Run the following commands to scale down db-monitor-svc, db-replication-svc, and db-backup-manager-svc:

a. Run the following commands to scale down db-monitor-svc:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier monitor
svc deployment name> --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale deploy mysql-cluster-db-monitor-svc --
replicas=0
```

b. Run the following commands to scale down db-replication-svc:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier
replication svc deployment name> --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale deploy mysql-cluster-Cluster1-Cluster2-
replication-svc --replicas=0
```

c. Run the following commands to scale down db-backup-manager-svc:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale deploy <cnDBTier backup
manager svc deployment name> --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale deploy mysql-cluster-db-backup-manager-svc
--replicas=0
```

3. Run the following command to scale down the SQL nodes:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmysqld --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale sts ndbmysqld --replicas=0
```

4. Run the following command to scale down the data nodes:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmtd --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale sts ndbmtd --replicas=0
```

5. Run the following command to scale down the management nodes:

```
$ kubectl -n <CNDBTIER_NAMESPACE_NAME> scale sts ndbmgmd --replicas=0
```

For example:

```
$ kubectl -n cluster1 scale sts ndbmgmd --replicas=0
```

7.2 Starting or Stopping cnDBTier Georeplication Service

This section provides the procedures to start or stop cnDBTier georeplication service.

7.2.1 Starting cnDBTier Georeplication Between Sites

This section provides the procedure to start cnDBTier georeplication service using the cnDBTier switchover APIs.

To start georeplication between the two sites, perform the switchover on each site with respect to the other site.

Following are some example scenarios:

1. In a 2 site scenario, to start the georeplication between site 1 and site 2, perform the following steps:
   a. Start switchover on site 1 with respect to site 2.
   b. Start switchover on site 2 with respect to site 1.
2. In a 3 site scenario, to start the georeplication between site 1, site 2, and site 3, perform the following steps:
   a. Start switchover on site 1 with respect to site 2.
   b. Start switchover on site 1 with respect to site 3.
   c. Start switchover on site 2 with respect to site 1.
   d. Start switchover on site 2 with respect to site 3.
   e. Start switchover on site 3 with respect to site 1.
   f. Start switchover on site 3 with respect to site 2.
3. In a 4 site scenario, to start georeplication between site 1, site 2, site3, and site4, perform the following steps:
   a. Start switchover on site 1 with respect to site 2.
   b. Start switchover on site 1 with respect to site 3.
   c. Start switchover on site 1 with respect to site 4.
   d. Start switchover on site 2 with respect to site 1.
   e. Start switchover on site 2 with respect to site 3.
   f. Start switchover on site 2 with respect to site 4.
   g. Start switchover on site 3 with respect to site 1.
   h. Start switchover on site 3 with respect to site 2.
   i. Start switchover on site 3 with respect to site 4.
   j. Start switchover on site 4 with respect to site 1.
   k. Start switchover on site 4 with respect to site 2.
   l. Start switchover on site 4 with respect to site 3.

cnDBTier provides a REST API to start the switchover which can be used to make different API calls depending on the requirement:

> **Note**
>
> Ensure that you perform the switchover on all the sites to start the replication. For example, if you want to start the georeplication between site 1 and site 2, switchover API call on both site 1 and site 2.

Use any one of the following APIs based on your requirement:

1. PUT */ocdbtier/georeplication/switchover/start/sitename/{siteName}*: This call allows you to start the replication switchover on a site (siteName) with respect to all the other sites.
2. PUT */ocdbtier/georeplication/switchover/start/sitename/{siteName}/remotesitename/{remoteSiteName}*: This call allows you to start the replication switchover on a site (siteName) with respect to a remote site (remoteSiteName).
3. PUT */ocdbtier/georeplication/switchover/start/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}*: This call allows you to start the replication switchover on a site (siteName) with respect to a remote site (remoteSiteName) for a channel group (replChannelGroupId).

To start the cnDBTier georeplication service using the switchover API, perform the following:

1. Run the following command to get the LoadBalancer IP of the replication service on the site:

   ```
   $ IP=$(kubectl get svc -n <namespace> | grep repl | awk '{print $4}' |
   head -n 1 )
   ```

   where, `<namespace>` is the namespace of the failed site.

   For example, run the following command to get the LoadBalancer IP of the replication service on cluster1:

   ```
   $ IP=$(kubectl get svc -n cluster1 | grep repl | awk '{print $4}' | head -
   n 1 )
   ```

2. Run the following command to get the LoadBalancer Port of the replication service on the site:

   ```
   $ PORT=$(kubectl get svc -n <namespace> | grep repl | awk '{print $5}' |
   cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
   ```

   where, `<namespace>` is the namespace of the failed site.

   For example, run the following command to get the LoadBalancer port of the replication service on cluster1:

   ```
   $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk '{print $5}' |  cut
   -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
   ```

3. **To Start the replication service in cnDBTier with respect to siteName**:

Run the following command to start the replication service in cnDBTier with respect to siteName:

> **Note**
>
> Replace `$IP` and `$PORT` in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
sitename/{siteName}
```

For example, run the following command to start the replication service in cnDBTier with respect to cluster1 on all the other mate sites:

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
sitename/cluster1
```

Sample output:

```
{
    "replicationSwitchOver":"start"
}
```

4. **To Start the replication service in cnDBTier with respect to siteName and remoteSiteName**:

   Run the following command to start the replication service in cnDBTier with respect to siteName and remoteSiteName:

   > **Note**
   >
   > Replace `$IP` and `$PORT` in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

   ```
   $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
   sitename/{siteName}/remotesitename/{remoteSiteName}
   ```

   For example, run the following command to start the replication service in cnDBTier with respect to cluster1 and cluster2:

   ```
   $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
   sitename/cluster1/remotesitename/cluster2
   ```

   Sample output:

   ```
   {
       "replicationSwitchOver":"start"
   }
   ```

5. **To Start the replication service in cnDBTier with respect to siteName and remoteSiteName**:

   Run the following command to start the replication service in cnDBTier with respect to `siteName`, `remoteSiteName`, and `replChannelGroupId` only:

   > **Note**
   >
   > Replace $IP and $PORT in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

   ```
   $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
   sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/
   {replChannelGroupId}
   ```

   For example, run the following command to start the replication service in cnDBTier with respect to cluster1, cluster2, and replication channel group ID "1":

   ```
   $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/start/
   sitename/cluster1/remotesitename/cluster2/replchannelgroupid/1
   ```

   Sample output:

   ```
   {
       "replicationSwitchOver":"start"
   }
   ```

   > **Note**
   >
   > For more information about the API response payloads, error codes, and curl commands for starting georeplication service, see the cnDBTier Switchover APIs section.

Example scenario: 3 site setup (site 1, site 2, and site 3)

The following example provides the sample steps to restart replication in a three-site setup (site 1, site 2, site 3) considering the following scenarios:

Following are assumptions for this scenario:

- Georeplication must be restarted to and from site 3.
- Georeplication between site1 and site2 is up and running successfully.

Procedure to restart the replication in a 3 site setup:

1. Perform step 1 and step 2 to get the site IP and PORT details. This example considers the following site details.
   - Site 1:
     - site name: cluster 1
     - site1-site3-replication-svc Loadbalancer service IP: 10.233.51.13

  - site1-site3-replication-svc Loadbalancer service PORT: 80
- Site 2:
  - Site name: cluster2
  - site2-site3-replication-svc Loadbalancer service IP: 10.233.52.23
  - site2-site3-replication-svc Loadbalancer service PORT: 80
- Site 3:
  - Site name: cluster3
  - site3-site1-replication-svc Loadbalancer service IP: 10.233.53.31
  - site3-site1-replication-svc Loadbalancer service PORT: 80

2. **Note**

   Perform the steps 2 to 4 from a bash shell in any db-replication-pod.

   Start the replication switchover on site 3 with respect to other sites, that is, site 1 and site 2:

   ```
   curl -X PUT http://10.233.53.31:80/ocdbtier/georeplication/switchover/
   start/sitename/cluster3
   ```

3. Start the replication switchover on site 1 with respect to site 3:

   ```
   curl -X PUT http://10.233.51.13:80/ocdbtier/georeplication/switchover/
   start/sitename/cluster1/remotesitename/cluster3
   ```

4. Start the replication switchover on site 2 with respect to site 3:

   ```
   curl -X PUT http://10.233.52.23:80/ocdbtier/georeplication/switchover/
   start/sitename/cluster2/remotesitename/cluster3
   ```

5. Verify if the replication to and from site 3 has started.

Note

This procedure can be extended to a 4 site setup scenario.

7.2.2 Stopping cnDBTier Georeplication Between Sites

This section provides the procedure to stop the cnDBTier georeplication service using cnDBTier switchover and stop replica APIs.

To stop the georeplication between the two sites, perform the stop switchover and replica on each site with respect to the other site.

Following are some example scenarios:

1. In a 2 site setup, to stop the georeplication between site 1 and site 2, perform the following steps:
   Site 1:

- Stop the switchover on site 1 with respect to site 2.
- Stop the replica on site 1 with respect to site 2.

Site 2:

- Stop the switchover on site 2 with respect to site 1.
- Stop the replica on site 2 with respect to site 1.

2. In a 3 site setup, to stop the georeplication between site 1, site 2, and site 3, perform the following steps:
   Site 1:
   - Stop the switchover on site 1 with respect to site 2.
   - Stop the replica on site 1 with respect to site 2.
   - Stop the switchover on site 1 with respect to site 3.
   - Stop the replica on site 1 with respect to site 3.

   Site 2:
   - Stop the switchover on site 2 with respect to site 1.
   - Stop the replica on site 2 with respect to site 1.
   - Stop the switchover on site 2 with respect to site 3.
   - Stop the replica on site 2 with respect to site 3.

   Site 3:
   - Stop the switchover on site 3 with respect to site 1.
   - Stop the replica on site 3 with respect to site 1.
   - Stop the switchover on site 3 with respect to site 2.
   - Stop the replica on site 3 with respect to site 2.
3. In a 4 site setup, to stop the georeplication between site 1 and site 2 and site3 and site4, you must perform the following steps:
   Site 1:
   - Stop the switchover on site 1 with respect to site 2.
   - Stop the replica on site 1 with respect to site 2.
   - Stop the switchover on site 1 with respect to site 3.
   - Stop the replica on site 1 with respect to site 3.
   - Stop the switchover on site 1 with respect to site 4.
   - Stop the replica on site 1 with respect to site 4.

   Site 2:
   - Stop the switchover on site 2 with respect to site 1.
   - Stop the replica on site 2 with respect to site 1.
   - Stop the switchover on site 2 with respect to site 3.
   - Stop the replica on site 2 with respect to site 3.
   - Stop the switchover on site 2 with respect to site 4.
   - Stop the replica on site 2 with respect to site 4.

   Site 3:

- Stop the switchover on site 3 with respect to site 1.
- Stop the replica on site 3 with respect to site 1.
- Stop the switchover on site 3 with respect to site 2.
- Stop the replica on site 3 with respect to site 2.
- Stop the switchover on site 3 with respect to site 4.
- Stop the replica on site 3 with respect to site 4.

Site 4:

- Stop the switchover on site 4 with respect to site 1.
- Stop the replica on site 4 with respect to site 1.
- Stop the switchover on site 4 with respect to site 2.
- Stop the replica on site 4 with respect to site 2.
- Stop the switchover on site 4 with respect to site 3.
- Stop the replica on site 4 with respect to site 3.

cnDBTier provides two REST APIs to stop the switchover and to stop the replica. These APIs can be used to make different API calls depending on your requirement:

> **Note**
>
> Ensure that you perform the switchover on all the sites to stop the replication. For example, if you want to stop the georeplication between site 1 and site 2,stop the switchover and stop the replica using the API on both site 1 and site 2.

Use one of the following APIs to stop the switchover and stop the replica on both site 1 and site 2 based on the requirement:

1. PUT */ocdbtier/georeplication/switchover/stop/sitename/{siteName}*: This call allows you to stop replication switchover on a site (siteName) with respect to all the other mate sites.
   PUT */ocdbtier/georeplication/stopreplica/sitename/{siteName}*: This call allows you to stop replica on a site (siteName) with respect to all the other mate sites.
2. PUT */ocdbtier/georeplication/switchover/stop/sitename/{siteName}/remotesitename/{remoteSiteName}*: This call allows you to stop replication switchover on a site (siteName) with respect to a remote site (remoteSiteName).
   PUT */ocdbtier/georeplication/stopreplica/sitename/{siteName}/remotesitename/{remoteSiteName}*: This call allows you to stop replica on a site (siteName) with respect to a remote site (remoteSiteName).
3. PUT */ocdbtier/georeplication/switchover/stop/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}*: This call allows you to stop replication switchover on a site (siteName) with respect to a remote site (remoteSiteName) for a channel group (replChannelGroupId).
   PUT */ocdbtier/georeplication/stopreplica/sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/{replChannelGroupId}*: This call allows you to stop replica on a site (siteName) with respect to a remote site (remoteSiteName) for a channel group (replChannelGroupId).

Perform the following steps to stop the cnDBTier georeplication service using the stop replication APIs:

1. Perform the following steps to stop the cnDBTier replication service switchover and stop the replication channel:
   a. Run the following command to get the LoadBalancer IP of the replication service on the site:

      ```
      $ IP=$(kubectl get svc -n <namespace> | grep repl | awk '{print $4}' |
      head -n 1 )
      ```

      where, `<namespace>` is the namespace of the failed site.

      For example, run the following command to get the LoadBalancer IP of the replication service on cluster1:

      ```
      $ IP=$(kubectl get svc -n cluster1 | grep repl | awk '{print $4}' |
      head -n 1 )
      ```

   b. Run the following command to get the LoadBalancer Port of the replication service on the site:

      ```
      $ PORT=$(kubectl get svc -n <namespace> | grep repl | awk '{print $5}'
      |  cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
      ```

      where, `<namespace>` is the namespace of the failed site.

      For example, run the following command to get the LoadBalancer Port of the replication service on cluster1:

      ```
      $ PORT=$(kubectl get svc -n cluster1 | grep repl | awk '{print $5}' |
      cut -d '/' -f 1 |  cut -d ':' -f 1 | head -n 1)
      ```

   c. Run the following command to stop the replication service switchover and stop the replication channel in cnDBTier with respect to siteName:

      > **Note**
      >
      > Replace `$IP` and `$PORT` in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

      ```
      $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
      sitename/{siteName}
      ```

      ```
      $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
      sitename/{siteName}
      ```

      For example, run the following command to stop the replication service switchover and stop the replication channel in cnDBTier with respect to cluster1:

      ```
      $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
      sitename/cluster1
      ```

Sample output:

```
{
    "replicationSwitchOver":"stop"
}
```

Run the following command to stop the replication channel in cnDBTier with respect to cluster 1:

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
sitename/cluster1
```

Sample output:

```
{
    "stopReplica":"stop"
}
```

Alternatively, run the following command to stop the replication service switchover and stop the replication channel in cnDBTier with respect to siteName and remoteSiteName:

> **Note**
>
> Replace `$IP` and `$PORT` in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
sitename/{siteName}/remotesitename/{remoteSiteName}
```

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
sitename/{siteName}/remotesitename/{remoteSiteName}
```

For example, run the following command to stop the replication service switchover and stop the replication channel in cnDBTier with respect to cluster1 and cluster2:

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
sitename/cluster1/remotesitename/cluster2
```

Sample output:

```
{
    "replicationSwitchOver":"stop"
}
```

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
sitename/cluster1/remotesitename/cluster2
```

Sample output:

```
{
    "stopReplica":"stop"
}
```

Run the following command to stop the replication service switchover in cnDBTier with respect to siteName, remoteSiteName, and replChannelGroupId:

> **Note**
>
> Replace `$IP` and `$PORT` in the command with the LoadBalancer IP and port numbers obtained from steps 1 and 2.

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/
{replChannelGroupId}
```

```
 $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
sitename/{siteName}/remotesitename/{remoteSiteName}/replchannelgroupid/
{replChannelGroupId}
```

For example, run the following command to stop the replication service switchover in cnDBTier with respect to cluster1, cluster2, and replication channel group ID "1":

```
$ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/switchover/stop/
sitename/cluster1/remotesitename/cluster2/replchannelgroupid/1
```

Sample output:

```
{
    "replicationSwitchOver":"stop"
}
```

```
 $ curl -X PUT http://$IP:$PORT/ocdbtier/georeplication/stopreplica/
sitename/cluster1/remotesitename/cluster2/replchannelgroupid/1
```

Sample output:

```
{
    "stopReplica":"stop"
    }
```

> **Note**
>
> For more information about the API response payloads, error codes, and curl commands to stop replication service switchover and stop the replication channel, see cnDBTier Switchover APIs and cnDBTier Stop Replica APIs.

Example scenario: 3 site setup (site 1, site 2, site 3)

The following example provides the sample steps to stop replication in a three-site setup (site 1, site 2, site 3) considering the following scenarios:

Following are assumptions for this scenario:

- Georeplication to and from site 3 must be stopped.
- Georeplication between site1 and site2 must continue to run successfully.

Procedure to stop the replication in a 3 site setup

1. Perform steps 1a and 1b, or steps 2a and 2b to get the site IP and PORT details. This example considers the following site details.
   - Site 1:
     - site name: cluster 1
     - site1-site3-replication-svc Loadbalancer service IP: 10.233.51.13
     - site1-site3-replication-svc Loadbalancer service PORT: 80
   - Site 2:
     - Site name: cluster2
     - site2-site3-replication-svc Loadbalancer service IP: 10.233.52.23
     - site2-site3-replication-svc Loadbalancer service PORT: 80
   - Site 3:
     - Site name: cluster3
     - site3-site1-replication-svc Loadbalancer service IP: 10.233.53.31
     - site3-site1-replication-svc Loadbalancer service PORT: 80
2. > **Note**
   >
   > Perform the steps 2 to 4 from a bash shell in any db-replication-pod.

   Stop the replication switchover and stop the replica on site 3 with respect to the other sites, that is, site 1 and site 2.

2:

```
curl -X PUT http://10.233.53.31:80/ocdbtier/georeplication/switchover/stop/
sitename/cluster3
```

```
{
    "replicationSwitchOver":"stop"
    }
```

```
curl -X PUT http://10.233.53.31:80/ocdbtier/georeplication/stopreplica/
sitename/cluster3
```

```
{
    "stopReplica":"stop"
}
```

3. Stop the replication switchover and stop the replica on site 1 with respect to site 3:

```
curl -X PUT http://10.233.51.13:80/ocdbtier/georeplication/switchover/stop/
sitename/cluster1/remotesitename/cluster3
```

```
{
    "replicationSwitchOver":"stop"
    }
```

```
curl -X PUT http://10.233.51.13:80/ocdbtier/georeplication/stopreplica/
sitename/cluster1/remotesitename/cluster3
```

```
{
    "stopReplica":"stop"
}
```

4. Stop replication switchover and Stop replica on site 2 with respect to site 3:

```
curl -X PUT http://10.233.52.23:80/ocdbtier/georeplication/switchover/stop/
sitename/cluster2/remotesitename/cluster3
```

```
{"replicationSwitchOver":"stop"}
```

```
curl -X PUT http://10.233.52.23:80/ocdbtier/georeplication/stopreplica/
sitename/cluster2/remotesitename/cluster3
```

```
{
    "stopReplica":"stop"
}
```

5. Verify if the replication to and from site 3 has stopped.

> **Note**
>
> This procedure can be extended to a four site setup scenario.

7.3 Scaling cnDBTier Pods

cnDBTier 25.1.103 supports horizontal and vertical scaling of pods for improved performance. This section describes the horizontal and vertical scaling procedures for SQL and database pods.

7.3.1 Horizontal Scaling

This section describes the procedures to horizontally scale **ndbappmysqld** and **ndbmtd** pods.

7.3.1.1 Scaling ndbappmysqld Pods

cnDBTier 25.1.103 supports autoscaling of cnDBTier ndbappmysqld pods when cnDBTier is deployed with a service account. For more information, see Scaling ndbappmysqld Pods With Service Account. When cnDBTier is deployed without a service account, you must manually scale the ndbappmysqld pods. This section describes the procedures to scale the cnDBTier ndbappmysqld pods when cnDBTier is deployed without service account and configurations to consider when cnDBTier is deployed with service account.

> **Note**
>
> Before scaling, ensure that the worker nodes have adequate resources to support scaling.

Considerations
The examples in these procedures consider a cnDBTier setup deployed with two ndbmgmd, two ndbmtd, two ndbmysqld, and two ndbappmysqld pods. The ndbappmysqld pods of this cnDBtier setup are scaled up from replica count two to four in this procedure.

7.3.1.1.1 Scaling ndbappmysqld Pods Without Service Account

This section describes the procedure to manually scale the cnDBTier ndbappmysqld pods when cnDBTier is deployed without service account.

> **Note**
>
> ndbappmysqld auto scaling requires service account. If the cnDBTier is deployed without the service account, then auto scaling is disabled.

1. Increase the replica count of the ndbappmysqld pods in the `custom_values.yaml` file under global.ndbappReplicaCount:

   ```
   global:
     ndbappReplicaCount: 4
   ```

> **Note**
>
> The cnDBTier is initially deployed with two ndbappmysqld pods and increased to a replica count of four in this step.

2. Upgrade cnDBTier with the new `ndbappReplicaCount` by following the upgrade procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

When the helm upgrade completes, the ndbappmysqld replica count is increased to the value updated in the `custom_values.yaml` file.

7.3.1.1.2 Scaling ndbappmysqld Pods With Service Account

This section describes the procedure to scale the cnDBTier ndbappmysqld pods when cnDBTier is deployed with service account.

Scaling cnDBTier ndbappmysqld When Autoscaling is Enabled

When cnDBTier is deployed with a service account and autoscaling is enabled, the ndbappmysqld pods are scaled automatically.

Ensure that autoscaling is enabled for cnDBTier ndbappmysqld pods in the `custom_values.yaml` file under autoscaling.ndbapp:

```
autoscaling:
  ndbapp:
    enabled: true
```

> **Note**
>
> Apply the above change to the cnDBTier Helm chart by following the "Upgrading cnDBTier Clusters" procedure in the *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*. cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

When autoscaling is enabled, ndbappmysqld is scaled between ndbappReplicaCount and ndbappReplicaMaxCount according to the CPU and RAM usage defined in the `custom_values.yaml` file:

```
horizontalPodAutoscaler:
  memory:
    enabled: true
    averageUtilization: 80
  cpu:
    enabled: false
    averageUtilization: 80
```

Scaling cnDBTier ndbappmysqld When Autoscaling is Disabled

1. Increase the replica count of the ndbappmysqld pods in the `custom_values.yaml` file under global.ndbappReplicaCount:

   ```
   global:
     ndbappReplicaCount: 4
   ```

   > **Note**
   >
   > cnDBTier is initially deployed with two ndbappmysqld pods and increased to a replica count of four in this step.

2. Upgrade cnDBTier with the new `ndbappReplicaCount` by following the upgrade procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   > **Note**
   >
   > cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

   When the Helm upgrade completes, the ndbappmysqld replica count is increased to the value updated in the `custom_values.yaml` file.

7.3.1.2 Scaling ndbmtd Pods

cnDBTier supports only scaling up of data pods, and does not support scaling down of data pods. This section describes the manual procedure to scale up the cnDBTier ndbmtd pods.

> **Note**
>
> - Before scaling, ensure that the worker nodes have adequate resources to support scaling.
> - Divert the traffic during the horizontal scaling of the ndbmtd pods as the MySQL NDB cluster may go offline during the scaling process.

Considerations

The examples in this procedure consider a cnDBTier setup deployed with 2 ndbmgm, 2 ndbmtd, 2 ndbmysqld sql, and 2 ndbappmysqld pods. The ndbmtd pods of this cnDBTier setup are scaled up from replica count 2 to 4 in this procedure.

Procedure

1. Before scaling the data pods, perform the Helm test on the cnDBTier cluster to check the health of the cluster:

   ```
   $ helm test mysql-cluster -n <namespace>
   ```

   Example:

   ```
   $ helm test mysql-cluster -n occne-cndbtier
   ```

Sample output:

```
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 08:10:11 2025
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 2
TEST SUITE:     mysql-cluster-node-connection-test
Last Started:    Mon May 20 10:03:51 2025
Last Completed:  Mon May 20 10:04:16 2025
Phase:          Succeeded
```

You can also check if all the NDB pods are connected by checking the status of cnDBTier from the management `ndb_mgm` console:

```
$ kubectl -n occne-cndbtier exec ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.74.65  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.84.68  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.73.61  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.84.67  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.84.69  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.73.62  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.78.70  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.72.49  (mysql-8.4.3 ndb-8.4.3)
id=72 (not connected, accepting connect from ndbappmysqld-2.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=73 (not connected, accepting connect from ndbappmysqld-3.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

2. Enable `replicationskiperrors` in the `custom_values.yaml` file and apply the changes using the Helm upgrade procedure for all cnDBTier sites.

> **Note**
>
> Skip this step if `replicationskiperrors` is already enabled in the cnDBTier cluster.

```
global:
  replicationskiperrors:
    enable: true
```

3. Increase the replica count of the ndbmtd pod in the `custom_values.yaml` file:

> **Note**
>
> - The cnDBTier is deployed with 2 ndbmtd and increased to a replica count of 4 in this step.
> - You can only scale up the ndbmtd pod by an even number of increment and can't scale down the pods.

```
global:
  ndbReplicaCount: 4
```

4. Run the following command to upgrade the cnDBTier to increase the ndbmtd replica count:

> **Note**
>
> After the upgrade, the new ndbmtd pods can crash and restart. You can this error. Verify the status of the new pod before partitioning of data in step 14.

```
$ helm upgrade --no-hooks --set global.updateStrategy=OnDelete mysql-
cluster --namespace <namespace> occndbtier -f <path to custom_values.yaml>
```

5. Perform the following steps to scale the ndbmtd pods back to their original replica count (the replica count that the ndbmtd pods had before performing Step 3):

> **Note**
>
> In this case, the replica count was increased from 2 to 4 in Step 3. Therefore, in this step, scale back the replica count to *2*.

   a. Run the following commands to patch the horizontal pod autoscaling (hpa):

```
$ kubectl -n <namespace> patch hpa ndbmtd -p '{"spec": {"minReplicas":
2}}'
$ kubectl -n <namespace> patch hpa ndbmtd -p '{"spec": {"maxReplicas":
2}}'
```

b. Run the following command to scale down the ndbmtd sts replica count to 2:

```
$ kubectl -n <namespace> scale sts ndbmtd --replicas=2
```

c. After scaling down the ndbmtd sts replica count, terminate the newly added ndbmtd pods. Retain only the existing ndbmtd pods in the cluster.

6. Once the upgrade is complete, delete all the management pods simultaneously:

```
$ kubectl -n <namespace> delete pods ndbmgmd-0 ndbmgmd-1
```

7. Wait for the management pods to come back to the running state and connect to the cluster. Run the following command to verify the status of the pods:

```
$ kubectl -n occne-cndbtier exec ndbmgmd-0 -- ndb_mgm -e show
```

8. Delete the data pods one at a time. Wait for a deleted pod to return to the running state and connect to cluster before deleting the next one:

> **Note**
>
> Delete the data pods in descending order (ndbmtd-n, ndbmtd-(n-1), ndbmtd-(n-2), and so on).

For example:

a. Run the following command to delete pod ndbmtd-2:

```
$ kubectl -n <namespace> delete pod ndbmtd-2
```

b. Wait for ndbmtd-2 to return to the running state and connect back to the NDB cluster.

c. Run the following command to delete pod ndbmtd-1:

```
$ kubectl -n <namespace> delete pod ndbmtd-1
```

d. Wait for ndbmtd-1 to return to the running state and connect back to the NDB cluster.

e. Run the following command to delete pod ndbmtd-0:

```
$ kubectl -n <namespace> delete pod ndbmtd-0
```

9. Wait until all the data pods are up and running, and get connected to the NDB cluster. To check if the data pods are connected to the NDB cluster, log in to one of the management pods and check the status of the NDB cluster from the `ndb_mgm` console:

```
$ kubectl -n occne-cndbtier exec ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     4 node(s)
id=1    @10.233.74.65  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.84.68  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)
```

```
id=3 (not connected, accepting connect from ndbmtd-2.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=4 (not connected, accepting connect from ndbmtd-3.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.73.61  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.84.67  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.84.69  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.73.62  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.78.70  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.72.49  (mysql-8.4.3 ndb-8.4.3)
id=72 (not connected, accepting connect from ndbappmysqld-2.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=73 (not connected, accepting connect from ndbappmysqld-3.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - The newly added data pods, node IDs 3 and 4 in the sample output, are shown as "starting, no nodegroup". You can ignore these nodes.
> - The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

10. Delete the ndbmysqld pods one at a time. Wait for a deleted pod to return to the running state and connect to the cluster before deleting the next one:

    > **Note**
    >
    > Delete the pods in descending order (ndbmysqld-n, ndbmysqld-(n-1), ndbmysqld-(n-2), and so on).

    For example:

    a. Run the following command to delete pod ndbmysqld-2:

       ```
       $ kubectl -n <namespace> delete pod ndbmysqld-2
       ```

    b. Wait for ndbmysqld-2 to return to the running state and connect back to the NDB cluster.

    c. Run the following command to delete pod ndbmysqld-1:

       ```
       $ kubectl -n <namespace> delete pod ndbmysqld-1
       ```

    d. Wait for ndbmysqld-1 to return to the running state and connect back to the NDB cluster.

e. Run the following command to delete pod ndbmysqld-0:

```
$ kubectl -n <namespace> delete pod ndbmysqld-0
```

11. Wait for the ndbmysqld pods to return to running state and connect to the NDB cluster. To check if the data pods are connected to the NDB cluster, log in to one of the management pods and check the status of the NDB cluster from the `ndb_mgm` console:

```
$ kubectl -n occne-cndbtier exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     4 node(s)
id=1    @10.233.74.65  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.84.68  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)
id=3 (not connected, accepting connect from ndbmtd-2.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=4 (not connected, accepting connect from ndbmtd-3.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.73.61  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.84.67  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.84.69  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.73.62  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.78.70  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.72.49  (mysql-8.4.3 ndb-8.4.3)
id=72 (not connected, accepting connect from ndbappmysqld-2.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=73 (not connected, accepting connect from ndbappmysqld-3.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

12. Delete the ndbappmysqld pods one at a time. Wait for a deleted pod to return back to the running state before deleting the next pod.

> **Note**
>
> Delete the pods in descending order (ndbappmysqld-n, ndbappmysqld-(n-1), ndbappmysqld-(n-2), and so on).

For example:

a. Run the following command to delete pod ndbappmysqld-2:

```
$ kubectl -n <namespace> delete pod ndbappmysqld-2
```

b. Wait for ndbappmysqld-2 to return to the running state and connect back to the NDB cluster.

c. Run the following command to delete pod ndbappmysqld-1:

```
$ kubectl -n <namespace> delete pod ndbappmysqld-1
```

d. Wait for ndbappmysqld-1 to return to the running state and connect back to the NDB cluster.

e. Run the following command to delete pod ndbappmysqld-0:

```
$ kubectl -n <namespace> delete pod ndbappmysqld-0
```

13. Wait for the ndbappmysqld pods to return to the running state and connect to the NDB cluster. To check if the data pods are connected to the NDB cluster, log in to one of the management pods and check the status of the NDB cluster from the `ndb_mgm` console:

```
$ kubectl -n occne-cndbtier exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     4 node(s)
id=1    @10.233.74.65  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.84.68  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)
id=3 (not connected, accepting connect from ndbmtd-2.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=4 (not connected, accepting connect from ndbmtd-3.ndbmtdsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.73.61  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.84.67  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.84.69  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.78.70  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.72.49  (mysql-8.4.3 ndb-8.4.3)
id=72 (not connected, accepting connect from ndbappmysqld-2.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=73 (not connected, accepting connect from ndbappmysqld-3.ndbappmysqldsvc.occne-
cndbtier.svc.occne1-cgbu-cne-dbtier)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

14. Perform the following steps to scale up the ndbmtd pods to their increased replica count. That is, the replica count configured at Step 3:

    > **Note**
    >
    > In this case, the replica count was increased to *4* in Step 3. Therefore, in this step, scale back the replica count to *4*.

    a. Run the following commands to patch horizontal pod autoscaler (hpa):

    ```
    $ kubectl -n <namespace> patch hpa ndbmtd -p '{"spec": {"maxReplicas":
    4}}'
    $ kubectl -n <namespace> patch hpa ndbmtd -p '{"spec": {"minReplicas":
    4}}'
    ```

    b. Scale up the ndbmtd sts replica count to 4:

    ```
    $ kubectl -n <namespace> scale sts ndbmtd --replicas=4
    ```

    c. Wait for the ndbmtd pods to return to the running state and connect to the NDB cluster. To check if the data pods are connected to the NDB cluster, log in to one of the management pods and check the status of the NDB cluster from the `ndb_mgm` console:

    ```
    $ kubectl -n occne-cndbtier exec -it ndbmgmd-0 -- ndb_mgm -e show
    ```

    Sample output:

    ```
    Connected to Management Server at: localhost:1186
    Cluster Configuration
    ---------------------
    [ndbd(NDB)]     4 node(s)
    id=1    @10.233.74.65  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
    id=2    @10.233.84.68  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)
    id=3    @10.233.117.60  (mysql-8.4.3 ndb-8.4.3, starting, no nodegroup)
    id=4    @10.233.111.64  (mysql-8.4.3 ndb-8.4.3, starting, no nodegroup)

    [ndb_mgmd(MGM)] 2 node(s)
    id=49   @10.233.73.61  (mysql-8.4.3 ndb-8.4.3)
    id=50   @10.233.84.67  (mysql-8.4.3 ndb-8.4.3)

    [mysqld(API)]   10 node(s)
    id=56   @10.233.84.69  (mysql-8.4.3 ndb-8.4.3)
    id=57   @10.233.73.62  (mysql-8.4.3 ndb-8.4.3)
    id=70   @10.233.78.70  (mysql-8.4.3 ndb-8.4.3)
    id=71   @10.233.72.49  (mysql-8.4.3 ndb-8.4.3)
    id=72 (not connected, accepting connect from
    ndbappmysqld-2.ndbappmysqldsvc.occne-cndbtier.svc.occne1-cgbu-cne-dbtier)
    id=73 (not connected, accepting connect from
    ndbappmysqld-3.ndbappmysqldsvc.occne-cndbtier.svc.occne1-cgbu-cne-dbtier)
    ```

```
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - When the newly added ndbmtd pods are connected to the NDB cluster, they are shown in the "no nodegroup" state.
> - The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

15. Run the following command in the NDB Cluster management client to create the new node group. Node ID for the newly added ndbmtd pod is `<sequence no of the ndbmtd pod + 1>`.

    ```
    ndb_mgm>  CREATE NODEGROUP
    <node_id_for_pod_ndbmtd-2>,<node_id_for_pod_ndbmtd-3>
    ```

    For example:

    ```
    ndb_mgm>  CREATE NODEGROUP <(sequence no of pod ndbmtd-2) + 1>,<(sequence no of pod
    ndbmtd-3) + 1>

    [mysql@ndbmgmd-0 ~]$ ndb_mgm
    -- NDB Cluster -- Management Client --
    ndb_mgm>  CREATE NODEGROUP 3,4
    ```

    Sample output:

    ```
    Connected to Management Server at: localhost:1186
    Nodegroup 1 created
    ```

    > **Note**
    >
    > - This example considers that cnDBTier is initially created with two data pods (node IDs 1 and 2). In this step, the data pod count is scaled up from 2 to 4. Therefore, the node IDs 3 and 4 are assigned to the newly created data nodes.
    > - If you are adding more than two ndbmtd nodes to the cluster, then create the node groups for the first two nodes, then for the next pair, and so on. For example, if you are adding four ndbmtd nodes with node IDs x1, x2, x3, x4, then first create node groups for x1 and x2 and then for x3 and x4 as shown in the following code block:
    >
    >   ```
    >   ndb_mgm> CREATE NODEGROUP x1, x2
    >   ndb_mgm> CREATE NODEGROUP x3, x4
    >   ```

16. Depending on the following conditions, use georeplication recovery procedure or the `dbt_reorg_table_partition` script to redistribute the cluster data:

- If the mate site is available, then perform the georeplication recovery procedure to redistribute the data across all the data nodes (including the new data nodes). For georeplication procedure, see the "Restoring Georeplication Failure" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
- If the mate site is not available, perform the following steps to run the `dbt_reorg_table_partition` script to redistribute the data across all the data nodes (including the new data nodes).
- If the mate site is available, however you don't want to perform the georeplication recovery, then perform the following steps to run the `dbt_reorg_table_partition` script to redistribute the data across all the data nodes (including the new data nodes).

> **Note**
>
> When data nodes restart or a database backup is ongoing while running the `dbt_reorg_table_partition` script, rerun the script after the restart or backup is complete to ensure proper reorganization of all table partitions across all data nodes.

a. Run the following commands to source the `source_me` file. This adds the bin directory with the program to the user PATH and prompts you to enter the namespace. The namespace is used to set `DBTIER_NAMESPACE`. Additionally, it sets the `DBTIER_LIB` environment variable to the path of the directory containing the libraries needed by `dbt_reorg_table_partition`:

```
$ cd Artifacts/Scripts/tools
$ source ./source_me
```

Sample output:

```
NOTE: source_me must be sourced while your current directory is the
directory with the source_me file.

Enter cndbtier namespace: sitea
DBTIER_NAMESPACE = "sitea"

DBTIER_LIB=/home/cloud-user/user/deploy_cndbtier_sitea_25.1.103/
Artifacts/Scripts/tools/dbtier/lib

Adding /home/cloud-user/user/deploy_cndbtier_sitea_25.1.103/Artifacts/
Scripts/tools/dbtier/bin to PATH
PATH=/home/cloud-user/.local/bin:/home/cloud-user/bin:/usr/local/
bin:/usr/bin:/usr/local/sbin:/usr/sbin:/var/occne/cluster/occne3-user/
artifacts/istio-1.15.3/bin/:/var/occne/cluster/occne3-user/artifacts:/
home/cloud-user/user/deploy_cndbtier_sitea_25.1.103/Artifacts/Scripts/
tools/dbtier/bin
```

b. Run the `dbt_reorg_table_partition` script:

```
$ dbt_reorg_table_partition
```

Sample output:

```
dbt_reorg_table_partition 25.1.103
Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
2024-01-17T05:11:45Z INFO - Getting sts and sts pod info...
2024-01-17T05:11:45Z INFO - Getting MGM sts and sts pod info...
2024-01-17T05:11:45Z INFO - MGM_STS="ndbmgmd"
2024-01-17T05:11:45Z INFO - MGM_REPLICAS="2"
2024-01-17T05:11:45Z INFO - MGM_PODS:
    ndbmgmd-0
    ndbmgmd-1
2024-01-17T05:11:45Z INFO - Getting NDB sts and sts pod info...
2024-01-17T05:11:45Z INFO - NDB_STS="ndbmtd"
2024-01-17T05:11:45Z INFO - NDB_REPLICAS="2"
2024-01-17T05:11:45Z INFO - NDB_PODS:
    ndbmtd-0
    ndbmtd-1
2024-01-17T05:11:45Z INFO - Getting API sts and sts pod info...
2024-01-17T05:11:45Z INFO - API_STS="ndbmysqld"
2024-01-17T05:11:45Z INFO - API_REPLICAS="2"
2024-01-17T05:11:45Z INFO - API_PODS:
    ndbmysqld-0
    ndbmysqld-1
2024-01-17T05:11:45Z INFO - Getting APP sts and sts pod info...
2024-01-17T05:11:45Z INFO - APP_STS="ndbappmysqld"
2024-01-17T05:11:45Z INFO - APP_REPLICAS="2"
2024-01-17T05:11:45Z INFO - APP_PODS:
    ndbappmysqld-0
    ndbappmysqld-1
2024-01-17T05:11:45Z INFO - Getting deployment pod info...
2024-01-17T05:11:45Z INFO - grepping for backup-man (BAK_CHART_NAME)...
2024-01-17T05:11:46Z INFO - BAK_PODS:
    mysql-cluster-db-backup-manager-svc-57fb8ff49c-49p55
2024-01-17T05:11:46Z INFO - BAK_DEPLOY:
    mysql-cluster-db-backup-manager-svc
2024-01-17T05:11:46Z INFO - grepping for db-mon (MON_CHART_NAME)...
2024-01-17T05:11:46Z INFO - MON_PODS:
    mysql-cluster-db-monitor-svc-7b7559cd45-shm8r
2024-01-17T05:11:46Z INFO - MON_DEPLOY:
    mysql-cluster-db-monitor-svc
2024-01-17T05:11:46Z INFO - grepping for repl (REP_CHART_NAME)...
2024-01-17T05:11:46Z INFO - REP_PODS:
    mysql-cluster-siteb-local-replication-svc-9c4c59f87-6zl57
2024-01-17T05:11:46Z INFO - REP_DEPLOY:
    mysql-cluster-siteb-local-replication-svc
2024-01-17T05:11:46Z INFO - Reorganizing table partitions...
mysql.ndb_apply_status  optimize        status  OK
backup_info.DBTIER_BACKUP_INFO  optimize        status  OK
backup_info.DBTIER_BACKUP_COMMAND_QUEUE optimize        status  OK
backup_info.DBTIER_BACKUP_TRANSFER_INFO optimize        status  OK
mysql.ndb_replication   optimize        status  OK
hbreplica_info.DBTIER_HEARTBEAT_INFO    optimize        status  OK
replication_info.DBTIER_SITE_INFO       optimize        status  OK
replication_info.DBTIER_REPL_SITE_INFO  optimize        status  OK
replication_info.DBTIER_REPLICATION_CHANNEL_INFO        optimize
status  OK
```

```
replication_info.DBTIER_INITIAL_BINLOG_POSTION  optimize        status
OK
replication_info.DBTIER_REPL_ERROR_SKIP_INFO    optimize        status
OK
replication_info.DBTIER_REPL_EVENT_INFO optimize        status  OK
replication_info.DBTIER_REPL_SVC_INFO   optimize        status  OK
2024-01-17T05:12:10Z INFO - Reorganized Tables Partition Successfully
```

17. Run the following command in the management client to check if the data is distributed:

    ```
    ndb_mgm> ALL REPORT MEMORY
    ```

    For example:

    ```
    ndb_mgm> ALL REPORT MEMORY
    ```

    Sample output:

    ```
    Connected to Management Server at: localhost:1186
    Node 1: Data usage is 0%(58 32K pages of total 12755)
    Node 1: Index usage is 0%(45 32K pages of total 12742)
    Node 2: Data usage is 0%(58 32K pages of total 12755)
    Node 2: Index usage is 0%(45 32K pages of total 12742)
    Node 3: Data usage is 0%(15 32K pages of total 12780)
    Node 3: Index usage is 0%(20 32K pages of total 12785)
    Node 4: Data usage is 0%(15 32K pages of total 12780)
    Node 4: Index usage is 0%(20 32K pages of total 12785)
    ```

18. Run the Helm test on the cnDBTier cluster to check the health of the cluster:

    ```
    $ helm test mysql-cluster -n occne-cndbtier
    ```

    Sample output:

    ```
    NAME: mysql-cluster
    LAST DEPLOYED:  Mon May 20 08:10:11 2025
    NAMESPACE: occne-cndbtier
    STATUS: deployed
    REVISION: 2
    TEST SUITE:     mysql-cluster-node-connection-test
    Last Started:    Mon May 20 10:27:49 2025
    Last Completed:  Mon May 20 10:28:11 2025
    Phase:          Succeeded
    ```

    You can also verify the status of the cnDBTier from the `ndb_mgm` console by running the following command:

    ```
    $ kubectl -n occne-cndbtier exec ndbmgmd-0 -- ndb_mgm -e show
    ```

    Sample output:

    ```
    Connected to Management Server at: localhost:1186
    Cluster Configuration
    ---------------------
    [ndbd(NDB)]     4 node(s)
    id=1    @10.233.92.53  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
    id=2    @10.233.72.66  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
    id=3    @10.233.117.60  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 1)
    ```

```
id=4    @10.233.111.64  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 1, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.111.62  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.117.59  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   8 node(s)
id=56   @10.233.72.65  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.92.51  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.72.64  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.92.52  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

19. Disable `replicationskiperrors` in the `custom_values.yaml` file and apply the changes using the Helm upgrade procedure.

> **Note**
>
> Skip this step if you skipped Step 2.
>
> ```
> global:
>   replicationskiperrors:
>     enable: false
> ```

20. Run the following command to patch the ndbmtd, ndbmysqld, and ndbappmysqld statefulsets and update updateStrategy to RollingUpdate:

```
$ kubectl -n <namespace> patch sts <ndbmtd sts name> -p '{"spec":
{"updateStrategy":{"type":"RollingUpdate"}}}'

$ kubectl -n <namespace> patch sts <ndbmysqld sts name> -p '{"spec":
{"updateStrategy":{"type":"RollingUpdate"}}}'

$ kubectl -n <namespace> patch sts <ndbappmysqld sts name> -p '{"spec":
{"updateStrategy":{"type":"RollingUpdate"}}}'
```

7.3.2 Vertical Scaling

Currently, cnDBTier supports only manual vertical scaling of ndbmtd and SQL pods. This section describes the procedure to manually scale ndbmtd, ndbappmysqld, and ndbmysqld pods.

7.3.2.1 Scaling ndbmtd Pods

This section provides the procedures to vertically scale up ndbmtd pods.

Note

- Before scaling the pods, ensure that the worker nodes have adequate resources to support scaling.
- Perform the Helm test on the deployed cnDBTier cluster to check the health of the cluster:

  ```
  $ helm test mysql-cluster -n occne-cndbtier
  ```

  Sample output:

  ```
  NAME: mysql-cluster
  LAST DEPLOYED:  Mon May 20 03:24:03 2025
  NAMESPACE: occne-cndbtier
  STATUS: deployed
  REVISION: 1
  TEST SUITE:     mysql-cluster-node-connection-test
  Last Started:    Mon May 20 04:03:01 2025
  Last Completed:  Mon May 20 04:03:26 2025
  Phase:          Succeeded
  ```

  You can also verify the status of the cnDBTier from the `ndb_mgm` console by running the following command:

  ```
  $ kubectl -n occne-cndbtier exec -it ndbmgmd-0 -- ndb_mgm -e show
  ```

  Sample output:

  ```
  Connected to Management Server at: localhost:1186
  Cluster Configuration
  ---------------------
  [ndbd(NDB)]     2 node(s)
  id=1    @10.233.95.87  (mysql-8.0.34 ndb-8.0.34, Nodegroup: 0, *)
  id=2    @10.233.99.254  (mysql-8.0.34 ndb-8.0.34, Nodegroup: 0)

  [ndb_mgmd(MGM)] 2 node(s)
  id=49   @10.233.110.157  (mysql-8.0.34 ndb-8.0.34)
  id=50   @10.233.101.213  (mysql-8.0.34 ndb-8.0.34)

  [mysqld(API)]   10 node(s)
  id=56   @10.233.99.243  (mysql-8.0.34 ndb-8.0.34)
  id=57   @10.233.101.221  (mysql-8.0.34 ndb-8.0.34)
  id=70   @10.233.100.228  (mysql-8.0.34 ndb-8.0.34)
  id=71   @10.233.101.217  (mysql-8.0.34 ndb-8.0.34)
  id=222 (not connected, accepting connect from any host)
  id=223 (not connected, accepting connect from any host)
  id=224 (not connected, accepting connect from any host)
  id=225 (not connected, accepting connect from any host)
  ```

  The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for fault recovery. You can ignore these nodes.

Updating CPU and RAM

Perform the following steps to update CPU and RAM using the `custom_values.yaml` file:

1. Configure the required CPU and memory values in the `global` section of the `custom_values.yaml` file.
   For example:

   The following code block shows the old CPU and RAM values in the `custom_values.yaml` file

```
global:
  ndb:
    datamemory: 400M
ndb:
  resources:
    limits:
      cpu: 1
      memory: 4Gi
    requests:
      cpu: 1
      memory: 4Gi
```

   The following code block shows the updated CPU and RAM values in the `custom_values.yaml` file:

```
global:
  ndb:
    datamemory: 800M
ndb:
  resources:
    limits:
      cpu: 2
      memory: 8Gi
    requests:
      cpu: 2
      memory: 8Gi
```

2. Upgrade cnDBTier by performing a Helm upgrade with the modified `custom_values.yaml` file. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

Updating PVC

Updating PVC Using Helm Upgrade

Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for ndbmtd pods:
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

```
global:
  ndb:
```

```
    ndbdisksize: 3Gi
    ndbbackupdisksize: 3Gi
```

The following code block shows the updated PVC values in the `custom_values.yaml` file:

```
global:
  ndb:
    ndbdisksize: 6Gi
    ndbbackupdisksize: 6Gi
```

2. Run the following command to delete the ndbmtd statefulset and set the dependency to *orphan*:

   ```
   $ kubectl -n occne-cndbtier delete sts --cascade=orphan ndbmtd
   ```

3. Run the following command to delete the ndbmtd-1 pod and patch the pod's PVC values with the values updated in Step a:

   ```
   $ kubectl -n occne-cndbtier delete pod ndbmtd-1

   $ kubectl -n occne-cndbtier patch -p '{ "spec": { "resources":
   { "requests": { "storage": "6Gi" }}}}' pvc pvc-ndbmtd-ndbmtd-1
   $ kubectl -n occne-cndbtier patch -p '{ "spec": { "resources":
   { "requests": { "storage": "6Gi" }}}}' pvc pvc-backup-ndbmtd-ndbmtd-1
   ```

4. After patching the PVC values, wait for the new PV to link to the PVC. Run the following command to check if the PV reflects the updated PVC values:

   ```
   $ kubectl get pv | grep -w occne-cndbtier | grep ndbmtd-1
   ```

   Sample output:

   ```
   pvc-53fe7988-4a81-40d3-a366-fd894de89535  6Gi  RWO  Delete  Bound  occne-
   cndbtier/pvc-ndbmtd-ndbmtd-1  occne-dbtier-sc  62m
   ```

5. Upgrade cnDBTier with the modified `custom_values.yaml` file:

   ```
   $ helm upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml -
   n occne-cndbtier --no-hooks
   ```

6. Perform Step b through Step e for the ndbmtd-0 pod.

   > **Note**
   >
   > If you have more that two data pods, then follow Steps b to e for each ndbmtd pod in the following order: ndbmtd-n, ndbmtd-(n-1), and so on up to ndbmtd-0.

7. As cnDBTier Helm upgrade is performed with the "--no-hooks" option in step e, upgradeStrategy of the cnDBTier StatefulSets is changed to OnDelete. Therefore, perform the cnDBTier upgrade one more time to restore upgradeStrategy to RollingRestart:

> **Note**
>
> Before running the following command, ensure that you set the value of `OCCNE_NAMESPACE` variable in the command with your cnDBTier namespace.

```
helm -n ${OCCNE_NAMESPACE} upgrade ${OCCNE_RELEASE_NAME} occndbtier -f
occndbtier/custom_values.yaml
```

8. Run the Helm test on the cnDBTier cluster to check the health of the cluster:

   ```
   $ helm test mysql-cluster -n occne-cndbtier
   ```

   Sample output:

   ```
   NAME: mysql-cluster
   LAST DEPLOYED:  Mon May 20 04:43:20 2025
   NAMESPACE: occne-cndbtier
   STATUS: deployed
   REVISION: 4
   TEST SUITE:     mysql-cluster-node-connection-test
   Last Started:    Mon May 20 04:45:15 2025
   Last Completed:  Mon May 20 04:45:35 2025
   Phase:          Succeeded
   ```

Updating PVC Using `dbtscale_vertical_pvc`

`dbtscale_vertical_pvc` is an automated script to update PVC without manual intervention. Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for `ndbmtd` pods. Ensure that you only modify the `global.ndb.ndbdisksize`, `global.ndb.ndbbackupdisksize`, or both the sections.
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

   ```
   global:
     ndb:
       ndbdisksize: 2Gi
       ndbbackupdisksize: 3Gi
   ```

   The following code block shows the updated PVC values in the `custom_values.yaml` file:

   ```
   global:
     ndb:
       ndbdisksize: 3Gi
       ndbbackupdisksize: 4Gi
   ```

2. Run the following commands to navigate to the `Artifacts/Scripts/tools/` directory and source the `source_me` file:

> **Note**
>
> - Ensure that the `Artifacts/Scripts/tools/` directory contains the `source_me` file.
> - Enter the namespace of the cnDBTier cluster when prompted.

```
$ cd Artifacts/Scripts/tools/
$ source ./source_me
```

Sample output:

```
Enter cndbtier namespace: occne-cndbtier
DBTIER_NAMESPACE = "occne-cndbtier"

DBTIER_LIB=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/lib

Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin to
PATH
Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
rollbackscripts to PATH
PATH=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
rollbackscripts:/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/
bin:/home/dbtuser/.local/bin:/home/dbtuser/bin:/usr/local/bin:/usr/
bin:/usr/local/sbin:/usr/sbin
```

3. Run the `dbtscale_vertical_pvc` script with the `–pods=ndbmtd` option and pass the helm charts and the updated `custom_values.yaml` file as parameters:

```
$ dbtscale_vertical_pvc --pods=ndbmtd occndbtier
custom_values_scale_pvc.yaml
```

Sample output:

```
2024-12-17T14:40:15Z INFO - HELM_CHARTS = occndbtier
2024-12-17T14:40:15Z INFO - CUSTOM_VALUES_FILE =
custom_values_scale_pvc.yaml
dbtscale_vertical_pvc 25.1.100
Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
2024-12-17T14:40:15Z INFO - Started timer dbtscale_vertical_pvc: 1734446415
2024-12-17T14:40:15Z INFO - Started timer PHASE 0: 1734446415
2024-12-17T14:40:15Z INFO -
**************************************************************************
************************
2024-12-17T14:40:15Z INFO - BEGIN PHASE 0: Collect Site information
2024-12-17T14:40:15Z INFO -
**************************************************************************
************************
2024-12-17T14:40:15Z INFO - Using IPv4: LOOPBACK_IP="127.0.0.1"
2024-12-17T14:40:15Z INFO - DBTIER_NAMESPACE = occne-cndbtier
...
2024-12-17T14:40:26Z INFO - PODS_TO_SCALE="ndbmtd"
```

```
2024-12-17T14:40:26Z INFO - POD_TYPE="ndb"
2024-12-17T14:40:26Z INFO - STS_TO_DELETE="ndbmtd"
2024-12-17T14:40:26Z INFO - PODS_TO_RESTART="NDB_PODS"
2024-12-17T14:40:27Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
site-2-replication-svc
2024-12-17T14:40:27Z INFO - REPL_LEADER_PVC = pvc-site-1-site-2-
replication-svc
2024-12-17T14:40:27Z INFO - REPL_LEADER_POD = mysql-cluster-site-1-site-2-
replication-svc-74df5fww98q
2024-12-17T14:40:27Z INFO -
**************************************************************************
************************
2024-12-17T14:40:27Z INFO - END PHASE 0: Collect Site information
2024-12-17T14:40:27Z INFO -
**************************************************************************
************************
2024-12-17T14:40:27Z INFO - Ended timer PHASE 0: 1734446427
2024-12-17T14:40:27Z INFO - PHASE 0 took: 00 hr. 00 min. 12 sec.
2024-12-17T14:40:27Z INFO - Started timer PHASE 1: 1734446427
2024-12-17T14:40:27Z INFO -
**************************************************************************
************************
2024-12-17T14:40:27Z INFO - BEGIN PHASE 1: Verify disk sizes are supported
2024-12-17T14:40:27Z INFO -
**************************************************************************
************************
2024-12-17T14:40:27Z INFO - Current PVC sizes:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-backup-ndbmtd-ndbmtd-0                  Bound
pvc-55d60044-2df4-47b7-92aa-4d27d166db7f   2Gi        RWO
standard       <unset>                 30h
pvc-backup-ndbmtd-ndbmtd-1                  Bound
pvc-1d81991c-7c9a-4d79-9265-ee6c5ddaa8f2   2Gi        RWO
standard       <unset>                 30h
pvc-ndbmtd-ndbmtd-0                         Bound
pvc-8d55a76a-17e8-47d0-bb4b-8a6c31c76c96   3Gi        RWO
standard       <unset>                 30h
pvc-ndbmtd-ndbmtd-1                         Bound    pvc-2c6dd1ed-
ab48-40f4-ad23-43d9b030f03f   3Gi        RWO            standard
<unset>                 30h
2024-12-17T14:40:27Z INFO - Requested PVC sizes from
custom_values_scale_pvc.yaml:
  ndb:
    ndbdisksize: 4Gi
    ndbbackupdisksize: 3Gi
    use_separate_backup_disk: true
2024-12-17T14:40:27Z INFO - Current and requested disk values:
2024-12-17T14:40:27Z INFO - current_pvcsz=3Gi (3221225472),
requested_pvcsz=4Gi (4294967296)
2024-12-17T14:40:27Z INFO - requested_use_separate_backup_disk=true
2024-12-17T14:40:27Z INFO - current_pvcbackupsz=2Gi (2147483648),
requested_pvcbackupsz=3Gi (3221225472)
2024-12-17T14:40:27Z INFO - Verifying current and requested disk sizes...
2024-12-17T14:40:27Z INFO - Requested PVC values should not be equal to
```

```
current - PASSED
2024-12-17T14:40:27Z INFO - No requested value should be smaller than
current - PASSED
2024-12-17T14:40:27Z INFO - No requested value should be zero or negative
- PASSED
2024-12-17T14:40:27Z INFO - At least one requested value should be larger
than its current value - PASSED
2024-12-17T14:40:27Z INFO - Should not remove backup PVC - PASSED
2024-12-17T14:40:27Z INFO - db-replication-svc requested PVC values should
equal to current - PASSED
2024-12-17T14:40:27Z INFO - ndbmysqld requested PVC values should equal to
current - PASSED
2024-12-17T14:40:27Z INFO - ndbappmysqld requested PVC values should equal
to current - PASSED
2024-12-17T14:40:27Z INFO - Verified current and requested disk sizes.
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - END PHASE 1: Verify disk sizes are supported
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - Ended timer PHASE 1: 1734446427
2024-12-17T14:40:27Z INFO - PHASE 1 took: 00 hr. 00 min. 00 sec.
2024-12-17T14:40:27Z INFO - Started timer PHASE 2: 1734446427
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - BEGIN PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - Deleting STS...
2024-12-17T14:40:27Z INFO - kubectl -n occne-cndbtier delete sts --
cascade=orphan "ndbmtd"
statefulset.apps "ndbmtd" deleted
2024-12-17T14:40:27Z INFO - STS deleted
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - END PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - Ended timer PHASE 2: 1734446427
2024-12-17T14:40:27Z INFO - PHASE 2 took: 00 hr. 00 min. 00 sec.
2024-12-17T14:40:27Z INFO - Started timer PHASE 3: 1734446427
2024-12-17T14:40:27Z INFO -
************************************************************************
************************
2024-12-17T14:40:27Z INFO - BEGIN PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T14:40:27Z INFO -
************************************************************************
```

```
************************
2024-12-17T14:40:27Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 14:40:28 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 10
2024-12-17T14:40:32Z INFO - Helm upgrade returned
2024-12-17T14:40:32Z INFO -
********************************************************************************
************************
2024-12-17T14:40:32Z INFO - END PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T14:40:32Z INFO -
********************************************************************************
************************
2024-12-17T14:40:32Z INFO - Ended timer PHASE 3: 1734446432
2024-12-17T14:40:32Z INFO - PHASE 3 took: 00 hr. 00 min. 05 sec.
2024-12-17T14:40:32Z INFO - Started timer PHASE 4: 1734446432
2024-12-17T14:40:32Z INFO -
********************************************************************************
************************
2024-12-17T14:40:32Z INFO - BEGIN PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T14:40:32Z INFO -
********************************************************************************
************************
2024-12-17T14:40:32Z INFO - Determine NDB Node President...
2024-12-17T14:40:33Z INFO - PRESIDENT_NODE=1
2024-12-17T14:40:33Z INFO - PRESIDENT_GROUP=0
2024-12-17T14:40:33Z INFO - NODES_IN_PRESIDENTS_GROUP=(1 2)
2024-12-17T14:40:33Z INFO - pod_name_witout_id = "ndbmtd-"
2024-12-17T14:40:33Z INFO - pods_in_president_group = (ndbmtd-0 ndbmtd-1)
2024-12-17T14:40:33Z INFO - Restart pods after deleting their PVCs...
2024-12-17T14:40:33Z INFO - Deleting pods NOT in president's group (0)...
2024-12-17T14:40:33Z INFO - first_set_of_pods_to_delete = ()
2024-12-17T14:40:33Z INFO - delete_sts_pod_and_its_pvcs_one_at_a_time:
nothing to do; pods array is empty ()
2024-12-17T14:40:33Z INFO - Deleting president pod (ndbmtd-0)...
2024-12-17T14:40:33Z INFO - president_set = (ndbmtd-0)
2024-12-17T14:40:33Z INFO - Deleting PVCs for ndbmtd-0 (pvc-backup-ndbmtd-
ndbmtd-0 pvc-ndbmtd-ndbmtd-0)...
2024-12-17T14:40:33Z INFO - deleting pod ndbmtd-0 ...
persistentvolumeclaim "pvc-backup-ndbmtd-ndbmtd-0" deleted
persistentvolumeclaim "pvc-ndbmtd-ndbmtd-0" deleted
pod "ndbmtd-0" deleted
2024-12-17T14:40:45Z INFO - Waiting for condition: is_pod ndbmtd-0...
2024-12-17T14:40:45Z INFO - Condition occurred
2024-12-17T14:41:28Z INFO - Waiting for condition: is_pod_ready ndbmtd-0...
2024-12-17T14:41:28Z INFO - Condition occurred
2024-12-17T14:41:28Z INFO - kubectl -n occne-cndbtier get pod ndbmtd-0
NAME       READY   STATUS    RESTARTS   AGE
ndbmtd-0   3/3     Running   0          43s
2024-12-17T14:41:28Z INFO - kubectl -n occne-cndbtier get pvc pvc-backup-
```

```
ndbmtd-ndbmtd-0 pvc-ndbmtd-ndbmtd-0
NAME                          STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-backup-ndbmtd-ndbmtd-0   Bound    pvc-83582dba-f394-4a1e-
b1b1-3a1466f643e8   3Gi        RWO            standard
<unset>                 43s
pvc-ndbmtd-ndbmtd-0          Bound    pvc-0aa26c58-471d-4be3-
b148-9c192165daf6   4Gi        RWO            standard
<unset>                 43s
2024-12-17T14:41:28Z INFO - Deleting non-president pods in president's
group (0)...
2024-12-17T14:41:28Z INFO - pods_in_president_group_without_president =
(ndbmtd-1)
2024-12-17T14:41:28Z INFO - Deleting PVCs for ndbmtd-1 (pvc-backup-ndbmtd-
ndbmtd-1 pvc-ndbmtd-ndbmtd-1)...
2024-12-17T14:41:28Z INFO - deleting pod ndbmtd-1 ...
persistentvolumeclaim "pvc-backup-ndbmtd-ndbmtd-1" deleted
persistentvolumeclaim "pvc-ndbmtd-ndbmtd-1" deleted
pod "ndbmtd-1" deleted
2024-12-17T14:41:39Z INFO - Waiting for condition: is_pod ndbmtd-1...
2024-12-17T14:41:39Z INFO - Condition occurred
2024-12-17T14:42:20Z INFO - Waiting for condition: is_pod_ready ndbmtd-1...
2024-12-17T14:42:20Z INFO - Condition occurred
2024-12-17T14:42:20Z INFO - kubectl -n occne-cndbtier get pod ndbmtd-1
NAME       READY   STATUS    RESTARTS   AGE
ndbmtd-1   3/3     Running   0          41s
2024-12-17T14:42:20Z INFO - kubectl -n occne-cndbtier get pvc pvc-backup-
ndbmtd-ndbmtd-1 pvc-ndbmtd-ndbmtd-1
NAME                          STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-backup-ndbmtd-ndbmtd-1   Bound    pvc-419ea3ef-af00-4e58-
a5fb-9a774c764a6e   3Gi        RWO            standard
<unset>                 41s
pvc-ndbmtd-ndbmtd-1          Bound    pvc-fa0c7826-337d-4805-
a1dd-2b6f2961270a   4Gi        RWO            standard
<unset>                 41s
2024-12-17T14:42:20Z INFO - Pods restarted and their PVCs recreated.
2024-12-17T14:42:20Z INFO -
********************************************************************************
************************
2024-12-17T14:42:20Z INFO - END PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T14:42:20Z INFO -
********************************************************************************
************************
2024-12-17T14:42:20Z INFO - Ended timer PHASE 4: 1734446540
2024-12-17T14:42:20Z INFO - PHASE 4 took: 00 hr. 01 min. 48 sec.
2024-12-17T14:42:20Z INFO - Started timer PHASE 5: 1734446540
2024-12-17T14:42:20Z INFO -
********************************************************************************
************************
2024-12-17T14:42:20Z INFO - BEGIN PHASE 5: Upgrade cnDBTier
2024-12-17T14:42:20Z INFO -
********************************************************************************
```

```
************************
2024-12-17T14:42:20Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 14:42:21 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 11
2024-12-17T14:43:51Z INFO - Helm upgrade returned
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - END PHASE 5: Upgrade cnDBTier
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - Ended timer PHASE 5: 1734446631
2024-12-17T14:43:51Z INFO - PHASE 5 took: 00 hr. 01 min. 31 sec.
2024-12-17T14:43:51Z INFO - Started timer PHASE 6: 1734446631
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - BEGIN PHASE 6: Post-processing
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - CURRENT_PVCS:
NAME                                        STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-backup-ndbmtd-ndbmtd-0                  Bound
pvc-55d60044-2df4-47b7-92aa-4d27d166db7f   2Gi        RWO
standard       <unset>                 30h
pvc-backup-ndbmtd-ndbmtd-1                  Bound
pvc-1d81991c-7c9a-4d79-9265-ee6c5ddaa8f2   2Gi        RWO
standard       <unset>                 30h
pvc-ndbmtd-ndbmtd-0                         Bound
pvc-8d55a76a-17e8-47d0-bb4b-8a6c31c76c96   3Gi        RWO
standard       <unset>                 30h
pvc-ndbmtd-ndbmtd-1                         Bound    pvc-2c6dd1ed-
ab48-40f4-ad23-43d9b030f03f   3Gi        RWO            standard
<unset>                 30h
2024-12-17T14:43:51Z INFO - after_pvcs:
NAME                                        STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-backup-ndbmtd-ndbmtd-0                  Bound    pvc-83582dba-
f394-4a1e-b1b1-3a1466f643e8   3Gi        RWO            standard
<unset>                 3m6s
pvc-backup-ndbmtd-ndbmtd-1                  Bound    pvc-419ea3ef-
af00-4e58-a5fb-9a774c764a6e   3Gi        RWO            standard
<unset>                 2m12s
pvc-ndbmtd-ndbmtd-0                         Bound
pvc-0aa26c58-471d-4be3-b148-9c192165daf6   4Gi        RWO
standard       <unset>                 3m6s
```

```
pvc-ndbmtd-ndbmtd-1                          Bound    pvc-
fa0c7826-337d-4805-a1dd-2b6f2961270a   4Gi        RWO
standard       <unset>                 2m12s
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - END PHASE 6: Post-processing
2024-12-17T14:43:51Z INFO -
********************************************************************************
************************
2024-12-17T14:43:51Z INFO - Ended timer PHASE 6: 1734446631
2024-12-17T14:43:51Z INFO - PHASE 6 took: 00 hr. 00 min. 00 sec.
2024-12-17T14:43:51Z INFO - Ended timer dbtscale_vertical_pvc: 1734446631
2024-12-17T14:43:51Z INFO - dbtscale_vertical_pvc took: 00 hr. 03 min. 36
sec.
2024-12-17T14:43:51Z INFO - dbtscale_vertical_pvc completed successfully
```

7.3.2.2 Scaling ndbappmysqld Pods

This section provides the procedures to vertically scale up ndbappmysqld pods.

> **Note**
>
> - Before scaling the pods, ensure that the worker nodes have adequate resources to support scaling.
> - Before you proceed with the vertical scaling procedure for ndbappmysqld, perform a Helm test and ensure that all the cnDBTier services are running smoothly.

Updating CPU and RAM

Perform the following steps to update CPU and RAM using the `custom_values.yaml` file:

1. Configure the required CPU and memory values in the `global` section of the `custom_values.yaml` file.
   For example:

   ```
   ndbapp:
     resources:
       limits:
         cpu: 8
         memory: 10Gi
       requests:
         cpu: 8
         memory: 10Gi
   ```

2. Upgrade cnDBTier by performing a Helm upgrade with the modified `custom_values.yaml` file. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   > **Note**
   >
   > cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

Updating PVC

Updating PVC Using Helm Upgrade

Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for ndbappmysqld pods:

   ```
   global:
     ndbapp:
       ndbdisksize: 10Gi
   ```

2. Delete the ndbappmysqld statefulset and make the dependencies as orphan:

   ```
   $ kubectl -n occne-cndbtier delete sts --cascade=orphan ndbappmysqld
   ```

3. Delete the ndbappmysqld-1 pod and patch its PVCs with the new PVC value:
   a. Delete the ndbappmysqld-1 pod:

      ```
      $ kubectl -n occne-cndbtier delete pod ndbappmysqld-1
      ```

      Sample output:

      ```
      pod "ndbappmysqld-1" deleted
      ```

   b. Patch the PVCs of ndbappmysqld-1 pod with the new PVC values:

      ```
      $ kubectl -n occne-cndbtier patch -p '{ "spec": { "resources":
      { "requests": { "storage": "10Gi" }}}}' pvc pvc-ndbappmysqld-
      ndbappmysqld-1
      ```

   c. Wait for the new PV to attach with the PVC.
4. Upgrade cnDBTier with the modified `custom_values.yaml` file:

   ```
   $ helm upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml -
   n occne-cndbtier --no-hooks
   ```

5. Repeat steps b through d for ndbappmysqld-0.
6. As cnDBTier Helm upgrade is performed with the "--no-hooks" option in step d, upgradeStrategy of the cnDBTier StatefulSets is changed to OnDelete. Therefore, perform the cnDBTier upgrade one more time to restore upgradeStrategy to RollingRestart:

   > **Note**
   >
   > Before running the following command, ensure that you set the value of `OCCNE_NAMESPACE` variable in the command with your cnDBTier namespace.

   ```
   helm -n ${OCCNE_NAMESPACE} upgrade ${OCCNE_RELEASE_NAME} occndbtier -f
   occndbtier/custom_values.yaml
   ```

Updating PVC Using `dbtscale_vertical_pvc`

`dbtscale_vertical_pvc` is an automated script to update PVC without manual intervention. Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for `ndbmtd` pods. Ensure that you modify the `global.ndbapp.ndbdisksize` section only.
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

   ```
   global:
     ndbapp:
       ndbdisksize: 3Gi
   ```

   The following code block shows the updated PVC values in the `custom_values.yaml` file:

   ```
   global:
     ndbapp:
       ndbdisksize: 4Gi
   ```

2. Run the following commands to navigate to the `Artifacts/Scripts/tools/` directory and source the `source_me` file:

   > **Note**
   > - Ensure that the `Artifacts/Scripts/tools/` directory contains the `source_me` file.
   > - After running the script, enter the namespace of the cnDBTier cluster when prompted.

   ```
   $ cd Artifacts/Scripts/tools/
   $ source ./source_me
   ```

   Sample output:

   ```
   Enter cndbtier namespace: occne-cndbtier
   DBTIER_NAMESPACE = "occne-cndbtier"

   DBTIER_LIB=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/lib

   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin to
   PATH
   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
   rollbackscripts to PATH
   PATH=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
   rollbackscripts:/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/
   bin:/home/dbtuser/.local/bin:/home/dbtuser/bin:/usr/local/bin:/usr/
   bin:/usr/local/sbin:/usr/sbin
   ```

3. Run the `dbtscale_vertical_pvc` script with the `–pods=ndbappmysqld` option and pass the helm charts and the updated `custom_values.yaml` file as parameters:

   ```
   $ dbtscale_vertical_pvc --pods=ndbappmysqld occndbtier
   custom_values_scale_pvc.yaml
   ```

Sample output:

```
2024-12-17T18:36:39Z INFO - HELM_CHARTS = occndbtier
2024-12-17T18:36:39Z INFO - CUSTOM_VALUES_FILE =
custom_values_scale_pvc.yaml
dbtscale_vertical_pvc 25.1.100
Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
2024-12-17T18:36:39Z INFO - Started timer dbtscale_vertical_pvc: 1734460599
2024-12-17T18:36:39Z INFO - Started timer PHASE 0: 1734460599
2024-12-17T18:36:39Z INFO -
*************************************************************************
************************
2024-12-17T18:36:39Z INFO - BEGIN PHASE 0: Collect Site information
2024-12-17T18:36:39Z INFO -
*************************************************************************
************************
2024-12-17T18:36:39Z INFO - Using IPv4: LOOPBACK_IP="127.0.0.1"
2024-12-17T18:36:39Z INFO - DBTIER_NAMESPACE = occne-cndbtier
...
2024-12-17T18:36:51Z INFO - PODS_TO_SCALE="ndbappmysqld"
2024-12-17T18:36:51Z INFO - POD_TYPE="ndbapp"
2024-12-17T18:36:51Z INFO - STS_TO_DELETE="ndbappmysqld"
2024-12-17T18:36:51Z INFO - PODS_TO_RESTART="APP_PODS"
2024-12-17T18:36:51Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
site-2-replication-svc
2024-12-17T18:36:51Z INFO - REPL_LEADER_PVC = pvc-site-1-site-2-
replication-svc
2024-12-17T18:36:51Z INFO - REPL_LEADER_POD = mysql-cluster-site-1-site-2-
replication-svc-58856dds8ql
2024-12-17T18:36:51Z INFO -
*************************************************************************
************************
2024-12-17T18:36:51Z INFO - END PHASE 0: Collect Site information
2024-12-17T18:36:51Z INFO -
*************************************************************************
************************
2024-12-17T18:36:51Z INFO - Ended timer PHASE 0: 1734460611
2024-12-17T18:36:51Z INFO - PHASE 0 took: 00 hr. 00 min. 12 sec.
2024-12-17T18:36:51Z INFO - Started timer PHASE 1: 1734460611
2024-12-17T18:36:51Z INFO -
*************************************************************************
************************
2024-12-17T18:36:51Z INFO - BEGIN PHASE 1: Verify disk sizes are supported
2024-12-17T18:36:51Z INFO -
*************************************************************************
************************
2024-12-17T18:36:51Z INFO - Current PVC sizes:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbappmysqld-ndbappmysqld-0             Bound
pvc-64e675c9-458f-48dd-a827-f43784f695ae   3Gi        RWO
standard       <unset>                 33h
pvc-ndbappmysqld-ndbappmysqld-1             Bound    pvc-4e9879d8-
ce42-4115-9d7b-4d079d7d84ea   3Gi        RWO            standard
<unset>                 33h
```

```
2024-12-17T18:36:51Z INFO - Requested PVC sizes from
custom_values_scale_pvc.yaml:
  ndbapp:
    ndbdisksize: 4Gi
2024-12-17T18:36:51Z INFO - Current and requested disk values:
2024-12-17T18:36:51Z INFO - current_pvcsz=3Gi (3221225472),
requested_pvcsz=4Gi (4294967296)
2024-12-17T18:36:51Z INFO - Verifying current and requested disk sizes...
2024-12-17T18:36:51Z INFO - Requested PVC values should not be equal to
current - PASSED
2024-12-17T18:36:51Z INFO - No requested value should be smaller than
current - PASSED
2024-12-17T18:36:51Z INFO - No requested value should be zero or negative
- PASSED
2024-12-17T18:36:51Z INFO - At least one requested value should be larger
than its current value - PASSED
2024-12-17T18:36:51Z INFO - db-replication-svc requested PVC values should
equal to current - PASSED
2024-12-17T18:36:51Z INFO - ndbmysqld requested PVC values should equal to
current - PASSED
2024-12-17T18:36:51Z INFO - ndbmtd requested PVC values should equal to
current - PASSED
2024-12-17T18:36:51Z INFO - Verified current and requested disk sizes.
2024-12-17T18:36:51Z INFO -
********************************************************************************
************************
2024-12-17T18:36:51Z INFO - END PHASE 1: Verify disk sizes are supported
2024-12-17T18:36:51Z INFO -
********************************************************************************
************************
2024-12-17T18:36:51Z INFO - Ended timer PHASE 1: 1734460611
2024-12-17T18:36:51Z INFO - PHASE 1 took: 00 hr. 00 min. 00 sec.
2024-12-17T18:36:51Z INFO - Started timer PHASE 2: 1734460611
2024-12-17T18:36:51Z INFO -
********************************************************************************
************************
2024-12-17T18:36:51Z INFO - BEGIN PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T18:36:51Z INFO -
********************************************************************************
************************
2024-12-17T18:36:51Z INFO - Deleting STS...
2024-12-17T18:36:51Z INFO - kubectl -n occne-cndbtier delete sts --
cascade=orphan "ndbappmysqld"
statefulset.apps "ndbappmysqld" deleted
2024-12-17T18:36:52Z INFO - STS deleted
2024-12-17T18:36:52Z INFO -
********************************************************************************
************************
2024-12-17T18:36:52Z INFO - END PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T18:36:52Z INFO -
********************************************************************************
************************
2024-12-17T18:36:52Z INFO - Ended timer PHASE 2: 1734460612
2024-12-17T18:36:52Z INFO - PHASE 2 took: 00 hr. 00 min. 01 sec.
```

```
2024-12-17T18:36:52Z INFO - Started timer PHASE 3: 1734460612
2024-12-17T18:36:52Z INFO -
********************************************************************************
************************
2024-12-17T18:36:52Z INFO - BEGIN PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T18:36:52Z INFO -
********************************************************************************
************************
2024-12-17T18:36:52Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 18:36:52 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 12
2024-12-17T18:36:56Z INFO - Helm upgrade returned
2024-12-17T18:36:56Z INFO -
********************************************************************************
************************
2024-12-17T18:36:56Z INFO - END PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T18:36:56Z INFO -
********************************************************************************
************************
2024-12-17T18:36:56Z INFO - Ended timer PHASE 3: 1734460616
2024-12-17T18:36:56Z INFO - PHASE 3 took: 00 hr. 00 min. 04 sec.
2024-12-17T18:36:56Z INFO - Started timer PHASE 4: 1734460616
2024-12-17T18:36:56Z INFO -
********************************************************************************
************************
2024-12-17T18:36:56Z INFO - BEGIN PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T18:36:56Z INFO -
********************************************************************************
************************
2024-12-17T18:36:56Z INFO - Restart pods after deleting their PVCs...
2024-12-17T18:36:56Z INFO - pods_to_delete = (ndbappmysqld-0
ndbappmysqld-1)
2024-12-17T18:36:56Z INFO - Deleting PVCs for ndbappmysqld-0 (pvc-
ndbappmysqld-ndbappmysqld-0)...
2024-12-17T18:36:56Z INFO - deleting pod ndbappmysqld-0 ...
persistentvolumeclaim "pvc-ndbappmysqld-ndbappmysqld-0" deleted
pod "ndbappmysqld-0" deleted
2024-12-17T18:37:01Z INFO - Waiting for condition: is_pod ndbappmysqld-0...
2024-12-17T18:37:01Z INFO - Condition occurred
2024-12-17T18:37:51Z INFO - Waiting for condition: is_pod_ready
ndbappmysqld-0...
2024-12-17T18:37:51Z INFO - Condition occurred
2024-12-17T18:37:51Z INFO - Deleting PVCs for ndbappmysqld-1 (pvc-
ndbappmysqld-ndbappmysqld-1)...
2024-12-17T18:37:51Z INFO - deleting pod ndbappmysqld-1 ...
persistentvolumeclaim "pvc-ndbappmysqld-ndbappmysqld-1" deleted
pod "ndbappmysqld-1" deleted
2024-12-17T18:37:55Z INFO - Waiting for condition: is_pod ndbappmysqld-1...
```

```
2024-12-17T18:37:55Z INFO - Condition occurred
2024-12-17T18:38:36Z INFO - Waiting for condition: is_pod_ready
ndbappmysqld-1...
2024-12-17T18:38:36Z INFO - Condition occurred
2024-12-17T18:38:36Z INFO - kubectl -n occne-cndbtier get pod
ndbappmysqld-0 ndbappmysqld-1
NAME             READY   STATUS    RESTARTS   AGE
ndbappmysqld-0   2/2     Running   0          95s
ndbappmysqld-1   2/2     Running   0          41s
2024-12-17T18:38:36Z INFO - kubectl -n occne-cndbtier get pvc pvc-
ndbappmysqld-ndbappmysqld-0 pvc-ndbappmysqld-ndbappmysqld-1
NAME                               STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbappmysqld-ndbappmysqld-0   Bound    pvc-ccd68518-
ea7e-46b7-95f3-3db730a0f914   4Gi        RWO            standard
<unset>                 95s
pvc-ndbappmysqld-ndbappmysqld-1   Bound    pvc-0f5ba7b1-bb0a-4125-
bd5e-738b8b486bc6   4Gi        RWO            standard
<unset>                 41s
2024-12-17T18:38:36Z INFO - Pods restarted and their PVCs recreated.
2024-12-17T18:38:36Z INFO -
**************************************************************************
************************
2024-12-17T18:38:36Z INFO - END PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T18:38:36Z INFO -
**************************************************************************
************************
2024-12-17T18:38:36Z INFO - Ended timer PHASE 4: 1734460716
2024-12-17T18:38:36Z INFO - PHASE 4 took: 00 hr. 01 min. 40 sec.
2024-12-17T18:38:36Z INFO - Started timer PHASE 5: 1734460716
2024-12-17T18:38:36Z INFO -
**************************************************************************
************************
2024-12-17T18:38:36Z INFO - BEGIN PHASE 5: Upgrade cnDBTier
2024-12-17T18:38:36Z INFO -
**************************************************************************
************************
2024-12-17T18:38:36Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 18:38:36 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 13
2024-12-17T18:40:17Z INFO - Helm upgrade returned
2024-12-17T18:40:17Z INFO -
**************************************************************************
************************
2024-12-17T18:40:17Z INFO - END PHASE 5: Upgrade cnDBTier
2024-12-17T18:40:17Z INFO -
**************************************************************************
************************
2024-12-17T18:40:17Z INFO - Ended timer PHASE 5: 1734460817
```

```
2024-12-17T18:40:17Z INFO - PHASE 5 took: 00 hr. 01 min. 41 sec.
2024-12-17T18:40:17Z INFO - Started timer PHASE 6: 1734460817
2024-12-17T18:40:17Z INFO -
********************************************************************************
************************
2024-12-17T18:40:17Z INFO - BEGIN PHASE 6: Post-processing
2024-12-17T18:40:17Z INFO -
********************************************************************************
************************
2024-12-17T18:40:17Z INFO - CURRENT_PVCS:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbappmysqld-ndbappmysqld-0             Bound
pvc-64e675c9-458f-48dd-a827-f43784f695ae   3Gi        RWO
standard       <unset>                 33h
pvc-ndbappmysqld-ndbappmysqld-1             Bound    pvc-4e9879d8-
ce42-4115-9d7b-4d079d7d84ea   3Gi        RWO            standard
<unset>                 33h
2024-12-17T18:40:17Z INFO - after_pvcs:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbappmysqld-ndbappmysqld-0             Bound    pvc-ccd68518-
ea7e-46b7-95f3-3db730a0f914   4Gi        RWO            standard
<unset>                 3m16s
pvc-ndbappmysqld-ndbappmysqld-1             Bound    pvc-0f5ba7b1-
bb0a-4125-bd5e-738b8b486bc6   4Gi        RWO            standard
<unset>                 2m22s
2024-12-17T18:40:17Z INFO -
********************************************************************************
************************
2024-12-17T18:40:17Z INFO - END PHASE 6: Post-processing
2024-12-17T18:40:17Z INFO -
********************************************************************************
************************
2024-12-17T18:40:17Z INFO - Ended timer PHASE 6: 1734460817
2024-12-17T18:40:17Z INFO - PHASE 6 took: 00 hr. 00 min. 00 sec.
2024-12-17T18:40:17Z INFO - Ended timer dbtscale_vertical_pvc: 1734460817
2024-12-17T18:40:17Z INFO - dbtscale_vertical_pvc took: 00 hr. 03 min. 38
sec.
2024-12-17T18:40:17Z INFO - dbtscale_vertical_pvc completed successfully
```

7.3.2.3 Scaling ndbmysqld Pods

This section provides the procedures to vertically scale up ndbmysqld pods.

> **Note**
>
> - Before scaling the pods, ensure that the worker nodes have adequate resources to support scaling.
> - Before you proceed with the vertical scaling procedure for ndbmysqld, perform a Helm test and ensure that all the cnDBTier services are running smoothly.

Updating CPU and RAM

Perform the following steps to update CPU and RAM using the `custom_values.yaml` file:

1. Configure the required CPU and memory values in the `global` section of the `custom_values.yaml` file.
   For example:

   ```
   api:
     resources:
       limits:
         cpu: 8
         memory: 10Gi
       requests:
         cpu: 8
         memory: 10Gi
   ```

2. Upgrade cnDBTier by performing a Helm upgrade with the modified `custom_values.yaml` file. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Updating PVC

Updating PVC Using Helm Upgrade

Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for ndbmysqld pods:

   ```
   global:
     api:
       ndbdisksize: 10Gi
   ```

2. Delete the ndbmysqld statefulset and make the dependencies as orphan:

   ```
   $ kubectl -n occne-cndbtier delete sts --cascade=orphan ndbmysqld
   ```

3. Delete the ndbmysqld-1 pod and patch its PVCs with the new PVC value:
   a. Delete the ndbmysqld-1 pod:

      ```
      $ kubectl -n occne-cndbtier delete pod ndbmysqld-1
      ```

      Sample output:

      ```
      pod "ndbmysqld-1" deleted
      ```

   b. Patch the PVCs of ndbmysqld-1 pod with the new PVC values:

      ```
      $ kubectl -n occne-cndbtier patch -p '{ "spec": { "resources":
      { "requests": { "storage": "10Gi" }}}}' pvc pvc-ndbmysqld-ndbmysqld-1
      ```

4. Wait for the new PV to attach with the PVC. Run the following command to check if the PV reflects the updated PVC values:

   ```
   $ kubectl get pv | grep -w occne-cndbtier | grep ndbmysqld-1
   ```

Sample output:

```
pvc-ee960e06-6fae-48de-bd8d-1212fb26c24b   10Gi        RWO
Delete           Bound         occne-cndbtier/pvc-ndbmysqld-ndbmysqld-1
```

5. Upgrade cnDBTier with the modified `custom_values.yaml` file:

   ```
   $ helm upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml -
   n occne-cndbtier --no-hooks
   ```

6. Repeat steps b through e for ndbmysqld-0.
7. As cnDBTier Helm upgrade is performed with the "--no-hooks" option in step d, upgradeStrategy of the cnDBTier StatefulSets is changed to OnDelete. Therefore, perform the cnDBTier upgrade one more time to restore upgradeStrategy to RollingRestart:

   > **Note**
   >
   > Before running the following command, ensure that you set the value of `OCCNE_NAMESPACE` variable in the command with your cnDBTier namespace.

   ```
   helm -n ${OCCNE_NAMESPACE} upgrade ${OCCNE_RELEASE_NAME} occndbtier -f
   occndbtier/custom_values.yaml
   ```

Updating PVC Using `dbtscale_vertical_pvc`

`dbtscale_vertical_pvc` is an automated script to update PVC without manual intervention. Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for `ndbmysqld` pods. Ensure that you modify the `global.api.ndbdisksize` section only.
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

   ```
   global:
     api:
       ndbdisksize: 3Gi
   ```

   The following code block shows the updated PVC values in the `custom_values.yaml` file:

   ```
   global:
     api:
       ndbdisksize: 4Gi
   ```

2. Run the following commands to navigate to the `Artifacts/Scripts/tools/` directory and source the `source_me` file:

> **Note**
>
> - Ensure that the `Artifacts/Scripts/tools/` directory contains the `source_me` file.
> - After running the script, enter the namespace of the cnDBTier cluster when prompted.

```
$ cd Artifacts/Scripts/tools/
$ source ./source_me
```

Sample output:

```
Enter cndbtier namespace: occne-cndbtier
DBTIER_NAMESPACE = "occne-cndbtier"

DBTIER_LIB=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/lib

Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin to
PATH
Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
rollbackscripts to PATH
PATH=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
rollbackscripts:/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/
bin:/home/dbtuser/.local/bin:/home/dbtuser/bin:/usr/local/bin:/usr/
bin:/usr/local/sbin:/usr/sbin
```

3. Run the `dbtscale_vertical_pvc` script with the `–pods=ndbmysqld` option and pass the helm charts and the updated `custom_values.yaml` file as parameters:

```
$ dbtscale_vertical_pvc --pods=ndbmysqld occndbtier
custom_values_scale_pvc.yaml
```

Sample output:

```
2024-12-17T18:54:40Z INFO - HELM_CHARTS = occndbtier
2024-12-17T18:54:40Z INFO - CUSTOM_VALUES_FILE =
custom_values_scale_pvc.yaml
dbtscale_vertical_pvc 25.1.100
Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
2024-12-17T18:54:40Z INFO - Started timer dbtscale_vertical_pvc: 1734461680
2024-12-17T18:54:40Z INFO - Started timer PHASE 0: 1734461680
2024-12-17T18:54:40Z INFO -
************************************************************************
************************
2024-12-17T18:54:40Z INFO - BEGIN PHASE 0: Collect Site information
2024-12-17T18:54:40Z INFO -
************************************************************************
************************
2024-12-17T18:54:40Z INFO - Using IPv4: LOOPBACK_IP="127.0.0.1"
2024-12-17T18:54:40Z INFO - DBTIER_NAMESPACE = occne-cndbtier
...
```

```
2024-12-17T18:54:52Z INFO - PODS_TO_SCALE="ndbmysqld"
2024-12-17T18:54:52Z INFO - POD_TYPE="api"
2024-12-17T18:54:52Z INFO - STS_TO_DELETE="ndbmysqld"
2024-12-17T18:54:52Z INFO - PODS_TO_RESTART="API_PODS"
2024-12-17T18:54:52Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
site-2-replication-svc
2024-12-17T18:54:52Z INFO - REPL_LEADER_PVC = pvc-site-1-site-2-
replication-svc
2024-12-17T18:54:52Z INFO - REPL_LEADER_POD = mysql-cluster-site-1-site-2-
replication-svc-58856dds8ql
2024-12-17T18:54:52Z INFO -
**************************************************************************
************************
2024-12-17T18:54:52Z INFO - END PHASE 0: Collect Site information
2024-12-17T18:54:52Z INFO -
**************************************************************************
************************
2024-12-17T18:54:52Z INFO - Ended timer PHASE 0: 1734461692
2024-12-17T18:54:52Z INFO - PHASE 0 took: 00 hr. 00 min. 12 sec.
2024-12-17T18:54:52Z INFO - Started timer PHASE 1: 1734461692
2024-12-17T18:54:52Z INFO -
**************************************************************************
************************
2024-12-17T18:54:52Z INFO - BEGIN PHASE 1: Verify disk sizes are supported
2024-12-17T18:54:52Z INFO -
**************************************************************************
************************
2024-12-17T18:54:52Z INFO - Current PVC sizes:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmysqld-ndbmysqld-0                   Bound
pvc-09a977c0-8fea-47cc-b010-8ac02f870e53   3Gi        RWO
standard       <unset>                 34h
pvc-ndbmysqld-ndbmysqld-1                   Bound    pvc-d136cd51-
f4f0-4142-b92d-45f40d4fe65c   3Gi        RWO            standard
<unset>                 34h
2024-12-17T18:54:52Z INFO - Requested PVC sizes from
custom_values_scale_pvc.yaml:
  api:
    ndbdisksize: 4Gi
2024-12-17T18:54:52Z INFO - Current and requested disk values:
2024-12-17T18:54:52Z INFO - current_pvcsz=3Gi (3221225472),
requested_pvcsz=4Gi (4294967296)
2024-12-17T18:54:52Z INFO - Verifying current and requested disk sizes...
2024-12-17T18:54:52Z INFO - Requested PVC values should not be equal to
current - PASSED
2024-12-17T18:54:52Z INFO - No requested value should be smaller than
current - PASSED
2024-12-17T18:54:52Z INFO - No requested value should be zero or negative
- PASSED
2024-12-17T18:54:52Z INFO - At least one requested value should be larger
than its current value - PASSED
2024-12-17T18:54:52Z INFO - db-replication-svc requested PVC values should
equal to current - PASSED
2024-12-17T18:54:52Z INFO - ndbappmysqld requested PVC values should equal
```

```
to current - PASSED
2024-12-17T18:54:52Z INFO - ndbmtd requested PVC values should equal to
current - PASSED
2024-12-17T18:54:52Z INFO - Verified current and requested disk sizes.
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - END PHASE 1: Verify disk sizes are supported
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - Ended timer PHASE 1: 1734461692
2024-12-17T18:54:52Z INFO - PHASE 1 took: 00 hr. 00 min. 00 sec.
2024-12-17T18:54:52Z INFO - Started timer PHASE 2: 1734461692
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - BEGIN PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - Deleting STS...
2024-12-17T18:54:52Z INFO - kubectl -n occne-cndbtier delete sts --
cascade=orphan "ndbmysqld"
statefulset.apps "ndbmysqld" deleted
2024-12-17T18:54:52Z INFO - STS deleted
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - END PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - Ended timer PHASE 2: 1734461692
2024-12-17T18:54:52Z INFO - PHASE 2 took: 00 hr. 00 min. 00 sec.
2024-12-17T18:54:52Z INFO - Started timer PHASE 3: 1734461692
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - BEGIN PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T18:54:52Z INFO -
********************************************************************************
************************
2024-12-17T18:54:52Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 18:54:53 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 14
2024-12-17T18:54:57Z INFO - Helm upgrade returned
2024-12-17T18:54:57Z INFO -
```

```
********************************************************************************
************************
2024-12-17T18:54:57Z INFO - END PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T18:54:57Z INFO -
********************************************************************************
************************
2024-12-17T18:54:57Z INFO - Ended timer PHASE 3: 1734461697
2024-12-17T18:54:57Z INFO - PHASE 3 took: 00 hr. 00 min. 05 sec.
2024-12-17T18:54:57Z INFO - Started timer PHASE 4: 1734461697
2024-12-17T18:54:57Z INFO -
********************************************************************************
************************
2024-12-17T18:54:57Z INFO - BEGIN PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T18:54:57Z INFO -
********************************************************************************
************************
2024-12-17T18:54:57Z INFO - Restart pods after deleting their PVCs...
2024-12-17T18:54:57Z INFO - pods_to_delete = (ndbmysqld-0 ndbmysqld-1)
2024-12-17T18:54:57Z INFO - Deleting PVCs for ndbmysqld-0 (pvc-ndbmysqld-
ndbmysqld-0)...
2024-12-17T18:54:57Z INFO - deleting pod ndbmysqld-0 ...
persistentvolumeclaim "pvc-ndbmysqld-ndbmysqld-0" deleted
pod "ndbmysqld-0" deleted
2024-12-17T18:55:08Z INFO - Waiting for condition: is_pod ndbmysqld-0...
2024-12-17T18:55:08Z INFO - Condition occurred
2024-12-17T18:55:49Z INFO - Waiting for condition: is_pod_ready
ndbmysqld-0...
2024-12-17T18:55:49Z INFO - Condition occurred
2024-12-17T18:55:49Z INFO - Deleting PVCs for ndbmysqld-1 (pvc-ndbmysqld-
ndbmysqld-1)...
2024-12-17T18:55:49Z INFO - deleting pod ndbmysqld-1 ...
persistentvolumeclaim "pvc-ndbmysqld-ndbmysqld-1" deleted
pod "ndbmysqld-1" deleted
2024-12-17T18:56:00Z INFO - Waiting for condition: is_pod ndbmysqld-1...
2024-12-17T18:56:00Z INFO - Condition occurred
2024-12-17T18:56:40Z INFO - Waiting for condition: is_pod_ready
ndbmysqld-1...
2024-12-17T18:56:40Z INFO - Condition occurred
2024-12-17T18:56:40Z INFO - kubectl -n occne-cndbtier get pod ndbmysqld-0
ndbmysqld-1
NAME          READY   STATUS    RESTARTS   AGE
ndbmysqld-0   3/3     Running   0          92s
ndbmysqld-1   3/3     Running   0          41s
2024-12-17T18:56:40Z INFO - kubectl -n occne-cndbtier get pvc pvc-
ndbmysqld-ndbmysqld-0 pvc-ndbmysqld-ndbmysqld-1
NAME                         STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmysqld-ndbmysqld-0   Bound
pvc-84025c03-7f43-4c9a-8042-1c241ba365b5   4Gi        RWO
standard       <unset>                 92s
pvc-ndbmysqld-ndbmysqld-1   Bound    pvc-7f626556-8516-46fb-ac1c-
b0196b02fecf   4Gi        RWO            standard
<unset>                 41s
```

```
2024-12-17T18:56:40Z INFO - Pods restarted and their PVCs recreated.
2024-12-17T18:56:40Z INFO -
********************************************************************************
************************
2024-12-17T18:56:40Z INFO - END PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T18:56:40Z INFO -
********************************************************************************
************************
2024-12-17T18:56:40Z INFO - Ended timer PHASE 4: 1734461800
2024-12-17T18:56:40Z INFO - PHASE 4 took: 00 hr. 01 min. 43 sec.
2024-12-17T18:56:40Z INFO - Started timer PHASE 5: 1734461800
2024-12-17T18:56:40Z INFO -
********************************************************************************
************************
2024-12-17T18:56:40Z INFO - BEGIN PHASE 5: Upgrade cnDBTier
2024-12-17T18:56:40Z INFO -
********************************************************************************
************************
2024-12-17T18:56:40Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 18:56:41 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 15
2024-12-17T18:59:02Z INFO - Helm upgrade returned
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - END PHASE 5: Upgrade cnDBTier
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - Ended timer PHASE 5: 1734461942
2024-12-17T18:59:02Z INFO - PHASE 5 took: 00 hr. 02 min. 22 sec.
2024-12-17T18:59:02Z INFO - Started timer PHASE 6: 1734461942
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - BEGIN PHASE 6: Post-processing
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - CURRENT_PVCS:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmysqld-ndbmysqld-0                   Bound
pvc-09a977c0-8fea-47cc-b010-8ac02f870e53   3Gi        RWO
standard       <unset>                 34h
pvc-ndbmysqld-ndbmysqld-1                   Bound    pvc-d136cd51-
f4f0-4142-b92d-45f40d4fe65c   3Gi        RWO            standard
<unset>                 34h
2024-12-17T18:59:02Z INFO - after_pvcs:
```

```
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmysqld-ndbmysqld-0                   Bound
pvc-84025c03-7f43-4c9a-8042-1c241ba365b5   4Gi        RWO
standard       <unset>                 3m54s
pvc-ndbmysqld-ndbmysqld-1                   Bound
pvc-7f626556-8516-46fb-ac1c-b0196b02fecf   4Gi        RWO
standard       <unset>                 3m3s
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - END PHASE 6: Post-processing
2024-12-17T18:59:02Z INFO -
********************************************************************************
************************
2024-12-17T18:59:02Z INFO - Ended timer PHASE 6: 1734461942
2024-12-17T18:59:02Z INFO - PHASE 6 took: 00 hr. 00 min. 00 sec.
2024-12-17T18:59:02Z INFO - Ended timer dbtscale_vertical_pvc: 1734461942
2024-12-17T18:59:02Z INFO - dbtscale_vertical_pvc took: 00 hr. 04 min. 22
sec.
2024-12-17T18:59:02Z INFO - dbtscale_vertical_pvc completed successfully
```

7.3.2.4 Vertical Scaling of db-replication-svc Pods

This section provides the procedures to vertically scale up db-replication-svc pods.

> **Note**
>
> - Before scaling the pods, ensure that the worker nodes have adequate resources to support scaling.
> - Before you proceed with the vertical scaling of db-replication-svc, perform a Helm test and ensure that all the cnDBTier services are running smoothly.

Updating CPU and RAM

Perform the following steps to update CPU and RAM using the `custom_values.yaml` file:

1. Configure the required CPU and memory values in the `custom_values.yaml` file. For example:

```
db-replication-svc:
  resources:
    limits:
      cpu: 1
      memory: 2048Mi
      ephemeral-storage: 1Gi
    requests:
      cpu: 0.6
      memory: 1024Mi
      ephemeral-storage: 90Mi
```

2. Upgrade cnDBTier by performing a Helm upgrade with the modified `custom_values.yaml` file. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> cnDBTier supports upgrade in a TLS enabled cluster in this scenario only.

Updating PVC

Updating PVC Using Helm Upgrade

Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Perform the following steps to scale down the replication service pod:
   a. Identify the replication service of cnDBTier cluster1 with respect to cnDBTier cluster2:

      ```
      $ kubectl get deployment --namespace=cluster1
      ```

      Sample output:

      ```
      NAME                                                READY   UP-TO-DATE
      AVAILABLE   AGE
      mysql-cluster-cluster1-cluster2-replication-svc   1/1     1
      1           18m
      mysql-cluster-db-backup-manager-svc               1/1     1
      1           18m
      mysql-cluster-db-monitor-svc                      1/1     1
      1           18m
      ```

   b. Scale down the replication service of cnDBTier cluster1 with respect to cnDBTier cluster2:

      ```
      $ kubectl scale deployment mysql-cluster-cluster1-cluster2-replication-
      svc --namespace=cluster1 --replicas=0
      ```

      Sample output:

      ```
      deployment.apps/mysql-cluster-cluster1-cluster2-replication-svc scaled
      ```

2. Update the `custom_values.yaml` file with the new PVC values for ndbmysqld pods:
   The following example shows the PVC value in the `custom_values.yaml` file updated from 8Gi to 10Gi:

   Old PVC value:

   ```
   db-replication-svc:
     dbreplsvcdeployments:
       - name: cluster1-cluster2-replication-svc
         enabled: true
         pvc:
           name: pvc-cluster1-cluster2-replication-svc
           disksize: 8Gi
   ```

New PVC value:

```
db-replication-svc:
  dbreplsvcdeployments:
    - name: cluster1-cluster2-replication-svc
      enabled: true
      pvc:
        name: pvc-cluster1-cluster2-replication-svc
        disksize: 10Gi
```

> **Note**
>
> If you are providing a pod prefix for the DB replication service name, then use a name that is unique and small.

3. Patch PVCs of the DB replication service with the new PVC value:

```
$ kubectl -n cluster1 patch -p '{ "spec": { "resources": { "requests":
{ "storage": "10Gi" }}}}' pvc pvc-cluster1-cluster2-replication-svc
```

Sample output:

```
persistentvolumeclaim/pvc-cluster1-cluster2-replication-svc patched
```

4. Wait until new PV returns and gets attached to the existing PVC. Run the following commands to check the events:

```
$ kubectl get events -n cluster1
$ kubectl get pv | grep cluster1 | grep repl
```

Sample output:

```
pvc-5b9917ff-53d4-44cb-a5ef-3e37b201c376   8Gi        RWO
Delete           Bound    cluster2/pvc-cluster2-cluster1-replication-svc
occne-dbtier-sc            12m
pvc-e6526259-d007-4868-a4e2-d53a8569edc8   10Gi       RWO
Delete           Bound    cluster1/pvc-cluster1-cluster2-replication-svc
occne-dbtier-sc            15m
```

5. Upgrade cnDBTier with the modified `custom_values.yaml` file:

```
$ helm upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml -
n cluster1
```

When the helm upgrade is complete, the db-replication-svc pod comes up with the extended PVC size.

Updating PVC Using `dbtscale_vertical_pvc`

`dbtscale_vertical_pvc` is an automated script to update PVC without manual intervention. Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for the replication service pods. Ensure that you modify the `.db-replication-svc.dbreplsvcdeployments[0].pvc.disksize` section only.
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

   ```
   db-replication-svc:
     dbreplsvcdeployments:
       # if pod prefix is given then use the unique smaller name for this db
   replication service.
       - name: site-1-site-2-replication-svc
         enabled: true
         pvc:
           name: pvc-site-1-site-2-replication-svc
           disksize: 3Gi
   ```

   The following code block shows the updated PVC values in the `custom_values.yaml` file:

   ```
   db-replication-svc:
     dbreplsvcdeployments:
       # if pod prefix is given then use the unique smaller name for this db
   replication service.
       - name: site-1-site-2-replication-svc
         enabled: true
         pvc:
           name: pvc-site-1-site-2-replication-svc
           disksize: 4Gi
   ```

2. Run the following commands to navigate to the `Artifacts/Scripts/tools/` directory and source the `source_me` file:

   > **Note**
   > - Ensure that the `Artifacts/Scripts/tools/` directory contains the `source_me` file.
   > - After running the script, enter the namespace of the cnDBTier cluster when prompted.

   ```
   $ cd Artifacts/Scripts/tools/
   $ source ./source_me
   ```

   Sample output:

   ```
   Enter cndbtier namespace: occne-cndbtier
   DBTIER_NAMESPACE = "occne-cndbtier"

   DBTIER_LIB=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/lib

   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin to
   PATH
   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
   ```

```
rollbackscripts to PATH
PATH=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
rollbackscripts:/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/
bin:/home/dbtuser/.local/bin:/home/dbtuser/bin:/usr/local/bin:/usr/
bin:/usr/local/sbin:/usr/sbin
```

3. Run the `dbtscale_vertical_pvc` script with the `–pods=db-replication-svc` option and pass the helm charts and the updated `custom_values.yaml` file as parameters:

   ```
   $ dbtscale_vertical_pvc --pods=db-replication-svc occndbtier
   custom_values_scale_pvc.yaml
   ```

   Sample output:

   ```
   2024-12-17T19:07:02Z INFO - HELM_CHARTS = occndbtier
   2024-12-17T19:07:02Z INFO - CUSTOM_VALUES_FILE =
   custom_values_scale_pvc.yaml
   dbtscale_vertical_pvc <24.3.0>
   Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
   2024-12-17T19:07:02Z INFO - Started timer dbtscale_vertical_pvc: 1734462422
   2024-12-17T19:07:02Z INFO - Started timer PHASE 0: 1734462422
   2024-12-17T19:07:02Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T19:07:02Z INFO - BEGIN PHASE 0: Collect Site information
   2024-12-17T19:07:02Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T19:07:03Z INFO - Using IPv4: LOOPBACK_IP="127.0.0.1"
   2024-12-17T19:07:03Z INFO - DBTIER_NAMESPACE = occne-cndbtier
   ...
   2024-12-17T19:07:15Z INFO - PODS_TO_SCALE="db-replication-svc"
   2024-12-17T19:07:15Z INFO - POD_TYPE="db-replication-svc"
   2024-12-17T19:07:15Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
   site-2-replication-svc
   2024-12-17T19:07:15Z INFO - REPL_LEADER_PVC = pvc-site-1-site-2-
   replication-svc
   2024-12-17T19:07:15Z INFO - REPL_LEADER_POD = mysql-cluster-site-1-site-2-
   replication-svc-98476bwhhlp
   2024-12-17T19:07:15Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T19:07:15Z INFO - END PHASE 0: Collect Site information
   2024-12-17T19:07:15Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T19:07:15Z INFO - Ended timer PHASE 0: 1734462435
   2024-12-17T19:07:15Z INFO - PHASE 0 took: 00 hr. 00 min. 13 sec.
   2024-12-17T19:07:15Z INFO - Started timer PHASE 1: 1734462435
   2024-12-17T19:07:15Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T19:07:15Z INFO - BEGIN PHASE 1: Verify disk sizes are supported
   2024-12-17T19:07:15Z INFO -
   ********************************************************************************
   ```

```
************************
2024-12-17T19:07:15Z INFO - Current PVC sizes:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-site-1-site-2-replication-svc   Bound    pvc-1212dd3c-5100-467d-
ac54-0c569116a507   3Gi        RWO            standard
<unset>                 37h
2024-12-17T19:07:15Z INFO - Requested PVC sizes from
custom_values_scale_pvc.yaml:
    - name: lfg-site-1-site-2-replication-svc
      enabled: true
      pvc:
        name: pvc-site-1-site-2-replication-svc
        disksize: 4Gi
2024-12-17T19:07:15Z INFO - Current and requested disk values:
2024-12-17T19:07:15Z INFO - current_pvcsz=3Gi (3221225472),
requested_pvcsz=4Gi (4294967296)
2024-12-17T19:07:15Z INFO - Verifying current and requested disk sizes...
2024-12-17T19:07:15Z INFO - Requested PVC values should not be equal to
current - PASSED
2024-12-17T19:07:15Z INFO - No requested value should be smaller than
current - PASSED
2024-12-17T19:07:15Z INFO - No requested value should be zero or negative
- PASSED
2024-12-17T19:07:15Z INFO - At least one requested value should be larger
than its current value - PASSED
2024-12-17T19:07:15Z INFO - ndbmysqld requested PVC values should equal to
current - PASSED
2024-12-17T19:07:15Z INFO - ndbappmysqld requested PVC values should equal
to current - PASSED
2024-12-17T19:07:15Z INFO - ndbmtd requested PVC values should equal to
current - PASSED
2024-12-17T19:07:15Z INFO - Verified current and requested disk sizes.
2024-12-17T19:07:15Z INFO -
************************************************************************
************************
2024-12-17T19:07:15Z INFO - END PHASE 1: Verify disk sizes are supported
2024-12-17T19:07:15Z INFO -
************************************************************************
************************
2024-12-17T19:07:15Z INFO - Ended timer PHASE 1: 1734462435
2024-12-17T19:07:15Z INFO - PHASE 1 took: 00 hr. 00 min. 00 sec.
2024-12-17T19:07:15Z INFO - Started timer PHASE 2: 1734462435
2024-12-17T19:07:15Z INFO -
************************************************************************
************************
2024-12-17T19:07:15Z INFO - BEGIN PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T19:07:15Z INFO -
************************************************************************
************************
2024-12-17T19:07:15Z INFO - Scaling down deployment...
2024-12-17T19:07:15Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
site-2-replication-svc
2024-12-17T19:07:15Z INFO - kubectl -n occne-cndbtier scale deployment
```

```
mysql-cluster-site-1-site-2-replication-svc --replicas=0
deployment.apps/mysql-cluster-site-1-site-2-replication-svc scaled
2024-12-17T19:07:16Z INFO - Deployment scaled down
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - END PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - Ended timer PHASE 2: 1734462436
2024-12-17T19:07:16Z INFO - PHASE 2 took: 00 hr. 00 min. 01 sec.
2024-12-17T19:07:16Z INFO - Started timer PHASE 3: 1734462436
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - BEGIN PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - Patch pvc-site-1-site-2-replication-svc with
the new value (4294967296).
persistentvolumeclaim/pvc-site-1-site-2-replication-svc patched
2024-12-17T19:07:16Z INFO - Replication service PVC patched.
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - END PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - Ended timer PHASE 3: 1734462436
2024-12-17T19:07:16Z INFO - PHASE 3 took: 00 hr. 00 min. 00 sec.
2024-12-17T19:07:16Z INFO - Started timer PHASE 4: 1734462436
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - BEGIN PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T19:07:16Z INFO -
**************************************************************************
************************
2024-12-17T19:07:16Z INFO - Wait for the new PV to bound to existing pvc.
2024-12-17T19:07:19Z INFO - Waiting for condition:
is_requested_size_and_bound...
2024-12-17T19:07:19Z INFO - Condition occurred
2024-12-17T19:07:19Z INFO - PV attached to pvc-site-1-site-2-replication-
svc with requested size: 4294967296
2024-12-17T19:07:19Z INFO - PV:
NAME                                        CAPACITY   ACCESS MODES
RECLAIM POLICY   STATUS
CLAIM
                                           STORAGECLASS
```

```
VOLUMEATTRIBUTESCLASS   REASON   AGE
pvc-1212dd3c-5100-467d-ac54-0c569116a507   4Gi        RWO
Delete           Bound    occne-cndbtier/pvc-site-1-site-2-replication-
svc
standard            <unset>                         37h
2024-12-17T19:07:19Z INFO -
********************************************************************************
************************
2024-12-17T19:07:19Z INFO - END PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T19:07:19Z INFO -
********************************************************************************
************************
2024-12-17T19:07:19Z INFO - Ended timer PHASE 4: 1734462439
2024-12-17T19:07:19Z INFO - PHASE 4 took: 00 hr. 00 min. 03 sec.
2024-12-17T19:07:19Z INFO - Started timer PHASE 5: 1734462439
2024-12-17T19:07:19Z INFO -
********************************************************************************
************************
2024-12-17T19:07:19Z INFO - BEGIN PHASE 5: Upgrade cnDBTier
2024-12-17T19:07:19Z INFO -
********************************************************************************
************************
2024-12-17T19:07:19Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 19:07:20 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 16
2024-12-17T19:09:19Z INFO - Helm upgrade returned
2024-12-17T19:09:19Z INFO -
********************************************************************************
************************
2024-12-17T19:09:19Z INFO - END PHASE 5: Upgrade cnDBTier
2024-12-17T19:09:19Z INFO -
********************************************************************************
************************
2024-12-17T19:09:19Z INFO - Ended timer PHASE 5: 1734462559
2024-12-17T19:09:19Z INFO - PHASE 5 took: 00 hr. 02 min. 00 sec.
2024-12-17T19:09:19Z INFO - Started timer PHASE 6: 1734462559
2024-12-17T19:09:19Z INFO -
********************************************************************************
************************
2024-12-17T19:09:19Z INFO - BEGIN PHASE 6: Post-processing
2024-12-17T19:09:19Z INFO -
********************************************************************************
************************
2024-12-17T19:09:19Z INFO - CURRENT_PVCS:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-site-1-site-2-replication-svc   Bound    pvc-1212dd3c-5100-467d-
ac54-0c569116a507   3Gi        RWO            standard
<unset>                 37h
```

```
2024-12-17T19:09:19Z INFO - after_pvcs:
NAME                                        STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-site-1-site-2-replication-svc   Bound    pvc-1212dd3c-5100-467d-
ac54-0c569116a507   4Gi        RWO            standard
<unset>                 37h
2024-12-17T19:09:19Z INFO -
************************************************************************
************************
2024-12-17T19:09:19Z INFO - END PHASE 6: Post-processing
2024-12-17T19:09:19Z INFO -
************************************************************************
************************
2024-12-17T19:09:19Z INFO - Ended timer PHASE 6: 1734462559
2024-12-17T19:09:19Z INFO - PHASE 6 took: 00 hr. 00 min. 00 sec.
2024-12-17T19:09:19Z INFO - Ended timer dbtscale_vertical_pvc: 1734462559
2024-12-17T19:09:19Z INFO - dbtscale_vertical_pvc took: 00 hr. 02 min. 17
sec.
2024-12-17T19:09:19Z INFO - dbtscale_vertical_pvc completed successfully
```

7.3.2.5 Scaling of ndbmgmd Pods

This section provides the procedures to vertically scale up ndbmgmd pods.

> **Note**
>
> - Before scaling the pods, ensure that the worker nodes have adequate resources to support scaling.
> - Before you proceed with the vertical scaling procedure for ndbmgmd, perform a Helm Test and ensure that all the cnDBTier services are running smoothly.

Updating CPU and RAM

Perform the following steps to update CPU and RAM using the `custom_values.yaml` file:

1. Configure the required CPU and memory values in the `global` section of the `custom_values.yaml` file.
   For example:

```
mgm:
  ...
  resources:
    limits:
      cpu: 6
      memory: 12Gi
      ephemeral-storage: 1Gi
    requests:
      cpu: 6
      memory: 12Gi
      ephemeral-storage: 90Mi
```

2. Upgrade cnDBTier by performing a Helm upgrade with the modified `custom_values.yaml` file. For more information about the upgrade procedure, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

Updating PVC

Updating PVC Using Helm Upgrade

Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for ndbmgmd pods:

```
global:
  mgm:
    ndbdisksize: 10Gi
```

2. Delete the ndbmgmd statefulset and make the dependencies as orphan:

```
$ kubectl -n occne-cndbtier delete sts --cascade=orphan ndbmgmd
```

3. Delete the ndbmgmd-1 pod and patch its PVCs with the new PVC value:
   a. Delete the ndbmgmd-1 pod:

```
$ kubectl -n occne-cndbtier delete pod ndbmgmd-1
```

   Sample output:

```
pod "ndbmgmd-1" deleted
```

   b. Patch the PVCs of ndbmgmd-1 pod with the new PVC values:

```
$ kubectl -n occne-cndbtier patch -p '{ "spec": { "resources":
{ "requests": { "storage": "10Gi" }}}}' pvc pvc-ndbmgmd-ndbmgmd-1
```

4. Wait for the new PV to attach with the PVC. Run the following command to check if the PV reflects the updated PVC values:

```
$ kubectl get pv | grep -w occne-cndbtier | grep ndbmgmd-1
```

   Sample output:

```
pvc-8a58a7b4-25bb-4b32-a07a-728h8d792835   10Gi        RWO
Delete           Bound         occne-cndbtier/pvc-ndbmgmd-ndbmgmd-1
```

5. Upgrade cnDBTier with the modified `custom_values.yaml` file:

```
$ helm upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml -
n occne-cndbtier --no-hooks
```

6. Repeat steps b through e for ndbmgmd-0.

7. As cnDBTier Helm upgrade is performed with the "--no-hooks" option in step e, upgradeStrategy of the cnDBTier StatefulSets is changed to OnDelete. Therefore, perform the cnDBTier upgrade one more time to restore upgradeStrategy to RollingRestart:

   ```
   helm -n ${OCCNE_NAMESPACE} upgrade ${OCCNE_RELEASE_NAME} occndbtier -f
   occndbtier/custom_values.yaml
   ```

Updating PVC Using `dbtscale_vertical_pvc`

`dbtscale_vertical_pvc` is an automated script to update PVC without manual intervention. Perform the following steps to update the PVC value using `custom_values.yaml`:

1. Update the `custom_values.yaml` file with the new PVC values for the `ndbmgmd` pods. Ensure that you modify the `global.mgm.ndbdisksize` section only.
   For example:

   The following code block shows the old PVC values in the `custom_values.yaml` file:

   ```
   global:
     mgm:
       ndbdisksize: 2Gi
   ```

   The following code block shows the updated PVC values in the `custom_values.yaml` file:

   ```
   global:
     mgm:
       ndbdisksize: 3Gi
   ```

2. Run the following commands to navigate to the `Artifacts/Scripts/tools/` directory and source the `source_me` file:

   > **Note**
   > - Ensure that the `Artifacts/Scripts/tools/` directory contains the `source_me` file.
   > - After running the script, enter the namespace of the cnDBTier cluster when prompted.

   ```
   $ cd Artifacts/Scripts/tools/
   $ source ./source_me
   ```

   Sample output:

   ```
   Enter cndbtier namespace: occne-cndbtier
   DBTIER_NAMESPACE = "occne-cndbtier"

   DBTIER_LIB=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/lib

   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin to
   PATH
   Adding /home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
   rollbackscripts to PATH
   PATH=/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/bin/
   ```

```
rollbackscripts:/home/dbtuser/occne/cluster/site-1/Artifacts/Scripts/tools/
bin:/home/dbtuser/.local/bin:/home/dbtuser/bin:/usr/local/bin:/usr/
bin:/usr/local/sbin:/usr/sbin
```

3. Run the `dbtscale_vertical_pvc` script with the `–pods=ndbmgmd` option and pass the helm charts and the updated `custom_values.yaml` file as parameters:

   ```
   $ dbtscale_vertical_pvc --pods=ndbmgmd occndbtier
   custom_values_scale_pvc.yaml
   ```

   Sample output:

   ```
   2024-12-17T22:07:40Z INFO - HELM_CHARTS = occndbtier
   2024-12-17T22:07:40Z INFO - CUSTOM_VALUES_FILE =
   custom_values_scale_pvc.yaml
   dbtscale_vertical_pvc <24.3.0>
   Copyright (c) 2024 Oracle and/or its affiliates. All rights reserved.
   2024-12-17T22:07:40Z INFO - Started timer dbtscale_vertical_pvc: 1734473260
   2024-12-17T22:07:40Z INFO - Started timer PHASE 0: 1734473260
   2024-12-17T22:07:40Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T22:07:40Z INFO - BEGIN PHASE 0: Collect Site information
   2024-12-17T22:07:40Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T22:07:40Z INFO - Using IPv4: LOOPBACK_IP="127.0.0.1"
   2024-12-17T22:07:40Z INFO - DBTIER_NAMESPACE = occne-cndbtier
   ...
   2024-12-17T22:07:51Z INFO - PODS_TO_SCALE="ndbmgmd"
   2024-12-17T22:07:51Z INFO - POD_TYPE="mgm"
   2024-12-17T22:07:51Z INFO - STS_TO_DELETE="ndbmgmd"
   2024-12-17T22:07:51Z INFO - PODS_TO_RESTART="MGM_PODS"
   2024-12-17T22:07:51Z INFO - REPL_LEADER_DEPLOY = mysql-cluster-site-1-
   site-2-replication-svc
   2024-12-17T22:07:51Z INFO - REPL_LEADER_PVC = pvc-site-1-site-2-
   replication-svc
   2024-12-17T22:07:51Z INFO - REPL_LEADER_POD = mysql-cluster-site-1-site-2-
   replication-svc-6f549c46qt9
   2024-12-17T22:07:51Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T22:07:51Z INFO - END PHASE 0: Collect Site information
   2024-12-17T22:07:51Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T22:07:51Z INFO - Ended timer PHASE 0: 1734473271
   2024-12-17T22:07:51Z INFO - PHASE 0 took: 00 hr. 00 min. 11 sec.
   2024-12-17T22:07:51Z INFO - Started timer PHASE 1: 1734473271
   2024-12-17T22:07:51Z INFO -
   ********************************************************************************
   ************************
   2024-12-17T22:07:51Z INFO - BEGIN PHASE 1: Verify disk sizes are supported
   2024-12-17T22:07:51Z INFO -
   ********************************************************************************
   ```

```
************************
2024-12-17T22:07:51Z INFO - Current PVC sizes:
NAME                                        STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmgmd-ndbmgmd-0                       Bound    pvc-b718e19d-
c90a-4b5d-8d92-5c6f528d3643   2Gi        RWO            standard
<unset>                 40m
pvc-ndbmgmd-ndbmgmd-1                       Bound    pvc-
f5de0e40-170e-4e34-9ee0-7166466554ff   2Gi        RWO
standard       <unset>                 40m
2024-12-17T22:07:51Z INFO - Requested PVC sizes from
custom_values_scale_pvc.yaml:
  mgm:
    ndbdisksize: 3Gi
2024-12-17T22:07:51Z INFO - Current and requested disk values:
2024-12-17T22:07:51Z INFO - current_pvcsz=2Gi (2147483648),
requested_pvcsz=3Gi (3221225472)
2024-12-17T22:07:51Z INFO - Verifying current and requested disk sizes...
2024-12-17T22:07:51Z INFO - Requested PVC values should not be equal to
current - PASSED
2024-12-17T22:07:51Z INFO - No requested value should be smaller than
current - PASSED
2024-12-17T22:07:51Z INFO - No requested value should be zero or negative
- PASSED
2024-12-17T22:07:51Z INFO - At least one requested value should be larger
than its current value - PASSED
2024-12-17T22:07:51Z INFO - db-replication-svc requested PVC values should
equal to current - PASSED
2024-12-17T22:07:52Z INFO - ndbmysqld requested PVC values should equal to
current - PASSED
2024-12-17T22:07:52Z INFO - ndbappmysqld requested PVC values should equal
to current - PASSED
2024-12-17T22:07:52Z INFO - ndbmtd requested PVC values should equal to
current - PASSED
2024-12-17T22:07:52Z INFO - Verified current and requested disk sizes.
2024-12-17T22:07:52Z INFO -
************************************************************************
************************
2024-12-17T22:07:52Z INFO - END PHASE 1: Verify disk sizes are supported
2024-12-17T22:07:52Z INFO -
************************************************************************
************************
2024-12-17T22:07:52Z INFO - Ended timer PHASE 1: 1734473272
2024-12-17T22:07:52Z INFO - PHASE 1 took: 00 hr. 00 min. 01 sec.
2024-12-17T22:07:52Z INFO - Started timer PHASE 2: 1734473272
2024-12-17T22:07:52Z INFO -
************************************************************************
************************
2024-12-17T22:07:52Z INFO - BEGIN PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T22:07:52Z INFO -
************************************************************************
************************
2024-12-17T22:07:52Z INFO - Deleting STS...
2024-12-17T22:07:52Z INFO - kubectl -n occne-cndbtier delete sts --
```

```
cascade=orphan "ndbmgmd"
statefulset.apps "ndbmgmd" deleted
2024-12-17T22:07:52Z INFO - STS deleted
2024-12-17T22:07:52Z INFO -
********************************************************************************
************************
2024-12-17T22:07:52Z INFO - END PHASE 2: Delete/scale down statefulset/
deployment
2024-12-17T22:07:52Z INFO -
********************************************************************************
************************
2024-12-17T22:07:52Z INFO - Ended timer PHASE 2: 1734473272
2024-12-17T22:07:52Z INFO - PHASE 2 took: 00 hr. 00 min. 00 sec.
2024-12-17T22:07:52Z INFO - Started timer PHASE 3: 1734473272
2024-12-17T22:07:52Z INFO -
********************************************************************************
************************
2024-12-17T22:07:52Z INFO - BEGIN PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T22:07:52Z INFO -
********************************************************************************
************************
2024-12-17T22:07:52Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 22:07:52 2024
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 15
2024-12-17T22:07:55Z INFO - Helm upgrade returned
2024-12-17T22:07:55Z INFO -
********************************************************************************
************************
2024-12-17T22:07:56Z INFO - END PHASE 3: Upgrade cnDBTier --no-hooks or
patch db-replication-svc leader PVC
2024-12-17T22:07:56Z INFO -
********************************************************************************
************************
2024-12-17T22:07:56Z INFO - Ended timer PHASE 3: 1734473276
2024-12-17T22:07:56Z INFO - PHASE 3 took: 00 hr. 00 min. 04 sec.
2024-12-17T22:07:56Z INFO - Started timer PHASE 4: 1734473276
2024-12-17T22:07:56Z INFO -
********************************************************************************
************************
2024-12-17T22:07:56Z INFO - BEGIN PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T22:07:56Z INFO -
********************************************************************************
************************
2024-12-17T22:07:56Z INFO - Restart pods after deleting their PVCs...
2024-12-17T22:07:56Z INFO - pods_to_delete = (ndbmgmd-0 ndbmgmd-1)
2024-12-17T22:07:56Z INFO - Deleting PVCs for ndbmgmd-0 (pvc-ndbmgmd-
ndbmgmd-0)...
2024-12-17T22:07:56Z INFO - deleting pod ndbmgmd-0 ...
persistentvolumeclaim "pvc-ndbmgmd-ndbmgmd-0" deleted
```

```
pod "ndbmgmd-0" deleted
2024-12-17T22:08:07Z INFO - Waiting for condition: is_pod ndbmgmd-0...
2024-12-17T22:08:07Z INFO - Condition occurred
2024-12-17T22:08:29Z INFO - Waiting for condition: is_pod_ready
ndbmgmd-0...
2024-12-17T22:08:29Z INFO - Condition occurred
2024-12-17T22:08:29Z INFO - Deleting PVCs for ndbmgmd-1 (pvc-ndbmgmd-
ndbmgmd-1)...
2024-12-17T22:08:29Z INFO - deleting pod ndbmgmd-1 ...
persistentvolumeclaim "pvc-ndbmgmd-ndbmgmd-1" deleted
pod "ndbmgmd-1" deleted
2024-12-17T22:08:37Z INFO - Waiting for condition: is_pod ndbmgmd-1...
2024-12-17T22:08:37Z INFO - Condition occurred
2024-12-17T22:08:59Z INFO - Waiting for condition: is_pod_ready
ndbmgmd-1...
2024-12-17T22:08:59Z INFO - Condition occurred
2024-12-17T22:08:59Z INFO - kubectl -n occne-cndbtier get pod ndbmgmd-0
ndbmgmd-1
NAME        READY   STATUS    RESTARTS   AGE
ndbmgmd-0   2/2     Running   0          52s
ndbmgmd-1   2/2     Running   0          22s
2024-12-17T22:09:00Z INFO - kubectl -n occne-cndbtier get pvc pvc-ndbmgmd-
ndbmgmd-0 pvc-ndbmgmd-ndbmgmd-1
NAME                    STATUS
VOLUME                                     CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmgmd-ndbmgmd-0   Bound    pvc-9bb687b0-3bae-42d5-
a3f0-5cf0009cf246   3Gi        RWO            standard
<unset>                 53s
pvc-ndbmgmd-ndbmgmd-1   Bound    pvc-bc40c80c-39b1-4818-a1db-
ef204ff55c1f   3Gi        RWO            standard
<unset>                 23s
2024-12-17T22:09:00Z INFO - Pods restarted and their PVCs recreated.
2024-12-17T22:09:00Z INFO -
********************************************************************************
************************
2024-12-17T22:09:00Z INFO - END PHASE 4: Delete PVCs and restart pods or
wait for repl PV with new site to bound
2024-12-17T22:09:00Z INFO -
********************************************************************************
************************
2024-12-17T22:09:00Z INFO - Ended timer PHASE 4: 1734473340
2024-12-17T22:09:00Z INFO - PHASE 4 took: 00 hr. 01 min. 04 sec.
2024-12-17T22:09:00Z INFO - Started timer PHASE 5: 1734473340
2024-12-17T22:09:00Z INFO -
********************************************************************************
************************
2024-12-17T22:09:00Z INFO - BEGIN PHASE 5: Upgrade cnDBTier
2024-12-17T22:09:00Z INFO -
********************************************************************************
************************
2024-12-17T22:09:00Z INFO - Upgrading cnDBTier
(custom_values_scale_pvc.yaml)...
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED: Tue Dec 17 22:09:00 2024
```

```
NAMESPACE: occne-cndbtier
STATUS: deployed
REVISION: 16
2024-12-17T22:11:04Z INFO - Helm upgrade returned
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - END PHASE 5: Upgrade cnDBTier
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - Ended timer PHASE 5: 1734473464
2024-12-17T22:11:04Z INFO - PHASE 5 took: 00 hr. 02 min. 04 sec.
2024-12-17T22:11:04Z INFO - Started timer PHASE 6: 1734473464
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - BEGIN PHASE 6: Post-processing
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - CURRENT_PVCS:
NAME                                        STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmgmd-ndbmgmd-0                       Bound    pvc-b718e19d-
c90a-4b5d-8d92-5c6f528d3643   2Gi        RWO            standard
<unset>                 40m
pvc-ndbmgmd-ndbmgmd-1                       Bound    pvc-
f5de0e40-170e-4e34-9ee0-7166466554ff   2Gi        RWO
standard       <unset>                 40m
2024-12-17T22:11:04Z INFO - after_pvcs:
NAME                                        STATUS
VOLUME                                      CAPACITY   ACCESS MODES
STORAGECLASS   VOLUMEATTRIBUTESCLASS   AGE
pvc-ndbmgmd-ndbmgmd-0                       Bound
pvc-9bb687b0-3bae-42d5-a3f0-5cf0009cf246   3Gi        RWO
standard       <unset>                 2m57s
pvc-ndbmgmd-ndbmgmd-1                       Bound    pvc-
bc40c80c-39b1-4818-a1db-ef204ff55c1f   3Gi        RWO
standard       <unset>                 2m27s
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - END PHASE 6: Post-processing
2024-12-17T22:11:04Z INFO -
********************************************************************************
************************
2024-12-17T22:11:04Z INFO - Ended timer PHASE 6: 1734473464
2024-12-17T22:11:04Z INFO - PHASE 6 took: 00 hr. 00 min. 00 sec.
2024-12-17T22:11:04Z INFO - Ended timer dbtscale_vertical_pvc: 1734473464
2024-12-17T22:11:04Z INFO - dbtscale_vertical_pvc took: 00 hr. 03 min. 24
sec.
2024-12-17T22:11:04Z INFO - dbtscale_vertical_pvc completed successfully
```

7.4 Managing TLS

This section provides the procedures to enable TLS an modify cnDBTier certificates that are used to establish an encrypted connection for georeplication and for communication with NFs.

7.4.1 Managing TLS for Georeplication

This section provides the procedures to enable TLS for georeplication and modify cnDBTier certificates that are used to establish an encrypted connection between georeplication sites.

7.4.1.1 Enabling TLS for Georeplication

Perform the following steps to enable TLS for georeplication between cnDBTier sites.

1. Create all the required secrets using the "Creating Secret for TLS Certificates" procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
2. Enable TLS feature in the `custom_values.yaml` file:

```
global:
  tls:
    enable: true
```

3. Provide all the required certificates (such as, ca certificate, client certificate, and server certificate) for the respective `ndbmysqld` pods in the `custom_values.yaml` file:

```
tls:
  enable: true
  caCertificate: "<ca certificate file name>"
  tlsversion: "TLSv1.3"
  tlsMode: "<TLS mode>"
  ciphers:
    - TLS_AES_128_GCM_SHA256
    - TLS_AES_256_GCM_SHA384
    - TLS_CHACHA20_POLY1305_SHA256
    - TLS_AES_128_CCM_SHA256
  certificates:
    - name: ndbmysqld-0
      serverCertificate: "<server certificate name>"
      serverCertificateKey: "<server key name>"
      clientCertificate: "<client certificate name>"
      clientCertificateKey: "<client key name>"
    - name: ndbmysqld-1
      serverCertificate: "<server certificate name>"
      serverCertificateKey: "<server key name>"
      clientCertificate: "<client certificate name>"
      clientCertificateKey: "<client key name>"
```

For example:

```
tls:
  enable: true
```

```
caCertificate: "combine-ca.pem"
tlsversion: "TLSv1.3"
tlsMode: "VERIFY_CA"
ciphers:
  - TLS_AES_128_GCM_SHA256
  - TLS_AES_256_GCM_SHA384
  - TLS_CHACHA20_POLY1305_SHA256
  - TLS_AES_128_CCM_SHA256
certificates:
  - name: ndbmysqld-0
    serverCertificate: "server1-cert.pem"
    serverCertificateKey: "server1-key.pem"
    clientCertificate: "client1-cert.pem"
    clientCertificateKey: "client1-key.pem"
  - name: ndbmysqld-1
    serverCertificate: "server1-cert.pem"
    serverCertificateKey: "server1-key.pem"
    clientCertificate: "client1-cert.pem"
    clientCertificateKey: "client1-key.pem"
```

4. Follow the installation procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* to perform a Helm install with the updated `custom_values.yaml` file.

7.4.1.2 Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites

This section provides the procedure to modify cnDBTier certificates to establish an encrypted connection between georeplication sites using TLS.

> **Note**
>
> - If you update cnDBTier certificates in one site, ensure that you update the relevant Certificate Authority (CA) certificates in all the mate sites. This ensures that the new or switchover replication doesn't break due to incorrect certificates.
> - While recreating the secrets, ensure that the file names of the updated certificates are same as the old certificates.

1. Get the list of existing CA certificates of the cnDBTier cluster.

   > **Note**
   >
   > If the file name has a dot either in the extension or in its name, use an escape character \ before the dot.

```
$ kubectl get secret  cndbtier-trust-store-secret  -n
<cndbtier_namespace>  -o jsonpath="{.data.<ca_certificate_file_name>}" |
base64 --decode
```

For example:

```
$ kubectl get secret  cndbtier-trust-store-secret  -n occne-cndbtier -o
jsonpath="{.data.ca\.pem}" | base64 --decode
```

2. If you want to modify the secret of the existing CA certificates in the cnDBTier cluster, delete the secret using the following command. Otherwise, skip this step and move to Step 4.

   ```
   $ kubectl -n <namespace> delete secret cndbtier-trust-store-secret
   ```

   where, `<namespace>` is the name of the cnDBTier namespace.
   For example:

   ```
   $ kubectl -n occne-cndbtier delete secret cndbtier-trust-store-secret
   ```

3. If you deleted the secret of the existing CA certificates in the previous step, then create the `cndbtier-trust-store-secret` secret with the new CA certificates. For more information, see the "*Create Secret for TLS Certificates*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   ```
   $ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-trust-store-
   secret --from-file=<ca_certificate>
   ```

   For example:

   ```
   $ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-trust-store-
   secret --from-file=combine-ca.pem
   ```

4. Perform the following steps to get the existing server certificate and the server key of the cnDBTier cluster.

   > **Note**
   >
   > If the file names have dots either in the extension or in its name, use an escape character \ before the dots.

   a. Run the following command to get the server certificate:

      ```
      $ kubectl get secret  cndbtier-server-secret  -n <cndbtier_namespace>  -
      o jsonpath="{.data.<server_certificate_file_name>}" | base64 --decode
      ```

      For example:

      ```
      $ kubectl get secret  cndbtier-server-secret  -n occne-cndbtier -o
      jsonpath="{.data.server-cert\.pem}" | base64 --decode
      ```

b. Run the following command to get the server certificate key:

```
$ kubectl get secret  cndbtier-server-secret  -n <cndbtier_namespace>  -
o jsonpath="{.data.<server_certificate_key_file_name>}" | base64 --
decode
```

For example:

```
$ kubectl get secret  cndbtier-server-secret  -n occne-cndbtier -o
jsonpath="{.data.server-key\.pem}" | base64 --decode
```

5. If you want to modify the secret of the existing server certificate and server key secret, delete the secret using the following command. Otherwise, skip this step and move to Step 7.

```
$ kubectl -n <cndbtier_namespace> delete secret cndbtier-server-secret
```

For example:

```
$ kubectl -n occne-cndbtier delete secret cndbtier-server-secret
```

6. If you deleted the secret of the existing server certificate and server key in the previous step, then create the `cndbtier-server-secret` secret with the new server certificate and server key. For more information, see the "*Creating Secrets for TLS Certificates*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-server-
secret --from-file=<server_certificate> --from-
file=<server_certificate_key>
```

For example:

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-server-
secret --from-file=server-cert.pem --from-file=server-key.pem
```

7. [Optional] Perform the following steps to get the existing client certificate and client key of the cnDBTier cluster. You can skip this step if you know the list of certificates.

> **Note**
>
> If the file names have dots either in the extension or in its name, use an escape character \ before the dots.

a. Run the following command to get the client certificate:

```
$ kubectl get secret  cndbtier-client-secret  -n <cndbtier_namespace>  -
o jsonpath="{.data.<client_certificate_file_name>}" | base64 --decode
```

For example:

```
$ kubectl get secret  cndbtier-client-secret  -n occne-cndbtier -o
jsonpath="{.data.client-cert\.pem}" | base64 --decode
```

b. Run the following command to get the client certificate key:

```
$ kubectl get secret  cndbtier-client-secret  -n <cndbtier_namespace>  -
o jsonpath="{.data.<client_certificate_key_file_name>}" | base64 --
decode
```

For example:

```
$ kubectl get secret  cndbtier-client-secret  -n occne-cndbtier -o
jsonpath="{.data.client-key\.pem}" | base64 --decode
```

8. If you want to modify the secret of the existing client certificate and client key secret, delete the secret using the following command. Otherwise, skip this step and move to Step 10.

```
$ kubectl -n <cndbtier_namespace> delete secret cndbtier-client-secret
```

For example:

```
$ kubectl -n occne-cndbtier delete secret cndbtier-client-secret
```

9. If you deleted the secret of the existing client certificate and client key in the previous step, then create the `cndbtier-client-secret` secret with the new client certificate and client key. For more information, see the "*Creating Secrets for TLS Certificates*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-client-
secret --from-file=<client_certificate> --from-
file=<client_certificate_key>
```

For example:

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-client-
secret --from-file=client-cert.pem --from-file=client-key.pem
```

10. If you modified the CA certificates in the current site, then you must update the certificates in other sites too. Perform Steps 1 through 9 to modify the relevant certificates on all the mate sites.
11. Wait for the new certificates of the recreated secret to be automatically mounted to the replication SQL pods by the Kubernetes API server.

> **Note**
>
> This could take around 30 seconds. However, the wait time depends on the Kubernetes configuration and varies from environment to environment.

12. Perform the following steps to reload the TLS context on each replication SQL pod in the cnDBTier cluster:

    a. Check the number of replication SQL pods present in the cnDBTier cluster:

    ```
    $ kubectl get pods --namespace=<namespace of cnDBTier cluster> | grep
    ndbmysql
    ```

    For example:

    ```
    $ kubectl get pods --namespace=occne-cndbtier | grep ndbmysql
    ```

    Sample output:

    ```
    ndbmysqld-0                                                       3/3
    Running   0          103m
    ndbmysqld-1                                                       3/3
    Running   0          4h39m
    ndbmysqld-2                                                       3/3
    Running   0          4h37m
    ndbmysqld-3                                                       3/3
    Running   0          4h36m
    ndbmysqld-4                                                       3/3
    Running   0          4h34m
    ndbmysqld-5                                                       3/3
    Running   0          4h32m
    ```

    b. Reload the TLS context on each replication SQL pod:

    ```
    $ kubectl exec -it <replication SQL pod> --namespace=<namespace of
    cnDBTier cluster> -- mysql -h127.0.0.1 -uroot -p<root password> -e
    "ALTER INSTANCE RELOAD TLS;"
    ```

    For example:

    - Run the following command to reload the TLS context on ndbmysqld-0:

      ```
      $ kubectl exec -it ndbmysqld-0 --namespace=occne-cndbtier -- mysql -
      h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
      ```

      Sample output:

      ```
      Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
      sidecar, db-infra-monitor-svc
      mysql: [Warning] Using a password on the command line interface can
      be insecure.
      ```

    - Run the following command to reload the TLS context on ndbmysqld-1:

      ```
      $ kubectl exec -it ndbmysqld-1 --namespace=occne-cndbtier -- mysql -
      h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
      ```

Sample output:

```
Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
sidecar, db-infra-monitor-svc
mysql: [Warning] Using a password on the command line interface can
be insecure.
```

- Run the following command to reload the TLS context on ndbmysqld-2:

  ```
  $ kubectl exec -it ndbmysqld-2 --namespace=occne-cndbtier -- mysql -
  h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  mysql: [Warning] Using a password on the command line interface can
  be insecure.
  ```

- Run the following command to reload the TLS context on ndbmysqld-3:

  ```
  $ kubectl exec -it ndbmysqld-3 --namespace=occne-cndbtier -- mysql -
  h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  mysql: [Warning] Using a password on the command line interface can
  be insecure.
  ```

- Run the following command to reload the TLS context on ndbmysqld-4:

  ```
  $ kubectl exec -it ndbmysqld-4 --namespace=occne-cndbtier -- mysql -
  h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  mysql: [Warning] Using a password on the command line interface can
  be insecure.
  ```

- Run the following command to reload the TLS context on ndbmysqld-5:

  ```
  $ kubectl exec -it ndbmysqld-5 --namespace=occne-cndbtier -- mysql -
  h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  ```

```
mysql: [Warning] Using a password on the command line interface can
be insecure.
```

13. Repeat Step 12 on all the mate sites where you have updated the certificates.
14. Perform the following steps to run a rollout restart of the ndbmysqld pods in the cnDBTier cluster:
    a. Run the following command to get the statefulset name of the ndbmysqld pod:

    ```
    $ kubectl get statefulset --namespace=<namespace of cnDBTier cluster>
    ```

    For example:

    ```
    $ kubectl get statefulset --namespace=occne-cndbtier
    ```

    Sample output:

    ```
    NAME           READY   AGE
    ndbappmysqld   2/2     27h
    ndbmgmd        2/2     27h
    ndbmtd         2/2     27h
    ndbmysqld      2/2     27h
    ```

    b. Perform a rollout restart of the ndbmsqld pod:

    ```
    $ kubectl rollout restart statefulset <statefulset name of ndbmysqld> --
    namespace=<namespace of cnDBTier cluster>
    ```

    For example:

    ```
    $ kubectl rollout restart statefulset ndbmysqld  --namespace=occne-
    cndbtier
    ```

    Sample output:

    ```
    statefulset.apps/ndbmysqld restarted
    ```

    c. Wait for the rollout restart of the ndbmysqld pod to complete and check the status:

    ```
    $ kubectl rollout status statefulset <statefulset name of ndbmysqld> --
    namespace=<namespace of cnDBTier cluster>
    ```

    For example:

    ```
    $ kubectl rollout status statefulset ndbmysqld  --namespace=occne-
    cndbtier
    ```

    Sample output:

    ```
    Waiting for 1 pods to be ready...
    waiting for statefulset rolling update to complete 1 pods at revision
    ndbmysqld-7c6b9c9f84...
    ```

```
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
statefulset rolling update complete 2 pods at revision
ndbmysqld-7c6b9c9f84...
```

15. Repeat Step 14 on all the mate sites where you have updated the certificates.

7.4.2 Managing TLS for Communication with NFs

This section provides the procedures to enable TLS for communication with NFs and modify cnDBTier certificates that are used to establish a TLS connection between cnDBTier and NFs.

7.4.2.1 Enabling TLS for Communication with NFs

Perform the following steps to enable TLS for communication between cnDBTier and NFs.

1. Create all the required secrets using the "Creating Secret for TLS Certificates" procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
2. Set the `global/ndbappTLS/enable` parameter to *true* in the `custom_values.yaml` file to enable the TLS feature for NF communication:

   ```
   global:
     ndbappTLS:
       enable: true
   ```

3. Provide all the required certificates (such as, ca certificate, client certificate, and server certificate) for the application SQL pods in the `custom_values.yaml` file for the cnDBTier site:

   ```
   ndbappTLS:
     enable: true
     caSecret: cndbtier-ndbapp-trust-store-secret
     serverSecret: cndbtier-ndbapp-server-secret
     tlsversion: "TLSv1.3"
     caCertificate: "<ca certificate file name>"
     serverCertificate: "<server certificate name>"
     serverCertificateKey: "<server key name>"
   ```

   For example:

   ```
   ndbappTLS:
     enable: true
     caSecret: cndbtier-ndbapp-trust-store-secret
     serverSecret: cndbtier-ndbapp-server-secret
     tlsversion: "TLSv1.3"
     caCertificate: "combine-ca.pem"
     serverCertificate: "server1-cert.pem"
     serverCertificateKey: "server1-key.pem"
   ```

4. Follow the installation procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* to perform a Helm install with the updated `custom_values.yaml` file.

7.4.2.2 Modifying cnDBTier Certificates to Establish TLS for Communication with NFs

This section provides the procedure to modify cnDBTier certificates to establish an encrypted connection between cnDBTier and NFs using TLS.

> **Note**
>
> - If you update the cnDBTier certificates, ensure that you update the relevant Certificate Authority (CA) certificates on all relevant NFs. This ensures that NF traffic to cnDBTier is not disrupted due to incorrect certificates.
> - While recreating the secrets, ensure that the file names of the updated certificates are same as the old certificates.

1. Get the list of the existing CA certificates that are configured for the application SQL pod of the cnDBTier cluster:

   > **Note**
   >
   > If the file name has a dot either in the extension or in its name, use an escape character \ before the dot.

   ```
   $ kubectl get secret cndbtier-ndbapp-trust-store-secret  -n
   <cndbtier_namespace>  -o jsonpath="{.data.<ca_certificate_file_name>}" |
   base64 --decode
   ```

   For example:

   ```
   $ kubectl get secret cndbtier-ndbapp-trust-store-secret  -n occne-cndbtier
   -o jsonpath="{.data.ca\.pem}" | base64 --decode
   ```

2. If you want to modify the secret of the existing CA certificates in the cnDBTier cluster, delete the existing CA certificate(s) secret configured for the application SQL pod. Otherwise, skip this step and move to Step 4.

   ```
   $ kubectl -n <namespace> delete secret cndbtier-ndbapp-trust-store-secret
   ```

   where, `<namespace>` is the name of the cnDBTier namespace.
   For example:

   ```
   $ kubectl -n occne-cndbtier delete secret cndbtier-ndbapp-trust-store-
   secret
   ```

3. If you deleted the secret of the existing CA certificates in the previous step, then create the `cndbtier-ndbapp-trust-store-secret` secret with the new CA certificates. For more

information, see the "*Create Secret for TLS Certificates*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-ndbapp-
trust-store-secret --from-file=<ca_certificate>
```

For example:

```
$ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-ndbapp-
trust-store-secret --from-file=combine-ca.pem
```

4. Perform the following steps to get the existing server certificate and the server key of the cnDBTier cluster.

   > **Note**
   >
   > If the file names have dots either in the extension or in its name, use an escape character \ before the dots.

   a. Run the following command to get the server certificate:

      ```
      $ kubectl get secret  cndbtier-ndbapp-server-secret  -n
      <cndbtier_namespace>  -o
      jsonpath="{.data.<server_certificate_file_name>}" | base64 --decode
      ```

      For example:

      ```
      $ kubectl get secret  cndbtier-ndbapp-server-secret  -n occne-cndbtier -
      o jsonpath="{.data.server-cert\.pem}" | base64 --decode
      ```

   b. Run the following command to get the server certificate key:

      ```
      $ kubectl get secret  cndbtier-ndbapp-server-secret  -n
      <cndbtier_namespace>  -o
      jsonpath="{.data.<server_certificate_key_file_name>}" | base64 --decode
      ```

      For example:

      ```
      $ kubectl get secret  cndbtier-ndbapp-server-secret  -n occne-cndbtier -
      o jsonpath="{.data.server-key\.pem}" | base64 --decode
      ```

5. If you want to modify the secret of the existing server certificate and server key secret, delete the secret using the following command. Otherwise, skip this step and move to Step 7.

   ```
   $ kubectl -n <cndbtier_namespace> delete secret cndbtier-ndbapp-server-
   secret
   ```

   For example:

   ```
   $ kubectl -n occne-cndbtier delete secret cndbtier-ndbapp-server-secret
   ```

6. If you deleted the secret of the existing server certificate and server key in the previous step, then create the `cndbtier-ndbapp-server-secret` secret with the new server certificate and server key. For more information, see the "*Creating Secrets for TLS Certificates*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   ```
   $ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-ndbapp-
   server-secret --from-file=<server_certificate> --from-
   file=<server_certificate_key>
   ```

   For example:

   ```
   $ kubectl -n ${OCCNE_NAMESPACE} create secret generic cndbtier-ndbapp-
   server-secret --from-file=server-cert.pem --from-file=server-key.pem
   ```

7. If you modified the CA certificates in the current site, then you must update the certificates in other NFs too. Perform Steps 1 through 6 to modify the relevant certificates on all relevant NFs.
8. Wait for the new certificates of the recreated secret to be automatically mounted to the application SQL pods by the Kubernetes API server.

   > **Note**
   >
   > This could take around 30 seconds. However, the wait time depends on the Kubernetes configuration and varies from environment to environment.

9. Perform the following steps to reload the TLS context on each application SQL pod in the cnDBTier cluster:
   a. Check the number of application SQL pods present in the cnDBTier cluster:

      ```
      $ kubectl get pods --namespace=<namespace of cnDBTier cluster> | grep
      ndbappmysql
      ```

      For example:

      ```
      $ kubectl get pods --namespace=occne-cndbtier | grep ndbmysql
      ```

      Sample output:

      ```
      ndbappmysqld-0
      3/3     Running   0          103m
      ndbappmysqld-1
      3/3     Running   0          4h39m
      ```

   b. Reload the TLS context on each application SQL pod:

      ```
      $ kubectl exec -it <APP SQL pod> --namespace=<namespace of cnDBTier
      cluster> -- mysql -h127.0.0.1 -uroot -p<root password> -e "ALTER
      INSTANCE RELOAD TLS;"
      ```

      For example:

- Run the following command to reload the TLS context on ndbappmysqld-0:

  ```
  $ kubectl exec -it ndbappmysqld-0 --namespace=occne-cndbtier --
  mysql -h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD
  TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  mysql: [Warning] Using a password on the command line interface can
  be insecure.
  ```

- Run the following command to reload the TLS context on ndbappmysqld-1:

  ```
  $ kubectl exec -it ndbappmysqld-1 --namespace=occne-cndbtier --
  mysql -h127.0.0.1 -uroot -pNextGenCne -e "ALTER INSTANCE RELOAD
  TLS;"
  ```

  Sample output:

  ```
  Defaulted container "mysqlndbcluster" out of: mysqlndbcluster, init-
  sidecar, db-infra-monitor-svc
  mysql: [Warning] Using a password on the command line interface can
  be insecure.
  ```

10. Perform the following steps to run a rollout restart of the ndbappmysqld pods in the cnDBTier cluster:
    a. Run the following command to get the statefulset name of the ndbappmysqld pod:

       ```
       $ kubectl get statefulset --namespace=<namespace of cnDBTier cluster>
       ```

       For example:

       ```
       $ kubectl get statefulset --namespace=occne-cndbtier
       ```

       Sample output:

       ```
       NAME           READY   AGE
       ndbappmysqld   2/2     27h
       ndbmgmd        2/2     27h
       ndbmtd         2/2     27h
       ndbmysqld      2/2     27h
       ```

    b. Perform a rollout restart of the ndbappmysqld pod:

       ```
       $ kubectl rollout restart statefulset <statefulset name of
       ndbappmysqld> --namespace=<namespace of cnDBTier cluster>
       ```

For example:

```
$ kubectl rollout restart statefulset ndbappmysqld  --namespace=occne-
cndbtier
```

Sample output:

```
statefulset.apps/ndbappmysqld restarted
```

c. Wait for the rollout restart of the ndbappmysqld pod to complete and check the status:

```
$ kubectl rollout status statefulset <statefulset name of ndbappmysqld>
--namespace=<namespace of cnDBTier cluster>
```

For example:

```
$ kubectl rollout status statefulset ndbappmysqld  --namespace=occne-
cndbtier
```

Sample output:

```
Waiting for 1 pods to be ready...
waiting for statefulset rolling update to complete 1 pods at revision
ndbappmysqld-7c6b9c9f84...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
statefulset rolling update complete 2 pods at revision
ndbappmysqld-7c6b9c9f84...
```

7.5 Adding a Georedundant cnDBTier Cluster

This section describes the procedures to add a cnDBTier georedundant cluster to an existing single site, two site, and three site georedundant cnDBTier clusters.

> **Note**
>
> - If the existing Georedundant cnDBTier cluster is configured with single replication channel, then the new cnDBTier cluster being added by following this procedure must also be configured with a single replication channel.
> - If the existing Georedundant cnDBTier cluster is configured with multiple replication channels, then the new cnDBTier cluster being added by following this procedure must also be configured with multiple replication channel groups.

The procedures in this section use the following terms to identify the clusters:

1. cnDBTier Cluster1 (a.k.a. cluster1): The first cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.
2. cnDBTier Cluster2 (a.k.a. cluster2): The second cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.

3. cnDBTier Cluster3 (a.k.a. cluster3): The third cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.
4. cnDBTier Cluster4 (a.k.a. cluster4): The fourth cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.

Prerequisites

1. All the cnDBTier data nodes and SQL nodes that participate in georeplication, and at least one management node in the existing clusters must be up and running.
2. Georeplication must be established between the existing cnDBTier clusters.
3. All the cnDBTier clusters must be installed using cnDBTier 22.1.x or above.
4. All the cnDBTier clusters must have the same number of data nodes and node groups.

7.5.1 Adding cnDBTier Georedundant Cluster to Single Site cnDBTier Cluster

This section describes the procedure to add a cnDBTier georedundant cluster (cnDBTier cluster2) to an existing single site cnDBTier cluster (cnDBTier cluster1).

1. If TLS was configured on cnDBTier cluster1, then follow the Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites procedure to update the certificates in cnDBTier cluster1.

   > **Note**
   >
   > Perform this step on cnDBTier cluster1 only if you want to reconfigure the CA certificates for the new cnDBTier cluster.

2. Check if georeplication is enabled in cnDBTier cluster1 by performing the following steps:

   > **Note**
   >
   > The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster1 for every replication group.

   a. Ensure that the DB replication service in cnDBTier cluster1 is enabled and running successfully with respect to cnDBTier cluster2.

      ```
      $ kubectl -n cluster1 get pods | grep repl
      ```

      Sample output:

      ```
      mysql-cluster-cluster1-cluster2-replication-svc-5bdc46crzzhb   1/1     Running
      0          3m11s
      ```

   b. Ensure that at least two georeplication SQL nodes are configured in cluster1.

      ```
      $ kubectl -n cluster1 get pods | grep ndbmysqld
      ```

      Sample output:

```
ndbmysqld-0                    3/3     Running   0          4m14s
ndbmysqld-1                    3/3     Running   0          3m53s
```

c. Check the status of cnDBTier cluster1.

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   8 node(s)
id=56   @10.233.114.34   (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91    (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93    (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - If cluster1 satisfies all the conditions in Step 1, then georeplication is enabled in cnDBTier cluster1. Otherwise, georeplication is not enabled in cluster1.
> - The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes. This note is applicable to all similar outputs in this procedure.

3. If georeplication is not enabled in cluster1 as per Step 1, then perform the following steps to enable georeplication in cluster1. Else, skip to Step 3.

> **Note**
>
> - This step is not used to enable Multi Replication Channel Group on the existing cnDBTier cluster1. Multi replication channel groups with the required number of channel groups must be already configured on cnDBTier cluster1.
> - Do not run a Helm test when performing a conversion procedure.

a. Configure the remote mate site name (cluster2) in cnDBTier cluster1 by enabling and configuring the replication service using the `custom_values.yaml` file.

Example:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
dbreplsvcdeployments:
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cluster1-cluster2-replication-svc
      enabled: true
      .....
      .....
      .....
      replication:
        # Local site replication service LoadBalancer ip can be configured.
        localsiteip: ""
        matesitename: "cluster2"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster1 to at least two in the `custom_values.yaml` file.

   Example with output:

   ```
   $ vi occndbtier/custom_values.yaml
   apiReplicaCount: 2
   ```

c. Upgrade cnDBTier cluster1 by using the CSAR package.

   ```
   $ helm upgrade mysql-cluster occndbtier --namespace cluster1 -f
   occndbtier/custom_values.yaml
   ```

   Sample output:

   ```
   Release "mysql-cluster" has been upgraded. Happy Helming!
   NAME: mysql-cluster
   LAST DEPLOYED:  Mon May 20 11:10:32 2025
   NAMESPACE: cluster1
   STATUS: deployed
   REVISION: 2
   ```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 1 are restarted. Verify the status of the cluster by performing the following steps:

   i. Check the status of pods running cluster1:

      ```
      $ kubectl get pods --namespace=cluster1
      ```

      Sample output:

      ```
      NAME
      READY   STATUS    RESTARTS       AGE
      mysql-cluster-cluster1-cluster2-replication-svc-7676cc7bd62zssl
      1/1     Running   0              153m
      mysql-cluster-db-backup-manager-svc-c77df67b7-tqnd2
      1/1     Running   0              153m
      mysql-cluster-db-monitor-svc-69ff969477-646tz
      ```

```
1/1     Running   0             147m
ndbappmysqld-0
2/2     Running   0             148m
ndbappmysqld-1
2/2     Running   0             147m
ndbmgmd-0
1/1     Running   0             152m
ndbmgmd-1
1/1     Running   0             152m
ndbmtd-0
2/2     Running   0             150m
ndbmtd-1
2/2     Running   0             151m
ndbmysqld-0
2/2     Running   0             147m
ndbmysqld-1
2/2     Running   0             147m
```

ii. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster
Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   8 node(s)
id=56   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91  (mysql-8.4.3 ndb-88.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

4. Install cnDBTier cluster2 by configuring cnDBTier cluster1 as mate site with at least two SQL pods. For information on installing a cnDBTier cluster, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> - If multiple replication channel groups are enabled, then install cnDBTier cluster2 by configuring cnDBTier cluster1 as mate site with at least four SQL pods.
> - Do not run a Helm test when performing the conversion procedure.
> - If you are going to enable encryption, ensure that the new site uses the same encryption key.

5. Check if the georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster2 by running the following commands:

   > **Note**
   >
   > The following commands and examples are applicable for a single replication channel group only. If multi replication channel groups are enabled, then check if the georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster2 for every replication channel group.

   ```
   $ kubectl -n cluster1 exec -it ndbmysqld-0 -- bash
   $ mysql -h 127.0.0.1 -uroot -p
   Password:
   mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
   ```

   Sample output:

   ```
   +-----------------+-----------------+------------+--------------------+---------
   +-------------+-----------+-----------+--------------------+----------------------+
   | remote_site_name | remote_server_id | channel_id | remote_signaling_ip | role    |
   start_epoch  | site_name | server_id | start_ts            | replchannel_group_id |
   +-----------------+-----------------+------------+--------------------+---------
   +-------------+-----------+-----------+--------------------+----------------------+
   | cluster1         |             1000 |    2005601 | 10.233.51.94        | ACTIVE
   |         NULL | cluster2  |      2000 | 2024-02-19 19:10:45 |                    1 |
   | cluster1         |             1001 |    2005702 | 10.233.10.190       | STANDBY
   |         NULL | cluster2  |      2001 | 2024-02-19 19:10:44 |                    1 |
   | cluster2         |             2000 |    2005601 | 10.233.8.24         | ACTIVE
   |         NULL | cluster1  |      1000 | 2024-02-19 19:10:44 |                    1 |
   | cluster2         |             2001 |    2005702 | 10.233.61.239       | STANDBY
   |         NULL | cluster1  |      1001 | 2024-02-19 19:10:45 |                    1 |
   +-----------------+-----------------+------------+--------------------+---------
   +-------------+-----------+-----------+--------------------+----------------------+

   4 rows in set (0.01 sec)
   ```

6. Restore the cnDBTier cluster1 data in cnDBTier cluster2 and reestablish the georeplication channels by performing the fault recovery procedure. You can perform the georeplication recovery using cnDBtier or CNC Console. For more information, see the *Georeplication Failure Between cnDBTier Clusters in Two Site Replication* section of *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
7. Verify the replication status in cnDBTier cluster1 and cnDBTier cluster2 by performing the following steps:

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then verify the replication status in cnDBTier cluster1 and cnDBTier cluster2 for every replication group.

a. Log in to the cnDBTier cluster1 Bastion Host and check the replication status in the active replication channel:

```
$ kubectl -n cluster1 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+-------------+-----------+-----------+--------------------
+----------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch  | site_name | server_id | start_ts            |
replchannel_group_id |
+-----------------+-----------------+-----------+--------------------
+---------+-------------+-----------+-----------+--------------------
+----------------------+
| cluster1         |             1000 |    2005601 | 10.233.51.94        |
ACTIVE  |         NULL | cluster2  |      2000 | 2024-02-19 19:10:45
|                    1 |
| cluster1         |             1001 |    2005702 | 10.233.10.190       |
STANDBY |         NULL | cluster2  |      2001 | 2024-02-19 19:10:44
|                    1 |
| cluster2         |             2000 |    2005601 | 10.233.8.24         |
ACTIVE  |         NULL | cluster1  |      1000 | 2024-02-19 19:10:44
|                    1 |
| cluster2         |             2001 |    2005702 | 10.233.61.239       |
STANDBY |         NULL | cluster1  |      1001 | 2024-02-19 19:10:45
|                    1 |
+-----------------+-----------------+-----------+--------------------
+---------+-------------+-----------+-----------+--------------------
+----------------------+
4 rows in set (0.01 sec)
```

b. Check if the replication is turned on (that is, `Replica_IO_Running` and `Replica_SQL_Running` are set to `Yes`) in the ACTIVE replication channel. Example to check cluster 1:

```
$ kubectl -n cluster1 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
```

Sample output:

```
Password:
mysql> SHOW REPLICA STATUS\G;
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.0.147
                  Source_User: occnerepluser
```

```
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 16442
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for more
updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

Example to check cluster 2:

```
$ kubectl -n cluster1 exec -it ndbmysqld-1 -- bash
$ mysql -h 127.0.0.1 -uroot -p
```

Sample output:

```
Password:
mysql> SHOW REPLICA STATUS\G;
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.9.35
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 26970
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

c. Log in to the cnDBTier cluster2 Bastion Host and check the replication status in the active replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------
+----------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch  | site_name | server_id | start_ts            |
replchannel_group_id |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------
```

```
+---------------------+
| cluster1         |             1000 |    2005601 | 10.233.51.94        |
ACTIVE  |         NULL | cluster2  |      2000 | 2024-02-19 19:10:45
|                   1 |
| cluster1         |             1001 |    2005702 | 10.233.10.190       |
STANDBY |         NULL | cluster2  |      2001 | 2024-02-19 19:10:44
|                   1 |
| cluster2         |             2000 |    2005601 | 10.233.8.24         |
ACTIVE  |         NULL | cluster1  |      1000 | 2024-02-19 19:10:44
|                   1 |
| cluster2         |             2001 |    2005702 | 10.233.61.239       |
STANDBY |         NULL | cluster1  |      1001 | 2024-02-19 19:10:45
|                   1 |
+-----------------+-----------------+-----------+--------------------
+---------+-------------+-----------+-----------+--------------------
+---------------------+
4 rows in set (0.00 sec)
```

d. Check if the replication is turned on (that is, `Replica_IO_Running` and `Replica_SQL_Running` are set to `Yes`) in the ACTIVE replication channel. Example for ndbmysqld-0:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.13.41
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 32792
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 17215
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for more
updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

Example for ndbmysqld-1:

```
$ kubectl -n cluster2 exec -it ndbmysqld-1 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
            Replica_IO_State:
                 Source_Host: 10.233.39.110
                 Source_User: occnerepluser
                 Source_Port: 3306
               Connect_Retry: 60
             Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 9785
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

> **Note**
>
> As data is replicated to cnDBTier cluster2 and georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster2, the newly added cnDBTier cluster (cluster2) can also be used by the NFs for database operations.

7.5.2 Adding cnDBTier Georedundant Cluster to Two-Site cnDBTier Clusters

This section describes the procedure to add a cnDBTier georedundant cluster (cnDBTier cluster3) to the existing two-site georedundant cnDBTier clusters (cnDBTier cluster1 and cnDBTier cluster2).

1. If TLS was configured on cnDBTier cluster1 and cluster 2, then follow the Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites procedure to update the certificates in cnDBTier cluster1 and cluster 2.

   > **Note**
   >
   > Perform this step on those cnDBTier clusters on which you want to reconfigure the CA certificates for the new cnDBTier cluster.

2. Check if georeplication is enabled in cnDBTier cluster1 with respect to cnDBTier cluster3 by performing the following steps:

   > **Note**
   >
   > The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster1 for every replication group with respect to cnDBTier cluster3.

   a. Ensure that the DB replication service in cnDBTier cluster1 is enabled and running successfully with respect to cnDBTier cluster3:

      ```
      $ kubectl -n cluster1 get pods | grep repl
      ```

Sample output:

```
mysql-cluster-cluster1-cluster2-replication-svc-5bdc46crzzhb   1/1     Running
0          3m11s
mysql-cluster-cluster1-cluster3-replication-svc-7955b6b6fbdc   1/1     Running
2          3m09s
```

b. Ensure that at least four georeplication SQL nodes are configured in cluster1:

```
$ kubectl -n cluster1 get pods | grep ndbmysqld
```

Sample output:

```
ndbmysqld-0                                                       3/3
Running   0          4m14s
ndbmysqld-1                                                       3/3
Running   0          3m53s
ndbmysqld-2                                                       3/3
Running   0          3m21s
ndbmysqld-3                                                       3/3
Running   0          3m01s
```

c. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

Note

- The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes.
- If cluster1 satisfies all the conditions in Step 1, then georeplication is enabled in cnDBTier cluster1. Otherwise, georeplication is not enabled.

3. If georeplication is not enabled in cluster1 as per Step 1, then perform the following steps to enable georeplication in cnDBTier cluster1 with respect to cnDBTier cluster3. Else, skip to Step 3.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then configure remote mate site name (cluster3) in cnDBTier cluster1 by following the *Configuring Multiple Replication channel groups* procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* and skip steps a and b in the following substeps.

a. Configure the remote mate site name (cluster3) in cnDBTier cluster1 by enabling and configuring the replication service using the `custom_values.yaml` file:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
 dbreplsvcdeployments:
    ....
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cluster1-cluster3-replication-svc
      enabled: true
      mysql:
        dbtierservice: "mysql-connectivity-service"
        dbtierreplservice: "ndbmysqldsvc"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-2 LoadBalancer
service
        primaryhost: "ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-
dbtier"
        port: "3306"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-2 LoadBalancer
service
        primarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        primaryhostserverid: "1002"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-3 LoadBalancer
service
        secondaryhost: "ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-
dbtier"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-3 LoadBalancer
service
        secondarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        secondaryhostserverid: "1003"
      replication:
        # Local site replication service LoadBalancer ip can be
configured.
        localsiteip: ""
        matesitename: "cluster3"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster1 to at least four in the `custom_values.yaml` file:

> **Note**
>
> `apiReplicaCount` is set to "4" as you are adding the third site. The first two ndbmysqld are used for replication between site one and site two only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site3.

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
apiReplicaCount: 4
```

c. Upgrade cnDBTier cluster1 by using the CSAR package. For more information, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then upgrade cnDBTier cluster2 by providing appropriate multi-group values file.

```
$ helm upgrade mysql-cluster occndbtier --namespace cluster1 --no-hooks
-f occndbtier/custom_values.yaml
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 11:10:32 2025
NAMESPACE: cluster1
STATUS: deployed
REVISION: 2
```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 1 are restarted. Verify the status of the cluster by performing the following steps:

i. Check the status of pods running cluster1:

```
$ kubectl get pods --namespace=cluster1
```

Sample output:

```
NAME
READY   STATUS    RESTARTS       AGE
mysql-cluster-cluster1-cluster2-replication-svc-7676cc7bd62zssl
1/1     Running   0              153m
mysql-cluster-db-backup-manager-svc-c77df67b7-tqnd2
1/1     Running   0              153m
mysql-cluster-db-monitor-svc-69ff969477-646tz
1/1     Running   0              147m
ndbappmysqld-0
```

```
2/2     Running   0             148m
ndbappmysqld-1
2/2     Running   0             147m
ndbmgmd-0
1/1     Running   0             152m
ndbmgmd-1
1/1     Running   0             152m
ndbmtd-0
2/2     Running   0             150m
ndbmtd-1
2/2     Running   0             151m
ndbmysqld-0
2/2     Running   0             147m
ndbmysqld-1
2/2     Running   0             147m
```

ii. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster
Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   8 node(s)
id=56   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

4. Check if georeplication is enabled in cnDBTier cluster2 with respect to cnDBTier cluster3 by performing the following steps:

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster2 for every replication group with respect to cnDBTier cluster3.

a. Ensure that the DB replication service in cnDBTier cluster2 is enabled and running successfully with respect to cnDBTier cluster3:

```
$ kubectl -n cluster2 get pods | grep repl
```

Sample output:

```
mysql-cluster-cluster2-cluster1-replication-svc-5bdc46crzzhb   1/1     Running
0          3m11s
mysql-cluster-cluster2-cluster3-replication-svc-7955b6b6fbdc   1/1     Running
2          3m39s
```

b. Ensure that at least four georeplication SQL nodes are configured in cluster2:

```
$ kubectl -n cluster2 get pods | grep ndbmysqld
```

Sample output:

```
ndbmysqld-0                                                    3/3
Running   0          4m14s
ndbmysqld-1                                                    3/3
Running   0          3m53s
ndbmysqld-2                                                    3/3
Running   0          3m21s
ndbmysqld-3                                                    3/3
Running   0          3m01s
```

c. Check the status of cnDBTier cluster2:

```
$ kubectl -n cluster2 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
```

```
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - If cluster2 satisfies all the conditions in Step 3, then georeplication is enabled in cnDBTier cluster2. Otherwise, georeplication is not enabled in cluster2.
> - The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes.

5. If georeplication is not enabled in cluster2 as per Step 3, then perform the following steps to enable georeplication in cluster2 with respect to cluster3. Else, skip to Step 5.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then configure remote mate site name (cluster3) in cnDBTier cluster2 by following the *Configuring Multiple Replication channel groups* procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* and skip steps a and b in the following substeps.

a. Configure the remote mate site name (cluster3) in cnDBTier cluster2 by enabling and configuring the replication service using the `custom_values.yaml` file:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
 dbreplsvcdeployments:
    ....
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cluster2-cluster3-replication-svc
      enabled: true
      mysql:
        dbtierservice: "mysql-connectivity-service"
        dbtierreplservice: "ndbmysqldsvc"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-2 LoadBalancer
service
        primaryhost: "ndbmysqld-2.ndbmysqldsvc.cluster2.svc.occne4-cgbu-cne-
dbtier"
        port: "3306"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-2 LoadBalancer
service
        primarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        primaryhostserverid: "2002"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-3 LoadBalancer
service
        secondaryhost: "ndbmysqld-3.ndbmysqldsvc.cluster2.svc.occne4-cgbu-cne-
dbtier"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-3 LoadBalancer
```

```
service
        secondarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        secondaryhostserverid: "2003"
      replication:
        # Local site replication service LoadBalancer ip can be configured.
        localsiteip: ""
        matesitename: "cluster3"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster2 to at least four in the `custom_values.yaml` file:

> **Note**
>
> `apiReplicaCount` is set to "4" as you are adding the third site. The first two ndbmysqld are used for replication between site one and site two only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site3.

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
apiReplicaCount: 4
```

c. Upgrade cnDBTier cluster2 by using the CSAR package. For more information, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then upgrade cnDBTier cluster2 by providing appropriate multi-group values file.

```
$ helm upgrade mysql-cluster occndbtier --namespace cluster2 --no-hooks
-f occndbtier/custom_values.yaml
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 11:10:32 2025
NAMESPACE: cluster2
STATUS: deployed
REVISION: 2
```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 2 are restarted. Verify the status of the cluster by performing the following steps:

i. Check the status of pods running cluster2:

```
$ kubectl get pods --namespace=cluster2
```

Sample output:

```
NAME
READY   STATUS    RESTARTS       AGE
mysql-cluster-cluster2-cluster1-replication-svc-578c6578c85d2z5
1/1     Running   0              3m
mysql-cluster-cluster2-cluster3-replication-svc-578c6578c8kpzpv
1/1     Running   0              3m
mysql-cluster-db-backup-manager-svc-688f7cf97d-dxjdt
1/1     Running   0              148m
mysql-cluster-db-monitor-svc-7cdb4f4dd4-l6t87
1/1     Running   0              148m
ndbappmysqld-0
2/2     Running   0              148m
ndbappmysqld-1
2/2     Running   0              147m
ndbmgmd-0
1/1     Running   0              152m
ndbmgmd-1
1/1     Running   0              152m
ndbmtd-0
2/2     Running   0              150m
ndbmtd-1
2/2     Running   0              151m
ndbmysqld-0
2/2     Running   0              147m
ndbmysqld-1
2/2     Running   0              147m
ndbmysqld-2
2/2     Running   0              148m
ndbmysqld-3
2/2     Running   0              149m
```

ii. Check the status of cnDBTier cluster2:

```
$ kubectl -n cluster2 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster
Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   10 node(s)
id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91  (mysql-8.4.3 ndb-8.4.3)
```

```
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

6. Install cnDBTier cluster3 by configuring cnDBTier cluster1 as the first mate site and cnDBTier cluster2 as the second mate site with at least four SQL pods. For information on installing the cnDBTier cluster, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   > **Note**
   >
   > - If multiple replication channel groups are enabled, then install cnDBTier cluster3 by configuring cnDBTier cluster1 as first mate site and cnDBTier cluster2 as second mate site with at least eight SQL pods.
   > - Do not run a Helm test when performing the conversion procedure.
   > - If you are going to enable encryption, ensure that the new site uses the same encryption key.

7. Check if georeplication channels are established between cnDBTier cluster3 and cnDBTier cluster1, and cnDBTier cluster3 and cnDBTier cluster2 by following the procedures described in the Checking Georeplication Status Between Clusters section.
8. Restore the data of cnDBTier cluster1 or cnDBTier cluster2 in cnDBTier cluster3 and re-establish the georeplication channels between cnDBTier cluster1 and cnDBTier cluster3, and cnDBTier cluster2 and cnDBTier cluster3. You can perform the georeplication recovery using cnDBtier or CNC Console. For procedures on restoring the cluster data and re-establishing the georeplication channels, refer to the *Georeplication Failure between cnDBTier Clusters in Three Site Replication* section of *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
9. Check if georeplication channels are established between cnDBTier cluster3 and cnDBTier cluster1, and cnDBTier cluster3 and cnDBTier cluster2 by following the procedures described in the Checking Georeplication Status Between Clusters section.

   > **Note**
   >
   > As data is replicated to cnDBTier cluster3 and georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster3, and cnDBTier cluster2 and cnDBTier cluster3, the newly added cnDBTier cluster (cnDBTier cluster3) can also be used by the NFs for database operations.

7.5.3 Adding cnDBTier Georedundant Cluster to Three-Site cnDBTier Clusters

This section describes the procedure to add a cnDBTier georedundant cnDBTier cluster4 to the existing three-site cnDBTier clusters (cnDBTier cluster1, cnDBTier cluster2, and cnDBTier cluster3).

1. If TLS was configured on cnDBTier cluster 1, cluster 2, and cluster 3, then follow the Modifying cnDBTier Certificates to Establish TLS Between Georeplication Sites procedure to update the certificates in cnDBTier cluster 1, cluster 2, and cluster 3.

   Note

   Perform this step on those cnDBTier clusters on which you want to reconfigure the CA certificates for the new cnDBTier cluster.

2. Check if georeplication is enabled in cnDBTier cluster1 with respect to cnDBTier cluster4 by performing the following steps:

   Note

   The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster1 for every replication group with respect to cnDBTier cluster4.

   a. Ensure that the DB replication service in cnDBTier cluster1 is enabled and running successfully with respect to cnDBTier cluster4:

      ```
      $ kubectl -n cluster1 get pods | grep repl
      ```

      Sample output:

      ```
      mysql-cluster-cluster1-cluster2-replication-svc-5bdc46crzzhb   1/1     Running
      0          3m11s
      mysql-cluster-cluster1-cluster3-replication-svc-7955b6b6fbdc   1/1     Running
      2          3m39s
      mysql-cluster-cluster1-cluster4-replication-svc-bd977fc5bnd5   1/1     Running
      2          3m11s
      ```

   b. Ensure that at least six georeplication SQL nodes are configured in cluster1:

      ```
      $ kubectl -n cluster1 get pods | grep ndbmysqld
      ```

      Sample output:

      ```
      ndbmysqld-0                                                    3/3
      Running   0          4m14s
      ndbmysqld-1                                                    3/3
      Running   0          3m53s
      ndbmysqld-2                                                    3/3
      Running   0          3m21s
      ndbmysqld-3                                                    3/3
      ```

```
Running   0          3m01s
ndbmysqld-4                                                    3/3
Running   0          2m48s
ndbmysqld-5                                                    3/3
Running   0          2m31s
```

c. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.114.34   (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91    (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34   (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91    (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.62.226   (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.14.15    (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93    (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - If cluster1 satisfies all the conditions in Step 1, then georeplication is enabled in cnDBTier cluster1. Otherwise, georeplication is not enabled.
> - The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes. This note is applicable to all similar outputs in this procedure.

3. If georeplication is not enabled in cluster1 as per Step 1, then perform the following steps to enable georeplication in cnDBTier cluster1 with respect to cnDBTier cluster4. Else, skip to Step 3.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then configure remote mate site name (cluster4) in cnDBTier cluster1 by following the *Configuring Multiple Replication channel groups* procedure in Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide and skip steps a and b in the following substeps.

a. Configure the remote mate site name (cluster4) in cnDBTier cluster1 by enabling and configuring the replication service using the `custom_values.yaml` file:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
dbreplsvcdeployments:
    ....
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cluster1-cluster4-replication-svc
      # Local site replication service LoadBalancer ip can be configured.
      enabled: true
      mysql:
        dbtierservice: "mysql-connectivity-service"
        dbtierreplservice: "ndbmysqldsvc"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-4 LoadBalancer
service
        primaryhost: "ndbmysqld-4.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-
dbtier"
        port: "3306"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-4 LoadBalancer
service
        primarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        primaryhostserverid: "1004"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondaryhost: "ndbmysqld-5.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-
dbtier"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        secondaryhostserverid: "1005"
      replication:
        localsiteip: ""
        matesitename: "cluster4"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster1 to at least six in the `custom_values.yaml`:

> **Note**
>
> `apiReplicaCount` is set to "6" as you are adding the third site. The first four ndbmysqld are used for replication between site one, site two, and site three only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site4.

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
apiReplicaCount: 6
```

c. Upgrade cnDBTier cluster1 by using the CSAR package:

> **Note**
>
> The following command and example are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then upgrade cnDBTier cluster1 by providing appropriate multi-group values file.

```
$ helm upgrade mysql-cluster occndbtier --namespace cluster1 --no-hooks
-f occndbtier/custom_values.yaml
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 11:10:32 2025
NAMESPACE: cluster1
STATUS: deployed
REVISION: 2
```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 1 are restarted. Verify the status of the cluster by performing the following steps:

i. Check the status of pods running cluster1:

```
$ kubectl get pods --namespace=cluster1
```

Sample output:

```
NAME
READY   STATUS    RESTARTS       AGE
mysql-cluster-cluster1-cluster2-replication-svc-5bdc46crzzhb
1/1     Running   0              153m
mysql-cluster-cluster1-cluster3-replication-svc-7955b6b6fbdc
1/1     Running   0              153m
mysql-cluster-cluster1-cluster4-replication-svc-bd977fc5bnd5
1/1     Running   2              3m11s
mysql-cluster-db-backup-manager-svc-c77df67b7-tqnd2
1/1     Running   0              153m
mysql-cluster-db-monitor-svc-69ff969477-646tz
```

```
1/1     Running   0             147m
ndbappmysqld-0
2/2     Running   0             148m
ndbappmysqld-1
2/2     Running   0             147m
ndbmgmd-0
1/1     Running   0             152m
ndbmgmd-1
1/1     Running   0             152m
ndbmtd-0
2/2     Running   0             150m
ndbmtd-1
2/2     Running   0             151m
ndbmysqld-0
2/2     Running   0             147m
ndbmysqld-1
2/2     Running   0             147m
ndbmysqld-2
2/2     Running   0             148m
ndbmysqld-3
2/2     Running   0             149m
ndbmysqld-4
2/2     Running   0             147m
ndbmysqld-5
2/2     Running   0             147m
```

ii. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster
Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql- ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.124.92    (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135   (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34    (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91     (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.15.24     (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.48.74     (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117   (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93     (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
```

```
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

4. Check if georeplication is enabled in cnDBTier cluster2 with respect to cnDBTier cluster4 by performing the following steps:

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster2 for every replication group with respect to cnDBTier cluster4.

   a. Ensure that the DB replication service in cnDBTier cluster2 is enabled and running successfully with respect to cnDBTier cluster4:

```
$ kubectl -n cluster2 get pods | grep repl
```

   Sample output:

```
mysql-cluster-cluster2-cluster1-replication-svc-5bdc46crzzhb   1/1     Running
0          3m11s
mysql-cluster-cluster2-cluster3-replication-svc-7955b6b6fbdc   1/1     Running
2          3m39s
mysql-cluster-cluster2-cluster4-replication-svc--556c99fcdzh   1/1     Running
2          3m05s
```

   b. Ensure that at least six georeplication SQL nodes are configured in cluster2:

> **Note**
>
> `apiReplicaCount` is set to "6" as you are adding the third site. The first four ndbmysqld are used for replication between site one, site two, and site three only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site4.

```
$ kubectl -n cluster2 get pods | grep ndbmysqld
```

   Sample output:

```
ndbmysqld-0                                                       3/3
Running   0          4m14s
ndbmysqld-1                                                       3/3
Running   0          3m53s
ndbmysqld-2                                                       3/3
Running   0          3m21s
```

```
ndbmysqld-3                                                       3/3
Running   0          3m01s
ndbmysqld-4                                                       3/3
Running   0          2m59s
ndbmysqld-5                                                       3/3
Running   0          2m43s
```

c. Check the status of cnDBTier cluster2:

```
$ kubectl -n cluster2 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.114.34    (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.85.91     (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.114.34    (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.85.91     (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.24.121    (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.85.22     (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117   (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93     (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

Note

- The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes.
- If cluster2 satisfies all the conditions in Step 3, then georeplication is enabled in cnDBTier cluster2. Otherwise, georeplication is not enabled in cluster2.

5. If georeplication is not enabled in cluster2 as per Step 3, then perform the following steps to enable georeplication in cluster2 with respect to cluster4. Else, skip to Step 5.

Note

The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then configure remote mate site name (cluster4) in cnDBTier cluster2 by following the *Configuring Multiple Replication channel groups* procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* and skip steps a and b in the following substeps.

a. Configure the remote mate site name (cluster4) in cnDBTier cluster2 by enabling and configuring the replication service using the `custom_values.yaml` file:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
dbreplsvcdeployments:
    ....
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cluster2-cluster4-replication-svc
      enabled: true
      mysql:
        dbtierservice: "mysql-connectivity-service"
        dbtierreplservice: "ndbmysqldsvc"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-4 LoadBalancer
service
        primaryhost: "ndbmysqld-4.ndbmysqldsvc.cluster2.svc.occne4-cgbu-cne-
dbtier"
        port: "3306"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-4 LoadBalancer
service
        primarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        primaryhostserverid: "2004"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondaryhost: "ndbmysqld-5.ndbmysqldsvc.cluster2.svc.occne4-cgbu-cne-
dbtier"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        secondaryhostserverid: "2005"
      replication:
        # Local site replication service LoadBalancer ip can be configured.
        localsiteip: ""
        matesitename: "cluster4"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster2 to at least six in the `custom_values.yaml` file:

> **Note**
>
> `apiReplicaCount` is set to "6" as you are adding the fourth site. The first four ndbmysqld are used for replication between site one, site two, and site three only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site4.

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
apiReplicaCount: 6
```

c. Upgrade cnDBTier cluster2 by using the CSAR package. For more information, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then upgrade cnDBTier cluster2 by providing appropriate multi-group values file.

```
$ helm upgrade mysql-cluster occndbtier --namespace cluster2 --no-hooks
-f occndbtier/custom_values.yaml
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 11:10:32 2025
NAMESPACE: cluster2
STATUS: deployed
REVISION: 2
```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 2 are restarted. Verify the status of the cluster by performing the following steps:

i. Check the status of pods running cluster2:

```
$ kubectl get pods --namespace=cluster2
```

Sample output:

```
NAME
READY   STATUS    RESTARTS       AGE
mysql-cluster-cluster2-cluster1-replication-svc-5bdc46cryyaa
1/1     Running   0              153m
mysql-cluster-cluster2-cluster3-replication-svc-7955b6b6ghht
1/1     Running   0              153m
mysql-cluster-cluster2-cluster4-replication-svc-c574d6cj6mlp
1/1     Running   2              153m
mysql-cluster-db-backup-manager-svc-c77df67b7-tqnd2
1/1     Running   0              153m
mysql-cluster-db-monitor-svc-69ff969477-646tz
1/1     Running   0              147m
ndbappmysqld-0
2/2     Running   0              148m
ndbappmysqld-1
2/2     Running   0              147m
ndbmgmd-0
1/1     Running   0              152m
ndbmgmd-1
1/1     Running   0              152m
ndbmtd-0
2/2     Running   0              150m
ndbmtd-1
2/2     Running   0              151m
```

```
ndbmysqld-0
2/2     Running   0             147m
ndbmysqld-1
2/2     Running   0             147m
ndbmysqld-2
2/2     Running   0             148m
ndbmysqld-3
2/2     Running   0             149m
ndbmysqld-4
2/2     Running   0             147m
ndbmysqld-5
2/2     Running   0             147m
```

ii. Check the status of cnDBTier cluster2:

```
$ kubectl -n cluster2 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster
Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.124.111  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.110.81  (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.110.41  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.98.102  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

6. Check if georeplication is enabled in cnDBTier cluster3 with respect to cnDBTier cluster4 by performing the following steps:

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check if georeplication is enabled in cnDBTier cluster3 for every replication group with respect to cnDBTier cluster4.

a. Ensure that the DB replication service in cnDBTier cluster3 is enabled and running successfully with respect to cnDBTier cluster4:

```
$ kubectl -n cluster3 get pods | grep repl
```

Sample output:

```
mysql-cluster-cluster3-cluster1-replication-svc-5bdc46crzzhb   1/1     Running
0          3m11s
mysql-cluster-cluster3-cluster2-replication-svc-7955b6b6fbdc   1/1     Running
2          3m39s
mysql-cluster-cluster3-cluster4-replication-svc--556c99fcdzh   1/1     Running
2          3m05s
```

b. Ensure that at least six georeplication SQL nodes are configured in cluster3:

```
$ kubectl -n cluster3 get pods | grep ndbmysqld
```

Sample output:

```
ndbmysqld-0                                                    3/3
Running   0          4m14s
ndbmysqld-1                                                    3/3
Running   0          3m53s
ndbmysqld-2                                                    3/3
Running   0          3m21s
ndbmysqld-3                                                    3/3
Running   0          3m01s
ndbmysqld-4                                                    3/3
Running   0          2m59s
ndbmysqld-5                                                    3/3
Running   0          2m43s
```

c. Check the status of cnDBTier cluster3:

```
$ kubectl -n cluster3 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.71.24     (mysql-8.4.3 ndb-8.4.3)
```

```
id=57   @10.233.119.18    (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.69.23     (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.116.21    (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.70.16     (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.20     (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117   (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93     (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

Note

- The node IDs 222 to 225 in the sample output are shown as "not connected" as these nodes are added as empty slot IDs used for georeplication recovery. You can ignore these nodes.
- If cluster3 satisfies all the conditions in Step 5, then georeplication is enabled in cnDBTier cluster3. Otherwise, georeplication is not enabled in cluster3.

7. If georeplication is not enabled in cluster3 as per Step 5, then perform the following steps to enable georeplication in cluster3 with respect to cluster4. Else, skip to Step 7.

Note

The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then configure remote mate site name (cluster4) in cnDBTier cluster3 by following the *Configuring Multiple Replication channel groups* procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide* and skip steps a and b in the following substeps.

a. Configure the remote mate site name (cluster4) in cnDBTier cluster3 by enabling and configuring the replication service using the `custom_values.yaml` file:

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
dbreplsvcdeployments:
    ....
    # if pod prefix is given then use the unique smaller name for this db
replication service.
    - name: cndbtiercluster3-cndbtiercluster4-replication-svc
      enabled: true
      mysql:
        dbtierservice: "mysql-connectivity-service"
        dbtierreplservice: "ndbmysqldsvc"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-4 LoadBalancer
service
        primaryhost: "ndbmysqld-4.ndbmysqldsvc.cluster3.svc.occne4-cgbu-cne-
dbtier"
        port: "3306"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-4 LoadBalancer
```

```
service
        primarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        primaryhostserverid: "3004"
        # if cndbtier, use CLUSTER-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondaryhost: "ndbmysqld-5.ndbmysqldsvc.cluster3.svc.occne4-cgbu-cne-
dbtier"
        # if cndbtier, use EXTERNAL-IP from the ndbmysqldsvc-5 LoadBalancer
service
        secondarysignalhost: ""
        # serverid is unique; retrieve it for the site being configured
        secondaryhostserverid: "3005"
      replication:
        # Local site replication service LoadBalancer ip can be configured.
        localsiteip: ""
        matesitename: "cluster4"
        remotesiteip: ""
```

b. Configure the number of SQL pods in cnDBTier cluster3 to at least six in the `custom_values.yaml` file:

> **Note**
>
> `apiReplicaCount` is set to "6" as you are adding the third site. The first four ndbmysqld are used for replication between site one, site two, and site three only. The two ndbmysqld pods that are newly added will be responsible for replication between site1 and site4.

```
$ vi occndbtier/custom_values.yaml
```

Sample output:

```
apiReplicaCount: 6
```

c. Upgrade cnDBTier cluster3 by using the CSAR package. For more information, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then upgrade cnDBTier cluster3 by providing appropriate multi group values file.

```
$ helm upgrade mysql-cluster occndbtier --namespace cluster3 --no-hooks
-f occndbtier/custom_values.yaml
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 11:10:32 2025
NAMESPACE: cluster3
```

```
STATUS: deployed
REVISION: 2
```

d. Wait until the upgrade is complete and all the pods of cnDBTier cluster 3 are restarted. Verify the status of the cluster by performing the following steps:

   i. Check the status of pods running cluster3:

   ```
   $ kubectl get pods --namespace=cluster3
   ```

   Sample output:

   ```
   mysql-cluster-cluster3-cluster1-replication-svc-5bdc46dsttic
   1/1     Running   0              153m
   mysql-cluster-cluster3-cluster2-replication-svc-7955b6c7eced
   1/1     Running   0              153m
   mysql-cluster-cluster3-cluster4-replication-svc-556c99fdeyah
   1/1     Running   2              153m
   mysql-cluster-db-backup-manager-svc-8bf9448b8-w8pvf
   1/1     Running   0              153m
   mysql-cluster-db-monitor-svc-8bf9559b8-v8qwg
   1/1     Running   0              147m
   ndbappmysqld-0
   2/2     Running   0              148m
   ndbappmysqld-1
   2/2     Running   0              147m
   ndbmgmd-0
   1/1     Running   0              152m
   ndbmgmd-1
   1/1     Running   0              152m
   ndbmtd-0
   2/2     Running   0              150m
   ndbmtd-1
   2/2     Running   0              151m
   ndbmysqld-0
   2/2     Running   0              147m
   ndbmysqld-1
   2/2     Running   0              147m
   ndbmysqld-2
   2/2     Running   0              148m
   ndbmysqld-3
   2/2     Running   0              149m
   ndbmysqld-4
   2/2     Running   0              147m
   ndbmysqld-5
   2/2     Running   0              147m
   ```

   ii. Check the status of cnDBTier cluster3:

   ```
   $ kubectl -n cluster3 exec -it ndbmgmd-0 -- ndb_mgm -e show
   ```

   Sample output:

   ```
   Connected to Management Server at: localhost:1186 Cluster
   Configuration
   ---------------------
   ```

```
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   12 node(s)
id=56   @10.233.71.24     (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.119.18    (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.69.23     (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.116.21    (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.70.16     (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.20     (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117   (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93     (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery. You can ignore these node IDs.

8. Install cnDBTier cluster4 by configuring cnDBTier cluster1 as the first mate site and cnDBTier cluster2 as the second mate site with at least six SQL pods. For information on installing the cnDBTier cluster, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   > **Note**
   >
   > - The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then install cnDBTier cluster4 by configuring cnDBTier cluster1 as first mate site, cnDBTier cluster2 as second mate site and cnDBTier cluster3 as third mate site with at least twelve SQL pods.
   > - Do not run a Helm test when you are performing a conversion procedure.
   > - If you are going to enable encryption, ensure that the new site uses the same encryption key.

9. Check if georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster4, cnDBTier cluster2 and cnDBTier cluster4, and cnDBTier cluster3 and cnDBTier cluster4 by following the procedures described in the Checking Georeplication Status Between Clusters section.
10. Restore the data of cnDBTier cluster1, cnDBTier cluster2, or cnDBTier cluster3 in cnDBTier cluster4 and re-establish the georeplication channels between cnDBTier cluster1 and cnDBTier cluster4, cnDBTier cluster2 and cnDBTier cluster4, and cnDBTier cluster3 and cnDBTier cluster4. You can perform the georeplication recovery using cnDBtier or CNC

Console. For procedures on restoring the cluster data and re-establishing the georeplication channels, refer to the *Georeplication Failure between cnDBTier Clusters in Four Site Replication* section of *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

11. Check if georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster4, cnDBTier cluster2 and cnDBTier cluster4, and cnDBTier cluster3 and cnDBTier cluster4 by following the procedures described in the Checking Georeplication Status Between Clusters section.

> **Note**
>
> As data is replicated to cnDBTier cluster4 and georeplication channels are established between cnDBTier cluster1 and cnDBTier cluster4, cnDBTier cluster2 and cnDBTier cluster4, and cnDBTier cluster3 and cnDBTier cluster4, the newly added cnDBTier cluster (cnDBTier cluster4) can be used by the NFs for database operations.

7.6 Removing a Georedundant cnDBTier Cluster

This section describes the procedures to remove a georedundant cluster from an existing multisite setup (two-site, three-site, or four-site) using the `dbtremovesite` script.

The following terminologies are used in the procedures to refer to a cluster in a multisite:

- cnDBTier Cluster1 (cluster1): The first cloud native cnDBTier cluster in a two-site, three-site, or four-site georeplication setup.
- cnDBTier Cluster2 (cluster2): The second cloud native cnDBTier cluster in a two-site, three-site, or four-site georeplication setup.
- cnDBTier Cluster3 (cluster3): The third cloud native cnDBTier cluster in a two-site, three-site, or four-site georeplication setup.
- cnDBTier Cluster4 (cluster4): The fourth cloud native cnDBTier cluster in a two-site, three-site, or four-site georeplication setup.

Prerequisites

Before performing the following procedures, ensure that you meet the following prerequisites:

- Multiple cnDBTier clusters must be installed.
- The cnDBTier cluster that needs to be removed must be a part of the multisite setup.

> **Note**
>
> - To perform these procedures, georeplication may or may not be established correctly between multiple cnDBTier clusters.
> - Ensure that there is no traffic in the cnDBTier cluster that is being removed from the multisite setup.

7.6.1 Extracting cnDBTier Cluster Script

This section describes the procedure to extract the cnDBTier cluster script.

1. Extract CSAR package:

   ```
   $ unzip occndbtier_csar_vzw_25_1_103_0_0.zip
   ```

2. Run the `source_me` file:

   ```
   $ cd Artifacts/Scripts/tools
   $ source ./source_me
   ```

   Sample output:

   ```
   NOTE: source_me must be sourced while your current directory is the
   directory with the source_me file.

   Enter cndbtier namespace: cluster1
   DBTIER_NAMESPACE = "cluster1"

   DBTIER_LIB=/home/cgbu-cne-dbtier/csar/rc4.25.1.103/Artifacts/Scripts/
   tools/lib

   Adding /home/cgbu-cne-dbtier/csar/25.1.103/Artifacts/Scripts/tools/bin to
   PATH
   PATH=/home/cgbu-cne-dbtier/csar/25.1.103/Artifacts/Scripts/tools/bin:/home/
   cgbu-cne-dbtier/.local/bin:/home/cgbu-cne-dbtier/bin:/usr/local/bin:/usr/
   bin:/usr/local/sbin:/usr/sbin:/var/occne/cluster/thrust7a/artifacts/
   istio-1.15.3/bin/:/var/occne/cluster/thrust7a/artifacts:/home/cgbu-cne-
   dbtier/luis/bin:/home/cgbu-cne-dbtier/luis/usr/bin
   ```

3. Check if the `dbtremovesite` script is present in the lib and bin directory:

   ```
   $ cd Artifacts/Scripts/tools/bin
   $ ls -lrth dbtremovesite
   ```

   Sample output:

   ```
   total 104K
   -rwx------. 1 cloud-user cloud-user 120 Apr 23 05:46 dbtremovesite
   ```

> **Note**
>
> The `dbtremovesite` script does not take any arguments for removing the cnDBTier cluster details from the other available cnDBTier clusters. You must perform the following procedures to remove the cluster.

7.6.2 Removing cnDBTier Cluster 4

This section provides the procedure to remove cnDBTier cluster 4 from a georeplication multisite setup.

> **Note**
>
> The cluster and namespace names used in this procedure may vary depending on your namespace and cluster name. Ensure that you replace the values as per your setup.

1. Perform the following steps to uninstall cnDBTier cluster 4 in a site. For more information, see the "Uninstalling cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide.*
   a. Run the following commands to uninstall cnDBTier cluster 4:

      ```
      $ helm uninstall mysql-cluster -n cluster4
      ```

   b. Run the following commands to delete the PVCs of cnDBTier cluster 4:

      ```
      $ kubectl -n cluster4 get pvc
      $ kubectl -n cluster4 delete pvc <PVC Names>
      ```

      where, `<PVC Names>` is the PVC names of cnDBTier Cluster 4.
2. Perform the following steps to delete the records related to cluster 4 from all the other available sites (cluster 1, cluster 2, and cluster 3):
   a. Log in to cnDBTier cluster 1 and delete the records related to cluster 4 using the `dbtremovesite` script:

      > **Note**
      >
      > `source_me` must be sourced while your current directory is the directory with the source_me file.

      ```
      $ source ./source_me
      NOTE: source_me must be sourced while your current directory is the
      directory with the source_me file.

      Enter cndbtier namespace: cluster1

      $ dbtremovesite
      ```

      When the `dbtremovesite` script prompts you to select the cluster that needs to be removed, select cluster 4 by typing *yes* against the cluster 4 option. Type *no* for the rest of the cluster options.

      Sample output:

      ```
      Does cluster1 need to be removed (yes/no/exit)? no
      Does cluster2 need to be removed (yes/no/exit)? no
      Does cluster3 need to be removed (yes/no/exit)? no
      Does cluster4 need to be removed (yes/no/exit)? yes
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_NAME = cluster1
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_ID = 1
      2024-04-23T05:47:00Z INFO - Removing cluster4 (Site 4)
      ```

```
2024-04-23T05:47:00Z INFO - Make sure that cnDBTier cluster(cluster4)
is uninstalled in Site 4
DO YOU WANT TO PROCEED (yes/no/exit)? yes
ARE YOU SURE (yes/no/exit)? yes
------------------------
------------------------
------------------------
2024-04-23T05:47:45Z INFO - Ended timer PHASE 6: 1713851265
2024-04-23T05:47:45Z INFO - PHASE 6 took: 00 hr. 00 min. 02 sec.
2024-04-23T05:47:45Z INFO - Ended timer dbtremovesite: 1713851265
2024-04-23T05:47:45Z INFO - dbtremovesite took: 00 hr. 00 min. 57 sec.
2024-04-23T05:47:45Z INFO - dbtremovesite completed successfully
```

b. Repeat step a on cluster 2 to delete the records related to cluster 4.

c. Repeat step a on cluster 3 to delete the records related to cluster 4.

3. Remove the remote site IP address configurations related to cluster 4 and restart all the DB replication service deployments on all the other available sites (cluster 1, cluster 2, and cluster 3):

   a. Perform the following steps to remove the remote site IP address configurations related to cluster 4 and restart all the DB replication service deployments on cluster 1:

      i. Log in to the Bastion Host of cluster 1.

      ii. If fixed IP addresses are not configured to the LoadBalancer services, configure `remotesiteip` with `""` for cluster 4 remote site in the `custom_values.yaml` file of cluster 1:

```
$ vi cndbtier_cluster1_custom_values.yaml

- name: cluster1-cluster4-replication-svc
  enabled: true
  ------------------------------------
  ------------------------------------
  ------------------------------------
    replication:
      localsiteip: ""
      localsiteport: "80"
      channelgroupid: "1"
      matesitename: "cluster4"
      remotesiteip: ""
      remotesiteport: "80"
```

      iii. If fixed IP addresses are not configured to the LoadBalancer services, upgrade cnDBTier cluster 1:

```
$ helm upgrade mysql-cluster occndbtier -n cluster1 -f
cndbtier_cluster1_custom_values.yaml
```

      iv. Scale down and scale up all the DB replication service deployments in cluster 1:

```
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=0
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
```

```
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=1
```

v. Wait until all the pods are up on cluster 1 and verify:

```
$ kubectl -n cluster1 get pods
```

b. Repeat step a to remove the remote site IP address configurations related to cluster 4 and restart all the DB replication service deployments on cluster 2:

> **Note**
>
> Replace `cluster1` in the commands (in step a) with `cluster2`. However, the values may vary depending on the cluster and namespace names in your setup.

c. Repeat step a to remove the remote site IP address configurations related to cluster 4 and restart all the DB replication service deployments on cluster 3:

> **Note**
>
> Replace `cluster1` in the commands (in step a) with `cluster3`. However, the values may vary depending on the cluster and namespace names in your setup.

7.6.3 Removing cnDBTier Cluster 3

This section provides the procedure to remove cnDBTier cluster 3 from a georeplication multisite setup.

> **Note**
>
> The cluster and namespace names used in this procedure may vary depending on your namespace and cluster name. Ensure that you replace the values as per your setup.

1. Perform the following steps to uninstall cnDBTier cluster 3 in a site. For more information, see the "Uninstalling cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide.*

   a. Run the following commands to uninstall cnDBTier cluster 3:

   ```
   $ helm uninstall mysql-cluster -n cluster3
   ```

   b. Run the following commands to delete the PVCs of cnDBTier cluster 3:

   ```
   $ kubectl -n cluster3 get pvc
   $ kubectl -n cluster3 delete pvc <PVC Names>
   ```

   where, `<PVC Names>` is the PVC names of cnDBTier Cluster 3.

2. Perform the following steps to delete the records related to cluster 3 from all the other sites (cluster 1, cluster 2, and cluster 4):
   a. Log in to cnDBTier cluster 1 and delete the records related to cluster 3 using the `dbtremovesite` script:

      ```
      $ source ./source_me

      NOTE: source_me must be sourced while your current directory is the
      directory with the source_me file.

      Enter cndbtier namespace: cluster1

      $ dbtremovesite
      ```

      When the `dbtremovesite` script prompts you to select the cluster that needs to be removed, select cluster 3 by typing *yes* against the cluster 3 option. Type *no* for the rest of the cluster options.

      Sample output:

      ```
      Does cluster1 need to be removed (yes/no/exit)? no
      Does cluster2 need to be removed (yes/no/exit)? no
      Does cluster3 need to be removed (yes/no/exit)? yes
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_NAME = cluster1
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_ID = 1
      2024-04-23T05:47:00Z INFO - Removing cluster3 (Site 3)
      2024-04-23T05:47:00Z INFO - Make sure that cnDBTier cluster(cluster3)
      is uninstalled in Site 3
      DO YOU WANT TO PROCEED (yes/no/exit)? yes
      ARE YOU SURE (yes/no/exit)? yes
      -------------------------
      -------------------------
      -------------------------
      2024-04-23T05:47:45Z INFO - Ended timer PHASE 6: 1713851265
      2024-04-23T05:47:45Z INFO - PHASE 6 took: 00 hr. 00 min. 02 sec.
      2024-04-23T05:47:45Z INFO - Ended timer dbtremovesite: 1713851265
      2024-04-23T05:47:45Z INFO - dbtremovesite took: 00 hr. 00 min. 57 sec.
      2024-04-23T05:47:45Z INFO - dbtremovesite completed successfully
      ```

   b. Repeat step a on cluster 2 to delete the records related to cluster 3.
   c. Repeat step a on cluster 4 to delete the records related to cluster 3.
3. Remove the remote site IP address configurations related to cluster 3 and restart all the DB replication service deployments on all the other sites (cluster 1, cluster 2, and cluster 4):
   a. Perform the following steps to remove the remote site IP address configurations related to cluster 3 and restart all the DB replication service deployments on cluster 1:
      i. Log in to the Bastion Host of cluster 1.

ii. If fixed IP addresses are not configured to the LoadBalancer services, configure `remotesiteip` with "" for cluster 3 remote site in the `custom_values.yaml` file of cluster 1:

```
$ vi cndbtier_cluster1_custom_values.yaml

- name: cluster1-cluster3-replication-svc
  enabled: true
    ------------------------------------
    ------------------------------------
    ------------------------------------
      replication:
        localsiteip: ""
        localsiteport: "80"
        channelgroupid: "1"
        matesitename: "cluster3"
        remotesiteip: ""
        remotesiteport: "80"
```

iii. If fixed IP addresses are not configured to the LoadBalancer services, upgrade cnDBTier cluster 1:

```
$ helm upgrade mysql-cluster occndbtier -n cluster1 -f
cndbtier_cluster1_custom_values.yaml
```

iv. Scale down and scale up all the DB replication service deployments in cluster 1:

```
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=0
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=1
```

v. Wait until all the pods are up on cluster 1 and verify:

```
$ kubectl -n cluster1 get pods
```

b. Repeat step a to remove the remote site IP address configurations related to cluster 3 and restart all the DB replication service deployments on cluster 2:

> **Note**
>
> Replace `cluster1` in the commands with `cluster2`. However, the values may vary depending on the cluster and namespace names in your setup.

c. Repeat step a to remove the remote site IP address configurations related to cluster 3 and restart all the DB replication service deployments on cluster 4:

> **Note**
>
> Replace `cluster1` in the commands with `cluster4`. However, the values may vary depending on the cluster and namespace names in your setup.

7.6.4 Removing cnDBTier Cluster 2

This section provides the procedure to remove cnDBTier cluster 2 from a georeplication multisite setup.

> **Note**
>
> The cluster and namespace names used in this procedure may vary depending on your namespace and cluster name. Ensure that you replace the values as per your setup.

1. Perform the following steps to uninstall cnDBTier cluster 2 in a site. For more information, see the "Uninstalling cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide.*
   a. Run the following commands to uninstall cnDBTier cluster 2:

      ```
      $ helm uninstall mysql-cluster -n cluster2
      ```

   b. Run the following commands to delete the PVCs of cnDBTier cluster 2:

      ```
      $ kubectl -n cluster2 get pvc
      $ kubectl -n cluster2 delete pvc <PVC Names>
      ```

      where, `<PVC Names>` is the PVC names of cnDBTier cluster 2.
2. Perform the following steps to delete the records related to cluster 2 from all the other available sites (cluster 1, cluster 3, and cluster 4):
   a. Log in to cnDBTier cluster 1 and delete the records related to cluster 2 using the `dbtremovesite` script:

      ```
      $ source ./source_me

      NOTE: source_me must be sourced while your current directory is the
      directory with the source_me file.

      Enter cndbtier namespace: cluster1

      $ dbtremovesite
      ```

      When the `dbtremovesite` script prompts you to select the cluster that needs to be removed, select cluster 2 by typing *yes* against the cluster 2 option. Type *no* for the rest of the cluster options.

      Sample output:

      ```
      Does cluster1 need to be removed (yes/no/exit)? no
      Does cluster2 need to be removed (yes/no/exit)? yes
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_NAME = cluster1
      2024-04-23T05:47:00Z INFO - CURRENT_SITE_ID = 1
      2024-04-23T05:47:00Z INFO - Removing cluster2 (Site 2)
      2024-04-23T05:47:00Z INFO - Make sure that cnDBTier cluster(cluster2)
      ```

```
is uninstalled in Site 2
DO YOU WANT TO PROCEED (yes/no/exit)? yes
ARE YOU SURE (yes/no/exit)? yes
------------------------
------------------------
------------------------
2024-04-23T05:47:45Z INFO - Ended timer PHASE 6: 1713851265
2024-04-23T05:47:45Z INFO - PHASE 6 took: 00 hr. 00 min. 02 sec.
2024-04-23T05:47:45Z INFO - Ended timer dbtremovesite: 1713851265
2024-04-23T05:47:45Z INFO - dbtremovesite took: 00 hr. 00 min. 57 sec.
2024-04-23T05:47:45Z INFO - dbtremovesite completed successfully
```

b. Repeat step a on cluster 3 to delete the records related to cluster 2.

c. Repeat step a on cluster 4 to delete the records related to cluster 2.

3. Remove the remote site IP address configurations related to cluster 2 and restart all the DB replication service deployments on all the other sites (cluster 1, cluster 3, and cluster 4):

   a. Perform the following steps to remove the remote site IP address configurations related to cluster 2 and restart all the DB replication service deployments on cluster 1:

      i. Log in to the Bastion Host of cluster 1.

      ii. If fixed IP addresses are not configured to the LoadBalancer services, configure `remotesiteip` with `""` for cluster 2 remote site in the `custom_values.yaml` file of cluster 1:

```
$ vi cndbtier_cluster1_custom_values.yaml

- name: cluster1-cluster2-replication-svc
  enabled: true
  ------------------------------------
  ------------------------------------
  ------------------------------------
    replication:
      localsiteip: ""
      localsiteport: "80"
      channelgroupid: "1"
      matesitename: "cluster2"
      remotesiteip: ""
      remotesiteport: "80"
```

      iii. If fixed IP addresses are not configured to the LoadBalancer services, upgrade cnDBTier cluster 1:

```
$ helm upgrade mysql-cluster occndbtier -n cluster1 -f
cndbtier_cluster1_custom_values.yaml
```

      iv. Scale down and scale up all the DB replication service deployments in cluster 1:

```
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=0
$ kubectl -n cluster1 scale deploy $(kubectl -n cluster1 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=1
```

v. Wait until all the pods are up on cluster 1 and verify:

```
$ kubectl -n cluster1 get pods
```

b. Repeat step a to remove the remote site IP address configurations related to cluster 2 and restart all the DB replication service deployments on cluster 3:

> **Note**
>
> Replace `cluster1` in the commands with `cluster3`. However, the values may vary depending on the cluster and namespace names in your setup.

c. Repeat step a to remove the remote site IP address configurations related to cluster 2 and restart all the DB replication service deployments on cluster 4:

> **Note**
>
> Replace `cluster1` in the commands with `cluster4`. However, the values may vary depending on the cluster and namespace names in your setup.

7.6.5 Removing cnDBTier Cluster 1

This section provides the procedure to remove cnDBTier cluster 1 from a georeplication multisite setup.

> **Note**
>
> The cluster and namespace names used in this procedure may vary depending on your namespace and cluster name. Ensure that you replace the values as per your setup.

1. Perform the following steps to uninstall cnDBTier cluster 1 in a site. For more information, see the "Uninstalling cnDBTier" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide.*
   a. Run the following commands to uninstall cnDBTier cluster 1:

   ```
   $ helm uninstall mysql-cluster -n cluster1
   ```

   b. Run the following commands to delete the PVCs of cnDBTier cluster 1:

   ```
   $ kubectl -n cluster1 get pvc
   $ kubectl -n cluster1 delete pvc <PVC Names>
   ```

   where, `<PVC Names>` is the PVC names of cnDBTier cluster 1.
2. Perform the following steps to delete the records related to cluster 1 from all the other available sites (cluster 2, cluster 3, and cluster 4):

a. Log in to cnDBTier cluster 1 and delete the records related to cluster 1 using the `dbtremovesite` script:

```
$ source ./source_me

NOTE: source_me must be sourced while your current directory is the
directory with the source_me file.

Enter cndbtier namespace: cluster4

$ dbtremovesite
```

When the `dbtremovesite` script prompts you to select the cluster that needs to be removed, select cluster 4 by typing *yes* against the cluster 4 option. Type *no* for the rest of the cluster options.

Sample output:

```
Does cluster1 need to be removed (yes/no/exit)? no
Does cluster2 need to be removed (yes/no/exit)? no
Does cluster3 need to be removed (yes/no/exit)? no
Does cluster4 need to be removed (yes/no/exit)? yes
2024-04-23T05:47:00Z INFO - CURRENT_SITE_NAME = cluster1
2024-04-23T05:47:00Z INFO - CURRENT_SITE_ID = 1
2024-04-23T05:47:00Z INFO - Removing cluster4 (Site 4)
2024-04-23T05:47:00Z INFO - Make sure that cnDBTier cluster(cluster4)
is uninstalled in Site 4
DO YOU WANT TO PROCEED (yes/no/exit)? yes
ARE YOU SURE (yes/no/exit)? yes
-------------------------
-------------------------
-------------------------
2024-04-23T05:47:45Z INFO - Ended timer PHASE 6: 1713851265
2024-04-23T05:47:45Z INFO - PHASE 6 took: 00 hr. 00 min. 02 sec.
2024-04-23T05:47:45Z INFO - Ended timer dbtremovesite: 1713851265
2024-04-23T05:47:45Z INFO - dbtremovesite took: 00 hr. 00 min. 57 sec.
2024-04-23T05:47:45Z INFO - dbtremovesite completed successfully
```

b. Repeat step a on cluster 3 to delete the records related to cluster 1.

c. Repeat step a on cluster 4 to delete the records related to cluster 1.

3. Remove the remote site IP address configurations related to cluster 1 and restart all the DB replication service deployments on all the other sites (cluster 2, cluster 3, and cluster 4):

a. Perform the following steps to remove the remote site IP address configurations related to cluster 1 and restart all the DB replication service deployments on cluster 2:

i. Log in to the cnDBTier cluster4.

ii. If fixed IP addresses are not configured to the LoadBalancer services, configure `remotesiteip` with `""` for cluster 1 remote site in the `custom_values.yaml` file of cluster 4:

```
$ vi cndbtier_cluster2_custom_values.yaml

- name: cluster2-cluster1-replication-svc
```

```
enabled: true
--------------------------------------
--------------------------------------
--------------------------------------
  replication:
    localsiteip: ""
    localsiteport: "80"
    channelgroupid: "1"
    matesitename: "cluster1"
    remotesiteip: ""
    remotesiteport: "80"
```

iii. If fixed IP addresses are not configured to the LoadBalancer services, upgrade cnDBTier cluster 2:

```
$ helm upgrade mysql-cluster occndbtier -n cluster2 -f
cndbtier_cluster2_custom_values.yaml
```

iv. Scale down and scale up all the DB replication service deployments in cluster 2:

```
$ kubectl -n cluster2 scale deploy $(kubectl -n cluster2 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=0
$ kubectl -n cluster2 scale deploy $(kubectl -n cluster2 get
deployments | awk '{print $1}' | egrep -i 'repl|monitor|backup-
manager') --replicas=1
```

v. Wait until all the pods are up on cluster 2 and verify:

```
$ kubectl -n cluster2 get pods
```

b. Repeat step a to remove the remote site IP address configurations related to cluster 1 and restart all the DB replication service deployments on cluster 3:

> **Note**
>
> Replace `cluster2` in the commands with `cluster3`. However, the values may vary depending on the cluster and namespace names in your setup.

c. Repeat step a to remove the remote site IP address configurations related to cluster 1 and restart all the DB replication service deployments on cluster 4:

> **Note**
>
> Replace `cluster2` in the commands with `cluster4`. However, the values may vary depending on the cluster and namespace names in your setup.

7.7 Adding and Removing Replication Channel Group

This section describes the procedures to convert a single replication channel group to multiple replication channel groups and vice versa.

The procedures in this section uses the following terms to identify the clusters:

1. cnDBTier Cluster1 (a.k.a. cluster1): The first cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.
2. cnDBTier Cluster2 (a.k.a. cluster2): The second cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.
3. cnDBTier Cluster3 (a.k.a. cluster3): The third cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.
4. cnDBTier Cluster4 (a.k.a. cluster4): The fourth cloud native based DBTier cluster in a two site, three site, or four site georeplication setup.

Prerequisites

1. All the cnDBTier data nodes and SQL nodes that participate in georeplication, and at least one management node in the existing clusters must be up and running.
2. Georeplication must be established between the existing cnDBTier clusters.
3. All the cnDBTier clusters must be installed using cnDBTier 22.3.x or above.
4. All the cnDBTier clusters must have the same number of data nodes and node groups.

> **Note**
>
> - cnDBTier supports two replication groups in each cnDBTier mate sites. To convert an existing single replication group to multi replication group, freshly install cnDBTier 22.3.x or above, or upgrade your existing cnDBTier to 22.3.x or above.
> - Before running this procedure, take a backup of the data and download the backup for safety purposes.
> - This procedure requires downtime for other cnDBTIer sites.
> - This procedure is not supported in cnDBTier setups where TLS is enabled.

7.7.1 Converting Single Replication Channel Group to Multiple Replication Channel Groups

This section describes the procedure to convert a single replication channel group to multiple replication channel groups.

> **Note**
>
> This procedure is not supported for cnDBTier setups where TLS is enabled.

To convert a single replication channel group to multiple replication channel groups:

1. Consider any one of the cnDBTier clusters as a leader cluster (cluster1) and move all the NFs' traffic to that cluster. All the pods of leader cluster must be up and running.
2. Wait for replication to be updated in every cnDBTier cluster so that the database is consistent across all the cnDBTier clusters.

3. Scale down the replication service deployments in each site: Log in to Bastion Host of each of the cnDBTier Clusters and scale down the DB replication service deployments:

   ```
   $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
   'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
   cluster> scale deployment --replicas=0
   ```

   Example:

   ```
   # scaling down the DB replication service deployments of cluster1
   $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
   r kubectl -n cluster1 scale deployment --replicas=0
   deployment.apps/mysql-cluster-cluster1-cluster2-repl-svc scaled
   deployment.apps/mysql-cluster-cluster1-cluster3-repl-svc scaled
   deployment.apps/mysql-cluster-cluster1-cluster4-repl-svc scaled

   # scaling down the DB replication service deployments of cluster2
   $ kubectl -n cluster2 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
   r kubectl -n cluster2 scale deployment --replicas=0
   deployment.apps/mysql-cluster-cluster2-cluster1-repl-svc scaled
   deployment.apps/mysql-cluster-cluster2-cluster3-repl-svc scaled
   deployment.apps/mysql-cluster-cluster2-cluster4-repl-svc scaled

   # scaling down the DB replication service deployments of cluster3
   $ kubectl -n cluster3 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
   r kubectl -n cluster3 scale deployment --replicas=0
   deployment.apps/mysql-cluster-cluster3-cluster1-repl-svc scaled
   deployment.apps/mysql-cluster-cluster3-cluster2-repl-svc scaled
   deployment.apps/mysql-cluster-cluster3-cluster3-repl-svc scaled

   # scaling down the DB replication service deployments of cluster4
   $ kubectl -n cluster4 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
   r kubectl -n cluster4 scale deployment --replicas=0
   deployment.apps/mysql-cluster-cluster4-cluster1-repl-svc scaled
   deployment.apps/mysql-cluster-cluster4-cluster2-repl-svc scaled
   deployment.apps/mysql-cluster-cluster4-cluster3-repl-svc scaled
   ```

4. Log in to the Bastion Host of each cnDBTier cluster, and stop and reset replica of all ndbmysqld pods to gracefully stop the replication channels:

   ```
   $ kubectl -n <namespace of cnDBTier cluster> exec -ti <ndbmysqld pod name>
   -- mysql -h 127.0.0.1 -uroot -pNextGenCne
   mysql> stop replica;
   mysql> reset replica all;
   ```

   Example to stop and reset replica of all ndbmysqld pods in cluster1:

   ```
   $ kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
   mysql> stop replica;
   Query OK, 0 rows affected (0.01 sec)
   mysql> reset replica all;
   Query OK, 0 rows affected (0.01 sec)

   $ kubectl -n cluster1 exec -ti ndbmysqld-1 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
   mysql> stop replica;
   Query OK, 0 rows affected (0.01 sec)
   mysql> reset replica all;
   Query OK, 0 rows affected (0.01 sec)

   $ kubectl -n cluster1 exec -ti ndbmysqld-2 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
   ```

```
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-3 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-4 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-5 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)
```

> **Note**
>
> You can use the same example to stop and reset replica of all ndbmysqld pods in cluster2, cluster3, and cluster4 by replacing the cluster names with cluster2, cluster3, and cluster4 respectively.

5. On the leader site, delete all the entries from all the tables of the replication_info database:

```
$kubectl -n <namespace of leader cnDBTier cluster> exec -ti ndbmysqld-0 --
mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
mysql> DELETE from replication_info.DBTIER_SITE_INFO;
mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
```

   Example with output:

```
$kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
Query OK, 24 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
Query OK, 12 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_SITE_INFO;
Query OK, 4 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
Query OK, 32 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
Query OK, 0 rows affected (0.00 sec)
mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
Query OK, 0 rows affected (0.00 sec)
```

6. Uninstall cnDBTier Cluster2 if exists.
7. Uninstall cnDBTier Cluster3 if exists.

8. Uninstall cnDBTier Cluster4 if exists.

   > **Note**
   >
   > To uninstall cnDBTier clusters in steps 6, 7 and 8, follow the "Uninstalling DBTier" procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

9. Make changes specific to multiple replication channel groups in the `custom_values.yaml` file by following the "Configuring Multiple Replication Channel Groups" procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
10. On updating the custom_values.yaml file, upgrade the cnDBTier leader site (cluster1) by running the following command:

    ```
    $ helm upgrade  mysql-cluster --namespace <namespace of leader cnDBTier
    cluster> occndbtier -f occndbtier/custom_values.yaml --no-hooks
    ```

    Example:

    ```
    $ helm upgrade  mysql-cluster --namespace cluster1 occndbtier -f
    occndbtier/custom_values.yaml --no-hooks
    ```

    Sample output:

    ```
    Release "mysql-cluster" has been upgraded. Happy Helming!
    NAME: mysql-cluster
    LAST DEPLOYED:  Mon May 20 10:19:42 2025
    NAMESPACE: cluster1
    STATUS: deployed
    REVISION: 2
    ```

11. Restart the management, data, and SQL pods of cnDBTier cluster by performing the following steps:
    a. Log in to the Bastion Host of cnDBTier cluster and scale down the DB replication service deployments of the cnDBTier leader site (cluster1):

       ```
       $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
       'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of
       cnDBTier cluster> scale deployment --replicas=0
       ```

       Example:

       ```
       # scale down the db replication service deployments of cluster1
       $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}'
       | xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=0
       ```

       Sample output:

       ```
       deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp1 scaled
       deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp2 scaled
       deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp1 scaled
       deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp2 scaled
       ```

```
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp2 scaled
```

b. Restart all the management pods of cnDBTier leader site (cluster1) by performing the following steps:

   i. Identify the list of management pods at cnDBTier cluster1:

   ```
   $ kubectl get pods --namespace=cluster1 | grep 'mgmd'
   ```

   Sample output:

   ```
   ndbmgmd-0                                                 2/2
   Running            0          9m34s
   ndbmgmd-1                                                 2/2
   Running            0          9m4s
   ```

   ii. Delete all the management pods of cnDBTier cluster1 to restart the management pods:

   ```
   $ kubectl delete pod ndbmgmd-0 ndbmgmd-1 --namespace=cluster1
   ```

   Sample output:

   ```
   pod "ndbmgmd-0" deleted
   pod "ndbmgmd-1" deleted
   ```

   iii. Wait for the management pods to restart and run the following command to check if the management pods are up and running:

   ```
   $ kubectl get pods --namespace=cluster1 | grep 'mgmd'
   ```

   Sample output:

   ```
   ndbmgmd-0                                                   2/2     Running
   0          4m29s
   ndbmgmd-1                                                   2/2     Running
   0          4m12s
   ```

   iv. Check the status of cnDBTier cluster1.

   ```
   $ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
   ```

   Sample output:

   ```
   Connected to Management Server at: localhost:1186 Cluster Configuration
   ---------------------
   [ndbd(NDB)]     2 node(s)
   id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
   id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

   [ndb_mgmd(MGM)] 2 node(s)
   id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
   id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

   [mysqld(API)]   18 node(s)
   id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
   id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
   id=58   @10.233.113.87  (mysql-8.4.3 ndb-8.4.3)
   id=59   @10.233.114.32  (mysql-8.4.3 ndb-8.4.3)
   ```

```
id=60   @10.233.108.33  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.230  (mysql-8.4.3 ndb-8.4.3)
id=62   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=63   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=64   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=65   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=66   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=67   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

Note

- The API pods with node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.
- The SQL pods with node IDs 62 to 67 in the sample output are the newly added pods. These pods remain in the not connected state until all the data nodes are restarted.

c. Restart the data pods sequentially by performing the following steps:

i. Identify the list of data pods at cnDBTier cluster1:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

Sample output:

```
ndbmtd-0                                                3/3     Running
0          14m
ndbmtd-1                                                3/3     Running
0          13m
```

ii. Delete the first data pod of cnDBTier cluster1 (in this example, ndbmtd-0) such that the pod restarts:

```
$ kubectl delete pod ndbmtd-0 --namespace=cluster1
```

Sample output:

```
pod "ndbmtd-0" deleted
```

iii. Wait for the first data pod to restart and run the following command to check if the first pod is up and running:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

Sample output:

```
ndbmtd-0                                                  3/3     Running
0          65s
ndbmtd-1                                                  3/3     Running
0          13m
```

iv. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
--------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   18 node(s)
id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.113.87  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.114.32  (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.108.33  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.230  (mysql-8.4.3 ndb-8.4.3)
id=62   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=63   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=64   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=65   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=66   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=67   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

Note

- The API pods with node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.
- The SQL pods with node IDs 62 to 67 in the sample output are the newly added pods. These pods remain in the not connected state until all the data nodes are restarted.

v. Follow Step ii through Step iv to delete and restart each of the remaining data pods of cnDBTier cluster1.

d. Log in to Bastion Host of the cnDBTier cluster and scale up the db replication service deployments of cnDBTier leader site (cluster1).

```
$ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of
cnDBTier cluster> scale deployment --replicas=1
```

Example:

```
# scale up the db replication service deployments of cluster1
$ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}'
| xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=1
```

Sample output:

```
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp2 scaled
```

e. Perform the following steps to restart the monitor service pod of the leader site (cnDBTier cluster1):

i. Identify the monitor service pod at cnDBTier cluster1:

```
$ kubectl get pods --namespace=cluster1 | grep 'monitor'
```

Sample output:

```
mysql-cluster-db-monitor-svc-8bf9448b8-4cghv           1/1     Running
0               13h
```

ii. Delete the monitor service pod of cnDBTier cluster1:

```
$ kubectl delete pod mysql-cluster-db-monitor-svc-8bf9448b8-4cghv --
namespace=cluster1
```

Sample output:

```
pod "mysql-cluster-db-monitor-svc-8bf9448b8-4cghv" deleted
```

iii. Wait until the monitor service pod is up and running. You can check the status of the pod by running the following command:

```
$ kubectl get pods --namespace=cluster1 | grep 'monitor'
```

Sample output:

```
mysql-cluster-db-monitor-svc-8bf9448b8-w8pvf           1/1     Running
0               109s
```

12. Wait until all the pods of the leader site are up and running. Verify if the data node, API nodes, and management nodes are connected to the cnDBTier cluster by running the following command:

    ```
    # Checking the status of MySQL NDB Cluster in cnDBTier cluster
    $ kubectl -n <namespace of leader cnDBTier Cluster> exec -it ndbmgmd-0 --
    ndb_mgm -e show
    ```

    Example:

    ```
    $ kubectl -n cluster1 exec ndbmgmd-0 -- ndb_mgm -e show
    ```

    Sample output:

    ```
    Connected to Management Server at: localhost:1186
    Cluster Configuration
    ---------------------
    [ndbd(NDB)]     2 node(s)
    id=1    @10.233.92.53  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
    id=2    @10.233.72.66  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)

    [ndb_mgmd(MGM)] 2 node(s)
    id=49   @10.233.111.62  (mysql-8.4.3 ndb-8.4.3)
    id=50   @10.233.117.59  (mysql-8.4.3 ndb-8.4.3)

    [mysqld(API)]  10 node(s)
    id=56   @10.233.72.65  (mysql-8.4.3 ndb-8.4.3)
    id=57   @10.233.92.51  (mysql-8.4.3 ndb-8.4.3)
    id=58   @10.233.81.112  (mysql-8.4.3 ndb-8.4.3)
    id=59   @10.233.64.07  (mysql-8.4.3 ndb-8.4.3)
    id=60   @10.233.71.16  (mysql-8.4.3 ndb-8.4.3)
    id=61   @10.233.114.196  (mysql-8.4.3 ndb-8.4.3)
    id=62   @10.233.84.212  (mysql-8.4.3 ndb-8.4.3)
    id=63   @10.233.108.21  (mysql-8.4.3 ndb-8.4.3)
    id=64   @10.233.121.20  (mysql-8.4.3 ndb-8.4.3)
    id=65   @10.233.109.231  (mysql-8.4.3 ndb-8.4.3)
    id=66   @10.233.121.37  (mysql-8.4.3 ndb-8.4.3)
    id=67   @10.233.84.38  (mysql-8.4.3 ndb-8.4.3)
    id=70   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
    id=71   @10.233.113.109  (mysql-8.4.3 ndb-8.4.3)
    id=222 (not connected, accepting connect from any host)
    id=223 (not connected, accepting connect from any host)
    id=224 (not connected, accepting connect from any host)
    id=225 (not connected, accepting connect from any host)
    ```

    > **Note**
    >
    > Node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.

13. Upgrade the leader cnDBTier cluster using the custom_values.yaml file that you updated in Step 9. For more information on upgrading cnDBTier, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

14. Scale down the replication services of cnDBTier leader site (cluster1). Log in to Bastion Host of cnDBTier Cluster and scale down the DB replication service deployments:

    ```
    $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
    'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
    cluster> scale deployment --replicas=0
    ```

    For example, run the following command to scale down the DB replication service deployments of cluster1:

    ```
    $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' |
    xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=0
    ```

    Sample output:

    ```
    deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp1 scaled
    deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp2 scaled
    deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp1 scaled
    deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp2 scaled
    deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp1 scaled
    deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp2 scaled
    ```

15. Delete all entries from all the tables of replication_info database on the leader site:

    ```
    $kubectl -n <namespace of leader cnDBTier cluster> exec -ti ndbmysqld-0 --
    mysql -h 127.0.0.1 -uroot -pNextGenCne
    mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
    mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
    mysql> DELETE from replication_info.DBTIER_SITE_INFO;
    mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
    mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
    mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
    ```

    Example with output:

    ```
    $kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
    mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
    Query OK, 24 rows affected (0.01 sec)
    mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
    Query OK, 12 rows affected (0.01 sec)
    mysql> DELETE from replication_info.DBTIER_SITE_INFO;
    Query OK, 4 rows affected (0.01 sec)
    mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
    Query OK, 32 rows affected (0.01 sec)
    mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
    Query OK, 0 rows affected (0.00 sec)
    mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
    Query OK, 0 rows affected (0.00 sec)
    ```

16. Scale up the replication services of cnDBTier leader site (cluster1). Log in to Bastion Host of cnDBTier cluster and scale up the DB replication service deployments:

    ```
    $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
    'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
    cluster> scale deployment --replicas=1
    ```

For example, run the following command to scale up the DB replication service deployments of cluster1:

```
$ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
r kubectl -n cluster1 scale deployment --replicas=1
```

Sample output:

```
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp2 scaled
```

17. Reinstall cnDBTier Cluster2 by following the Adding cnDBTier Georedundant Cluster to Single Site cnDBTier Cluster procedure.
18. Reinstall cnDBTier Cluster3 by following the Adding cnDBTier Georedundant Cluster to Two Site cnDBTier Clusters procedure.
19. Reinstall cnDBTier Cluster4 by following the Adding cnDBTier Georedundant Cluster to Four Site cnDBTier Clusters procedure.

7.7.2 Converting Multiple Replication Channel Groups to Single Replication Channel Group

This section describes the procedure to convert multiple replication channel groups to single replication channel group.

> **Note**
>
> This procedure is not supported for cnDBTier setups where TLS is enabled.

This procedure can be used if multiple replication channel groups are enabled in the cnDBTier cluster and if you want to convert it to a single replication group due to a rollback to the previous versions or any other reasons.

To convert multiple replication channel groups to single replication channel group:

1. Consider any one of the cnDBTier clusters as a leader cluster (cluster1) and move all the NFs' traffic to that cluster. All the pods of leader cluster must be up and running.
2. Wait for replication to be updated in every cnDBTier cluster so that the database is consistent across all the cnDBTier clusters.
3. Scale down the replication service deployments in each site: Log in to Bastion Host of each of the cnDBTier Clusters and scale down the DB replication service deployments:

   ```
   $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
   'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
   cluster> scale deployment --replicas=0
   ```

   Example:

   ```
   # scaling down the DB replication service deployments of cluster1
   $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
   r kubectl -n cluster1 scale deployment --replicas=0
   ```

```
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster2-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-grp2 scaled

# scaling down the DB replication service deployments of cluster2 If exists
$ kubectl -n cluster2 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
r kubectl -n cluster2 scale deployment --replicas=0
deployment.apps/mysql-cluster-cluster2-cluster1-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster2-cluster1-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster2-cluster3-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster2-cluster3-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster2-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster2-cluster4-repl-grp2 scaled

# scaling down the DB replication service deployments of cluster3 If exists
$ kubectl -n cluster3 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
r kubectl -n cluster3 scale deployment --replicas=0
deployment.apps/mysql-cluster-cluster3-cluster1-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster3-cluster1-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster3-cluster2-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster3-cluster2-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster3-cluster4-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster3-cluster4-repl-grp2 scaled

# scaling down the DB replication service deployments of cluster4 If exists
$ kubectl -n cluster4 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
r kubectl -n cluster4 scale deployment --replicas=0
deployment.apps/mysql-cluster-cluster4-cluster1-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster4-cluster1-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster4-cluster2-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster4-cluster2-repl-grp2 scaled
deployment.apps/mysql-cluster-cluster4-cluster3-repl-grp1 scaled
deployment.apps/mysql-cluster-cluster4-cluster3-repl-grp2 scaled
```

4. Log in to the Bastion Host of each cnDBTier cluster, and stop and reset replica of all ndbmysqld pods to gracefully stop the replication channels:

```
$ kubectl -n <namespace of cnDBTier cluster> exec -ti <ndbmysqld pod name>
-- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
mysql> reset replica all;
```

Example to stop and reset replica of all ndbmysqld pods in cluster1:

```
$ kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-1 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-2 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
```

```
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-3 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-4 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-5 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-6 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-7 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-8 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-9 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-10 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)

$ kubectl -n cluster1 exec -ti ndbmysqld-11 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
mysql> stop replica;
Query OK, 0 rows affected (0.01 sec)
mysql> reset replica all;
Query OK, 0 rows affected (0.01 sec)
```

> **Note**
>
> You can use the same example to stop and reset replica of all ndbmysqld pods in cluster2, cluster3, and cluster4 by replacing the cluster names with cluster2, cluster3, and cluster4 respectively.

5. On the leader site, delete all the entries from all the tables of the replication_info database:

   ```
   $kubectl -n <namespace of leader cnDBTier cluster> exec -ti ndbmysqld-0 --
   mysql -h 127.0.0.1 -uroot -pNextGenCne
   mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
   mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
   mysql> DELETE from replication_info.DBTIER_SITE_INFO;
   mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
   mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
   mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
   ```

   Example with output:

   ```
   $kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
   mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
   Query OK, 4 rows affected (0.01 sec)
   mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
   Query OK, 2 rows affected (0.01 sec)
   mysql> DELETE from replication_info.DBTIER_SITE_INFO;
   Query OK, 2 rows affected (0.01 sec)
   mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
   Query OK, 8 rows affected (0.01 sec)
   mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
   Query OK, 0 rows affected (0.00 sec)
   mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
   Query OK, 0 rows affected (0.00 sec)
   ```

6. Uninstall cnDBTier Cluster2 if exists.
7. Uninstall cnDBTier Cluster3 if exists.
8. Uninstall cnDBTier Cluster4 if exists.

> **Note**
>
> To uninstall cnDBTier clusters in steps 6, 7 and 8, follow the "Uninstalling DBTier" procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

9. Remove or disable the configurations specific to multiple replication channel groups from the `custom_values.yaml` file.
10. On updating the custom_values.yaml file, upgrade the cnDBTier leader site (cluster1) by running the following command:

    ```
    $ helm upgrade  mysql-cluster --namespace <namespace of leader cnDBTier
    cluster> occndbtier -f occndbtier/custom_values.yaml --no-hooks
    ```

Example:

```
$ helm upgrade  mysql-cluster --namespace cluster1 occndbtier -f
occndbtier/custom_values.yaml --no-hooks
```

Sample output:

```
Release "mysql-cluster" has been upgraded. Happy Helming!
NAME: mysql-cluster
LAST DEPLOYED:  Mon May 20 10:19:42 2025
NAMESPACE: cluster1
STATUS: deployed
REVISION: 2
```

11. Restart the management, data, and SQL pods of cnDBTier cluster by performing the following steps:
    a. Log in to the Bastion Host of cnDBTier cluster and scale down the DB replication service deployments of the cnDBTier leader site (cluster1):

       ```
       $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
       'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of
       cnDBTier cluster> scale deployment --replicas=0
       ```

       Example:

       ```
       # scale down the db replication service deployments of cluster1
       $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}'
       | xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=0
       ```

       Sample output:

       ```
       deployment.apps/mysql-cluster-cluster1-cluster2-repl-svc scaled
       deployment.apps/mysql-cluster-cluster1-cluster3-repl-svc scaled
       deployment.apps/mysql-cluster-cluster1-cluster4-repl-svc scaled
       ```

    b. Restart all the management pods of cnDBTier leader site (cluster1) by performing the following steps:
       i. Identify the list of management pods at cnDBTier cluster1:

          ```
          $ kubectl get pods --namespace=cluster1 | grep 'mgmd'
          ```

          Sample output:

          ```
          ndbmgmd-0                                          2/2
          Running            0          9m34s
          ndbmgmd-1                                          2/2
          Running            0          9m4s
          ```

       ii. Delete all the management pods of cnDBTier cluster1 to restart the management pods:

          ```
          $ kubectl delete pod ndbmgmd-0 ndbmgmd-1 --namespace=cluster1
          ```

          Sample output:

```
pod "ndbmgmd-0" deleted
pod "ndbmgmd-1" deleted
```

iii. Wait for the management pods to restart and run the following command to check if the management pods are up and running:

```
$ kubectl get pods --namespace=cluster1 | grep 'mgmd'
```

Sample output:

```
ndbmgmd-0                                                 2/2     Running
0          4m29s
ndbmgmd-1                                                 2/2     Running
0          4m12s
```

iv. Check the status of cnDBTier cluster1.

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   18 node(s)
id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.113.87  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.114.32  (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.108.33  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.230  (mysql-8.4.3 ndb-8.4.3)
id=62   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=63   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=64   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=65   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=66   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=67   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - The API pods with node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.
> - The SQL pods with node IDs 62 to 67 in the sample output are the newly added pods. These pods remain in the not connected state until all the data nodes are restarted.

c. Restart the data pods sequentially by performing the following steps:

i. Identify the list of data pods at cnDBTier cluster1:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

Sample output:

```
ndbmtd-0                                                  3/3     Running
0          14m
ndbmtd-1                                                  3/3     Running
0          13m
```

ii. Delete first data pod of cnDBTier cluster1 (ndbmtd-0) such that the pod restarts:

```
$ kubectl delete pod ndbmtd-0 --namespace=cluster1
```

Sample output:

```
pod "ndbmtd-0" deleted
```

iii. Wait for the first data pod to restart and run the following command to check if the first pod is up and running:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

Sample output:

```
ndbmtd-0                                                  3/3     Running
0          65s
ndbmtd-1                                                  3/3     Running
0          13m
```

iv. Check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)
```

```
[mysqld(API)]   18 node(s)
id=56   @10.233.124.92  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.114.135  (mysql-8.4.3 ndb-8.4.3)
id=58   @10.233.113.87  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.114.32  (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.108.33  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.230  (mysql-8.4.3 ndb-8.4.3)
id=62   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=63   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=64   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=65   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=66   (not connected, accepting connect from
ndbmysqld-2.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=67   (not connected, accepting connect from
ndbmysqld-3.ndbmysqldsvc.cluster1.svc.occne4-cgbu-cne-dbtier)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> - The API pods with node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.
> - The SQL pods with node IDs 62 to 67 in the sample output are the newly added pods. These pods remain in the not connected state until all the data nodes are restarted.

v. Follow Step ii through Step iv to delete and restart the second data pod of cnDBTier cluster1 (ndbmtd-1).

d. Log in to Bastion Host of the cnDBTier cluster and scale up the db replication service deployments of cnDBTier leader site (cluster1).

```
$ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of
cnDBTier cluster> scale deployment --replicas=1
```

Example:

```
# scale up the db replication service deployments of cluster1
$ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}'
| xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=1
```

Sample output:

```
deployment.apps/mysql-cluster-cluster1-cluster2-repl-svc scaled
deployment.apps/mysql-cluster-cluster1-cluster3-repl-svc scaled
deployment.apps/mysql-cluster-cluster1-cluster4-repl-svc scaled
```

e. Perform the following steps to restart the monitor service pod of the leader site (cnDBTier cluster1):

i. Identify the monitor service pod at cnDBTier cluster1:

```
$ kubectl get pods --namespace=cluster1 | grep 'monitor'
```

Sample output:

```
mysql-cluster-db-monitor-svc-8bf9448b8-4cghv           1/1     Running
0               13h
```

ii. Delete the monitor service pod of cnDBTier cluster1:

```
$ kubectl delete pod mysql-cluster-db-monitor-svc-8bf9448b8-4cghv --
namespace=cluster1
```

Sample output:

```
pod "mysql-cluster-db-monitor-svc-8bf9448b8-4cghv" deleted
```

iii. Wait until the monitor service pod is up and running. You can check the status of the pod by running the following command:

```
$ kubectl get pods --namespace=cluster1 | grep 'monitor'
```

Sample output:

```
mysql-cluster-db-monitor-svc-8bf9448b8-w8pvf           1/1     Running
0               109s
```

12. Wait until all the pods of the leader site are up and running. Verify if the data node, API nodes, and management nodes are connected to the cnDBTier cluster by running the following command:

```
$ kubectl -n <namespace of leader cnDBTier Cluster> exec -it ndbmgmd-0 --
ndb_mgm -e show
```

Example:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186
Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.92.53  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.72.66  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.111.62  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.117.59  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]  10 node(s)
id=56   @10.233.72.65  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.92.51  (mysql-8.4.3 ndb-8.4.3)
```

```
id=58   @10.233.113.87  (mysql-8.4.3 ndb-8.4.3)
id=59   @10.233.114.32  (mysql-8.4.3 ndb-8.4.3)
id=60   @10.233.108.33  (mysql-8.4.3 ndb-8.4.3)
id=61   @10.233.78.230  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.72.64  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.92.52  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as they are added as empty API slots for georeplication recovery. You can ignore these nodes.

13. Upgrade the leader cnDBTier cluster using the custom_values.yaml file that you updated in Step 9. For more information on upgrading cnDBTier, see *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
14. Scale down the replication services of cnDBTier leader site (cluster1). Log in to Bastion Host of cnDBTier Cluster and scale down the DB replication service deployments:

    ```
    $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
    'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
    cluster> scale deployment --replicas=0
    ```

    For example, run the following command to scale down the DB replication service deployments of cluster1:

    ```
    $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' |
    xargs -L1 -r kubectl -n cluster1 scale deployment --replicas=0
    ```

    Sample output:

    ```
    deployment.apps/mysql-cluster-cluster1-cluster2-repl-svc scaled
    deployment.apps/mysql-cluster-cluster1-cluster3-repl-svc scaled
    deployment.apps/mysql-cluster-cluster1-cluster4-repl-svc scaled
    ```
15. Delete all entries from all the tables of replication_info database on the leader site:

    ```
    $kubectl -n <namespace of leader cnDBTier cluster> exec -ti ndbmysqld-0 --
    mysql -h 127.0.0.1 -uroot -pNextGenCne
    mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
    mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
    mysql> DELETE from replication_info.DBTIER_SITE_INFO;
    mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
    mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
    mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
    ```

    Example with output:

    ```
    $kubectl -n cluster1 exec -ti ndbmysqld-0 -- mysql -h 127.0.0.1 -uroot -pNextGenCne
    mysql> DELETE from replication_info.DBTIER_REPLICATION_CHANNEL_INFO;
    Query OK, 4 rows affected (0.01 sec)
    mysql> DELETE from replication_info.DBTIER_REPL_SITE_INFO;
    ```

```
Query OK, 2 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_SITE_INFO;
Query OK, 2 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_INITIAL_BINLOG_POSTION;
Query OK, 8 rows affected (0.01 sec)
mysql> DELETE from replication_info.DBTIER_REPL_ERROR_SKIP_INFO;
Query OK, 0 rows affected (0.00 sec)
mysql> DELETE from replication_info.DBTIER_REPL_EVENT_INFO;
Query OK, 0 rows affected (0.00 sec)
```

16. Scale up the replication services of cnDBTier leader site (cluster1). Log in to Bastion Host of cnDBTier cluster and scale up the DB replication service deployments:

    ```
    $ kubectl -n <namespace of cnDBTier cluster> get deployments | egrep
    'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <namespace of cnDBTier
    cluster> scale deployment --replicas=1
    ```

    For example, run the following command to scale up the DB replication service deployments of cluster1:

    ```
    $ kubectl -n cluster1 get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -
    r kubectl -n cluster1 scale deployment --replicas=1
    ```

    Sample output:

    ```
    deployment.apps/mysql-cluster-cluster1-cluster2-repl-svc scaled
    deployment.apps/mysql-cluster-cluster1-cluster3-repl-svc scaled
    deployment.apps/mysql-cluster-cluster1-cluster4-repl-svc scaled
    ```

17. Reinstall cnDBTier Cluster2 by following the Adding cnDBTier Georedundant Cluster to Single Site cnDBTier Cluster procedure.
18. Reinstall cnDBTier Cluster3 by following the Adding cnDBTier Georedundant Cluster to Two Site cnDBTier Clusters procedure.
19. Reinstall cnDBTier Cluster4 by following the Adding cnDBTier Georedundant Cluster to Three Site cnDBTier Clusters procedure.

7.8 Managing Passwords and Secrets

This section provides the procedures to manage cnDBTier passwords and secrets.

7.8.1 Modifying cnDBTier Password Encryption Key

Encryption key is used to encrypt the replication username and password stored in the database using the Advanced Encryption Standard (AES) algorithm. This section provides the procedure to modify the encryption key used to encrypt the replication username and password.

> **Note**
>
> If you update an encryption key on one site, ensure that you use the same encryption key across all the other mate sites.

1. Run the `hooks.sh` script with the `--update-encryption-key` flag to change the encryption secret and encrypt the replication username and password using the new encryption key.

> **Note**
>
> Replace the values of the environment variables in the commands with the values corresponding to your cluster.

```
export OCCNE_NAMESPACE="occne-cndbtier"
export MYSQL_CONNECTIVITY_SERVICE="mysql-connectivity-service"
export MYSQL_USERNAME="occneuser"
export MYSQL_PASSWORD="<password for the user occneuser>"
export MYSQL_CMD="kubectl -n <namespace> exec <ndbmysqld-0/ndbappmysqld-0
pod name> -- mysql --binary-as-hex=0 --show-warnings"
export NEW_ENCRYPTION_KEY="<new_encryption_password>"
export DBTIER_REPLICATION_SVC_DATABASE="replication_info"
export APP_STS_NAME="ndbappmysqld"
# Optional: Uncomment the line below to decrypt the encrypted credentials
with a custom key.
# export CURRENT_ENCRYPTION_KEY="<current_encryption_password>"


occndbtier/files/hooks.sh --update-encryption-key
```

2. Perform rollout restart of ndbmysqld on the cnDBTier cluster:
   a. Run the following command to fetch the statefulset name of ndbmysqld:

      ```
      $ kubectl get statefulset --namespace=<namespace of cnDBTier cluster>
      ```

      For example:

      ```
      $ kubectl get statefulset --namespace=occne-cndbtier
      ```

      Sample output:

      ```
      NAME           READY   AGE
      ndbappmysqld   2/2     27h
      ndbmgmd        2/2     27h
      ndbmtd         2/2     27h
      ndbmysqld      2/2     27h
      ```

   b. Perform rollout restart of ndbmsqld:

      ```
      $ kubectl rollout restart statefulset <statefulset name of ndbmysqld> --
      namespace=<namespace of cnDBTier cluster>
      ```

      For example:

      ```
      $ kubectl rollout restart statefulset ndbmysqld  --namespace=occne-
      cndbtier
      ```

Sample output:

```
statefulset.apps/ndbmysqld restarted
```

c. Wait until the rollout restart of ndbmysqld pod completes. Run the following command to check the status:

```
$ kubectl rollout status statefulset <statefulset name of ndbmysqld> --
namespace=<namespace of cnDBTier cluster>
```

For example:

```
$ kubectl rollout status statefulset ndbmysqld  --namespace=occne-
cndbtier
```

Sample output:

```
Waiting for 1 pods to be ready...
waiting for statefulset rolling update to complete 1 pods at revision
ndbmysqld-7c6b9c9f84...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
statefulset rolling update complete 2 pods at revision
ndbmysqld-7c6b9c9f84...
```

3. After the rollout restart, run the following command to ensure that the replication is UP on all cnDBTier sites:

```
$ kubectl -n <namespace of cnDBTier cluster> exec -it ndbmysqld-0 -- curl
http://mysql-cluster-db-monitor-svc.<namespace of cnDBTier
cluster>:8080/db-tier/status/replication/realtime
```

where, `<namespace>` is the namespace name of the of cnDBTier cluster.

The value of `replicationStatus` in the output indicates if the local site is able to replicate data from that remote site:

- "UP": Indicates that the local site is able to replicate data from that remote site.
- "DOWN": Indicates that the local site is not able to replicate data from the respective remote site.

For example, run the following command to check the georeplication status of cnDBTier cluster2 configured with other remote sites:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- curl http://mysql-cluster-db-
monitor-svc.cluster2:8080/db-tier/status/replication/realtime
```

Sample output:

```
[
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster1",
    "replicationStatus": "UP",
```

```
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
      }
    ]
  },
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster3",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
      }
    ]
  },
  {
    "localSiteName": "cluster2",
    "remoteSiteName": "cluster4",
    "replicationStatus": "UP",
    "secondsBehindRemote": 0,
    "replicationGroupDelay": [
      {
        "replchannel_group_id": "1",
        "secondsBehindRemote": 0
      }
    ]
  }
]
```


In the sample output, the value of `remotesiteName` is "UP" for the `localSiteName` cluster1, cluster3, and cluster4. This indicates that the cluster2 for `localSiteName` cluster2 is able to replicate data from `remotesiteName` cluster1, cluster3, and cluster4.

4. Repeat steps 1, 2, and 3 on the other cnDBTier mate sites.

7.8.2 Changing cnDBTier Passwords

This section provides the procedures to change cnDBTier passwords such as root user, occneuser, and occnerepluser passwords in a stand-alone and multisite georeplication setup using the `dbtpasswd` bash script.

Note

- The password changes are applicable only to the current site and are not replicated in the mate sites.
- Ensure that your password meets the following password policy requirements:
  - Password must be between 20 and 32 characters in length.
  - Password must contain at least one lower case letter.
  - Password must contain at least one upper case letter.
  - Password must include at least one digit.
  - Password must include at least one of the following special characters: `,%~+.:_/-`
- Any character that does not meet the complexity requirements mentioned in the previous note is not supported as it may break the functionality of the `dbtpasswd` script.

Changing a cnDBTier password involves the following steps:

1. Adding a new password in MySQL.

   Note

   The old password is active until the pods are restarted and the transitional operations are complete.

2. Replacing the current or old password with the new password in Kubernetes secret.
3. Restarting the configured cnDBTier pods to use the new Kubernetes secret (This step is not applicable while changing an NF password).
4. Discarding the old password in MySQL.

The `dbtpasswd` bash script automates these steps and provides a single script to change all cnDBTier passwords at once. The script also provides options to run selective steps as changing passwords often requires running selective transitional operations, such as restarting pods, while both passwords are still valid.

You can use `dbtpasswd` to:

- change one or more cnDBTier passwords in a single site or cluster. Changing a cnDBTier password on a site includes changing the password in MySQL and Kubernetes secret, restarting all required cnDBTier pods, and updating passwords on cnDBTier database tables if necessary.
- change passwords on a live cluster with no service interruption.
- change NF passwords. However, when changing an NF password, *dbtpasswd* can change the password in the Kubernetes secret and database only. You have to manually restart NF pods as a separate user action.

To provide flexibility and support for changing non-cnDBTier passwords (that is, NF passwords), `dbtpasswd` provides a range of options for controlling the phases of execution. For example, you can configure *dbtpasswd* to only add the new password to the database, change it in the Kubernetes secret, and then stop. After running the other operations, you can configure the script and run it again to discard the old password only.

MySQL Dual Password

The `dbtpasswd` script uses the MySQL Dual Password feature to first add the new password and then discard the old MySQL password after database values and secrets are changed and the pods are restarted. Both the passwords are valid until the old password is discarded.

> **Note**
>
> MySQL Dual Password is not supported for changing the root password.

Support for Non-cnDBTier Secrets on Different Namespace

To support changing NF passwords, that have their secrets on a namespace different from the cnDBTier namespace, `dbtpasswd` provides the `--nf-namespace` to configure the namespace in which the secrets are stored. For more information about this option, see Configuration Options.

7.8.2.1 Prerequisites

Before changing the cnDBTier passwords ensure that the following prerequisites are met:

- The `dbtpasswd` scripti must be properly installed. For more information, see Installing and Using dbtpasswd Script.
- If you are changing the replication password in a multisite setup, then ensure that the DB Replication is up and running between all of the sites in the system.

7.8.2.2 Installing and Using dbtpasswd Script

This section provides details about installing and using the `dbtpasswd` script to change cnDBTier passwords.

Installing the dbtpasswd Script

Run the following commands to source and add the bin directory containing the dbtpasswd program to the user's path.

```
cd Artifacts/Scripts/tools
source ./source_me
```

The system prompts you to enter the namespace and uses the same to set the DBTIER_NAMESPACE. It also sets the `DBTIER_LIB` environment variable with the path to the directory containing the libraries needed by *dbtpasswd*.

Using the dbtpasswd Script

You can use the dbtpasswd script in the following ways:

```
dbtpasswd [-h | --help]
dbtpasswd [OPTIONS] [SECRET...]
```

7.8.2.3 Configuration Options

This section describes the list of options that are available to configure the dbtpasswd script.

Table 7-1 Configuration Options

Option	Usage	Example
-h | --help	This option is used to print the help message and exit.	`dbtpasswd --help`
-v | --version	This option is used to print script's version.	`dbtpasswd --version`
--debug	This option is used to output DEBUG log message to standard error, stderr.	`dbtpasswd --debug`
--skip-namespace-test	This option is used to skip testing that the namespace in DBTIER_NAMESPACE exists in the current cluster.	`dbtpasswd --skip-namespace-test`
--rollout-watch-timeout=0s	This option is used to define the time to wait before ending the rollout status watch. Set this value to zero if you donot want to wait before ending the rollout status watch. Use a corresponding time unit to set other values. For example: 1s, 2m, 3h.	`dbtpasswd --rollout-watch-timeout=0s`
--no-checks	This option is used to skip verifying if replication to mate sites is UP, when updating a replication password.	`dbtpasswd --no-checks`
--no-discard	This option is used to change a password without discarding the old password.	To change all cnDBTier passwords, but retain the old passwords: `dbtpasswd --no-discard`
--discard-only	This option is used to only discard the old password.	`dbtpasswd --discard-only`
--secrets-only	This option is used to change the password in the secrets only.	`dbtpasswd --secrets-only`
--mysql-only	This option is used to change the passwords in MySQL only. **Note:** The current secret password must be the current MySQL password. Therefore, if you are using the `--mysql-only` and `--secrets-only` options to change the passwords, you must first change the MySQL password and then the secret password.	`dbtpasswd --mysql-only`

Table 7-1 (Cont.) Configuration Options

Option	Usage	Example
--secrets-and-mysql-only	This option is used to change the passwords in the secrets and MySQL only.	`dbtpasswd --secrets-and-mysql-only`
--restart-only	This option is used to only restart the pods configured to use cnDBTier secrets and doesn't change the passwords.	`dbtpasswd --restart-only`

--nf-namespace=<namespace_where_secrets_are>	Non-cnDBTier secrets may be stored on a namespace different from the cnDBTier namespace. This option is used to provide the details of the namespace where the non-cnDBTier secrets are stored to support changing NF passwords.
	Note: All non-cnDBTier secrets must be stored in the NF namespace. All cnDBTier secrets must be stored in DBTIER_NAMESPACE.
		• To change a non-DBTier password in its secret, which is on a different namespace, and in mysql:
		`dbtpasswd --secrets-and-mysql-only --nf-namespace=other-namespace-name nf-secret-on-diff-namespace`
		• To discard a non-DBTier old password whose secret is on a different namespace:
		`dbtpasswd --discard-only --nf-namespace=other-namespace-name nf-secret-on-diff-namespace`
		• To change a non-DBTier password in its secret, which is on same namespace as cnDBTier, and in mysql:
		`dbtpasswd --secrets-and-mysql-only nf-secret-on-same-namespace`
		• To discard a non-DBTier old password whose secret is on the same namespace as cnDBTier:
		`dbtpasswd --discard-only nf-secret-on-same-namespace`

Note

Use the `dbtpasswd --help` command to refer to more examples.

7.8.2.4 Changing All cnDBTier Passwords in a Site

Run the following command to change all the cnDBTier passwords in a cnDBTier site:

```
$ dbtpasswd
```

Sample output:

```
2022-12-23T21:54:24Z INFO - Changing password for user root
Current password:
Enter new password:
Enter new password again:
2022-12-23T21:54:39Z INFO - Changing password for user occneuser
Current password:
Enter new password:
Enter new password again:
2022-12-23T21:54:58Z INFO - Changing password for user occnerepluser
Current password:
Enter new password:
Enter new password again:
2022-12-23T21:55:05Z INFO - Getting sts and sts pod info...
2022-12-23T21:55:12Z INFO - MGM_STS="ndbmgmd"
2022-12-23T21:55:12Z INFO - MGM_REPLICAS="2"
2022-12-23T21:55:12Z INFO -
    ndbmgmd-0
    ndbmgmd-1
2022-12-23T21:55:18Z INFO - NDB_STS="ndbmtd"
2022-12-23T21:55:18Z INFO - NDB_REPLICAS="2"
2022-12-23T21:55:18Z INFO -
    ndbmtd-0
    ndbmtd-1
2022-12-23T21:55:25Z INFO - API_STS="ndbmysqld"
2022-12-23T21:55:25Z INFO - API_REPLICAS="2"
2022-12-23T21:55:25Z INFO -
    ndbmysqld-0
    ndbmysqld-1
2022-12-23T21:55:29Z INFO - APP_STS="ndbappmysqld"
2022-12-23T21:55:29Z INFO - APP_REPLICAS="2"
2022-12-23T21:55:29Z INFO -
    ndbappmysqld-0
    ndbappmysqld-1
2022-12-23T21:55:29Z INFO - Getting deployment pod info...
2022-12-23T21:55:29Z INFO - grepping for backup-man (BAK_CHART_NAME)...
2022-12-23T21:55:36Z INFO -
    mysql-cluster-db-backup-manager-svc-7bb947f5f9-nc45s
2022-12-23T21:55:36Z INFO -
    mysql-cluster-db-backup-manager-svc
2022-12-23T21:55:36Z INFO - grepping for db-mon (MON_CHART_NAME)...
2022-12-23T21:55:42Z INFO -
    mysql-cluster-db-monitor-svc-5cff4bf789-g86rr
2022-12-23T21:55:42Z INFO -
    mysql-cluster-db-monitor-svc
2022-12-23T21:55:42Z INFO - grepping for replicat (REP_CHART_NAME)...
2022-12-23T21:55:47Z INFO -
    mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-b4f8d9g6hbc
2022-12-23T21:55:47Z INFO -
    mysql-cluster-lfg-site-1-lfg-site-2-replication-svc
2022-12-23T21:55:47Z INFO - Labeling pods with dbtier-app...
pod/ndbmgmd-0 not labeled
pod/ndbmgmd-1 not labeled
```

```
pod/ndbmtd-0 not labeled
pod/ndbmtd-1 not labeled
pod/ndbappmysqld-0 not labeled
pod/ndbappmysqld-1 not labeled
pod/ndbmysqld-0 not labeled
pod/ndbmysqld-1 not labeled
pod/mysql-cluster-db-backup-manager-svc-7bb947f5f9-nc45s not labeled
pod/mysql-cluster-db-monitor-svc-5cff4bf789-g86rr not labeled
pod/mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-b4f8d9g6hbc not labeled
2022-12-23T21:56:08Z INFO - Pods labeled with dbtier-app
2022-12-23T21:56:08Z INFO - Verifying Geo Replication to mates...
2022-12-23T21:56:18Z INFO - Geo Replication to mates is UP
2022-12-23T21:56:18Z INFO - Changing mysql password for 'root'@'localhost'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T21:56:29Z INFO - Mysql password changed
2022-12-23T21:56:33Z INFO - Patching secret, occne-mysqlndb-root-secret, with new
password
secret/occne-mysqlndb-root-secret patched
2022-12-23T21:56:36Z INFO - Secret, occne-mysqlndb-root-secret, patched with new password
2022-12-23T21:56:36Z INFO - Adding new mysql password for 'occneuser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T21:56:48Z INFO - New mysql password added
2022-12-23T21:56:54Z INFO - Patching secret, occne-secret-db-monitor-secret, with new
password
secret/occne-secret-db-monitor-secret patched
2022-12-23T21:56:58Z INFO - Secret, occne-secret-db-monitor-secret, patched with new
password
2022-12-23T21:56:58Z INFO - Adding new mysql password for 'occnerepluser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T21:57:10Z INFO - New mysql password added
2022-12-23T21:57:10Z INFO - Changing password in replication_info.DBTIER_REPL_SITE_INFO
table...
2022-12-23T21:57:16Z INFO - Using replication pod: mysql-cluster-lfg-site-1-lfg-site-2-
replication-svc-b4f8d9g6hbc
2022-12-23T21:57:16Z INFO - Using replication pod container: lfg-site-1-lfg-site-2-
replication-svc
2022-12-23T21:57:16Z INFO - MYSQL_REPLICATION_SITE_NAME = lfg-site-1
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T21:57:28Z INFO - Password changed in replication_info.DBTIER_REPL_SITE_INFO
table
2022-12-23T21:57:35Z INFO - Patching secret, occne-replication-secret-db-replication-
secret, with new password
secret/occne-replication-secret-db-replication-secret patched
2022-12-23T21:57:38Z INFO - Secret, occne-replication-secret-db-replication-secret,
patched with new password
2022-12-23T21:57:38Z INFO - Starting rollover restarts at 2022-12-23T21:57:38Z
2022-12-23T21:57:38Z INFO - number of db-replication-svc deployments: 1
2022-12-23T21:57:38Z INFO - Patching deployment 0: mysql-cluster-lfg-site-1-lfg-site-2-
replication-svc...
deployment.apps/mysql-cluster-lfg-site-1-lfg-site-2-replication-svc patched (no change)
2022-12-23T21:57:41Z INFO - Rollout restarting mysql-cluster-lfg-site-1-lfg-site-2-
replication-svc...
deployment.apps/mysql-cluster-lfg-site-1-lfg-site-2-replication-svc restarted
...
2022-12-23T22:01:53Z INFO - ndbmtd pods rollout restarted
...
2022-12-23T22:02:11Z INFO - ndbappmysqld pods rollout restarted
...
2022-12-23T22:02:27Z INFO - ndbmysqld pods rollout restarted
...
2022-12-23T22:02:48Z INFO - db-backup-manager-svc pods rollout restarted
...
```

```
2022-12-23T22:03:08Z INFO - db-monitor-svc pods rollout restarted
2022-12-23T22:03:08Z INFO - Discarding old mysql password for 'occneuser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T22:03:20Z INFO - Old mysql password discarded
2022-12-23T22:03:20Z INFO - Discarding old mysql password for 'occnerepluser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-23T22:03:30Z INFO - Old mysql password discarded
2022-12-23T22:03:30Z INFO - Password(s) updated successfully
```

7.8.2.5 Changing All Passwords in a Stand-Alone or Georeplication Site

This section provides the command to change all cnDBTier passwords in a stand-alone site or a site where Georeplication has been configured but the mate sites are not configured.

```
$ dbtpasswd
```

Sample output:

```
2023-10-12T21:34:05Z INFO - DBTIER_NAMESPACE = occne-cndbtier
2023-10-12T21:34:05Z INFO - Testing namespace, occne-cndbtier, exists...
2023-10-12T21:34:05Z INFO - Should be able to see namespace, occne-cndbtier, with
"kubectl get ns -o name occne-cndbtier" - PASSED
2023-10-12T21:34:05Z INFO - Namespace, occne-cndbtier, exists
2023-10-12T21:34:05Z INFO - Changing password for user root 2023-01-03T19:06:31Z INFO -
Changing password for user root
Current password:
Enter new password:
Enter new password again:
2023-10-12T21:34:06Z INFO - Changing password for user occneuser
Current password:
Enter new password:
Enter new password again:
2023-10-12T21:34:06Z INFO - Changing password for user occnerepluser
Current password:
Enter new password:
Enter new password again:  2023-10-12T21:34:06Z INFO - Getting sts and sts pod info...
2023-10-12T21:34:06Z INFO - Getting MGM sts and sts pod info...
2023-10-12T21:34:07Z INFO - MGM_STS="ndbmgmd"
2023-10-12T21:34:07Z INFO - MGM_REPLICAS="2"
2023-10-12T21:34:07Z INFO - MGM_PODS:
    ndbmgmd-0
    ndbmgmd-1
2023-10-12T21:34:07Z INFO - Getting NDB sts and sts pod info...
2023-10-12T21:34:07Z INFO - NDB_STS="ndbmtd"
2023-10-12T21:34:07Z INFO - NDB_REPLICAS="2"
2023-10-12T21:34:07Z INFO - NDB_PODS:
    ndbmtd-0
    ndbmtd-1
2023-10-12T21:34:07Z INFO - Getting API sts and sts pod info...
2023-10-12T21:34:07Z INFO - API_STS="ndbmysqld"
2023-10-12T21:34:07Z INFO - API_REPLICAS="6"
2023-10-12T21:34:07Z INFO - API_PODS:
    ndbmysqld-0
    ndbmysqld-1
    ndbmysqld-2
    ndbmysqld-3
    ndbmysqld-4
    ndbmysqld-5
2023-10-12T21:34:07Z INFO - Getting APP sts and sts pod info...
2023-10-12T21:34:07Z INFO - APP_STS="ndbappmysqld"
2023-10-12T21:34:07Z INFO - APP_REPLICAS="2"
```

```
2023-10-12T21:34:07Z INFO - APP_PODS:
    ndbappmysqld-0
    ndbappmysqld-1
2023-10-12T21:34:07Z INFO - Getting deployment pod info...
2023-10-12T21:34:07Z INFO - grepping for backup-man (BAK_CHART_NAME)...
2023-10-12T21:34:07Z INFO - BAK_PODS:
    mysql-cluster-db-backup-manager-svc-78fdcdfd98-gpml2
2023-10-12T21:34:07Z INFO - BAK_DEPLOY:
    mysql-cluster-db-backup-manager-svc
2023-10-12T21:34:07Z INFO - grepping for db-mon (MON_CHART_NAME)...
2023-10-12T21:34:07Z INFO - MON_PODS:
    mysql-cluster-db-monitor-svc-ccc9bfbfd-5z45b
2023-10-12T21:34:07Z INFO - MON_DEPLOY:
    mysql-cluster-db-monitor-svc
2023-10-12T21:34:07Z INFO - grepping for repl (REP_CHART_NAME)...
2023-10-12T21:34:08Z INFO - REP_PODS:
    mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-67d96bg9z5m
    mysql-cluster-lfg-site-1-lfg-site-3-replication-svc-8f77b9xrrqt
    mysql-cluster-lfg-site-1-lfg-site-4-replication-svc-ddc647dt78q
2023-10-12T21:34:08Z INFO - REP_DEPLOY:
    mysql-cluster-lfg-site-1-lfg-site-2-replication-svc
    mysql-cluster-lfg-site-1-lfg-site-3-replication-svc
    mysql-cluster-lfg-site-1-lfg-site-4-replication-svc
2023-10-12T21:34:08Z INFO - Labeling pods with dbtier-app...
pod/ndbmgmd-0 labeled
pod/ndbmgmd-1 labeled
pod/ndbmtd-0 labeled
pod/ndbmtd-1 labeled
pod/ndbappmysqld-0 labeled
pod/ndbappmysqld-1 labeled
pod/ndbmysqld-0 labeled
pod/ndbmysqld-1 labeled
pod/ndbmysqld-2 labeled
pod/ndbmysqld-3 labeled
pod/ndbmysqld-4 labeled
pod/ndbmysqld-5 labeled
pod/mysql-cluster-db-backup-manager-svc-78fdcdfd98-gpml2 labeled
pod/mysql-cluster-db-monitor-svc-ccc9bfbfd-5z45b labeled
pod/mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-67d96bg9z5m labeled
pod/mysql-cluster-lfg-site-1-lfg-site-3-replication-svc-8f77b9xrrqt labeled
pod/mysql-cluster-lfg-site-1-lfg-site-4-replication-svc-ddc647dt78q labeled
2023-10-12T21:34:41Z INFO - Pods labeled with dbtier-app
2023-10-12T21:34:42Z INFO - DBTIER_REPL_SITE_INFO table is empty (num_of_recs=0);
indicating SINGLE SITE SETUP...
2023-10-12T21:34:42Z INFO - Changing mysql password for 'root'@'localhost'...
2023-10-12T21:34:43Z INFO - Mysql password changed
2023-10-12T21:34:43Z INFO - Patching secret, occne-mysqlndb-root-secret, with new
password
secret/occne-mysqlndb-root-secret patched
2023-10-12T21:34:43Z INFO - Secret, occne-mysqlndb-root-secret, patched with new password
2023-10-12T21:34:43Z INFO - Adding new mysql password for 'occneuser'@'%'...
2023-10-12T21:34:43Z INFO - New mysql password added
2023-10-12T21:34:43Z INFO - Patching secret, occne-secret-db-monitor-secret, with new
password
secret/occne-secret-db-monitor-secret patched
2023-10-12T21:34:44Z INFO - Secret, occne-secret-db-monitor-secret, patched with new
password
2023-10-12T21:34:44Z INFO - Adding new mysql password for 'occnerepluser'@'%'...
2023-10-12T21:34:44Z INFO - New mysql password added
2023-10-12T21:34:44Z INFO - Patching secret, occne-replication-secret-db-replication-
secret, with new password
secret/occne-replication-secret-db-replication-secret patched
```

```
2023-10-12T21:34:44Z INFO - Secret, occne-replication-secret-db-replication-secret,
patched with new password
2023-10-12T21:34:44Z INFO - Starting rollover restarts at 2023-10-12T21:34:44Z
2023-10-12T21:34:44Z INFO - number of db-replication-svc deployments: 3
2023-10-12T21:34:44Z INFO - Patching deployment 0: mysql-cluster-lfg-site-1-lfg-site-2-
replication-svc...
2023-10-12T21:34:47Z INFO - Patching deployment 1: mysql-cluster-lfg-site-1-lfg-site-3-
replication-svc...
2023-10-12T21:34:47Z INFO - Patching deployment 2: mysql-cluster-lfg-site-1-lfg-site-4-
replication-svc...
2023-10-12T21:34:48Z INFO - Waiting for deployment mysql-cluster-lfg-site-1-lfg-site-2-
replication-svc to rollout restart...
Waiting for deployment "mysql-cluster-lfg-site-1-lfg-site-2-replication-svc" rollout to
finish: 0 out of 1 new replicas have been updated...
Waiting for deployment "mysql-cluster-lfg-site-1-lfg-site-2-replication-svc" rollout to
finish: 0 out of 1 new replicas have been updated...
Waiting for deployment "mysql-cluster-lfg-site-1-lfg-site-2-replication-svc" rollout to
finish: 0 out of 1 new replicas have been updated...
Waiting for deployment "mysql-cluster-lfg-site-1-lfg-site-2-replication-svc" rollout to
finish: 0 of 1 updated replicas are available...
deployment "mysql-cluster-lfg-site-1-lfg-site-2-replication-svc" successfully rolled out
2023-10-12T21:36:19Z INFO - Waiting for deployment mysql-cluster-lfg-site-1-lfg-site-3-
replication-svc to rollout restart...
deployment "mysql-cluster-lfg-site-1-lfg-site-3-replication-svc" successfully rolled out
2023-10-12T21:36:19Z INFO - Waiting for deployment mysql-cluster-lfg-site-1-lfg-site-4-
replication-svc to rollout restart...
deployment "mysql-cluster-lfg-site-1-lfg-site-4-replication-svc" successfully rolled out
2023-10-12T21:36:22Z INFO - number of db-backup-manager-svc deployments: 1
2023-10-12T21:36:22Z INFO - Patching deployment 0: mysql-cluster-db-backup-manager-svc...
2023-10-12T21:36:23Z INFO - number of db-monitor-svc deployments: 1
2023-10-12T21:36:23Z INFO - Patching deployment 0: mysql-cluster-db-monitor-svc...
2023-10-12T21:36:23Z INFO - Waiting for statefulset ndbmtd to rollout restart...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
waiting for statefulset rolling update to complete 1 pods at revision ndbmtd-d7bf774f6...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
statefulset rolling update complete 2 pods at revision ndbmtd-d7bf774f6...
2023-10-12T21:37:49Z INFO - Waiting for statefulset ndbappmysqld to rollout restart...
statefulset rolling update complete 2 pods at revision ndbappmysqld-5b8948d47d...
2023-10-12T21:37:49Z INFO - Waiting for statefulset ndbmysqld to rollout restart...
Waiting for 1 pods to be ready...
waiting for statefulset rolling update to complete 4 pods at revision
ndbmysqld-94dd7fcbb...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
waiting for statefulset rolling update to complete 5 pods at revision
ndbmysqld-94dd7fcbb...
Waiting for 1 pods to be ready...
Waiting for 1 pods to be ready...
statefulset rolling update complete 6 pods at revision ndbmysqld-94dd7fcbb...
2023-10-12T21:38:32Z INFO - Waiting for deployment mysql-cluster-db-backup-manager-svc
to rollout restart...
deployment "mysql-cluster-db-backup-manager-svc" successfully rolled out
2023-10-12T21:38:33Z INFO - Waiting for deployment mysql-cluster-db-monitor-svc to
rollout restart...
deployment "mysql-cluster-db-monitor-svc" successfully rolled out
2023-10-12T21:38:33Z INFO - Discarding old mysql password for 'occneuser'@'%'...
2023-10-12T21:38:33Z INFO - Old mysql password discarded
2023-10-12T21:38:33Z INFO - Discarding old mysql password for 'occnerepluser'@'%'...
2023-10-12T21:38:34Z INFO - Old mysql password discarded
2023-10-12T21:38:34Z INFO - Password(s) updated successfully
```

7.8.2.6 Changing All cnDBTier Passwords in Phases

This section provides the procedure to change all cnDBTier Passwords in Phases.

1. Run the following command to add the new passwords to MySQL (retain the old passwords) and change the passwords in the Kubernetes secret:

   ```
   $ dbtpasswd --secrets-and-mysql-only
   ```

   Sample output:

   ```
   2022-12-24T03:41:08Z INFO - Changing password for user root
   Current password:
   Enter new password:
   Enter new password again:
   2022-12-24T03:41:08Z INFO - Changing password for user occneuser
   Current password:
   Enter new password:
   Enter new password again:
   2022-12-24T03:41:09Z INFO - Changing password for user occnerepluser
   Current password:
   Enter new password:
   Enter new password again:
   2022-12-24T03:41:09Z INFO - Getting sts and sts pod info...
   2022-12-24T03:41:09Z INFO - MGM_STS="ndbmgmd"
   2022-12-24T03:41:09Z INFO - MGM_REPLICAS="2"
   2022-12-24T03:41:09Z INFO -
       ndbmgmd-0
       ndbmgmd-1
   2022-12-24T03:41:09Z INFO - NDB_STS="ndbmtd"
   2022-12-24T03:41:09Z INFO - NDB_REPLICAS="2"
   2022-12-24T03:41:09Z INFO -
       ndbmtd-0
       ndbmtd-1
   2022-12-24T03:41:09Z INFO - API_STS="ndbmysqld"
   2022-12-24T03:41:09Z INFO - API_REPLICAS="2"
   2022-12-24T03:41:09Z INFO -
       ndbmysqld-0
       ndbmysqld-1
   2022-12-24T03:41:09Z INFO - APP_STS="ndbappmysqld"
   2022-12-24T03:41:09Z INFO - APP_REPLICAS="2"
   2022-12-24T03:41:10Z INFO -
       ndbappmysqld-0
       ndbappmysqld-1
   2022-12-24T03:41:10Z INFO - Getting deployment pod info...
   2022-12-24T03:41:10Z INFO - grepping for backup-man (BAK_CHART_NAME)...
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-db-backup-manager-svc-c4648f6bc-jpkt9
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-db-backup-manager-svc
   2022-12-24T03:41:10Z INFO - grepping for db-mon (MON_CHART_NAME)...
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-db-monitor-svc-7d684c7c6f-gvv76
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-db-monitor-svc
   2022-12-24T03:41:10Z INFO - grepping for replicat (REP_CHART_NAME)...
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-7b689frvfr2
   2022-12-24T03:41:10Z INFO -
       mysql-cluster-lfg-site-1-lfg-site-2-replication-svc
   ```

```
2022-12-24T03:41:10Z INFO - Labeling pods with dbtier-app...
pod/ndbmgmd-0 not labeled
pod/ndbmgmd-1 not labeled
pod/ndbmtd-0 not labeled
pod/ndbmtd-1 not labeled
pod/ndbappmysqld-0 not labeled
pod/ndbappmysqld-1 not labeled
pod/ndbmysqld-0 not labeled
pod/ndbmysqld-1 not labeled
pod/mysql-cluster-db-backup-manager-svc-c4648f6bc-jpkt9 not labeled
pod/mysql-cluster-db-monitor-svc-7d684c7c6f-gvv76 not labeled
pod/mysql-cluster-lfg-site-1-lfg-site-2-replication-svc-7b689frvfr2 not labeled
2022-12-24T03:41:11Z INFO - Pods labeled with dbtier-app
2022-12-24T03:41:11Z INFO - Verifying Geo Replication to mates...
2022-12-24T03:41:14Z INFO - Geo Replication to mates is UP
2022-12-24T03:41:14Z INFO - Changing mysql password for 'root'@'localhost'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:41:15Z INFO - Mysql password changed
2022-12-24T03:41:15Z INFO - Patching secret, occne-mysqlndb-root-secret, with new
password
secret/occne-mysqlndb-root-secret patched
2022-12-24T03:41:15Z INFO - Secret, occne-mysqlndb-root-secret, patched with new
password
2022-12-24T03:41:15Z INFO - Adding new mysql password for 'occneuser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:41:15Z INFO - New mysql password added
2022-12-24T03:41:16Z INFO - Patching secret, occne-secret-db-monitor-secret, with
new password
secret/occne-secret-db-monitor-secret patched
2022-12-24T03:41:16Z INFO - Secret, occne-secret-db-monitor-secret, patched with new
password
2022-12-24T03:41:16Z INFO - Adding new mysql password for 'occnerepluser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:41:16Z INFO - New mysql password added
2022-12-24T03:41:16Z INFO - Changing password in
replication_info.DBTIER_REPL_SITE_INFO table...
2022-12-24T03:41:16Z INFO - Using replication pod: mysql-cluster-lfg-site-1-lfg-
site-2-replication-svc-7b689frvfr2
2022-12-24T03:41:16Z INFO - Using replication pod container: lfg-site-1-lfg-site-2-
replication-svc
2022-12-24T03:41:16Z INFO - MYSQL_REPLICATION_SITE_NAME = lfg-site-1
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:41:17Z INFO - Password changed in
replication_info.DBTIER_REPL_SITE_INFO table
2022-12-24T03:41:17Z INFO - Patching secret, occne-replication-secret-db-replication-
secret, with new password
secret/occne-replication-secret-db-replication-secret patched
2022-12-24T03:41:17Z INFO - Secret, occne-replication-secret-db-replication-secret,
patched with new password
2022-12-24T03:41:17Z INFO - Password(s) updated successfully
```

2. Run the following command to restart the appropriate cnDBTier pods:

   ```
   $ dbtpasswd --restart-only
   ```

   Sample output:

   ```
   2022-12-24T03:58:36Z INFO - Changing password for user root
   Current password:
   2022-12-24T03:58:41Z INFO - Changing password for user occneuser
   Current password:
   2022-12-24T03:58:46Z INFO - Changing password for user occnerepluser
   ```

```
Current password:
2022-12-24T03:58:49Z INFO - Getting sts and sts pod info...
...
2022-12-24T04:01:39Z INFO - db-monitor-svc pods rollout restarted
2022-12-24T04:01:39Z INFO - Password(s) updated successfully
```

3. Once the necessary transition is done, run the following command to discard the old MySQL cnDBTier passwords:

```
$ dbtpasswd --discard-only
```

Sample output:

```
2022-12-24T03:51:40Z INFO - Changing password for user root
Current password:
2022-12-24T03:52:04Z INFO - Changing password for user occneuser
Current password:
2022-12-24T03:52:07Z INFO - Changing password for user occnerepluser
Current password:
2022-12-24T03:52:09Z INFO - Getting sts and sts pod info...
...
2022-12-24T03:52:12Z INFO - Discarding old mysql password for 'occneuser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:52:12Z INFO - Old mysql password discarded
2022-12-24T03:52:12Z INFO - Discarding old mysql password for 'occnerepluser'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-24T03:52:13Z INFO - Old mysql password discarded
2022-12-24T03:52:13Z INFO - Password(s) updated successfully
```

7.8.2.7 Changing an NF Password

This section provides a sample procedure to change an NF password when the secret is stored in an NF namespace that is different from the cnDBTier namespace.

1. Run the following commands to change the password on the secret and add a new password to MySQL.

> **Note**
>
> When the output prompts for the current password, enter the current password in the NF secret.

```
$ export DBTIER_NAMESPACE="dbtier_namespace"
$ dbtpasswd --secrets-and-mysql-only --nf-namespace=name-of-nf-namespace
nf-secret-in-nf-namespace
```

Sample output:

```
2022-12-15T23:27:19Z INFO - Changing password for user luis
Current password:
Enter new password:
Enter new password again:
...
2022-12-15T23:27:37Z INFO - Adding new mysql password for 'luis'@'%'...
mysql: [Warning] Using a password on the command line interface can be insecure.
2022-12-15T23:27:37Z INFO - New mysql password added
2022-12-15T23:27:37Z INFO - Patching secret, nf-secret-in-nf-namespace, with new
```

```
password
secret/nf-secret-in-nf-namespace patched
2022-12-15T23:27:37Z INFO - Secret, nf-secret-in-nf-namespace, patched with new
password
2022-12-15T23:27:37Z INFO - Password(s) updated successfully
```

2. Run the following command to discard the old password in MySQL, after restarting NF pods, adding new NF passwords on mate sites, or both.

> **Note**
>
> - When the output prompts for the current password, enter the current password in the NF secret.
> - The NF secret must be present on `nf-namespace` and the corresponding MySQL user must be present with the corresponding password.

```
$ dbtpasswd --discard-only --nf-namespace=name-of-nf-namespace nf-secret-
in-nf-namespace
```

Sample output:

```
2022-12-15T23:28:48Z INFO - Changing password for user luis
Current password:
...
2022-12-15T23:28:53Z INFO - Discarding old mysql password for 'luis'@'%'...
mysql: [Warning] Using a password on the command line interface can be
insecure.
2022-12-15T23:28:54Z INFO - Old mysql password discarded
2022-12-15T23:28:54Z INFO - Password(s) updated successfully
```

7.8.3 Modifying cnDBTier Backup Encryption Password

This section provides the procedure to modify the cnDBTier backup encryption password.

1. Get the existing backup encryption password (occne-backup-encryption-secret):

```
$ kubectl get secret  occne-backup-encryption-secret  -n
<cndbtier_namespace>  -o jsonpath="{.data.backup_encryption_password}" |
base64 --decode
```

For example,

```
$ kubectl get secret  occne-backup-encryption-secret  -n occne-cndbtier -o
jsonpath="{.data.backup_encryption_password}" | base64 --decode
```

> **Note**
>
> Skip this step if you already know the existing occne-backup-encryption-secret password.

2. Delete the existing backup encryption secret:

   ```
   $ kubectl -n <cndbtier_namespace> delete secret occne-backup-encryption-secret
   ```

   For example,

   ```
   $ kubectl -n occne-cndbtier delete secret occne-backup-encryption-secret
   ```

3. Run the following command to create secret with a new password. For information about the password policies, see the "Creating Secrets" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

   ```
   $ kubectl -n <cndbtier_namespace>  create secret generic occne-backup-encryption-secret --from-literal="backup_encryption_password=<new_password>"
   ```

   For example,

   ```
   $ kubectl -n  occne-cndbtier create secret generic occne-backup-encryption-secret --from-literal="backup_encryption_password=NextGenCne"
   ```

4. Scale down the replication service and backup manager service deployments. After scaling down, wait until all the replication service and backup manager pods are DOWN:

   ```
   $ kubectl -n <cndbtier_namespace> get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <cndbtier_namespace> scale deployment --replicas=0
   $ kubectl -n <cndbtier_namespace> get deployments | egrep 'db-backup-manager-svc' | awk '{print $1}' | xargs -L1 -r kubectl -n <cndbtier_namespace> scale deployment --replicas=0
   ```

   For example,

   ```
   $ kubectl -n occne-cndbtier get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n occne-cndbtier scale deployment --replicas=0
   $ kubectl -n occne-cndbtier get deployments | egrep 'db-backup-manager-svc' | awk '{print $1}' | xargs -L1 -r kubectl -n occne-cndbtier scale deployment --replicas=0
   ```

5. Scale up the replication service and backup manager service deployments. After scaling up, wait until all the replication service and backup manager pods are UP:

   ```
   $ kubectl -n <cndbtier_namespace> get deployments | egrep 'repl' | awk '{print $1}' | xargs -L1 -r kubectl -n <cndbtier_namespace> scale deployment --replicas=1
   $ kubectl -n <cndbtier_namespace> get deployments | egrep 'db-backup-manager-svc' | awk '{print $1}' | xargs -L1 -r kubectl -n <cndbtier_namespace> scale deployment --replicas=1
   ```

For example,

```
$ kubectl -n occne-cndbtier get deployments | egrep 'repl' | awk
'{print $1}' | xargs -L1 -r kubectl -n occne-cndbtier scale deployment --
replicas=1
$ kubectl -n occne-cndbtier get deployments | egrep 'db-backup-manager-
svc' | awk '{print $1}' | xargs -L1 -r kubectl -n occne-cndbtier scale
deployment --replicas=1
```

7.8.4 Modifying SSH Keys for Transferring Backups

This section provides the procedure to modify Secure Shell (SSH) keys for securely transferring cnDBTier backups.

1. Perform the following steps to move the existing SSH keys to the backup directory and delete the existing SSH secrets:
   a. Perform the following steps to move the existing SSH keys to the backup directory:
      i. Identify the location of the existing SSH keys:

         ```
         $ ls /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/
         ```

         For example:

         ```
         $ ls /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/
         ```

         Sample output:

         ```
         cndbtier_id_rsa cndbtier_id_rsa.pub
         ```

      ii. Move the existing SSH keys from the location identified in the previous step to the backup directory:

         ```
         $ sshBackupDateTime=$(date +"%m-%d-%y-%H-%M-%S")
         $ mkdir -p /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/$
         {sshBackupDateTime}
         $ mv <SSH private key file name> /var/occne/cluster/$
         {OCCNE_CLUSTER}/cndbtierssh/${sshBackupDateTime}/
         $ mv <SSH public key file name> /var/occne/cluster/${OCCNE_CLUSTER}/
         cndbtierssh/${sshBackupDateTime}/
         ```

         For example:

         ```
         $ sshBackupDateTime=$(date +"%m-%d-%y-%H-%M-%S")
         $ mkdir -p /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/$
         {sshBackupDateTime}
         $ mv /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/cndbtier_id_rsa /var/
         occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/${sshBackupDateTime}/
         $ mv /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/
         cndbtier_id_rsa.pub /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/$
         {sshBackupDateTime}/
         ```

   b. Perform the following steps to delete the existing SSH or Secure File Transfer Protocol (SFTP) secrets from the current cnDBTier cluster:

i. Identify the SSH or SFTP secrets from the current cluster by running the following command:

```
$ kubectl get secrets --namespace=<namespace of cnDBTier Cluster> |
grep ssh
```

For example:

```
$ kubectl get secrets --namespace=cluster1 | grep ssh
```

Sample output:

```
cndbtier-ssh-private-key
Opaque               1      7d
cndbtier-ssh-public-key
Opaque               1      7d
```

ii. Delete the SSH or SFTP secrets from the current cluster by running the following commands:

```
$ kubectl delete secret cndbtier-ssh-private-key --
namespace=<namespace of cnDBTier Cluster>
$ kubectl delete secret cndbtier-ssh-public-key --
namespace=<namespace of cnDBTier Cluster>
```

Example to delete a private key:

```
$ kubectl delete secret cndbtier-ssh-private-key --
namespace=cluster1
```

Sample output:

```
secret "cndbtier-ssh-private-key" deleted
```

Example to delete a public key:

```
$ kubectl delete secret cndbtier-ssh-public-key --namespace=cluster1
```

Sample output:

```
secret "cndbtier-ssh-public-key" deleted
```

2. Create the SSH keys by running the following commands:

```
$ mkdir -p -m 0700 /var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh
$ ssh-keygen -b 4096 -t rsa -C "cndbtier key" -f "/var/occne/cluster/$
{OCCNE_CLUSTER}/cndbtierssh/cndbtier_id_rsa" -q -N ""
```

For more information about creating SSH secrets, see "Creating SSH Keys" in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

3. Create the SFTP secrets by running the following commands:

```
$ kubectl create secret generic cndbtier-ssh-private-key --from-
file=id_rsa=/var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/
cndbtier_id_rsa -n ${OCCNE_NAMESPACE}
$ kubectl create secret generic cndbtier-ssh-public-key --from-
file=id_rsa.pub=/var/occne/cluster/${OCCNE_CLUSTER}/cndbtierssh/
cndbtier_id_rsa.pub -n ${OCCNE_NAMESPACE}
```

   For more information about creating SFTP secrets, see step 2 of "Creating Secrets" in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

4. Perform the following steps to restart the data nodes sequentially in an ascending order (ndbmtd-0, ndbmtd-1, and so on):

   a. Identify the list of data pods in the cnDBTier cluster:

```
$ kubectl get pods --namespace=<namespace of cnDBTier Cluster> | grep
'ndbmtd'
```

      For example, use the following command to identify the list of data pods in cnDBTier cluster1:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

      Sample output:

```
ndbmtd-0                                                  3/3
Running   0          14m
ndbmtd-1                                                  3/3
Running   0          13m
```

   b. Delete the first data pod of the cnDBTier cluster:

```
$ kubectl delete pod ndbmtd-0 --namespace=<namespace of cnDBTier
Cluster>
```

      For example, use the following command to delete the first data pod of cnDBTier cluster1:

```
$ kubectl delete pod ndbmtd-0 --namespace=cluster1
```

      Sample output:

```
pod "ndbmtd-0" deleted
```

   c. Wait for the first data pod to come up and verify if the pod is up by running the following command:

```
$ kubectl get pods --namespace=<namespace of cnDBTier Cluster> | grep
'ndbmtd'
```

For example:

```
$ kubectl get pods --namespace=cluster1 | grep 'ndbmtd'
```

Sample output:

```
ndbmtd-0                                                  3/3
Running   0          65s
ndbmtd-1                                                  3/3
Running   0          13m
```

d. Check the status of the cnDBTier cluster:

```
$ kubectl -n <namespace of cnDBTier Cluster> exec -it ndbmgmd-0 --
ndb_mgm -e show
```

For example, use the following command to check the status of cnDBTier cluster1:

```
$ kubectl -n cluster1 exec -it ndbmgmd-0 -- ndb_mgm -e show
```

Sample output:

```
Connected to Management Server at: localhost:1186 Cluster Configuration
---------------------
[ndbd(NDB)]     2 node(s)
id=1    @10.233.85.92  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0)
id=2    @10.233.114.33  (mysql-8.4.3 ndb-8.4.3, Nodegroup: 0, *)

[ndb_mgmd(MGM)] 2 node(s)
id=49   @10.233.65.167  (mysql-8.4.3 ndb-8.4.3)
id=50   @10.233.127.115  (mysql-8.4.3 ndb-8.4.3)

[mysqld(API)]   8 node(s)
id=56   @10.233.120.210  (mysql-8.4.3 ndb-8.4.3)
id=57   @10.233.124.93  (mysql-8.4.3 ndb-8.4.3)
id=70   @10.233.127.117  (mysql-8.4.3 ndb-8.4.3)
id=71   @10.233.85.93  (mysql-8.4.3 ndb-8.4.3)
id=222 (not connected, accepting connect from any host)
id=223 (not connected, accepting connect from any host)
id=224 (not connected, accepting connect from any host)
id=225 (not connected, accepting connect from any host)
```

> **Note**
>
> Node IDs 222 to 225 in the sample output are shown as "not connected" as these are added as empty slot IDs that are used for georeplication recovery.

e. Repeat steps a through d to delete the remaining data pods (ndbmtd-1, ndbmtd-2, and so on).

5. Perform the following steps to restart all the replication services of the current cluster:

a. Identify the replication service running in the current cluster:

```
$ kubectl get pods --namespace=<namespace of cnDBTier Cluster>
```

For example:

```
$ kubectl get pods --namespace=cluster1
```

Sample output:

```
NAME
READY   STATUS    RESTARTS        AGE
mysql-cluster-cluster1-cluster2-replication-svc-5d4b8fd685tshzd
1/1     Running   1 (13h ago)     13h
```

b. Delete all the replication service pods of the current cluster:

```
$ kubectl delete pod <replication service pod name> --
namespace=<namespace of cnDBTier Cluster>
```

For example,

```
$ kubectl delete pod mysql-cluster-cluster1-cluster2-replication-
svc-5d4b8fd685tshzd --namespace=cluster1
```

Sample output:

```
pod "mysql-cluster-cluster1-cluster2-replication-svc-5d4b8fd685tshzd"
delete
```

6. Follow steps 1 through 5 to replace the SSH or SFTP keys and secrets on the other georeplication cnDBTier clusters.

> **Note**
>
> The SSH or SFTP secrets must be the same across all the georeplication cnDBTier clusters.

7.8.5 Modifying Transparent Data Encryption Password

This section provides the procedure to modify the Transparent Data Encryption (TDE) password.

1. Get the existing TDE password (occne-tde-encrypted-filesystem-secret):

```
$ kubectl -n <cndbtier_namespace> get secret  occne-tde-encrypted-
filesystem-secret  -o jsonpath="{.data.filesystem-password}" | base64 --
decode
```

For example,

```
$ kubectl -n occne-cndbtier get secret  occne-tde-encrypted-filesystem-
secret  -o jsonpath="{.data.filesystem-password}" | base64 --decode
```

2. Delete the existing TDE secret:

```
$ kubectl -n <cndbtier_namespace> delete secret occne-tde-encrypted-
filesystem-secret
```

For example,

```
$ kubectl -n occne-cndbtier delete secret occne-tde-encrypted-filesystem-
secret
```

3. Run the following command to create secret with a new password. For information about the password policies, see the "Creating Secrets" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

```
$ kubectl -n <cndbtier_namespace> create secret generic occne-tde-
encrypted-filesystem-secret --from-literal="filesystem-password=<new_tde-
encryption-password>"
```

For example,

```
$ kubectl -n occne-cndbtier create secret generic occne-tde-encrypted-
filesystem-secret --from-literal="filesystem-password=NextGenCne"
```

4. Perform a cnDBTier upgrade by following the procedure in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

7.9 Modifying HTTPS Certificates

This section provides the procedure to modify HTTPS certificates.

1. Create a new certificate by following the sample procedure provided in the "Creating HTTPS or TLS Certificates for Encrypted Connection" section of *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.
2. Run the following commands to take a backup of the existing secrets (keystore and credentials) of all the sites where you want to modify the certificates:

```
$ kubectl -n <cndbtier_namespace> get secret cndbtier-https-cert-file -o
yaml > cndbtier-https-cert-file-backup.yaml
$ kubectl -n <cndbtier_namespace> get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keystorepassword}" | base64 --decode
$ kubectl -n <cndbtier_namespace> get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keystoretype}" | base64 --decode
$ kubectl -n <cndbtier_namespace> get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keyalias}" | base64 --decode
$ kubectl -n <cndbtier_namespace> get secret cndbtier-https-cert-cred -o
jsonpath="{.data.clientkeyalias}" | base64 --decode
```

where, `<cndbtier_namespace>` is the name of the cnDBTier namespace.

For example:

```
$ kubectl -n cluster1 get secret cndbtier-https-cert-file -o yaml >
cndbtier-https-cert-file-backup.yaml
$ kubectl -n cluster1 get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keystorepassword}" | base64 --decode
$ kubectl -n cluster1 get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keystoretype}" | base64 --decode
$ kubectl -n cluster1 get secret cndbtier-https-cert-cred -o
jsonpath="{.data.keyalias}" | base64 --decode
$ kubectl -n cluster1 get secret cndbtier-https-cert-cred -o
jsonpath="{.data.clientkeyalias}" | base64 --decode
```

3. Delete the old HTTPS secrets of all the sites where you want to modify the certificates:

```
$ kubectl get secrets -n <cndbtier_namespace>
$ kubectl -n <cndbtier_namespace> delete secrets <cndbtier-https-cert-
cred> <cndbtier-https-cert-file>
```

For example:

```
$ export OCCNE_NAMESPACE= "cluster1"
$ kubectl get secrets -n ${OCCNE_NAMESPACE}
$ kubectl delete secrets cndbtier-https-cert-cred cndbtier-https-cert-file
-n ${OCCNE_NAMESPACE}
```

4. Create the new HTTPS secret using the new server certificate created in Step 1, on all the sites where you want to modify the certificates. For more information about creating HTTPs secrets, see the "*Creating Secrets*" section in *Oracle Communications Cloud Native Core, cnDBTier Installation, Upgrade, and Fault Recovery Guide*.

> **Note**
>
> - You can update `server-cert.pem` and `client-cert.pem` when required.
> - You must use the maintenance window to update `ca-cert.pem`. After creating new secrets with new `ca-cert.pem`, restart the replication service and monitor the service of each site where the certificates are modified.

7.10 Modifying Remote Server Configurations for Secure Transfer of Backups

cnDBTier requires the following remote server configurations to securely transfer backups:

- IP address or Fully Qualified Domain Name (FQDN)
- Secure File Transfer Protocol (SFTP) port
- The path where the backups are to be securely transferred
- SSH key and username that are configured in the form of secrets

This section provides the procedure to modify remote server configurations in cnDBTier.

1. Perform the following steps to update the remote server configurations such as `remoteserverip`, `remoteserverport`, and `remoteserverpath`:
   a. Locate the `custom_values.yaml` file.
   b. Edit the configurations as per your requirement.

   > **Note**
   >
   > The `faultrecoverybackuptransfer` parameter is set to *false* by default in the `custom_values.yaml` file. Therefore, even if the `/global/remotetransfer/enable` parameter is set to *true*, the system will not transfer the backups taken during fault recovery to the remote server. If you want the backups taken for fault recovery to be transferred to the remote server, set the `faultrecoverybackuptransfer` parameter to *true*.

   The following code block provides a template to configure the remote transfer parameters:

   ```
   global:
   ....
   ....
     remotetransfer:
       enable: true
       faultrecoverybackuptransfer: true
       remoteserverip: "< IP address of the remote server>"
       remoteserverport: "<SFTP Port of the remote server>"
       remoteserverpath: "<path where cndbtier backups will be stored>"
   ```

   For example:

   ```
   global:
   ....
   ....
     remotetransfer:
        enable: true
        faultrecoverybackuptransfer: true
        remoteserverip: "10.75.216.8"
        remoteserverport: "2022"
        remoteserverpath: "/var/occnedb"
   ```

2. Perform the following steps to change the username of the remote server:
   a. Delete the `occne-remote-server-username-secret` secret by running the following command:

   ```
   $ kubectl -n <namespace> delete secret occne-remote-server-username-
   secret
   ```

   Where, `<namespace>` is the namespace of cnDBTier.

For example,

```
$  kubectl  -n occne-cndbtier  delete secret occne-remote-server-username-secret
```

b. Recreate the secret with a new username by running the following command:

```
$  kubectl -n <namespace> create secret generic occne-remote-server-username-secret --from-literal="remote_server_user_name=<user_name>"
```

Where,

- `<namespace>` is the namespace of cnDBTier.
- `<user_name>` is the new username of the remote server.

For example,

```
$  kubectl  -n occne-cndbtier  create secret generic occne-remote-server-username-secret --from-literal="remote_server_user_name=cndbtierbackupserver"
```

As per the example, the username of the remote server is *cndbtierbackupserver*.

3. Perform the following steps to update the SSH key of the remote server:
   a. Delete the `occne-remoteserver-privatekey-secret` secret by running the following command:

```
$ kubectl -n <namespace> delete secret occne-remoteserver-privatekey-secret
```

Where, `<namespace>` is the namespace of cnDBTier.

For example,

```
$ kubectl -n occne-cndbtier delete secret occne-remoteserver-privatekey-secret
```

   b. Copy the private SSH key of the remote server and save it in a file.
   c. Create the secret by using the file created in the previous step:

```
$ kubectl -n <namespace> create secret generic occne-remoteserver-privatekey-secret --from-file=id_rsa=<private key path>
```

Where,

- `<namespace>` is the namespace of cnDBTier
- `<private key path>` is the path to the private key file created in step b. The file path must include the file name.

For example,

```
$ kubectl -n occne-cndbtier create secret generic occne-remoteserver-
privatekey-secret --from-file=id_rsa=/var/occne/cluster/dbtier/
remoteserver_id_rsa
```

As per the example, the private key of the remote server is saved in the `/var/occne/cluster/dbtier/` directory with the file name `remoteserver_id_rsa`.

4. Upgrade the cnDBTier cluster to update all the configurations changed in steps 1, 2, and 3:

   ```
   $  helm  upgrade mysql-cluster occndbtier -f occndbtier/custom_values.yaml
   -n <namespace>
   ```

   Where, `<namespace>` is the namespace of cnDBTier.

5. If the replication service pods are not restarted after helm upgrade in the previous step, run the following command to manually delete the replication service pods:

   ```
   $ kubectl -n <cndbtier_namespace> delete pod <replication_pod_name>
   ```

7.11 Checking the Georeplication Status Between Clusters

This section describes the following procedures to check the georeplication status of a cnDBTier cluster in a site with a remote site:

1. Checking the Georeplication Status of cnDBTier cluster1 with Remote Sites
2. Checking the Georeplication Status of cnDBTier cluster2 with Remote Sites
3. Checking the Georeplication Status of cnDBTier cluster3 with Remote Sites
4. Checking the Georeplication Status of cnDBTier cluster4 with Remote Sites

> **Note**
>
> Replace the name of the cnDBTier cluster namespaces(cluster1, cluster2, cluster3, and cluster4) with the actual name of your namespaces in each of the commands in this section.

Checking the Georeplication Status of cnDBTier cluster1 with Remote Sites

Perform the following steps to check the georeplication status of cnDBTier cluster1 with remote sites (cnDBTier cluster2, cnDBTier cluster3, and cnDBTier cluster4):

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check the georeplication status in cnDBTier cluster1 with remote sites (cnDBTier cluster2, cnDBTier cluster3, and cnDBTier cluster4) for every replication group.

1. Run the following commands to check the georeplication status of cnDBTier cluster1 with respect to cnDBTier cluster2:

```
$ kubectl -n cluster1 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (2000, 2001) AND remote_site_name = "cluster2";
```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| cluster2         |             2000 |       8970 | 10.233.0.147        |
ACTIVE  |        NULL | cluster1  |      1000 | 2022-04-04 19:10:44 |
| cluster2         |             2001 |       4597 | 10.233.9.35         |
STANDBY |        NULL | cluster1  |      1001 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

2. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster2.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE replication channel:

```
$ kubectl -n cluster1 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.0.147
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 16442
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
```

```
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                    ....
                    ....
                    ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                    ....
                    ....
```

3. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster2.

   > **Note**
   >
   > When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

   The following example describes the commands to check the replication status of the STANDBY replication channel:

   ```
   $ kubectl -n cluster1 exec -it ndbmysqld-1 -- bash
   $ mysql -h 127.0.0.1 -uroot -p
   Password:
   mysql> SHOW REPLICA STATUS\G;
   ```

   Sample output:

   ```
   *************************** 1. row ***************************
               Replica_IO_State:
                    Source_Host: 10.233.9.35
                    Source_User: occnerepluser
                    Source_Port: 3306
                  Connect_Retry: 60
                Source_Log_File: mysql-bin.000005
            Read_Source_Log_Pos: 26970
                 Relay_Log_File: mysql-relay-bin.000002
                  Relay_Log_Pos: 2228
          Relay_Source_Log_File: mysql-bin.000005
             Replica_IO_Running: No
            Replica_SQL_Running: No
   ```

4. Run the following commands to check the georeplication status of cnDBTier cluster1 with respect to cnDBTier cluster3:

   ```
   $ kubectl -n cluster1 exec -it ndbmysqld-2 -- bash
   $ mysql -h 127.0.0.1 -uroot -p
   Password:
   mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
   where remote_server_id in (3000, 3001) AND remote_site_name = "cluster3";
   ```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| cluster3         |             3000 |       5533 | 10.233.16.34        |
ACTIVE  |        NULL | cluster1  |      1002 | 2022-04-04 19:10:44 |
| cluster3         |             3001 |       7918 | 10.233.41.15        |
STANDBY |        NULL | cluster1  |      1003 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

5. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE replication channel:

```
$ kubectl -n cluster1 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.16.34
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 18542
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                        ....
                        ....
                        ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
```

```
....
....
```

6. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY replication channel:

```
$ kubectl -n cluster1 exec -it ndbmysqld-3 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
               Replica_IO_State:
                  Source_Host: 10.233.41.15
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000006
          Read_Source_Log_Pos: 26421
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

7. Run the following commands to check the georeplication status of cnDBTier cluster1 with respect to cnDBTier cluster4:

```
$ kubectl -n cluster1 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (4000, 4001) AND remote_site_name = "cluster4";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| cluster4         |             4000 |       5909 | 10.233.57.61        |
```

```
ACTIVE  |        NULL | cluster1  |      1004 | 2022-04-04 19:10:44 |
| cluster4         |             4001 |       1937 | 10.233.54.145       |
STANDBY |        NULL | cluster1  |      1005 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

8. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster4.

   > **Note**
   >
   > When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`

   The following example describes the commands to check the replication status of the ACTIVE replication channel::

   ```
   $ kubectl -n cluster1 exec -it ndbmysqld-4 -- bash
   $ mysql -h 127.0.0.1 -uroot -p
   Password:
   mysql> SHOW REPLICA STATUS\G;
   ```

   Sample output:

   ```
   *************************** 1. row ***************************
                 Replica_IO_State: Waiting for master to send event
                    Source_Host: 10.233.57.61
                    Source_User: occnerepluser
                    Source_Port: 3306
                   Connect_Retry: 60
                 Source_Log_File: mysql-bin.000004
           Read_Source_Log_Pos: 185
                Relay_Log_File: mysql-relay-bin.000002
                 Relay_Log_Pos: 11203
         Relay_Source_Log_File: mysql-bin.000007
            Replica_IO_Running: Yes
           Replica_SQL_Running: Yes
                           ....
                           ....
                           ....
     Replica_SQL_Running_State: Replica has read all relay log; waiting for
   more updates
            Source_Retry_Count: 86400
                           ....
                           ....
   ```

9. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster1 with respect to cnDBTier cluster4.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY replication channel:

```
$ kubectl -n cluster1 exec -it ndbmysqld-5 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.54.145
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 26420
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

Checking the Georeplication Status of cnDBTier cluster2 with Remote Sites

Perform the following steps to check the georeplication status of cnDBTier cluster2 with remote sites (cnDBTier cluster1, cnDBTier cluster3, and cnDBTier cluster4):

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check the georeplication status in cnDBTier cluster2 with remote sites (cnDBTier cluster1, cnDBTier cluster3, and cnDBTier cluster4) for every replication group.

1. Run the following commands to check the georeplication status of cnDBtier cluster2 with respect to cnDBTier cluster1:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (1000, 1001) AND remote_site_name = "cluster1";
```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| cluster1         |            1000 |       8970 | 10.233.13.41        |
ACTIVE  |        NULL | cluster2  |      2000 | 2022-04-04 19:10:44 |
| cluster1         |            1001 |       4597 | 10.233.39.110       |
STANDBY |        NULL | cluster2  |      2001 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

2. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBtier cluster2 with respect to cnDBTier cluster1.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.13.41
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000009
          Read_Source_Log_Pos: 16480
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                        ....
                        ....
                        ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
```

```
....
....
```

3. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster2 with respect to cnDBTier cluster1.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-1 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.39.110
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000007
          Read_Source_Log_Pos: 13270
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

4. Run the following commands to check the georeplication status of cnDBTier cluster2 with respect to cnDBTier cluster3:

```
$ kubectl -n cluster2 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (3002, 3003) AND remote_site_name = "cluster3";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| cluster3         |             3002 |       9981 | 10.233.62.226       |
```

```
ACTIVE  |        NULL | cluster2  |      2002 | 2022-04-04 19:10:44 |
| cluster3         |             3003 |       9319 | 10.233.14.15        |
STANDBY |        NULL | cluster2  |      2003 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

5. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster2 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.62.226
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000008
          Read_Source_Log_Pos: 16485
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

6. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster2 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-3 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.14.15
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000008
          Read_Source_Log_Pos: 13670
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

7. Run the following commands to check the georeplication status of cnDBTier cluster2 with respect to cnDBTier cluster4:

```
$ kubectl -n cluster2 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (4002, 4003) AND remote_site_name = "cluster4";
```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| cluster4         |             4002 |       4500 | 10.233.42.33        |
ACTIVE  |        NULL | cluster2  |      2004 | 2022-04-04 19:10:44 |
| cluster4         |             4003 |       9921 | 10.233.48.56        |
STANDBY |        NULL | cluster2  |      2005 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
```

```
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

8. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster2 with respect to cnDBTier cluster4.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.42.33
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

9. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster2 with respect to cnDBTier cluster4.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster2 exec -it ndbmysqld-5 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.48.56
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

Checking the Georeplication Status of cnDBTier cluster3 with Remote Sites

Perform the following steps to check the georeplication status of cnDBTier cluster3 with remote sites (cnDBTier cluster1, cnDBTier cluster2, and cnDBTier cluster4):

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check the georeplication status in cnDBTier cluster3 with remote sites (cnDBTier cluster1, cnDBTier cluster2, and cnDBTier cluster4) for every replication group.

1. Run the following commands to check the georeplication status of cnDBtier cluster3 with respect to cnDBTier cluster1:

```
$ kubectl -n cluster3 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (1002, 1003) AND remote_site_name = "cluster1";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
```

```
| cluster1         |             1002 |       5533 | 10.233.15.214       |
ACTIVE  |       NULL | cluster3  |      3000 | 2022-04-04 19:10:44 |
| cluster1         |             1003 |       7918 | 10.233.24.249       |
STANDBY |       NULL | cluster3  |      3001 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
2 rows in set (0.00 sec)
```

2. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBtier cluster3 with respect to cnDBTier cluster1.

   > **Note**
   >
   > When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

   The following example describes the commands to check the replication status of the ACTIVE Replication channel:

   ```
   $ kubectl -n cluster3 exec -it ndbmysqld-0 -- bash
   $ mysql -h 127.0.0.1 -uroot -p
   Password:
   mysql> SHOW REPLICA STATUS\G;
   ```

   Sample output:

   ```
   *************************** 1. row ***************************
                Replica_IO_State: Waiting for master to send event
                     Source_Host: 10.233.15.214
                     Source_User: occnerepluser
                     Source_Port: 3306
                   Connect_Retry: 60
                 Source_Log_File: mysql-bin.000005
             Read_Source_Log_Pos: 34765
                  Relay_Log_File: mysql-relay-bin.000002
                   Relay_Log_Pos: 11203
           Relay_Source_Log_File: mysql-bin.000007
              Replica_IO_Running: Yes
             Replica_SQL_Running: Yes
                               ....
                               ....
                               ....
       Replica_SQL_Running_State: Replica has read all relay log; waiting for
   more updates
              Source_Retry_Count: 86400
                               ....
                               ....
   ```

3. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBtier cluster3 with respect to cnDBTier cluster1.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster3 exec -it ndbmysqld-1 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.24.249
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

4. Run the following commands to check the georeplication status of cnDBTier cluster3 with respect to cnDBTier cluster2:

```
$ kubectl -n cluster3 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (2002, 2003) AND remote_site_name = "cluster2";
```

Sample output:

```
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+-----------+--------------------
+---------+------------+----------+----------+--------------------+
| cluster2         |             2002 |       9981 | 10.233.34.252       |
ACTIVE  |        NULL | cluster3  |      3002 | 2022-04-04 19:10:44 |
| cluster2         |             2003 |       9319 | 10.233.15.228       |
STANDBY |        NULL | cluster3  |      3003 | 2022-04-04 19:10:45 |
+-----------------+-----------------+-----------+--------------------
```

```
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

5. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster3 with respect to cnDBTier cluster2.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster3 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.34.252
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

6. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster3 with respect to cnDBTier cluster2.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster3 exec -it ndbmysqld-3 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
               Replica_IO_State:
                  Source_Host: 10.233.15.228
                  Source_User: occnerepluser
                  Source_Port: 3306
                 Connect_Retry: 60
               Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

7. Run the following commands to check the georeplication status of cnDBTier cluster3 with respect to cnDBTier cluster4:

```
$ kubectl -n cluster3 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (4004, 4005) AND remote_site_name = "cluster4";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| cluster4         |             4004 |       3625 | 10.233.63.121       |
ACTIVE  |        NULL | cluster3  |      3004 | 2022-04-04 19:10:44 |
| cluster4         |             4005 |       3837 | 10.233.40.173       |
STANDBY |        NULL | cluster3  |      3005 | 2022-04-04 19:10:45 |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

8. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster3 with respect to cnDBTier cluster4.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster3 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.63.121
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

9. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster3 with respect to cnDBTier cluster4.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster3 exec -it ndbmysqld-5 -- bash
$ mysql -h 127.0.0.1 -uroot -p
```

```
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.40.173
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

Checking the Georeplication Status of cnDBTier cluster4 with Remote Sites

Perform the following steps to check the georeplication status of cnDBTier cluster4 with remote sites (cnDBTier cluster1, cnDBTier cluster2, and cnDBTier cluster3):

> **Note**
>
> The following commands and examples are applicable for a single replication channel group only. If multiple replication channel groups are enabled, then check the georeplication status in cnDBTier cluster4 with remote sites (cnDBTier cluster1, cnDBTier cluster2, and cnDBTier cluster3) for every replication group.

1. Run the following commands to check the georeplication status of cnDBtier cluster4 with respect to cnDBTier cluster1:

```
$ kubectl -n cluster4 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (1004, 1005) AND remote_site_name = "cluster1";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+------------+-----------+-----------+--------------------+
| cluster1         |             1004 |       5909 | 10.233.37.108       |
ACTIVE  |        NULL | cluster4  |      4000 | 2022-04-04 19:10:44 |
| cluster1         |             1005 |       1937 | 10.233.11.31        |
STANDBY |        NULL | cluster4  |      4001 | 2022-04-04 19:10:45 |
+-----------------+-----------------+------------+--------------------
```

```
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

2. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBtier cluster4 with respect to cnDBTier cluster1.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster4 exec -it ndbmysqld-0 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.37.108
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

3. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBtier cluster4 with respect to cnDBTier cluster1.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster4 exec -it ndbmysqld-1 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.11.31
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

4. Run the following commands to check the georeplication status of cnDBTier cluster4 with respect to cnDBTier cluster2:

```
$ kubectl -n cluster4 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (2004, 2005) AND remote_site_name = "cluster2";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| cluster2         |             2004 |       4500 | 10.233.15.245       |
ACTIVE  |        NULL | cluster4  |      4002 | 2022-04-04 19:10:44 |
| cluster2         |             2005 |       9921 | 10.233.48.74        |
STANDBY |        NULL | cluster4  |      4003 | 2022-04-04 19:10:45 |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

5. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster4 with respect to cnDBTier cluster2.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster4 exec -it ndbmysqld-2 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.15.245
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

6. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster4 with respect to cnDBTier cluster2.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel:

```
$ kubectl -n cluster4 exec -it ndbmysqld-3 -- bash
$ mysql -h 127.0.0.1 -uroot -p
```

```
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.48.74
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

7. Run the following commands to check the georeplication status of cnDBTier cluster4 with respect to cnDBTier cluster3:

```
$ kubectl -n cluster4 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> select * from replication_info.DBTIER_REPLICATION_CHANNEL_INFO
where remote_server_id in (3004, 3005) AND remote_site_name = "cluster3";
```

Sample output:

```
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| remote_site_name | remote_server_id | channel_id | remote_signaling_ip |
role    | start_epoch | site_name | server_id | start_ts            |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
| cluster3         |             3004 |       3625 | 10.233.3.32         |
ACTIVE  |        NULL | cluster4  |      4004 | 2022-04-04 19:10:44 |
| cluster3         |             3005 |       3837 | 10.233.14.89        |
STANDBY |        NULL | cluster4  |      4005 | 2022-04-04 19:10:45 |
+-----------------+-----------------+------------+--------------------
+---------+-------------+-----------+-----------+--------------------+
2 rows in set (0.00 sec)
```

8. Run the following commands to check if replication is turned on in the ACTIVE Replication channel of cnDBTier cluster4 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned on, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `Yes`.

The following example describes the commands to check the replication status of the ACTIVE Replication channel:

```
$ kubectl -n cluster4 exec -it ndbmysqld-4 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State: Waiting for master to send event
                  Source_Host: 10.233.3.32
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 34765
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 11203
        Relay_Source_Log_File: mysql-bin.000007
           Replica_IO_Running: Yes
          Replica_SQL_Running: Yes
                          ....
                          ....
                          ....
    Replica_SQL_Running_State: Replica has read all relay log; waiting for
more updates
           Source_Retry_Count: 86400
                          ....
                          ....
```

9. Run the following commands to check if replication is turned off in the STANDBY Replication channel of cnDBTier cluster4 with respect to cnDBTier cluster3.

> **Note**
>
> When replication is turned off, the `Replica_IO_Running` and `Replica_SQL_Running` parameters are set to `No`.

The following example describes the commands to check the replication status of the STANDBY Replication channel :

```
$ kubectl -n cluster4 exec -it ndbmysqld-5 -- bash
$ mysql -h 127.0.0.1 -uroot -p
Password:
mysql> SHOW REPLICA STATUS\G;
```

Sample output:

```
*************************** 1. row ***************************
             Replica_IO_State:
                  Source_Host: 10.233.14.89
```

```
                  Source_User: occnerepluser
                  Source_Port: 3306
                Connect_Retry: 60
              Source_Log_File: mysql-bin.000005
          Read_Source_Log_Pos: 24672
               Relay_Log_File: mysql-relay-bin.000002
                Relay_Log_Pos: 2228
        Relay_Source_Log_File: mysql-bin.000005
           Replica_IO_Running: No
          Replica_SQL_Running: No
```

7.12 Changing Authentication Plugin on cnDBTier Sites

Users created on cnDBTier setups older than 23.4.x (that is, 23.2.x, and 23.3.0) use the `mysql_native_password` plugin for authentication. As this plugin is deprecated in mysql version 8.0.34 (cnDBTier 23.3.0), you must use the `caching_sha2_password` plugin for user authentication. This section provides the steps to change the authentication plugin for users created on cnDBTier setups older than 23.3.1.

Note

- Perform this procedure on the `ndbappmysqld` pod of one site only.
- If you have upgraded to 24.1.x from a cnDBTier version older than 23.3.1, you must perform this procedure to change the authentication plugin after all the sites are upgraded.

Perform the following steps to alter a user to use the `caching_sha2_password` authentication plugin:

1. Log in to the `ndbappmysqld` pod:

   ```
   $ kubectl -n <namespace> exec -it ndbappmysqld-0 -- mysql -h::1 -uroot -
   p<password>
   ```

   where,

   - `<namespace>` is the namespace name
   - `<password>` is the password to access the `ndbappmysqld` pod

   For example:

   ```
   $ kubectl -n occne-cndbtier exec -it ndbappmysqld-0 -- mysql -h::1 -uroot -
   p<password>
   ```

2. Run the following MySQL command to change the authentication plugin:

   ```
   mysql> ALTER USER IF EXISTS <USER_NAME> IDENTIFIED WITH
   'caching_sha2_password' BY '<password>';
   ```

   where,

   - `<USER NAME>` is the name of the user.

- <password> is the password of user.

For example:

```
mysql> ALTER USER IF EXISTS occneuser IDENTIFIED WITH
'caching_sha2_password' BY 'NextGenCne';
mysql> ALTER USER IF EXISTS occnerepluser IDENTIFIED WITH
'caching_sha2_password' BY 'NextGenCne';
mysql> ALTER USER IF EXISTS root@localhost IDENTIFIED WITH
'caching_sha2_password' BY 'NextGenCne';
mysql> ALTER USER IF EXISTS root IDENTIFIED WITH 'caching_sha2_password'
BY 'NextGenCne';
mysql> ALTER USER IF EXISTS <NF_USER> IDENTIFIED WITH
'caching_sha2_password' BY 'NextGenCne';
```

If you want to roll back to cnDBTier 23.2.x, 23.3.x, 23.4.x, or 24.1.x after performing the above procedure, then you must change the authentication plugin to `mysql_native_password` before performing a rollback:

1. Log in to the `ndbappmysqld` pod:

   ```
   $ kubectl -n <namespace> exec -it ndbappmysqld-0 -- mysql -h::1 -uroot -
   p<password>
   ```

   where,

   - <namespace> is the namespace name.
   - <password> is the password to access the `ndbappmysqld` pod.

   For example:

   ```
   $ kubectl -n occne-cndbtier exec -it ndbappmysqld-0 -- mysql -h::1 -uroot -
   p<password>
   ```

2. Run the following mysql command to change the authentication plugin to `mysql_native_password`:

   ```
   mysql> ALTER USER IF EXISTS <USER_NAME> IDENTIFIED WITH
   'mysql_native_password' BY '<password>';
   ```

   where,

   - <USER NAME> is the name of the user.
   - <password> is the password of the user.

   For example:

   ```
   mysql> ALTER USER IF EXISTS occneuser IDENTIFIED WITH
   'mysql_native_password' BY 'NextGenCne';
   mysql> ALTER USER IF EXISTS occnerepluser IDENTIFIED WITH
   'mysql_native_password' BY 'NextGenCne';
   mysql> ALTER USER IF EXISTS root@localhost IDENTIFIED WITH
   'mysql_native_password' BY 'NextGenCne';
   mysql> ALTER USER IF EXISTS <NF_USER> IDENTIFIED WITH
   'caching_sha2_password' BY 'NextGenCne';
   ```